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SUBJECT: Forwards "NFPA Code Compliance Evaluation," Vols I-IV,per NRC 900426 App R SER.Installation of reflash capability on fire protection alarm sys delayed from 911231 to 941231.

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AEP:NRC:0692BY

Donald C. Cook Nuclear Plant Units 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
NFPA CODE REVIEW AND RELATED APPENDIX R
SER CLARIFICATIONS

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Attn: T. E. Murley

December 2, 1991

Dear Dr. Murley:

Reference: NRC Safety Evaluation Report, J. Giitter to
M. P. Alexich dated April 26, 1990

This letter provides information related to fire protection of the Donald C. Cook Nuclear Plant. Specifically, it 1) transmits our NFPA Code Review, and 2) clarifies a possible misunderstanding of the Cook Nuclear Plant fire alarm system circuit electronic supervision.

Regarding the NFPA Code Review, Attachment 1 to this letter provides an executive summary and an explanation of the NFPA Code Compliance documents. This attachment also contains justification for not performing a compliance review of some sections of the NFPA Code, specifically NFPA 17, 80, 90A and 232. Attachment 2 to this letter is the six volumes of the NFPA Code Compliance Report.

Regarding the fire alarm circuit, the April 26, 1990 Safety Evaluation Report (SER) indicates in Section 2.3.2 that all fire alarm system circuits are supervised in accordance with the NFPA 72D Code with the exception of two circuits in the control room. This, however, is not the case and has resulted in a discrepancy between the SER and our actual installation. There actually are more than two circuits that are not electronically supervised. These include some water flow, sprinkler alarms, fire detection, and suppression actuation/initiating systems that are not electronically supervised in accordance with NFPA 72D.

ZZZZ Rev Tim Colburn 12/6
1/1 See Attached Ltr

Justifications for each are outlined in Attachment 3 to this letter. This information has been extracted from the NFPA Code Review for your convenience. This response is based on the 1986 edition of NFPA 72D.

Section 2.3.2 of the subject SER also iterated our initial intent to have "reflash" capability installed on fire protection alarm systems by December 31, 1991. Because we have encountered scheduling difficulties with other modifications, such as installation of a new fire protection water supply, and because the fire alarm "reflash" project has proven to be more complex than originally perceived, it is now rescheduled for completion by December 31, 1994.

This document has been prepared following Corporate procedures that incorporate a reasonable set of control to ensure its accuracy and completeness prior to signature by the undersigned.

Sincerely,

E. E. Fitzpatrick
Vice President

dfw

Attachments

cc: D. H. Williams, Jr.
A. A. Blind - Bridgman
J. R. Padgett
G. Charnoff
NFEM Section Chief
A. B. Davis - Region III
NRC Resident Inspector - Bridgman

ATTACHMENT 1 TO

AEP:NRC:0692BY

NFPA CODE COMPLIANCE EXECUTIVE SUMMARY

SUMMARY OF NFPA CODE COMPLIANCE EVALUATIONS

NFPA 10, 12, 12A, 13, 14, 15, 17, 20, 30, 72D, 72E, 80, 90A and 232

FOR

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

INDIANA MICHIGAN POWER COMPANY

PREPARED BY:

PIPING, VALVES, HVAC & FIRE PROTECTION SECTION

AMERICAN ELECTRIC POWER SERVICE CORPORATION

November, 1991

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1.0 INTRODUCTION

1.1 Overview

The following is intended to provide a brief summary of the National Fire Protection Association (NFPA) Code Compliance reviews performed at Cook Nuclear Plant. These code compliance reviews were performed to evaluate certain fire protection systems against specific NFPA Codes. The fire protection systems of concern are those protecting safe shutdown and safety related systems in the Containment, Auxiliary, Turbine and Screenhouse Buildings. The fire protection systems in these areas have been evaluated against NFPA Codes 10, 12, 12A, 13, 14, 15, 72D and 72E.

1.2 Background

AEPSC has committed to fourteen NFPA Codes. These codes are NFPA 10, 12, 12A, 13, 14, 15, 17, 20, 30, 72D, 72E, 80, 90A and 232.

ABB Impell Corporation was contracted to review, evaluate and justify code compliance issues for NFPA 10, 12, 12A, 13, 14, 15, 72D and 72E. Only the fire detection and suppression systems located in certain safety related areas of the plant were evaluated by ABB Impell. The results of their review are contained in Report No. 09-0120-0123, dated May, 1988.

AEPSC conducted its own review of NFPA Codes 17, 20, 30, 80, 90A and 232 to determine its position on these remaining codes. AEPSC's decision to perform a code compliance review is based on several factors. These factors included the subject of the NFPA Code, the safety classification of the system(s) covered by the code, the degree of benefit to be gained, the extent of previous evaluations and the actual commitment which specifically references the NFPA Code. It was concluded that only NFPA 20 and 30 should have a code compliance review performed. The other NFPA Codes did not require a review because the applicable systems had been previously reviewed under a different format or were nonsafety related. AEPSC's positions on these codes are stated in Section 2.0.

NFPA 20 Code Compliance Evaluation for fire pumps was completed in December of 1988. NFPA 30 Code Compliance Evaluation for the storage of flammable liquids was completed in June of 1990. The results of these reviews are contained in their own code compliance evaluation reports.

During a November 1 and 2, 1989 meeting with the NRC (Messrs. D. Kubicki and J. Glitter of NRR and J. Ulie, Region III), we discussed our original NFPA Code Compliance Program. Our original NFPA Code Compliance Program was restricted to fire detection and suppression systems in certain safety related areas. The NRC requested that this review be expanded to cover all safety related areas. These additional fire protection systems (in the expanded areas) are to be reviewed against the "significant" deviations that were found in our original NFPA Code Compliance Review, ABB Impell Report 09-0120-0123. This also limits our review to only the NFPA Codes in which we have performed a past review. This NRC request was further documented in their SER, dated April 26, 1990, concerning their review of the Appendix R Safe Shutdown Capability Assessment, Proposed Modifications and Evaluations Report (Revision 1, dated December, 1986).

ABB Impell also performed our Expanded NFPA Code Compliance Report. Their review focused on the significant deficiencies previously identified under the original NFPA Code Compliance Report, No. 09-0120-0123. The significant deficiencies were defined as those that would impact system effectiveness (i.e., nozzle spacing, obstructions, system materials installed, etc.), supervision (i.e., method of connection to plant fire alarm system) and maintenance (i.e., surveillance performance and procedures). The results of their review are contained in Report No. 09-0120-0381 dated January, 1991.

These reports are a "snapshot in time" of the Cook Nuclear Plant compliance status with the NFPA codes. Future additions, deletions, and modifications to these systems will occur as the plant configuration changes. Engineering supplements to the NFPA Code Compliance Evaluation reports will be prepared to document and justify any further deviations from compliance with these codes which occur as a result of these configuration changes.

1.3 Scope of Work

Each code compliance evaluation reviews the identified fire protection systems and determines compliance with or noncompliance with specific NFPA Code requirements. The code requirements upon which the fire protection systems were reviewed were based on the edition years which were in effect at the time the systems were designed and/or installed or against the most current edition at the time of the evaluation.

The systems were evaluated against the code requirements for each NFPA Code edition to determine compliance, noncompliance and open items. Deviations (noncompliances) were reevaluated to determine whether each item could be deemed acceptable "as installed" based upon credited plant procedures or past practices at the plant. Deviations and open items which could not be justified on these bases or on changes to the specific code requirement in later editions, were then evaluated based on engineering judgements, calculations, analysis of plant design features, field reviews, etc. In instances where the deviation could not be justified, modifications are to be made to the systems.

The previous evaluations have concluded that the fire protection systems at Donald C. Cook Power Plant are generally in compliance with the NFPA Codes reviewed. These previous evaluations have also followed the above methodology.

The NFPA Codes reviewed in the above evaluation Reports are:

10 - Portable Fire Extinguishers
12 - Carbon Dioxide Extinguishing Systems
12A- Halon 1301 Fire Extinguishing Systems
13 - Installation of Sprinkler Systems
14 - Installation of Standpipe and Hose Systems
15 - Water Spray Fixed Systems
20 - Installation of Centrifugal Fire Pumps
30 - Flammable and Combustible Liquids Code
72D- Installation, Maintenance and Use of Proprietary Protective Signaling Systems
72E- Automatic Fire Detectors

The areas of the plant that have been reviewed include:

- Auxiliary Building (FZs 1, 1A-H, 3, 4, 5, 6N, 6M, 6S, 12, 22, 31, 32, 33, 33A-B, 34, 34A-B, 35, 36, 37, 43, 44A-H, 44N, 44S, 48-52, 61, 62A-C, 63A-C, 64A-B, 65A-B, 69-73, 105-117, 127, 136, 137, 138A-C, 146)
- Unit 1 Reactor Cable Tunnels Quadrants 1 through 4 (FZs 7-11, 38)
- Unit 2 Reactor Cable Tunnels Quadrants 1 through 4 (FZs 23-27 and 39)
- Unit 1 Power Systems Complex (FZs 13, 14, 15, 16, 40A-B, 41, 42A-D)
- Unit 2 Power Systems Complex (FZs 18, 19, 20, 21, 45, 46A-D, 47A-B)
- Units 1 and 2 Auxiliary Feedwater Pump Rooms in the Turbine Building (FZs 17A-G)
- Units 1 and 2 Essential Service Water Pump Rooms in the Screenhouse (FZs 29A-G)
- Units 1 and 2 Diesel Fire Pump Rooms in the Screenhouse (FZs 28, 30) and Turbine Building Pump Bay (FZ 2).
- Unit 1 Control Room (FZ 53)
- Unit 2 Control Room (FZ 54)
- Unit 1 Cable Vaults (FZs 55, 56, 57, 144)
- Unit 2 Cable Vaults (FZs 58, 59, 60, 145)
- Unit 1 Containment (FZs 66, 67, 68, 101, 103, 118, 120, 122, 132, 134)
- Unit 2 Containment (FZs 74, 75, 76, 102, 104, 119, 121, 123, 133, 135)
- Unit 1 Turbine Building (FZs 79, 80, 90, 91)
- Unit 2 Turbine Building (FZs 84, 85, 96, 97)
- Unit 2 Turbine Building Miscellaneous Oil Storage Room (FZ 89).
- Service Building Flammable Liquid Storage Room (FZ 131).
- Auxiliary Building H_2 Tube Racks (yard)
- Units 1 and 2 Main Transformers and Turbine Building Wall (yard)

1.4 Fire Protection Systems Reviewed

The fire protection systems which have been reviewed are identified in the various code compliance reports. Further details on the individual systems are given in the applicable reports. The reports include assumptions, access limitations, edition year and code sections that were not applicable and, therefore, were not evaluated.

1.5 Results of the Reviews

The results of each of these reviews are given in their respective Code Compliance Evaluation reports. These reports include information concerning scope, methodology, assumptions, conclusions, deviations, recommendations, justifications and references. Due to the size of the original reports, certain backup information has not been included in this submittal. This backup material includes copies of the NFPA Codes to which the systems were reviewed, walkdown notes and checklists, miscellaneous correspondence, etc. The information provided in this submittal contains sufficient detail to demonstrate Cook Nuclear Plant compliance with the NFPA Codes, justifications for deviations to specific code sections and recommended corrective actions for returning to compliance where engineering justifications were not warranted.

Each of the reports also includes a Code Compliance Verification Checklist for each NFPA Code. This checklist provides a section-by-section review of the Code. The checklist states the specific code requirements, identifies the method of verification used (walkdown, document review or both) and gives a summary of the results. This checklist is the final compilation of data obtained from the other walkdown and document review checklists that were performed during the review. The summary of results can list any of several possible code compliance categories; information only, not applicable, complies, does not comply or open item. It also lists the references used to make this conclusion. A listing of the references is provided prior to the code section-by-section review.

For the Contractor prepared reports 09-0120-0123 and 09-0120-0381, the "open items" and "does not comply" categories were then listed in the "Deviation and Recommendations/Justifications" Tables provided for each NFPA Code. Each table pulls together all the deviations for that particular Code and provides a recommendation for corrective action or provides a justification for acceptance of the deviation. The justifications that appear in the tables are simple in nature, straight forwarded in their reasoning and did not require extensive analysis or evaluation. However, for each of the NFPA Code Compliance reports, more detailed or supplemental justifications were also necessary in order to remove other recommendations given in the tables. In the case of the NFPA Code Compliance Evaluation report 09-0120-0123, the supplemental justifications are contained in Section 4.0. This Section was added by AEPSC in order to keep the entire report and its final justifications and recommendations together. These supplemental justifications were prepared by both the Contractor and AEPSC. For the Extended Code Compliance Evaluation report 09-0120-0381, the supplemental justifications are contained in Appendix B1, Deviation Evaluation Calculation No. 0120-164-007. These supplemental justifications were performed by the Contractor. A new appendix, Appendix B2, has also been added by AEPSC in order to keep the entire report and the AEPSC prepared final justifications and recommendations together.

For the AEPSC prepared NFPA 20 and 30 Code Compliance Evaluations, the justifications for the "open items" and "does not comply" categories appear directly in the Code Compliance Verification Checklist. A deviations and recommendation/ justification table is not used. A final listing of the conclusions and recommendations appears in Section 4.0 of the report.

The following provides a brief status of the various NFPA Code Compliance reports and the actions being taken to bring the plant into compliance with the code requirements.

1.5.1 NFPA Code Compliance Evaluation Report 09-0120-0123

The NFPA Code Compliance Evaluation reviewed only certain fire detection and suppression systems located in safety related areas of Cook Nuclear Plant. The exact areas of review are given in the report, but generally included the Auxiliary Building, the Unit 1 and 2 Auxiliary Feedwater Pump Rooms in the Turbine Buildings, the Unit 1 and 2 Essential Service Water Pump Rooms in the Screen House and the Unit 1 and 2 Control Rooms. The NFPA Codes included in this review were NFPA 10, 12, 12A, 13, 14, 15, 72D and 72E.

This evaluation also includes engineering justifications along with recommended corrective actions for the noted deficiencies. The noted deficiencies requiring corrective actions are described in the "Deviation and Recommendations/ Justifications" Tables for each NFPA Code. The list of recommendations was reduced even further by the development of supplemental justifications. These justifications appear in Section 4.0 of the report. The AEPSC prepared justifications were also independently reviewed by a consultant (ABB Impell). The consultant's concerns were addressed and did not result in additional design or procedural changes or the generation of new maintenance items.

Plant design changes, maintenance items and procedural changes which were necessary for the reviewed systems to maintain compliance with the various NFPA Codes are identified below. Many of the maintenance items were corrected under the plant's ongoing maintenance and surveillance program. A listing of the maintenance items is given in Section 4.0 of the report in a July 18, 1988 memo from B.J. Gerwe to P.H. Jacques. Supplemental justifications were also prepared for some of the maintenance items.

Note: During the course of implementing the plant design changes, additional engineering walkdowns and design reviews were performed. Some of these design change activities lead to the formation of additional supplemental justifications which removed various recommendations. These supplemental justifications were then filed with both the design change package and in Section 4.0 of the NFPA Code Compliance Evaluation report.

Schedule for Completion

The maintenance items and procedural changes required by this Report 09-0120-0123 have been completed except as noted below.

As stated in the November, 1990 NRC Appendix R Inspection Report 50-315/90018 and 50-316/90018, we committed to complete the two design change packages resulting from Report 09-0120-0123 by December 31, 1991. Work activities associated with certain portions of these design change packages are continuing. These two design change packages were RFC 12-3003 for sprinkler system modifications and RFC 12-3004 for detection system modifications.

NFPA 10 - Portable Fire Extinguishers

Justifications have been provided for closeout of some code deviations identified in the report. No design changes were required.

Maintenance Items: Remounted four fire extinguishers. Replaced five fire extinguishers which were no longer properly labeled.

Procedural Changes: Revised procedure to reference Fire Facilities drawings showing fire extinguisher locations.

NFPA 12 - Carbon Dioxide Extinguishing Systems

Justifications have been provided for closeout of some code deviations and a maintenance item identified in the report. No design changes were required.

Maintenance Items: Provided label for manual pull station. Removed obstructions to a CO_2 hose reel. Due to safety concerns, a justification has been prepared for the maintenance item which identified the need to reinstall copper tube pressure vent lines.

Procedural Changes: Revised procedure to annually check liquid level gauges.

NFPA 12A - Halon 1301 Fire Extinguishing Systems

Justifications have been provided for closeout of some code deviations and a maintenance item identified in the report. No design changes or procedural changes were required.

Maintenance Items: Provided labels for manual pull stations. Readjusted the cylinder racking for a system to firmly hold the halon cylinder. System nameplates for the Unit 1 and 2 control room cable vault systems will be provided by the end of 1991. A justification has been prepared for not providing system nameplates for non-Tech. Spec. halon systems.

NFPA 13 - Installation of Sprinkler Systems

Justifications have been provided for closeout of some code deviations identified in the report.

Design Change RFC 12-3003: Redesigned sprinkler piping to relocate obstructed sprinklers and avoid interferences in several locations within the Auxiliary Building and Auxiliary Feedwater Pump Corridor. Modified existing heat collection plates for sprinklers in Auxiliary Building to avoid interference with sidewall sprinkler discharge patterns. Installed two new sprinklers to increase area coverage in the Contractors Access Control Building.

Maintenance Items: Replaced a broken pressure gauge. Replacement of a painted sprinkler will be coordinated to be completed with a similar maintenance item identified under the extended NFPA Code Compliance Evaluation Report 09-0120-0381.

Procedural Changes: Revised procedures to add guidelines on replacement of sprinklers with painted or ornamental finishes.

NFPA 14 - Installation of Standpipe and Hose Systems

Justifications have been provided for closeout of some code deviations identified in the report.

Design Change RFC 12-3003: Installed a new sectionalizing valve in the Auxiliary Building distribution piping to isolate the east hose stations from the west. Although this was not a

specific code compliance deviation identified in the report, the valve has been provided to strengthen the ability to isolate the east hose stations from the west in order to ensure backup fire protection is available.

No maintenance items were required.

No procedural changes were required.

NFPA 15 - Water Spray Fixed Systems

Justifications have been provided for closeout of some code deviations identified in the report. No design changes or maintenance items were required.

Procedural Changes: Procedures need to be revised to verify operability of a charcoal filter unit. The applicable procedures will be revised by the end of 1992.

NFPA 72D - Installation, Maintenance and Use of Proprietary Protective Signaling Systems

Justifications have been provided for closeout of some code deviations identified in the report. No design changes were required.

Maintenance Items: Remounted three manual pull stations. Repaired or replaced improperly mounted valve tamper switch. Actions needed to prevent damage to circuit conductors were completed.

Procedural Changes: Revised procedures to confirm operability of sprinkler system water flow and low air supervisory alarm initiating devices and circuits. Revised procedures to verify reset of these signals received in control room.

Procedures need to be revised to confirm operability of a) hose station manual actuation station devices and circuits and high demand fire pump supervisory devices and circuits, b) to verify reset of these signals received in the control room, c) air flow testing of CFT containment charcoal filter piping and d) loop resistance testing of the RCP line type detectors. The applicable procedures will be revised by the end of 1992.

NFPA 72E - Automatic Fire Detectors

Justifications have been provided for closeout of some code deviations identified in the report.

Design Change RFC 12-3004: Added new ionization smoke detectors to supplement existing area coverage in several locations within the Auxiliary Building. Redesigned the ionization smoke detection systems in the switchgear cable spreading rooms of each unit. Installed a new smoke detection system in the Service Building laydown area and chemical storage room.

Maintenance Items: Cleaning of several detectors were required. Several detectors were missing their locking shells.

Procedural Changes: Procedures need to be revised to verify operability of RCP thermistors by a loop resistance test. The applicable procedures will be revised by the end of 1992.

1.5.2 Extended NFPA Code Compliance Evaluation Report 09-0120-0381

The Extended NFPA Code Compliance Evaluation reviewed the remaining safety related areas of the Cook Nuclear Plant that were not previously reviewed under Report 09-0120-0123. The exact areas of review are given in the report, but generally included the eastern portions of the Unit 1 and 2 Turbine Buildings, Unit 1 and 2 Containments, Unit 1 and 2 Transformer and Turbine Wall Water Spray Systems and the Unit 1 and 2 Diesel Fire Pump Rooms. The NFPA Codes included in this review were NFPA 10, 13, 14, 15, 72D and 72E. Note: NFPA 12 and 12A were not included in the extended evaluation because there were no CO_2 or halon systems included within the scope of the review.

This evaluation also includes engineering justifications along with recommended corrective actions for the noted deficiencies. These justifications appear in Appendix B1, Deviation Evaluation Calculation No. 0120-164-007, of the report. The noted deficiencies requiring corrective actions are described in the "Deviation and Recommendations/Justifications" Tables for each NFPA Code.

Plant design changes, maintenance items and procedural changes which are necessary for the reviewed systems to maintain compliance with the various NFPA Codes are identified below. Some of the maintenance items were corrected under the plant's ongoing maintenance and surveillance program.

Note: During the course of implementing the plant design changes, additional engineering walkdowns and design reviews will be performed. Some of these design change activities may lead to the formation of additional supplemental justifications which may remove a recommendation. These supplemental justifications will then be filed with both the design change package and Appendix B2 of the Extended NFPA Code Compliance Evaluation report.

Schedule for Completion

The design changes noted below are scheduled for completion by the end of 1994. Maintenance items and procedural changes are scheduled for completion by the end of 1992 unless otherwise noted below.

NFPA 10 - Portable Fire Extinguishers

Design Changes: Provide additional new fire extinguishers to meet recommended travel distances. Revise Fire Facility drawings accordingly to show these changes. Note: This design change is much simpler than the other design changes noted below and will be completed earlier than the end of 1994 date given above.

Maintenance Items: Corrective actions have been taken for extinguishers that were obstructed, required relocation to their designated location and required proper markings to indicate fire extinguisher placement. This item is considered closed.

Procedural Changes: Revised the surveillance procedures to include additional surveillance criteria to ensure extinguishers are unobstructed. Procedures need to be revised to include the remaining surveillance criteria identified by the report.

NFPA 13 - Installation of Sprinkler Systems

Design Changes: Install additional hangers. Install missing sprinklers and new sprinklers under obstructions. Relocate existing sprinklers to within proper distance from ceiling.

Maintenance Items: Provide a valve operator to a sectionalizing valve. Realign sprinkler nozzles. Replace several improperly installed sprinklers.

Maintenance Item: Replace painted sprinklers and remove any covers (plastic bags) which were not removed after painting. Work is to be completed by the end of 1993. Although sprinklers will be replaced, a review of the issue is provided in the report that indicates that this is not a significant problem.

No procedural changes are required.

NFPA 14 - Installation of Standpipe and Hose Systems

No design changes, maintenance items or procedural changes are required.

Calculations: Provide hydraulic calculations for the standpipe and hose systems to demonstrate compliance with the code design requirements when supplied from the new water supply and fire pump system being installed under RFC 12-3065 and from the existing diesel fire pumps only. Work is to be completed by the end of 1992.

NFPA 15 - Water Spray Fixed Systems

No design changes, maintenance items or procedural changes are required.

Calculations: Provide hydraulic calculations for the water spray suppression systems to demonstrate compliance with the code design requirements when supplied from the new fire pumps and existing diesel fire pumps and accounting for system modifications being performed under RFC 12-3065. Work is to be completed by the end of 1992.

NFPA 72D - Installation, Maintenance and Use of Proprietary Protective Signaling Systems

No design change or maintenance items are required.

Procedure Change: Revise the containment charcoal filter (CFT) unit surveillance procedure to verify piping integrity. Procedure change to be completed by the end of 1992.

Procedure Change: Revise the reactor coolant pump thermistor detection system surveillance procedure to perform loop resistance testing. Procedure change to be completed by the end of 1992.

NFPA 72E - Automatic Fire Detectors

No design change or maintenance items are required.

Procedure Change: Revise the reactor coolant pump the detection system surveillance procedure to perform lo resistance testing. (Note: Same recommendation as th Procedure Change under NFPA 72D.) Procedure change t completed by the end of 1992.

1.5.3 NFPA 20 Code Compliance Evaluation

The NFPA 20 Code Compliance Evaluation reviewed the installation of the plant fire pumps. The fire pumps in this study were the two high demand diesel fire pu: gpm rating), the two high demand electric fire pumps rating) and the one low demand electric fire pump (50 rating). This evaluation also includes the engineeri justifications for the noted deficiencies. These justifications appear in the section-by-section revie: NFPA 20 code. As described in Section 4.0 of the Cod Compliance Evaluation, plant design change (RFC 12-30 required to upgrade the battery capacity of each dies fire pump. This design change is scheduled to be com the end of 1994.

The correspondence section of the report (Attachment provides a chronology of the actions taken to resolve deficiency identified in Section 4.0 and any other re pump issues.

AEPSC's NFPA Code Compliance Evaluation report was al. independently reviewed by a consultant (ABB Impell). consultant's concerns were addressed and did not resu. additional design or procedural changes or the genera: new maintenance items.

Under a plant design change (RFC 12-3065) a new fire water supply (two aboveground storage tanks) and thre pumps (2500 gpm rating each) are being designed and i. The new fire pumps are designed to provide adequate f. fighting capability even with one pump inoperable. H order to maintain operational flexibility, the existi: fire pumps (2000 gpm rating each) will be maintained normally isolated position. The water supply for the 2000 gpm fire pumps is Lake Michigan. The existing e. driven fire pumps will be removed from service upon c of the design change. The NFPA 20 Code Compliance ev: will be revised once the new fire protection water su system becomes operational to reflect the design chan design change is scheduled to be operational by April

1.5.4 NFPA 30 Code Compliance Evaluation

The NFPA 30 Code Compliance Evaluation reviewed the s flammable liquids within the plant. This review incl specifically designed for the storage of these liquid: flammable liquid storage room in the service building miscellaneous oil storage room in the turbine buildin use of flammable liquid storage cabinets located thro plant. The requirements of Appendix A to BTP APCSB 9 Section D.2(d) are specific only to the storage of fl liquids. These requirements provided the guidance in determining the direction the code review would follo

This evaluation also includes engineering justifications along with recommended corrective actions for the noted deficiencies. These justifications appear in the section-by-section review of the NFPA 30 code. The noted deficiencies requiring corrective actions are described in Section 4.0 of the Code Compliance Evaluation. The correspondence section of the report (Attachment 6.1) provides a chronology of the actions taken to resolve the noted deficiencies identified in Section 4.0. Supplemental justifications which have resulted from the corrective actions are also contained in Attachment 6.1.

Plant design changes, maintenance items and procedural changes are required as identified below.

Design Change: Provide a second exit in the Miscellaneous Oil Storage Room, Fire Zone 89 (02-PM-836). This design change is scheduled for completion by the end of 1993.

Design Change: Provide a drainage system for the Miscellaneous Oil Storage Room and the Flammable Liquid Storage Room, Fire Zone 131, meeting both NFPA 30 and environmental requirements (12-PM-819). This change is scheduled for completion by the end of 1993.

Design Change: Modify existing HVAC system ductwork in the Flammable Liquid Storage Room (12-PM-819). This change is scheduled for completion by the end of 1993.

Maintenance Item: Repaired or replaced 3 flammable liquid storage cabinets. This maintenance item has been completed.

Maintenance Item: Removal of excess flammable liquid storage cabinets from Fire Zones 51 and 43. A justification has been prepared for this item and the issue is considered closed.

Procedure Change: Prepare a fire pre-plan for the Flammable Liquid Storage Room. This fire pre-plan will be completed by the end of 1991.

2.0 FIRE PROTECTION ON NFPA CODE COMPLIANCE REVIEWS

The following documents AEPSC Fire Protection's position on the nee perform NFPA Code Compliance Reviews on NFPA 17, 80, 90A and 232.

2.1 NFPA 17 - Dry Chemical Extinguishing Systems

Position: A code compliance review is not required.

Commitment Issue: The applicable fire suppression systems hav designed and installed in accordance with NFPA 17. (This comm was made in AEPSC's Response to Appendix A to BTP APCSB 9.5-1, II.A.5, dated January 31, 1977.)

Reasons: The fire suppression systems referred to in this com are the dry chemical extinguishing systems for the turbine bea the Units 1 and 2 turbine generators. These systems are locat the Turbine Building at elevation 633'. They are not technica specification systems, and the equipment they protect is not s related. There are no other dry chemical extinguishing system. installed at the plant. For these reasons, a review of these against the requirements of NFPA 17 is not considered necessar

2.2 NFPA 80 - Fire Doors and Windows

Position: A code compliance review is not required.

Commitment Issue: NRC inspection (50-315 & 50-316/82-08-15) identified that fire door assemblies for the Units 1 and 2 Wes Driven Auxiliary Feedwater Pump Rooms were not rated fire door assemblies and had not been fire tested to demonstrate their f resistance capabilities. In addition, the doors were not desi installed in accordance with NFPA 80.

Reasons: The unrated doors referred to in the commitment were provided for missile and jet impingement protection from the T Building. Since the time of the commitment, manual rolling fi. having a three-hour rating have also been installed in order t achieve the required three-hour rating for the enclosures.

Engineering evaluations for other non-rated fire door assembli fire area boundaries have been prepared and have found them to acceptable. They are presently contained in Chapters 7 and 9 Safe Shutdown Capability Assessment (SSCA) report which demons our Appendix R compliance. These fire doors are also identifi the Fire Hazards Analysis (FHA).

The NRC reviewed the fire door placements and ratings during t. review for compliance with Appendix A to BTP 9.5-1. In additi field reviews by the NRC, AEPSC responded to questions concern. fire door installations and ratings (refer to the NRC Appendix Questions/Positions, Question No. 9). The NRC concluded in th July, 1979 SER that with the installation and upgrade of certa. doors, the fire doors are provided or committed, where necessa: accordance with the provisions of Appendix A and, therefore, acceptable.

Commitment Issue: NRC inspection (50-315 & 50-316/82-08-17) identified two concerns over the qualification of safety relat door assemblies. First is the use of non-listed fire door fra Second is the degrading of the door's fire resistance rating d modifications made to the door.

Reasons: While this commitment does not specifically identify NFPA 80, it does reference basic requirements of a fire door. This issue has already been addressed through plant-wide reviews performed by UL and NUTECH engineers. These reviews centered around Tech Spec required fire doors and frames and their compliance with NFPA 80. The noted deficiencies were corrected or appropriate justifications have been prepared. AEPSC's response to these inspection items and the UL and NUTECH reports provides complete documentation of the issue and closeouts. This documentation is maintained by Architectural Design.

The above reasons show that the Tech Spec related fire doors have already been reviewed: 1) by the NRC for placement and rating, 2) by two consultants for compliance with NFPA 80, and 3) for evaluating the impact that non-rated fire doors have on safe shutdown when installed in fire area boundaries. Therefore, another review of NFPA 80 does not appear to be justified in providing any beneficial gain above the previous reviews or code related items which may not have been specifically addressed.

2.3 NFPA 90A - Installation of Air Conditioning and Ventilating Systems

Position: A code compliance review is not required.

Commitment Issue: Several fire dampers were found without their required fire rating label even though they were purchased as Class "A" fire rated dampers and that the frames were designed to NFPA 90A. (This commitment was made in a letter from W.G. Smith (IMPC) to Keppler (NRC) dated September 1, 1982.)

Reasons: Engineering evaluations for non-rated fire dampers in the fire area boundaries have been prepared and have found them to be acceptable. They are presently contained in Chapters 7 and 9 of the SSCA. These fire dampers are also identified in the FHA. The NRC's acceptance of our deviation request for deviations to providing fire dampers is given in their letter of August 17, 1985, from S.A. Varga (NRC) to J.E. Dolan (AEPSC).

During review of NFPA 72E under Report No. 09-0120-0123, the code requirements for the installation of smoke detectors in the Auxiliary Building HVAC units have been addressed.

Additionally, the NRC reviewed the HVAC system design and fire damper installations during their review for compliance with Appendix A to BTP 9.5-1. In addition to field reviews by the NRC, AEPSC responded to several questions concerning the HVAC system (refer to the NRC Appendix A 53 Questions/Positions, Question Nos. 2, 14 and 27). The NRC concluded in their July, 1979 SER that with the addition and upgrade of certain fire dampers, the dampers are provided or committed, where necessary, in accordance with the provisions of Appendix A and, therefore, acceptable.

AEPSC's review of NRC I.E. Information Notice 83-69 concluded that all of the fire dampers have a fire rating equal to or better than specified. Additionally, the dampers were inspected for installation and found to be acceptable following the completion of ongoing RFCs.

Based on the above, it is shown that technical specification related fire dampers and HVAC system design have already been reviewed by the NRC for damper placements, ratings and system design; reviewed by AEPSC for rating and installation; reviewed by a consultant for fire detectors in the Auxiliary Building HVAC systems; and evaluated to determine the impact of non-rated fire dampers in fire area

ATTACHMENT 2 TO

AEP:NRC:0692BY

NFPA CODE COMPLIANCE REVIEW

(IN BINDERS)

ABB Impell Report 09-0120-0123, "NFPA Code Compliance Evaluation," Revision 0, dated May, 1988, Volumes Nos. I, IV and V.

ABB Impell Report 09-0120-0381, "Extended NFPA Code Compliance Evaluation," Revision 1, dated January, 1991.

AEPSC, "NFPA 20 Code Compliance Evaluation", Revision 0, dated December, 1988.

AEPSC, "NFPA 30 Code Compliance Evaluation", Revision 0, dated June, 1990.

ATTACHMENT 3 TO

AEP:NRC:0692BY

JUSTIFICATION FOR PRESENT ALARM

CIRCUIT DESIGN WITHOUT ELECTRICAL SUPERVISION

The portions of the system outside the control rooms that are not supervised in accordance with NFPA 72D include water flow and sprinkler supervisory alarm initiating circuits and alarm signals between the local control panels and the control room. As documented in the NFPA 72D Code Compliance Report, the following alarm signals are not supervised to the requirements of NFPA 72D:

- CO_2 system Cardox and Alison control panel alarm and trouble signals,
- Reactor coolant pump (RCP) panel alarm and trouble signals,
- Containment cable tray detection panel alarm and trouble signals,
- Halon system Alison and Pyrotronics control panel alarm and trouble signals
- alarm initiating circuits for water flow,
- sprinkler supervisory (valve tamper and low air pressure switches) signals, and
- fire pump signals

The detection system alarm and trouble signals of the CO_2, RCP and containment cable tray systems interface with the control room via Alison control panels. The suppression system alarm and trouble signals of the CO_2 systems interface with the control rooms via Cardox control panels. The control room cable vault halon systems signals interface with the control rooms via Alison control panels. The plant computer room halon system signals interface with the control rooms via Pyrotronics low voltage System 3 control panels.

The NFPA Code Compliance Report also documents that the fire detection system alarm initiating circuits and the CO_2 and halon suppression system actuation (i.e., solenoids) circuits are properly supervised as required by their respective local control panel.

A properly supervised circuit as defined by NFPA 72D, Sections 3-9 and 3-10, is a circuit that verifies operability of the circuit by indicating a trouble condition at the associated control panel for both open circuit and ground fault conditions. The NFPA Code Compliance review identified that the annunciator circuits associated with the EF panels are not electrically supervised to detect open circuits or wire breaks. These annunciator circuits are properly supervised for detecting ground fault conditions. A review of our licensing documents indicates that we have committed to comply with the requirement to supervise for open circuits for only the fire detection systems. The NRC accepted this position in their SER for Appendix A to BTP APCSB 9.5-1, dated July 31, 1979.

Two of the 53 Appendix A follow-up questions posed by the NRC addressed circuit supervision. These questions were Numbers 16 and 53. Information was presented that identified those portions of the overall fire alarm system that were supervised. The Appendix A requirement for circuit supervision is limited to fire detection systems only. This was the commitment position taken by AEPSC as given in the response to Question 16b. The Appendix A SER also refers to only circuit supervision in the context of fire detection systems. The Appendix A SER states that the NRC "reviewed the fire detection system's design criteria and the basis to ensure that it conforms to the applicable sections of NFPA 72D, for Class B supervised circuits". Therefore, it is interpreted that the only NFPA 72D requirements for circuit supervision to which Cook Nuclear Plant is committed are for fire detection systems.

The Alison local detection control panels transmit signals to annunciator logic cabinets located behind the main control board containing the EF panel. The Cardox suppression system control panels and the Pyrotronics System 3 control panels for the computer rooms also transmit signals to the annunciator logic cabinets located behind the main control board. These annunciator logic cabinets transmit unsupervised alarm signals to the front of the EF panels. Since the signals between the logic cabinets and the EF panels run through the common enclosure of the control room horseshoe panel, they are not required to be supervised per Section 2-7.1.

The routine surveillance testing performed for the detection and suppression actuation and initiating circuits described above also comply with the requirements of NFPA 72D Section 2-4.3.d with the exception of the RCP systems. Section 2-4.3.d requires testing to be performed every six months. Alarms sent to the control rooms which are not electrically supervised are checked every six months. The RCP systems are functionally tested every 18 months due to the fact that the detection and suppression actuation devices are located within containment and are normally not accessible during plant operation. The function tests include checking for alarms at the local control panels and those sent to the control rooms. Operations also performs a once-per-shift visual examination of all fire panels. This examination includes checking for alarms and actuations which may have occurred. During a meeting held on November 1 and 2, 1989, at the Cook Nuclear Plant, Messrs. D. Kubicki of the NRC and B. J. Gerwe of AEPSC discussed the surveillance testing program.

Mr. Kubicki indicated that the current surveillance practices being implemented for the fire detection and suppression systems met the intent of the code and were considered acceptable.

Although the fire detection and suppression systems are being properly surveilled, all water flow and sprinkler supervisory devices (valve tamper and low air pressure switches) are not being verified as required by NFPA 72D. Justification for acceptance of these conditions is discussed below.

1) All of the water flow alarm devices and circuits, with the exception of the training buildings and technical support center (TSC), are verified for operability by simulated or actual flow test methods in accordance with plant procedures. The training buildings and TSC are non-safety related areas of the plant and have no impact on the operation of the plant.

2) The valve tamper alarm signals are not verified for receipt of a trouble signal in the control room during the performance of the valve cycling testing. However, the valves are inspected for correct position monthly by procedure. This inspection fulfills the intent of the valve tamper switch trouble signal.

contained within the enclosure of the control room horseshoe control panel. Section 2-7.1 does not require supervision of wiring within a common enclosure. Since the control room horseshoe panel is considered to be a common enclosure, this wiring need not be supervised.

#9201080214

NFPA 30 Code Compliance Evaluation

For

Donald C. Cook Nuclear Plant

Units 1 and 2

Indiana Michigan Power Company

Prepared by:

Piping, Valves, HVAC & Fire Protection Section

American Electric Power Service Corporation

Report Initiated

June, 1990

Storage Rooms Performed By:
P.J. Russell
Nuclear Engineering Department
PH&F Section

Storage Cabinets Performed By:
D.P. Ritzenthaler
Nuclear Engineering Department
PH&F Section

Approved By: 7/25/90
J.D. Grier
Nuclear Engineering Department
PH&F Section Manager

Table of Contents

1.0 Introduction

1.1 Overview

This binder contains the results of American Electric Power Service Corporation's (AEPSC) review of the Cook Nuclear Plant's storage of flammable and combustible liquids for its compliance with the National Fire Protection Association (NFPA) Codes. This code compliance review specifically deals with the combustible oil storage room, the flammable liquid storage room and the portable flammable liquid storage cabinets located within the plant. These rooms (Miscellaneous Oil Storage Room and Flammable Liquids Storage Room) and storage cabinets have been evaluated against NFPA 30 "Flammable and Combustible Liquids Code".

1.2 Background

In developing our Fire Protection Commitment Data Base, It was found that AEPSC had committed to NFPA 30. AEPSC engineers were assigned to review, evaluate and justify code compliance issues for this code. The results of their reviews are contained in this report.

1.3 Scope of Work

This analysis evaluates the dedicated flammable and combustible liquid storage rooms as well as the portable storage cabinets installed at the Donald C. Cook Nuclear Plant to the requirements of NFPA 30. The 1987 edition of NFPA 30 was the edition under which the rooms and cabinets have been initially evaluated. The 1987 edition year was chosen so that the rooms and cabinets would be reviewed against the most current code requirements.

The dedicated storage rooms are to be evaluated against the code requirements to determine compliance, noncompliance and open items. Deviations are to be reevaluated to determine whether each item could be deemed acceptable "as installed" based upon credited plant procedures or past practices at the plant. Deviations and open items which cannot be justified on these bases or on changes to the specific code requirements in later editions, are then to be evaluated based on engineering judgements, calculations, analysis of plant design features, field reviews, etc. In instances where the deviation cannot be justified, modifications are to be made to the systems. All justifications, evaluations and recommended modifications are described in the code compliance verification checklist portion of this report.

The areas of the plant that have been reviewed include:

- Unit 2 Turbine Building Miscellaneous Oil Storage Room (Fire Zone (FZ) 89).

- Service and Office Building Flammable Liquid Storage Room (FZ 131).

- Portable flammable liquid storage cabinet locations in the Auxiliary and Turbine Buildings.

The scope of this review is limited to these areas since they are the only areas where flammable liquids are stored or where combustible liquids are dispensed. It was determined that AEPSC's commitment in our 1977 Response to Appendix A to BTP APCSB 9.5-1, Section D.2.(d), dealt with flammable liquids only. Therefore, only the flammable liquids room (FZ 131) and the flammable liquid storage cabinets need be included in the scope of this review. However, in the practice of good fire protection engineering, the Miscellaneous Oil Storage room (FZ 89) has been included in this scope because of the dispensing operations which take place within this room.

Two chapters of NFPA 30 are not applicable to the Donald C. Cook Nuclear Plant. These chapters are as follows:

- Chapter 2 "Tank Storage".

- Chapter 3 "Piping, Valves and Fittings".

Chapter 2 does not apply since no permanent flammable liquid tanks exist within the security boundary. Likewise, Chapter 3 does not apply since no flammable liquid piping systems are installed within the Cook Nuclear Plant's security boundary.

Combustible oil storage tanks were not evaluated against this code since no commitments were made by AEPSC to install these systems within the NFPA 30 requirements.

Future modifications to the flammable and combustible liquid storage rooms are to be evaluated for NFPA 30 code compliance. Any noted deviations and/or justifications will be documented and contained within this report. Future storage of flammable and combustible liquids within the portable cabinets will remain under the control of plant procedure PMI-2270.

1.4 Fire Protection Systems Reviewed

The fire protection systems which have been reviewed are identified below:

Fire Area	Fire Zone	Unit	Description
B	89	2	Miscellaneous Oil Storage Room Sprinklers
B	131	1&2	Flammable Liquid Storage Room Sprinklers

Note: The review of the sprinkler systems in these areas was limited to only the sprinklers and piping network within the identified rooms.

1.5 General Assumption

This report utilized the following general assumption shown below:

(1) Specifications and drawings were used to evaluate the piping, fittings and miscellaneous hardware used in the storage rooms to confirm compliance with the requirements of the appropriated NFPA codes in effect at the time of this review.

(2) Workmanship and construction practices during of installation the systems complied with the code requirements in effect at the time.

(3) It is assumed that all surveillance tests and procedures are properly implemented.

2.0 Purpose

The purpose of NFPA 30 is "to reduce the hazard (flammable and combustible liquid storage) to a degree consistent with reasonable public safety, without undue interference with public convenience and necessity which require the use of flammable and combustible liquids. Thus, compliance with this standard does not eliminate all hazards in the use of flammable and combustible liquids".

With this statement in mind, it should be understood that it is recognized that the flammable and combustible liquids storage rooms as well as the portable storage cabinets installed at Donald C. Cook Nuclear Plant do not meet this standard verbatim. It is also recognized that these areas are not below the level of safety prescribed per NFPA 30, as demonstrated by this report. The fire protection "defense-in-depth" (as described within this text) philosophy assures plant safety.

3.0 Methodology

NFPA 30 was broken down into two distinct categories (storage rooms and storage cabinets). The Piping, Valves, HVAC and Fire Protection Section of the Nuclear Engineering Department was tasked with evaluating both of these categories.

NFPA 30 was reviewed in depth to determine which sections specifically addressed the ability of the storage facilities. Code sections covering topics, such as; information only, references to other NFPA codes, construction or equipment arrangement and nonrelevant types of occupancies were not included in this evaluation as these subjects do not affect the ability of the storage facilities.

The storage room portion of this review was performed by both a field walkdown (see NFPA 30 Walkdown Checklist portion of this binder (attachment 3)) and a document search. A summary of these results is contained in the NFPA 30 Compliance Evaluation portion of this binder.

This evaluation lists the applicable code sections; whether the installed systems did/did not comply or if the code sections were not applicable to the installed system; and comments or justifications for each noncomplying/not applicable section. This evaluation also has an additional column to identify the documents reviewed for verification of the specific code sections. One can see that each paragraph of the code was evaluated for compliance/noncompliance.

The storage cabinet portion of this review was performed by a field walkdown (see Storage Cabinet Walkdown portion of this binder (attachment 3)). A summary of these results is contained in the NFPA 30 Compliance Evaluation portion of this binder. This evaluation lists the applicable code sections; whether the installed systems did/did not comply or if the code sections were not applicable to the installed system; and comments or justifications for each noncomplying/not applicable section. This evaluation also has an additional column to identify the documents reviewed for verification of the specific code sections. Once again, one can see that all applicable paragraphs were evaluated for compliance/noncompliance.

In addition to the above mentioned portions of this binder, there also exists a "correspondence" section (attachment 1), as well as a section that contains a copy of the 1987 edition of NFPA 30 (attachment 2).

4.0 Conclusions/Recommendations

This evaluation concluded that flammable/combustible liquid storage areas of the Donald C. Cook Nuclear Plant are generally in compliance with NFPA 30. The storage areas were evaluated against the code requirements of the edition year identified to determine compliance, noncompliance, and open items. Deviations were reevaluated to determine whether each item could be deemed acceptable "as installed" based upon credited plant procedures or past practices at the plant. Deviations and open items which could not be justified are identified within this text and their recommendations are identified below.

4.1 1987 Code Edition Year (1989-90 Review Year)

4.1.1 Section 1.5, 4-4.2.1, 5-3.2.5 - Provide a second exit in the Miscellaneous Oil Storage Room, FZ 89. This exit shall be located in the west wall. The exit door need not be fire rated. The exit door should contain a window (similar to the door in the Flammable Liquid Storage Room, FZ-131) to provide explosion relief, heat and smoke venting. The exit shall be installed in accordance with NFPA 101, "Life Safety Code".

4.1.2 Sections 4-3.2 and 4-3.2.1 - Portable flammable liquid cabinets numbered 131-2, 69-1 and 44N-1 shall be repaired or replaced so that they meet the requirements of this code.

4.1.3 Section 4-4.2.5, 5-3.4.1 - A drainage system shall be provided for the Flammable Liquid Storage Room and the Miscellaneous Oil Storage Room. This drainage system shall meet the requirements of this code as well as all environmental requirements.

4.1.4 Section 5-5.4.1 - A fire pre-plan shall be written for the Flammable Liquid Storage Room.

4.1.5 Section 4-3.1 - Remove 3 cabinets from Fire Zone 51 and 1 cabinet from Fire Zone 43 so that we remain in compliance with this section.

4.1.6 Section 4-4.2.11 - Install necessary ductwork onto the existing HVAC inlet and exhaust of the flammable liquid storage room so that they meet the requirements stated in this section. Exhaust from the room should be directed to the exterior of the building without recirculation.

5.0 References

5.1 1987 Code Edition Year (1989-1990 Review Year)

1.	Drawing #2-4047-8	Turbine and Heater Bay Areas Basement Plan	6-29-81
2.	Drawing #1-4045-15	Turbine and Heater Bay Areas El. 591'-0" and 595'-0" Basement Plan	1-26-86
3.	FHA	Fire Hazards Analysis Rev. 4	1-31-90
4.	Drawing #12-4018-A-42	Door Schedule	7-16-87
5.	Drawing #12-4019-18	Door Schedule	1-16-87
6.	SSCA	Safe Shutdown Capability Assessment, Proposed Modifications and Evaluations, Rev. 1	12-86
7.	Fire Pre-Plans	Fire Pre-Plans	9-20-85
8.	Drawing #12-5681-A	New Oil Storage Room Turbine Building Unit 2	6-5-81
9.	PMI-2270	Fire Protection	4-24-89
10.	Drawing 1-5179-19	Station Drainage	5-1-90
11.	Drawing 2-5179-10	Station Drainage	4-17-79

Attachment 6.1

NFPA 30 Correspondence

NFPA 30 Code Compliance Evaluation

For

Donald C. Cook Nuclear Plant

Units 1 and 2

Indiana Michigan Power Company

AEP
INDIANA
MICHIGAN
POWER

Date November 18, 1991

Subject Fire Protection Code Compliance Review

From P.H. Jacques

To B.J. Gerwe

Per your request I have reviewed the status of Plant implementation of maintenance items and procedure revisions as outlined in the Code Compliance Review, Expanded Code Compliance Review, NFPA 30 Compliance Review and ESW Pump Room Area Extinguishers. With the exception of the items listed below all maintenance items and procedure revisions have been completed.

NFPA 30 Code Compliance

P.J. Russell memo dated June 29, 1990

Status

Complete

P.J. Russell memo dated July 2, 1990

Status

To be completed by Operations Department per your discussion with A. Puplis.

P.J. Russell memo dated July 10, 1990

Status

In some fire zones there are more than three flammable liquid cabinets. In these areas flammable liquid cabinets are used to store Class A combustibles such as cleaning materials, aerosols, grease, etc. We consider this to be an acceptable practice and monitor the additional cabinets on a regular basis.

Code Compliance Review - Impell Report No. 09-0120-0123

NFPA ~~13~~ 12A, Paragraph 1-9.5.6

BJH 11-20-91

Status

Signs will be made for the Unit 1 and Unit 2 Halon systems by December 31, 1991.

NFPA 72D, Paragraph 2034, 4052

Status

Plant procedures will be revised or new procedures developed to verify that alarms are received in the Control Room from those Auxiliary Building standpipes that are fed from piping equipped with a flow alarm or are controlled by ZMO-10 and ZMO-20 by June 1, 1992.

NFPA 12, Paragraph 1625

Status

The vent lines referred to in this item were not part of the original installation and will not be reinstalled for safety reasons. In the event of a blockage in any part of the vent line pressure can back up through the back side of the pilot valves opening the valves and allowing an uncontrolled discharge of CO2 into all of the areas connected to the vent line.

NFPA 13, Paragraphs 3-16.2.2, 3-16.3.5, 3-16.9.2

Status

This item will be completed with the Expanded Code Compliance review items.

NFPA 72D, Paragraph 2042 Item b.

Status

Relocation of fire detectors or installation of protective guards will require a design change.

FOR JUSTIFICATION OF THIS ITEM SEE 11-14-91 MEMO BY B.J. GERWE. BJH 11-20-91

Expanded Code Compliance Review
Impell Report No. 09-0120-0381

NFPA 10, Paragraph 4-3.2

Status

Procedure 12 SHP 2270 FIRE.001 has been revised to verify that fire extinguishers are clear. On fire extinguishers the operating instructions are applied by the manufacturer as is the hanging bracket. Since the extinguisher can only be hung one way we will not change the procedure. The monthly inspection is the document that verifies that the extinguisher has been inspected. The inspection procedures meet NFPA criteria.

NFPA 13, Paragraph 1041

Status

A walk down of the sprinklers will be completed and the sprinklers realigned as needed by December 31, 1992.

Valve 1-FP-196 was installed without a hand wheel. A determination will have to be made on whether one can be added without a design change.

Paragraph 3612

Status

A field walk down will be conducted and sprinkler heads changed as required by December 31, 1992.

Paragraphs 3681, 3682, 3683

Status

This item will be completed in 1992 or 1993 depending on budget allocation.

Paragraph 4143

Status

A walk down will be completed and sprinklers installed per applicable drawings by December 31, 1992.

NFPA 72D, Paragraphs 2034, 4052

Status

Procedures for the testing of the CFT Charcoal Filter Units will be completed by the start of the 1992 refueling outages for each unit.

ESW Extinguishers

Status

Per your request we have verified that the fire extinguishers in the ESW Pump Room area are all ABC Dry Chemical extinguishers.

P.H. Jacques

c: P.F. Carteaux
File

To: PAT J. RUSSELL@NED@AEPSC
John E Rutkowski@MANAGERIAL@COOK
James T Wojcik@MANAGERIAL@COOK,Scott T Ritts@ENV@COOK
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Eric C Mallen@ENV@COOK
Bcc:
From: Diane M Fitzgerald@ENV@COOK
Subject: Oil Room Floor Drains
Date: Friday, November 30, 1990 8:23:06 EST
Attach:
Certify: N
Forwarded by:

The purpose of this message is to summarize the various discussions, regulatory interpretations, and inspections which have occurred as a result of your July 12, 1990 memo regarding NFPA Code 30 compliance in the Cook Plant Miscellaneous Oil Storage Rooms.

It is recognized that the various environmental regulations which apply to the storage of oil and hazardous chemicals are all designed to ensure that spills are contained. To the contrary, NFPA Code 30 requires that drainage systems be provided to direct flammable liquids to a safe location. I&M and AEPSC Environmental personnel consulted regarding this regulatory dichotomy agreed that in cases such as this we must simply "do what we can" to comply with the intent of the both regulations.

Based on this philosophy, three options were discussed:

1. Routing floor drain flow within the rooms to new collection tanks
2. Installing CO2 fire suppression systems in the rooms
3. Providing curbs around the floor drains

Although cost estimates were not specifically calculated for the first two options, they were dismissed as viable options because of their impracticality, for a number of reasons. While there are some drawbacks to the installation of curbs around the floor drains, it was agreed that they would provide a reasonable amount of protection in the event of drum rupture, would allow for flow of fire protection water from the rooms, and would be relatively inexpensive to install.

Based on our meeting on November 29, I understand you will proceed with the curb design discussed with the Utility Crew (who work in the rooms), and will have the work package added to the existing plant modification to provide ventilation upgrades to the rooms. Please provide me with the drawings of the proposed curb design when they become available, and we'll see that they are reviewed by interested parties at the plant. Let me know if you need any more assistance on this project.

AEP
AMERICAN ELECTRIC POWER

Date November 15, 1990

Subject Cook Nuclear Plant
NFPA 30 Code Compliance
Flammable Liquid Storage Room

From P.J. Russell PJR 11-15-90

To 1) H.W. Young/M.R. Sanghavi MRS 11/15
2) NFPA 30 Code Compliance Report

As you know, Section 4-4.2.11 of NFPA 30 (1987 edition) requires us to exhaust air from a point within 12" of the Flammable Liquid Storage Room's floor with make-up inlets being located within 12" of the floor on the opposite side of the room. It is my understanding that you have initiated a plant modification (12-PM-819) to upgrade the existing HVAC configuration within this room to meet the intent of Section 4-4.2.11. One exception we are taking to Section 4-4.2.11 is the lack of an airflow switch interlocked to sound an audible alarm upon failure of the ventilation system. A justification allowing this deviation follows.

Per Attachment 1 (page 5 of 14) of Procedure 1-OHP-4030.001.001, this room is to be toured by the plant operators. One of the specifics that operators are to look for is that the HVAC fan is running (procedure step no. 2). Since operators are continuously checking the fan (once per shift), we feel that we already comply with the intent of this section of NFPA 30.

Please attach a copy of this memo to 12-PM-819 for historical records. Return the original to me so that the NFPA 30 Code Compliance Evaluation can be updated.

Concurrence: B.J. Gerwe, F.P. Engineer

RJR/gh

cc: R.L. Shoberg
J.D. Grier/B.J. Gerwe/P.J. Russell
File: NFPA 30 Code Compliance Evaluation

PIPING, HVAC

NOV 14 1990

FIRE PROTECTION

AEP
INDIANA MICHIGAN POWER

Date November 12, 1990

Subject Containment Requirements

From D. M. Fitzgerald

To D. L. Baker
C. E. Hawk

The purpose of this memo is to request an evaluation of proposed alternative means of containment for oil, polluting materials and hazardous waste at two locations at the Cook Plant.

Specifically, we utilize the Service Building Miscellaneous Oil Storage Room and Turbine Building Oil Storage Room for the storage of bulk oils, solvents, and other flammable/combustible liquids. The Service Building Miscellaneous Oil Storage Room is also used for temporary hazardous waste storage.

The floor drains in these rooms are routed to the Turbine Room Sump, however, they are plugged. The doorways to these rooms are also elevated at least 5 inches from the floor level to provide containment capacity within the rooms.

P. J. Russell of AEPSC Piping, HVAC and Fire Protection has informed us that the floor drain plugs must be removed to comply with Section 5-3.4.1. of NFPA Code 30. This code requires that drainage systems be provided to direct flammable or combustible leakage and fire protection water to a safe location.

Two alternate means of compliance were suggest by Russell:

- provide curbs around the drains
- provide a separate drainage tank for the runoff.

Considering the tank size required for the second option (able to contain the largest expected flammable and/or combustible liquid leak and simultaneous fire protection water discharge), the curbing option appears more desirable and more easily implemented (the curbs do, however, present a tripping hazard and create drum maneuvering difficulties.) Both Mr. Russell and myself welcome other suggestions for containment which will still comply with the NFPA Code.

Intra-System

Until a more desirable option is found, however, my specific question relates to whether the curbing option complies with the applicable environmental regulations. The regulations to be considered include, at a minimum;

40 CFR 112
40 CFR 265
Michigan Admin. Code Part 5, Rule 323
Michigan Act 64 Rules

In my own research on this matter, it was found that Rule 323.115 states that a containment area shall be so constructed that no liquid polluting material can escape therefrom by gravity through sewers, drains... to the surface water or ground waters of the state. Provided that we were able to provide sufficient capacity per the regulations, does this clause in and of itself preclude the use of curbs, since the polluting material would reach the groundwater in the event of drum rupture and fire system actuation?

Perhaps we can get together and brainstorm this issue. I would like to give P. Russell an answer by the end of November. Thanks in advance for your help.

/js

c: J. E. Rutkowski
J. T. Wojcik
[redacted]
Environmental Section Route

To: JEANETTE M. FITZPATRICK@NED@AEPSC
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Scott T Ritts@ENV@COOK,John P Carlson@ENV@COOK
Paul H Jacques@S_and_A@COOK
Bcc:
From: Diane M Fitzgerald@ENV@COOK
Subject: Floor Drains
Date: Friday, November 2, 1990 14:43:54 EST
Attach:
Certify: N
Forwarded by:

Pat Russell says you are the "lucky" member of his group to have a LAN terminal---please pass this message along to him. Thanks.

As we discussed the other day, we recognize the need to remove the floor drain plugs from the drains in the Service Building and Turbine Building Misc. Oil storage rooms, for fire protection reasons. We also agreed that constructing curbs around the floor drains in these rooms would allow large quantities of fire protection water to drain from the room to the Turbine Room Sump in the event of system actuation, but would also serve to contain run of the mill oil or chemical spills in the room. One drawback to the curbing is that they will make it more difficult to maneuever drums within the rooms (possible tripping hazard?)

However, in researching the regulations regarding the containment volume required, I'm not sure whether this design would comply with the regs. (For example, Michigan regulations addressing oil spillage containment require that "the area be so constructed that no oil can escape therefrom by gravity through sewers, drains or otherwise...to the surface or ground waters of the state.") I will ask our corporate Environmental staff for their opinion on this, and let you know the outcome. How about replacing the fire protection system in these rooms with a CO2 system????

AEP
AMERICAN
ELECTRIC
POWER

Date July 12, 1990

Subject Cook Nuclear Plant
NFPA 30 Code Compliance Evaluation

From P.J. Russell PJR 7-12-90

To D. Fitzgerald - Bridgman

Section 5-3.4.1 of NFPA 30, "Flammable and Combustible Liquid Code," requires that drainage systems be provided to direct flammable or combustible leakage and fire protection water to a safe location. During our NFPA 30 Code Compliance Evaluation, we noted that the drains within the flammable and combustible liquid storage rooms are plugged.

Since we have committed to meet the requirements of NFPA 30 in our 1977 response to Appendix A of BTP APCSB 9-5.1, we recommend that these plugs be removed. Obviously, once the drains are unplugged, we are exposing ourselves to the environmental concerns of allowing oils into the Turbine Building drainage system. We offer the following compromises so that both (environmental and fire protection) concerns are adequately covered.

- Provide a 2 1/4" curb around the open drain so that the largest expected flammable and/or combustible leak will not spill into the drainage system unless the fire protection system simultaneously discharges (Attachment 1). Obviously, the chances of this scenario occurring are remote. The fire pre-plans can be revised to include a section on the environmental concerns of a fire and simultaneous oil spill in these areas. The pre-plans can also include the clean-up actions needed if this scenario does, in fact, occur, or

- provide a separate drainage tank for the largest expected flammable and/or combustible liquid leak and simultaneous fire protection water discharge.

To assure that all environmental concerns are adequately addressed and that we meet the requirements of NFPA 30, we recommend that you review our proposals and initiate an acceptable design change to unplug the existing drains within the Flammable Liquid Storage Room (Fire Zone 131)

and the Miscellaneous Oil Storage Room (Fire Zone 89). Please initiate this design change by December 1, 1990. If you should have any questions or require additional information, please contact me at extension 2532.

P.J. Russell

PJR/gh

cc: A.A. Blind - Bridgman
P.H. Jacques - Bridgman
R.L. Shoberg
J.D. Grier/B.J. Gerwe/P.J. Russell
[redacted]

Attachment 1
Page 1 of 3

NEF-6.4A
(5/89)

CALCULATION ANALYSIS

Nuclear Engineering Department

PH&F SECTION SHEET 1 OF 3

I.D. NO. DCC-FP-12-MC07F

PLANT Cook Nuclear Plant UNIT 1 & 2

SAFETY RELATED YES ___ NO X

SYSTEM Fire Protection

COMPANY I&M

TITLE Drainage Adequacy In Flammable & Combustible Storage Areas.

CALCULATED BY: PJ Russell 7-12-90 DATE

FILE LOCATION PH&F Calc File

CHECKED BY: [signature] 7/13/90 DATE

MICROFILM NO. ___

APPROVED BY: [signature] 7/13/90 DATE

PROBLEM DESCRIPTION: Determine if a 24" inch curb is sufficient to keep the largest expected flammable and/or combustible liquid spill from entering the Turbine Bldg. drainage system.

DESIGN BASIS OR REFERENCES: see body of calc.

METHOD OF VERIFICATION: Recalculated

REVISIONS

NO.	REASON FOR CHANGE	PREP'D BY	DATE	CKD. BY	DATE	APVD. BY	DATE

METHOD OF VERIFICATION: ___

Dec-FP-12-M&OTF

(2-83)
GE-8(C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET 2 OF 2
DATE 7-12-90 BY PJR CK. WWR
COMPANY AEPSC G.O. N/A
PLANT D.C. Cook Nuclear Plant

SUBJECT Curb depth needed for largest spill within Flammable Liquid Storage Room (FZ 13)

PURPOSE: The purpose of this calculation is to determine if a 2¼" curb is sufficient to keep the largest expected spill from entering the Turbine Bldg. drainage system.

ASSUMPTIONS: ① Largest spill occurs when a complete collapse of the 55 gal. drum rack stge. occurs and every drum on the rack opens.
② 18 drums exist on the 18 position drum rack.

REFERENCES: Drwg. 1-4045-15

Calculations:

Room size ⇒ 19 ft x 41 ft ≈ 779 ft²

Spill size ⇒ 18 drums x 55 gal./drum = 990 gallons.

GIVEN: ① 2¼ inch curb exists around drain
② 7.48 gallons exist per ft³

Available Spill Volume = 779 ft² x (2¼ inch x 1 ft / 12 inch) = 146.06 ft³

How many gallons will fit?

146 ft³ x 7.48 gal/ft³ = 1,092.55 gallons

Conclusion

990 gallons < 1,092.55 gallons
therefore the spill is contained

23(9-83)
RM GE-8 (C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

DATE 7-12-90 BY [illegible] CK. DPK
COMPANY AEPSC G.O. N/A
PLANT D.C. Cook Nuclear Plant

SUBJECT Curb depth needed for largest spill within Miscellaneous Oil Stge. Rm. (FZ 89)

Purpose: The purpose of this calculation is to determine if a 2 1/4 inch curb is sufficient to keep the largest expected spill from entering the Turbine Bldg. drainage system.

Assumptions: (1) Largest spill occurs when a complete collapse of the 55 gal. drum rack stge. occurs and every drum on the rack spills.
(2) 12 drums exist on the 12 position drum rack.

References: Drwg. 2-4047-8

Calculations: GIVEN: 2 1/4 inch curbs; 7.48 gallons exist per ft^3

room size => 18.83 ft x 42 ft ≈ 791 ft^2

Available spill volume => $791\ ft^2 \times \left(2\tfrac{1}{4}\ inch \times \frac{1\ ft}{12\ inch}\right) = 148.31\ ft^3$

spill size (gallons) => $12\ drums \times 55\ \frac{gal}{drum} = 660$ gallons

How many gallons will fit in available spill volume?

$148\ ft^3 \times 7.48\ \frac{gal}{ft^3} = 1{,}107$ gallons

Conclusion:

660 gallons < 1,107 gallons
therefore the spill is contained

AEP
AMERICAN ELECTRIC POWER

12-PMA 819
PMDL #5
Pg. 1 OF 1

Date July 11, 1990

Subject Donald C. Cook Nuclear Plant
NFPA 30 Code Compliance
Flammable Liquid Storage Room

From P.J. Russell PJR 7-11-90

To 1) J.D. Grier
2) H.W. ~~Young~~ MRS 7/16/90

As you know, we have committed to meet the requirements of NFPA 30 in our 1977 response to Appendix A of BTP APCSB 9-5.1. Section 4-4.2.11 of this code requires us to exhaust air from a point within 12 inches of the Flammable Liquids Storage Room's floor with make-up inlets being located within 12 inches of the floor on the opposite side of the room. Exhaust from the room should be directed to the exterior of the building without recirculation. Obviously, these requirements are to prevent the accumulation of flammable vapors within the storage room.

During our NFPA 30 Code Compliance Walkdown of this area, we noted that we do not meet these HVAC requirements. To assure that the accumulation of flammable vapors does not occur within this room, we recommend that you initiate a design change to make necessary upgrades to the Flammable Liquid Storage Room's HVAC system. The proposed HVAC system shall include all of the requirements stated in Section 4-4.2.11 of NFPA 30. Please initiate this design change by December 1, 1990. If you should have any questions or require additional information for this design change, please contact me at extension 2532.

PJR/jmf

cc: R.L. Shoberg
B.J. Gerwe/P.J. Russell
File: NFPA 30 Code Compliance Evaluation

CODE ALSO, REQUIRES THE HVAC FAN FAILURE ALARM. BUT ACCORDING TO P. J. RUSSELL IT WILL BE COVERED UNDER CODE COMPLIANCE REVIEW SEPERATELY AND IS NOT PART OF THIS PM.

M. R. Sanghavi. 10/1/90

P. J. Russell
CONCURRANCE — F.P.E.

CC: P. J. RUSSELL

Intra-System

AEP
AMERICAN. ELECTRIC POWER

Date July 11, 1990

Subject Donald C. Cook Nuclear Plant
NFPA 30 Code Compliance Evaluation
Flammable Liquid Storage Room

From P.J. Russell PJR 7-11-90

To J.R. Rosing

Section 1-5 of NFPA 30 "Flammable and Combustible Liquid Code" requires that egress from flammable and combustible liquid storage areas be in accordance with NFPA 101 "Life Safety Code". Section 29-2.4.1 of NFPA 101 requires that every structure used for storage have at least two separate means of egress as remote from each other as practicable. During our NFPA 30 Code Compliance Evaluation, we noted that we do not meet this requirement in Fire Zone (FZ) 89 (Miscellaneous Oil Storage Room).

Since we have committed to meet the requirements of NFPA 30 in our 1977 response to Appendix A of BTP APCSB 9-5.1, we recommend that you initiate a design change to install another exit in the west wall of FZ 89. The exit door need not be fire rated. The exit door should contain a window (similar to the door in the Flammable Liquid Storage Room, FZ 131) to provide explosion relief, heat and smoke venting. The exit shall be installed in accordance with NFPA 101, Section 29.

Please initiate the design change by December 1, 1990. If you should have any questions or require additional information, please contact me at extension 2532.

PJR/jmf

DESIGN CHANGE
02-PM-836

cc: R.L. Shoberg
J.D. Grier/B.J. Gerwe/P.J. Russell
File: NFPA 30 Code Compliance Evaluation

AEP
AMERICAN ELECTRIC POWER

Date July 11, 1990 .

Subject Donald C. Cook Nuclear Plant
NFPA 30 Code Compliance
Flammable Liquid Storage Room

From P.J. Russell PJR 7-11-90

To 1) J.D. Grier
2) H.W. Young

As you know, we have committed to meet the requirements of NFPA 30 in our 1977 response to Appendix A of BTP APCSB 9-5.1. Section 4-4.2.11 of this code requires us to exhaust air from a point within 12 inches of the Flammable Liquids Storage Room's floor with make-up inlets being located within 12 inches of the floor on the opposite side of the room. Exhaust from the room should be directed to the exterior of the building without recirculation. Obviously, these requirements are to prevent the accumulation of flammable vapors within the storage room.

During our NFPA 30 Code Compliance Walkdown of this area, we noted that we do not meet these HVAC requirements. To assure that the accumulation of flammable vapors does not occur within this room, we recommend that you initiate a design change to make necessary upgrades to the Flammable Liquid Storage Room's HVAC system. The proposed HVAC system shall include all of the requirements stated in Section 4-4.2.11 of NFPA 30. Please initiate this design change by December 1, 1990. If you should have any questions or require additional information for this design change, please contact me at extension 2532.

PJR/jmf

cc: R.L. Shoberg
B.J. Gerwe/P.J. Russell
File: NFPA 30 Code Compliance Evaluation

Note: This is to be accomplished by
12-PM-819
PJR 7-11-90

Intra-System

AEP
AMERICAN ELECTRIC POWER

Date July 10, 1990

FOR CLOSEOUT SEE 11-18-91 MEMO FROM P. H. JACQUES TO B. J. GERWE

Subject Donald C. Cook Nuclear Plant
NFPA 30 Code Compliance
Flammable Liquid Cabinets

From P.J. Russell PJR 7-10-90

To P.H. Jacques

Section 4-3.1 of NFPA 30 "Flammable and Combustible Liquids Code" requires that not more than three storage cabinets can be located in a single fire area, except when, the cabinets are separated by at least 100 ft. During our NFPA 30 Code Compliance Evaluation, we noted that we do not meet this requirement in Fire Zones (FZ) 43 and 51. Currently, FZ 43 contains 4 cabinets while FZ 51 contains 6 cabinets.

Since we have committed to meet the requirements of NFPA 30 in our 1977 response to Appendix A of BTP APCSB 9-5.1, we recommend that you remove one storage cabinet from FZ 43 and three cabinets from FZ 51. If you should have any questions or require additional information, please contact me at extension 2532.

PJR/jmf

cc: A.A. Blind- Bridgman
J. Carlson - Bridgman
R.L. Shoberg RLS
J.D. Grier/B.J. Gerwe/P.J. Russell
File: NFPA 30 Code Compliance Evaluation

AEP
AMERICAN ELECTRIC POWER

Date July 2, 1990

REFER TO 11-18-91 MEMO FOR STATUS. MEMO FROM P.H. JACQUES TO B.J. GERWE.

Subject Donald C. Cook Nuclear Plant
NFPA 30 Code Compliance

From P.J. Russell 7-2-90

To P.H. Jacques - Bridgman

Section 5-5.4.1 of NFPA 30 "Flammable and Combustible Liquids Code" requires that we have an emergency action plan established for the Flammable Liquid Storage Room. During our NFPA 30 Code Compliance Evaluation, we noted that we do not meet this requirement.

Since we have committed to meet the requirements of NFPA 30 in our 1977 response to Appendix A of BTP APCSB 9-5.1, we recommend that you revise the fire pre-plans so that they specifically address the Flammable Liquids Storage Room. The pre-plan shall include all of the requirements included in Section 5-5.4.1 of NFPA 30. If you should have any questions or require additional information, please contact me at extension 2532.

PJR/jmf

cc: A.A. Blind - Bridgman
R.L. Shoberg
J.D. Grier/B.J. Gerwe/P.J. Russell
File: NFPA 30 Code Compliance Evaluation

AEP
AMERICAN ELECTRIC POWER

Date June 29, 1990

FOR CLOSEOUT SEE 11-18-91 MEMO FROM P. H. JACQUES TO B. J. GERWE.

Subject Donald C. Cook Nuclear Plant
NFPA 30 Code Compliance
Portable Flammable Liquid Cabinets

From P.J. Russell PJR 6-29-90

To P.H. Jacques - Bridgman

As you know, we have committed to meet the requirements of NFPA 30 in our 1977 response to Appendix A of BTP APCSB 9-5.1. Sections 4-3.2 and 4-3.2.1 of this code require that portable storage cabinets remain tightly closed. During our NFPA 30 Code Compliance Walkdown of the plant's cabinets we noted some deviations to these requirements. Cabinet number 131-2 was noted to have a broken handle and cabinets 44N-1 and 69-1 would not remain closed due to inadequate latches.

To assure that all portable flammable liquid cabinets meet the requirements of NFPA 30, we recommend that you take the necessary steps to either repair or replace these cabinets. Please respond to us in writing when these cabinets are upgraded into compliance so that we can update the Code Compliance Evaluation. If you should any questions or require additional information, please contact me at extension 2532.

PJR/jmf

cc: A.A. Blind - Bridgman
R.L. Shoberg
J.D. Grier/B.J. Gerwe/P.J. Russell/D.P. Ritzenthaler
File: NFPA 30 Code Compliance Evaluation

Attachment 6.2

NFPA 30 (1987 Edition)

NFPA 30 Code Compliance Evaluation

For

Donald C. Cook Nuclear Plant

Units 1 and 2

Indiana Michigan Power Company

NFPA 30

Flammable and Combustible Liquids Code

1987 Edition

This edition of NFPA 30, *Flammable and Combustible Liquids Code*, was prepared by the Technical Committee on Flammable and Combustible Liquids, released by the Correlating Committee on Flammable Liquids, and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 18-21, 1987 in Cincinnati, Ohio. It was issued by the Standards Council on July 17, 1987, with an effective date of August 7, 1987, and supersedes all previous editions.

The 1987 edition of this standard has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

Origin and Development of NFPA 30

From 1913 to 1957, this standard was written in the form of a municipal ordinance known as the *Suggested Ordinance for the Storage, Handling and Use of Flammable Liquids.* In 1957, the format was changed from a municipal ordinance to a Code, although the technical provisions were retained. During the 71-year existence of this suggested ordinance and code, numerous editions have been published as conditions and experiences have dictated.

Recent editions of NFPA 30 include 1977, 1981, 1984, and this 1987 edition. In 1984, the chapter on automotive and marine service stations was removed from NFPA 30 and was rewritten as an individual code, NFPA 30A, *Automotive and Marine Service Station Code.* In 1987, Chapter 5 (Industrial Plants), Chapter 6 (Bulk Plants and Terminals), Chapter 7 (Processing Plants), and Chapter 8 (Refineries, Chemical Plants, and Distilleries) were combined into a single chapter entitled "Operations."

Committee on Flammable Liquids

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E. I. duPont de Nemours & Co.

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(Rep. Textile Care Allied Trades Assn.)
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(Rep. Alliance of American Insurers)
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Russell C. Opferkuch, Joseph E. Seagram & Sons Inc.
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(Alternate to J. D. Kieffer)

Nonvoting

Michael B. Moore, U.S. Occupational Safety & Health Admin.
Richard F. Murphy, Exxon Research & Engineering Co.
(Rep. NFPA Foam Comm.)
Terence P. Smith, U.S. Occupational Safety & Health Admin.
(Alternate to M. B. Moore)

Robert P. Benedetti, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted time, changes in the membership may have occurred.

NOTE: Membership on a Committee shall not in and of itself constitute an endorsement of the Association or any document developed by the Committee on which the member serves.

Contents

NFPA 30

Flammable and Combustible Liquids Code

1987 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates explanatory material on that paragraph in Appendix A.

Information on referenced publications can be found in Chapter 6 and Appendix G.

Foreword

This standard, known as the *Flammable and Combustible Liquids Code*, is recommended for use as the basis of legal regulations. Its provisions are intended to reduce the hazard to a degree consistent with reasonable public safety, without undue interference with public convenience and necessity which require the use of flammable and combustible liquids. Thus, compliance with this standard does not eliminate all hazards in the use of flammable and combustible liquids. See the *Flammable and Combustible Liquids Code Handbook* for additional explanatory information.

Chapter 1 General Provisions

1-1 Scope and Application.

1-1.1 This code applies to all flammable and combustible liquids except those that are solid at 100°F (37.8°C) or above.

1-1.2 Requirements for the safe storage and use of the great variety of flammable and combustible liquids commonly available depend primarily on their fire characteristics, particularly the flash point, which is the basis for the several classifications of liquids as defined in Section 1-2. It should be noted that the classification of a liquid can be changed by contamination. For example, filling a Class II liquid into a tank which last contained a Class I liquid can alter its classification, as can exposing a Class II liquid to the vapors of a Class I liquid via an interconnecting vapor line (*see 2-2.6.4 and 2-3.5.6*). Care shall be exercised in such cases to apply the requirements appropriate to the actual classification.

1-1.3 The volatility of liquids is increased by heating. When Class II or Class III liquids are exposed to storage conditions, use conditions or process operations where they are naturally or artificially heated to or above their flash points, additional requirements may be necessary. These requirements include consideration for such items as ventilation, exposure to ignition sources, diking, and electrical area classification.

1-1.4 Additional requirements may be necessary for the safe storage and use of liquids that have unusual burning characteristics, that are subject to self-ignition when exposed to the air, that are highly reactive with other substances, that are subject to explosive decomposition, or have other special properties that dictate safeguards over and above those specified for a normal liquid of similar flash point classification.

1-1.5 In certain installations the provisions of this code may be altered at the discretion of the authority having jurisdiction after consideration of the special features such as topographical conditions, barricades, walls, adequacy of building exits, nature of occupancies, proximity to buildings or adjoining property and character of construction of such buildings, capacity and construction of proposed tanks and character of liquids to be stored, nature of process, degree of private fire protection to be provided, and the adequacy of facilities of the fire department to cope with flammable or combustible liquid fires.

1-1.6 Existing plants, equipment, buildings, structures, and installations for the storage, handling, or use of flammable or combustible liquids that are not in strict compliance with the terms of this code may be continued in use at the discretion of the authority having jurisdiction provided they do not constitute a recognized hazard to life or adjoining property. The existence of a situation that might result in an explosion or sudden escalation of a fire, such as inadequate ventilation of confined spaces, lack of adequate emergency venting of a tank, failure to fireproof the supports of elevated tanks, or lack of drainage or dikes to control spills may constitute such a hazard.

1-1.7 This code shall not apply to:

1-1.7.1 Transportation of flammable and combustible liquids. These requirements are contained in the U.S. Department of Transportation regulations or in NFPA 385, *Standard for Tank Vehicles for Flammable and Combustible Liquids.*

1-1.7.2 Storage, handling, and use of fuel oil tanks and containers connected with oil burning equipment. These requirements are covered separately in NFPA 31, *Standard for the Installation of Oil Burning Equipment.*

1-1.7.3 Storage of flammable and combustible liquids on farms and isolated construction projects. These requirements are covered separately in NFPA 395, *Standard for the Storage of Flammable and Combustible Liquids on Farms and Isolated Construction Projects.*

1-1.7.4 Liquids without flash points that can be flammable under some conditions, such as certain halogenated hydrocarbons and mixtures containing halogenated hydrocarbons. (*See NFPA 321, Standard on Basic Classification of Flammable and Combustible Liquids.*)

1-1.7.5 **Mists, sprays, or foams.** (*Except flammable aerosols in containers, which are included in Chapter 4.*)

1-1.8 Installations made in accordance with the applicable requirements of standards of the National Fire Protection Association: NFPA 32, *Standard for Drycleaning Plants;* NFPA 33, *Standard for Spray Appli-*

cation Using Flammable and Combustible Materials; NFPA 34, *Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids;* NFPA 35, *Standard for the Manufacture of Organic Coatings;* NFPA 36, *Standard for Solvent Extraction Plants;* NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines;* NFPA 45, *Standard for Fire Protection for Laboratories Using Chemicals;* and Chapter 10 of NFPA 99, *Standard for Health Care Facilities,* shall be deemed to be in compliance with this code.

1-1.9 Metrication. If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is regarded as the requirement. The given equivalent value may be approximate.

1-2 Definitions.

Aerosol. A material that is dispensed from its container as a mist, spray, or foam by a propellant under pressure.

Apartment House. A building or that portion of a building containing more than two dwelling units.

Approved. Acceptable to the "authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment, or material nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Assembly Occupancy. All buildings or portions of buildings used for gathering 50 or more persons for such purposes as deliberation, worship, entertainment, dining, amusement, or awaiting transportation.

Atmospheric Tank. A storage tank that has been designed to operate at pressures from atmospheric through 0.5 psig (760 mm Hg through 786 mm Hg) measured at the top of the tank.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

Barrel. A volume of 42 U.S. gal (158.9 L).

Basement. A story of a building or structure having $\frac{1}{2}$ or more of its height below ground level and to which access for fire fighting purposes is unduly restricted.

Boiling Point. The temperature at which a liquid exerts a vapor pressure of 14.7 psia (760 mm Hg). Where an accurate boiling point is unavailable for the material in question, or for mixtures that do not have a constant boiling point, for purposes of this code the 10 percent point of a distillation performed in accordance with ASTM D 86-82, *Standard Method of Test for Distillation of Petroleum Products,* may be used as the boiling point of the liquid.

Boil-Over. An event in the burning of certain oils in an open top tank when, after a long period of quiescent burning, there is a sudden increase in fire intensity associated with expulsion of burning oil from the tank. Boil-over occurs when the residues from surface burning become more dense than the unburned oil and sink below the surface to form a hot layer, which progresses downward much faster than the regression of the liquid surface. When this hot layer, called a "heat wave," reaches water or water-in-oil emulsion in the bottom of the tank, the water is first superheated, and subsequently boils almost explosively, overflowing the tank. Oils subject to boil-over consist of components having a wide range of boiling points, including both light ends and viscous residues. These characteristics are present in most crude oils, and can be produced in synthetic mixtures.

NOTE: A boil-over is an entirely different phenomenon from a slop-over or froth-over. Slop-over involves a minor frothing, which occurs when water is sprayed onto the hot surface of a burning oil. Froth-over is not associated with a fire but results when water is present or enters a tank containing hot viscous oil. Upon mixing, the sudden conversion of water to steam causes a portion of the tank contents to overflow.

Bulk Plant or Terminal. That portion of a property where liquids are received by tank vessel, pipelines, tank car, or tank vehicle, and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipeline, tank car, tank vehicle, portable tank, or container.

Chemical Plant. A large integrated plant or that portion of such a plant other than a refinery or distillery where liquids are produced by chemical reactions or used in chemical reactions.

Closed Container. A container as herein defined, so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures.

Combustible Liquids. See Liquids.

Container. Any vessel of 60 U.S. gal (227 L) or less capacity used for transporting or storing liquids.

Crude Petroleum. Hydrocarbon mixtures that have a flash point below 150°F (65.6°C) and that have not been processed in a refinery.

Distillery. A plant or that portion of a plant where liquids produced by fermentation are concentrated, and where the concentrated products may also be mixed, stored, or packaged.

Dwelling. A building occupied exclusively for residence purposes and having not more than two dwelling units or as a boarding or rooming house serving not more than 15 persons with meals or sleeping accommodations or both.

Dwelling Unit. One or more rooms arranged for the use of one or more individuals living together as a single housekeeping unit, with cooking, living, sanitary, and sleeping facilities.

Educational Occupancy. The occupancy or use of a building or structure or any portion thereof by persons assembled for the purpose of learning or of receiving educational instruction.

Fire Area. An area of a building separated from the remainder of the building by construction having a fire resistance of at least 1 hr and having all communicating openings properly protected by an assembly having a fire resistance rating of at least 1 hr.

Flammable Aerosol. An aerosol that is required to be labeled "Flammable" under the U.S. Federal Hazardous Substances Labeling Act.

Flash Point. The minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitible mixture with air near the surface of the liquid within the vessel as specified by appropriate test procedure and apparatus as follows:

(a) The flash point of a liquid having a viscosity less than 45 SUS at 100°F (37.8°C) and a flash point below 200°F (93°C) shall be determined in accordance with ASTM D 56-82, *Standard Method of Test for Flash Point by the Tag Closed Tester.*

(b) The flash point of a liquid having a viscosity of 45 SUS or more at 100°F (37.8°C) or a flash point of 200°F (93°C) or higher shall be determined in accordance with ASTM D 93-80, *Standard Method of Test for Flash Point by the Pensky Martens Closed Tester.*

(c) As an alternate, ASTM D 3828-81, *Standard Methods of Tests for Flash Point of Petroleum and Petroleum Products by Setaflash Closed Tester*, may be used for testing aviation turbine fuels within the scope of this procedure.

(d) As an alternate, ASTM D 3278-82, *Standard Method of Tests for Flash Point of Liquids by Setaflash Closed Tester*, may be used for paints, enamels, lacquers, varnishes, and related products and their components having flash points between 32°F (0°C) and 230°F (110°C), and having a viscosity lower than 150 stokes at 77°F (25°C).

(e) As an alternate, ASTM D 3828-79, *Standard Test Methods for Flash Point of Liquids by Setaflash Closetl Tester*, may be used for materials other than those for which specific Setaflash Methods exist (cf., ASTM D 3243-77 for aviation turbine fuels and ASTM D 3278-78 for paints, enamels, lacquers, varnishes, related products, and their components).

Hazardous Material or Hazardous Chemical. Material presenting dangers beyond the fire problems relating to flash point and boiling point. These dangers may arise from but are not limited to toxicity, reactivity, instability, or corrosivity.

Hazardous Reaction or Hazardous Chemical Reaction. Reactions that result in dangers beyond the fire problems relating to flash point and boiling point of either the reactants or of the products. These dangers may include but are not limited to toxic effects, reaction speed (including detonation), exothermic reaction, or production of unstable or reactive materials.

Hotel. Buildings or groups of buildings under the same management in which there are sleeping accommodations for hire, primarily used by transients who are lodged with or without meals, including but not limited to inns, clubs, motels, and apartment hotels.

Incidental Liquid Use or Storage. Use or storage as a subordinate activity to that which established the occupancy or area classification.

Institutional Occupancy. The occupancy or use of a building or structure or any portion thereof by persons harbored or detained to receive medical, charitable, or other care or treatment, or by persons involuntarily detained.

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Liquid. For the purpose of this code, any material that has a fluidity greater than that of 300 penetration asphalt when tested in accordance with ASTM D 5-78, *Test for Penetration for Bituminous Materials.* **When not otherwise identified, the term *liquid* shall mean both flammable and combustible liquids.**

Combustible Liquid. A liquid having a flash point at or above 100°F (37.8°C).

Combustible Liquids shall be subdivided as follows:

Class II liquids shall include those having flash points at or above 100°F (37.8°C) and below 140°F (60°C).

Class IIIA liquids shall include those having flash points at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB liquids shall include those having flash points at or above 200°F (93°C).

Flammable Liquid. A liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 lbs per sq in. (absolute) (2,068

mm Hg) at 100°F (37.8°C) shall be known as a Class I liquid.

Class I liquids shall be subdivided as follows:

Class IA shall include those having flash points below 73°F (22.8°C) and having a boiling point below 100°F (37.8°C).

Class IB shall include those having flash points below 73°F (22.8°C) and having a boiling point at or above 100°F (37.8°C).

Class IC shall include those having flash points at or above 73°F (22.8°C) and below 100°F (37.8°C).

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

Low-Pressure Tank. A storage tank designed to withstand an internal pressure above 0.5 psig (3.5 kPa) but not more than 15 psig (103.4 kPa) measured at the top of the tank.

Mercantile Occupancy. The occupancy or use of a building or structure or any portion thereof for the displaying, selling, or buying of goods, wares, or merchandise.

Occupancy Classification. The system of defining the predominant operating characteristic of a portion of a building or plant for purposes of applying relevant sections of this Code. This may include but is not limited to distillation, oxidation, cracking, and polymerization.

Office Occupancy. The occupancy or use of a building or structure or any portion thereof for the transaction of business, or the rendering or receiving of professional services.

Operating Unit (Vessel) or Process Unit (Vessel). The equipment in which a unit operation or unit process is conducted.

Operations. A general term that includes but is not limited to the use, transfer, storage, and processing of liquids.

Outdoor Occupancy Classification. Similar to occupancy classification except that it applies to outdoor operations not enclosed in a building or shelter.

Portable Tank. Any closed vessel having a liquid capacity over 60 U.S. gallons (227 L) and not intended for fixed installation.

Pressure Vessel. Any fired or unfired vessel within the scope of the applicable section of the ASME *Boiler and Pressure Vessel Code.*

Process or Processing. An integrated sequence of operations. The sequence may be inclusive of both physical and chemical operations, unless the term is modified to restrict it to one or the other. The sequence may involve, but is not limited to preparation; separation; purification; or change in state, energy content, or composition.

Protection for Exposures. Fire protection for structures on property adjacent to liquid storage. Fire protection for such structures shall be acceptable when located either within the jurisdiction of any public fire department, or adjacent to plants having private fire brigades capable of providing cooling water streams on structures on property adjacent to liquid storage.

Refinery. A plant in which flammable or combustible liquids are produced on a commercial scale from crude petroleum, natural gasoline, or other hydrocarbon sources.

Safety Can. An approved container, of not more than 5 gal (18.9 L) capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.

Separate Inside Storage Area. A room or building used for the storage of liquids in containers or portable tanks, separated from other types of occupancies. Such areas may include:

Inside Room. A room totally enclosed within a building and having no exterior walls.

Cut-Off Room. A room within a building and having at least one exterior wall.

Attached Building. A building having only one common wall with a building having other type occupancies.

Service Stations.

Automotive Service Station. That portion of property where liquids used as motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles and shall include any facilities available for the sale and service of tires, batteries, and accessories, and for minor automotive maintenance work. Major automotive repairs, painting, body and fender work are excluded.

Marine Service Station. That portion of a property where liquids used as fuels are stored and dispensed from fixed equipment on shore, piers, wharves, or floating docks into the fuel tanks of self-propelled craft, and shall include all facilities used in connection therewith.

Service Station Located Inside Buildings. That portion of an automotive service station lo-

cated within the perimeter of a building or building structure that also contains other occupancies. The service station may be enclosed or partially enclosed by the building walls, floors, ceilings, or partitions, or may be open to the outside. The service station dispensing area shall mean that area of the service station required for dispensing of fuels to motor vehicles. Dispensing of fuel at manufacturing, assembly, and testing operations is not included within this definition.

Stable Liquid. Any liquid not defined as unstable.

Unit Operation or Unit Process. A segment of a physical or chemical process that may or may not be integrated with other segments to constitute the manufacturing sequence.

Unstable Liquid. A liquid which, in the pure state or as commercially produced or transported, will vigorously polymerize, decompose, undergo condensation reaction, or will become self-reactive under conditions of shock, pressure, or temperature.

Vapor Pressure. The pressure, measured in lb per sq in. (absolute), exerted by a volatile liquid as determined by ASTM D 323-82, *Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)*.

Vapor Processing Equipment. Those components of a vapor processing system designed to process vapors or liquids captured during filling operations at service stations, bulk plants, or terminals.

Vapor Processing System. A system designed to capture and process vapors displaced during filling operations at service stations, bulk plants, or terminals by use of mechanical and/or chemical means. Examples are systems using blower-assist for capturing vapors, and refrigeration, absorption, and combustion systems for processing vapors.

Vapor Recovery System. A system designed to capture and retain, without processing, vapors displaced during filling operations at service stations, bulk plants, or terminals. Examples are balanced-pressure vapor displacement systems and vacuum-assist systems without vapor processing.

Ventilation. As specified in this code, ventilation is for the prevention of fire and explosion. It is considered adequate if it is sufficient to prevent accumulation of significant quantities of vapor-air mixtures in concentration over one-fourth of the lower flammable limit.

Warehouses.

General-Purpose Warehouse. A separate, detached building or portion of a building used only for warehousing-type operations.

NOTE: Warehousing operations referred to above are those operations not accessible to the public and include general purpose, merchandise, distribution, and industrial warehouse-type operations.

Liquid Warehouse. A separate, detached building or attached building used for warehousing-type operations for liquids.

Wharf. Any dock, pier, bulkhead, or other structure over or contiguous to navigable water with direct physical access from land, the primary function of which is the transfer of liquid cargo in bulk between shore installations and any tank vessel, such as ship, barge, lighter boat, or other mobile floating craft.

1-3 Storage. Liquids shall be stored in tanks or in containers in accordance with Chapter 2 or Chapter 4.

1-4 Pressure Vessel. All new pressure vessels containing liquids shall comply with 1-4.1, 1-4.2, or 1-4.3, as applicable.

1-4.1 Fired pressure vessels shall be designed and constructed in accordance with Section I (Power Boilers), or Section VIII, Division 1 or Division 2 (Pressure Vessels), as applicable, of the 1983 ASME *Boiler and Pressure Vessel Code*.

1-4.2 Unfired pressure vessels shall be designed and constructed in accordance with Section VIII, Division 1 or Division 2, of the 1983 ASME *Boiler and Pressure Vessel Code*.

1-4.3 Fired and unfired pressure vessels that do not conform to 1-4.1 or 1-4.2 may be used provided approval has been obtained from the state or other governmental jurisdiction in which they are to be used. Such pressure vessels are generally referred to as "State Special."

1-5 Exits. Egress from buildings and areas covered by this code shall be in accordance with NFPA *101®*, *Life Safety Code®*.

Chapter 2 Tank Storage

2-1 Design and Construction of Tanks.

2-1.1 Materials. Tanks shall be designed and built in accordance with recognized good engineering standards for the material of construction being used, and shall be of steel or approved noncombustible material, with the following limitations and exceptions:

(a) The material of tank construction shall be compatible with the liquid to be stored. In case of doubt about the properties of the liquid to be stored, the supplier, producer of the liquid, or other competent authority shall be consulted.

(b) Tanks constructed of combustible materials shall be subject to the approval of the authority having jurisdiction and limited to:

1. Installation underground, or

2. Use where required by the properties of the liquid stored, or

3. Storage of Class IIIB liquids aboveground in areas not exposed to a spill or leak of Class I or Class II liquid, or

4. Storage of Class IIIB liquids inside a building protected by an approved automatic fire extinguishing system.

(c) Unlined concrete tanks may be used for storing liquids having a gravity of 40 degrees API or heavier. Concrete tanks with special linings may be used for other services provided the design is in accordance with sound engineering practice.

(d) Tanks may have combustible or noncombustible linings.

(e) Special engineering consideration may be required if the specific gravity of the liquid to be stored exceeds that of water or if the tank is designed to contain liquids at a liquid temperature below 0°F (−17.8°C).

2-1.2 Fabrication.

2-1.2.1 Tanks may be of any shape or type consistent with sound engineering design.

2-1.2.2 Metal tanks shall be welded, riveted, and caulked, or bolted, or constructed by use of a combination of these methods.

2-1.3 Atmospheric Tanks.

2-1.3.1 Atmospheric tanks, including those incorporating secondary containment, shall be built in accordance with recognized standards of design *or* approved equivalents. Atmospheric tanks shall be built, installed, and used within the scopes of their approvals or any of the following:

(a) Underwriters Laboratories Inc., *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*, UL142-1981; *Standard for Steel Underground Tanks for Flammable and Combustible Liquids*, UL58-1976; or *Standard for Steel Inside Tanks for Oil Burner Fuel*, UL80-1980.

(b) American Petroleum Institute Standard No. 650, *Welded Steel Tanks for Oil Storage*, Sixth Edition, 1980.

(c) American Petroleum Institute Specifications 12B, *Bolted Tanks for Storage of Production Liquids*, Twelfth Edition, January 1977; 12D, *Field Welded Tanks for Storage of Production Liquids*, Eighth Edition, January 1982; or 12F, *Shop Welded Tanks for Storage of Production Liquids*, Seventh Edition, January 1982.

(d) American Society for Testing and Materials, *Standard Specification for Glass-Fiber Reinforced Polyester Underground Petroleum Storage Tanks*, ASTM D 4021-81.

(e) Underwriters Laboratories Inc., *Standard for Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products*, UL 1316-83.

2-1.3.2 Low-pressure tanks and pressure vessels may be used as atmospheric tanks.

2-1.3.3 Atmospheric tanks shall not be used for the storage of a liquid at a temperature at or above its boiling point.

2-1.4 Low-Pressure Tanks.

2-1.4.1 The normal operating pressure of the tank shall not exceed the design pressure of the tank.

2-1.4.2 Low-pressure tanks shall be built in accordance with recognized standards of design. Low-pressure tanks may be built in accordance with:

(a) American Petroleum Institute Standard No. 620, *Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks*, Fifth Edition, 1982.

(b) The principles of the *Code for Unfired Pressure Vessels*, Section VIII, Division I of the ASME *Boiler and Pressure Vessel Code*, 1983 Edition.

2-1.4.3 Tanks built according to Underwriters Laboratories Inc. requirements in 2-1.3.1 may be used for operating pressures not exceeding 1 psig (6.9 kPa) and shall be limited to 2.5 psig (17.2 kPa) under emergency venting conditions.

2-1.4.4 Pressure vessels may be used as low-pressure tanks.

2-1.5 Pressure Vessels.

2-1.5.1 The normal operating pressure of the vessel shall not exceed the design pressure of the vessel.

2-1.5.2 Storage tanks designed to withstand pressures above 15 psig (103.4 kPa) shall meet the requirements of Section 1-4.

2-1.6 Provisions for Internal Corrosion.

2-1.6.1 When tanks are not designed in accordance with the American Petroleum Institute, American Society of Mechanical Engineers, or the Underwriters Laboratories Inc. Standards, or if corrosion is anticipated beyond that provided for in the design formulas used, additional metal thickness or suitable protective coatings or linings shall be provided to compensate for the corrosion loss expected during the design life of the tank.

2-2 Installation of Outside Aboveground Tanks.

2-2.1 Location with Respect to Property Lines, Public Ways, and Important Buildings on the Same Property.

2-2.1.1 Every aboveground tank for the storage of Class I, Class II, or Class IIIA liquids, (except as provided in 2-2.1.2) and those liquids with boil-over characteristics and unstable liquids, operating at pressures not in excess of 2.5 psig (17.2 kPa) and designed with a weak roof-to-shell seam (*see 2-2.5.3*), or equipped with emergency venting devices that will not permit pressures to exceed 2.5 psig (17.2 kPa), shall be located in accordance with Table 2-1. Where tank spacing is contingent on a weak roof-to-shell seam design, the user shall present evidence certifying such construction to the authority having jurisdiction, upon request.

(a) For the purpose of Section 2-2, a floating roof tank is defined as one that incorporates either:

1. A pontoon or double-deck metal floating roof in an open-top tank in accordance with API Standard 650, or

2. A fixed metal roof with ventilation at the top and roof eaves in accordance with API Standard 650,

and containing a metal floating roof or cover meeting any one of the following requirements:

a. A pontoon or double-deck metal floating roof meeting the requirements of API Standard 650.

b. A metal floating cover supported by liquid-tight metal floating devices that provide sufficient buoyancy to prevent the liquid surface from being exposed when half of the flotation is lost.

(b) An internal metal floating pan, roof, or cover that does not meet the requirements of (a) 2., or one that uses plastic foam (except for seals) for flotation, even if encapsulated in metal or fiberglass, shall be considered a fixed roof tank.

2-2.1.2 Vertical tanks having a weak roof-to-shell seam (*see 2-2.5.3*) and storing Class IIIA liquids may be located at one-half the distances specified in Table 2-1, provided the tanks are not within a diked area or drainage path for a tank storing a Class I or Class II liquid.

2-2.1.3 Every aboveground tank for the storage of Class I, Class II, or Class IIIA liquids, except those liquids with boil-over characteristics and unstable liquids, operating at pressures exceeding 2.5 psig (17.2 kPa) or equipped with emergency venting that will permit pressures to exceed 2.5 psig (17.2 kPa), shall be located in accordance with Table 2-2.

2-2.1.4 Every aboveground tank for storage of liquids with boil-over characteristics shall be located in accordance with Table 2-3. Liquids with boil-over characteristics shall not be stored in fixed roof tanks larger than 150 ft (45.7 m) in diameter, unless an approved inerting system is provided on the tank.

2-2.1.5 Every aboveground tank for the storage of unstable liquids shall be located in accordance with Table 2-4.

2-2.1.6 Every aboveground tank for the storage of Class IIIB liquids, excluding unstable liquids, shall be located in accordance with Table 2-5, except when located within a diked area or drainage path for a tank(s) storing a Class I or Class II liquid. When a Class IIIB liquid storage tank is within the diked area or drainage path for a Class I or Class II liquid, 2-2.1.1 or 2-2.1.2 shall apply.

2-2.1.7 Where two tank properties of diverse ownership have a common boundary, the authority having jurisdiction may, with the written consent of the owners of the two properties, substitute the distances provided in 2-2.2.1 through 2-2.2.6 for the minimum distances set forth in 2-2.1.

2-2.1.8 Where end failure of horizontal pressure tanks and vessels can expose property, the tank shall be placed with the longitudinal axis parallel to the nearest important exposure.

2-2.2 Spacing (Shell-to-Shell) between Any Two Adjacent Aboveground Tanks.

2-2.2.1 Tanks storing Class I, II, or IIIA stable liquids shall be separated in accordance with Table 2-7, except as provided in 2-2.2.2.

2-2.2.2 Crude petroleum tanks having individual capacities not exceeding 126,000 gal (3,000 barrels), when located at production facilities in isolated locations, need not be separated by more than 3 ft (0.90 m).

2-2.2.3 Tanks used only for storing Class IIIB liquids may be spaced no less than 3 ft (0.90 m) apart unless within a diked area or drainage path for a tank storing a Class I or II liquid, in which case the provisions of Table 2-7 apply.

Table 2-1 Stable Liquids (Operating Pressure 2.5 psig or Less) (17.2 kPa)

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way and Shall Be Not Less Than 5 Feet	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property and Shall Be Not Less Than 5 Feet
Floating Roof [See 2-2.1.1(a)]	Protection for Exposures*	½ times diameter of tank	⅛ times diameter of tank
	None	Diameter of tank but need not exceed 175 feet	⅛ times diameter of tank
Vertical with Weak Roof-to-Shell Seam (See 2-2.5.3)	Approved foam or inerting system** on tanks not exceeding 150 feet in diameter***	½ times diameter of tank	⅛ times diameter of tank
	Protection for Exposures*	Diameter of tank	⅓ times diameter of tank
	None	2 times diameter of tank but need not exceed 350 feet	⅓ times diameter of tank
Horizontal and Vertical with Emergency Relief Venting to Limit Pressures to 2.5 psig	Approved inerting system** on the tank or approved foam system on vertical tanks	½ times Table 2-6	½ times Table 2-6
	Protection for Exposures*	Table 2-6	Table 2-6
	None	2 times Table 2-6	Table 2-6

* See definition for "Protection for Exposures."
** See NFPA 69, *Standard for Explosion Prevention Systems.*
*** For tanks over 150 ft in diameter, use "Protection for Exposures" or "None," as applicable.
SI Units: 1 ft = 0.30 m.

Table 2-2 Stable Liquids (Operating Pressure Greater Than 2.5 psig) (17.2 kPa)

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property
Any Type	Protection for Exposures*	1½ times Table 2-6 but shall not be less than 25 feet	1½ times Table 2-6 but shall not be less than 25 feet
	None	3 times Table 2-6 but shall not be less than 50 feet	1½ times Table 2-6 but shall not be less than 25 feet

* See definition for "Protection for Exposures."
SI Units: 1 ft = 0.30 m.

Table 2-3 Boil-over Liquids

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way and Shall Be Not Less Than 5 Feet	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property and Shall Be Not Less Than 5 Feet
Floating Roof [See 2-2.1.1(a)]	Protection for Exposures*	½ times diameter of tank	⅛ times diameter of tank
	None	Diameter of tank	⅛ times diameter of tank
Fixed Roof [See 2-2.1.4(a)]	Approved foam or inerting system**	Diameter of tank	⅛ times diameter of tank
	Protection for Exposures*	2 times diameter of tank	⅜ times diameter of tank
	None	4 times diameter of tank but need not exceed 350 feet	⅜ times diameter of tank

* See definition for "Protection for Exposures."
** See NFPA 69, *Standard for Explosion Prevention Systems.*
SI Units: 1 ft = 0.30 m.

Table 2-4 Unstable Liquids

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property
Horizontal and Vertical Tanks with Emergency Relief Venting to Permit Pressure Not in Excess of 2.5 psig	Tank protected with any one of the following: Approved water spray, Approved inerting,* Approved insulation and refrigeration, Approved barricade	Table 2-6 but not less than 25 feet	Not less than 25 feet
	Protection for Exposures**	2½ times Table 2-6 but not less than 50 feet	Not less than 50 feet
	None	5 times Table 2-6 but not less than 100 feet	Not less than 100 feet
Horizontal and Vertical Tanks with Emergency Relief Venting to Permit Pressure Over 2.5 psig	Tank protected with any one of the following: Approved water spray, Approved inerting,* Approved insulation and refrigeration, Approved barricade	2 times Table 2-6 but not less than 50 feet	Not less than 50 feet
	Protection for Exposures**	4 times Table 2-6 but not less than 100 feet	Not less than 100 feet
	None	8 times Table 2-6 but not less than 150 feet	Not less than 150 feet

* See NFPA 69, *Standard for Explosion Prevention Systems.*
** See definition for "Protection for Exposures."
SI Units: 1 ft = 0.30 m.

Table 2-5 Class IIIB Liquids

Capacity Gallons	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property
12,000 or less	5	5
12,001 to 30,000	10	5
30,001 to 50,000	10	10
50,001 to 100,000	15	10
100,001 or more	15	15

SI Units: 1 ft = 0.30 m; 1 gal = 3.8 L.

Table 2-6
Reference Table for Use in Tables 2-1 to 2-4

Capacity Tank Gallons	Minimum Distance in Feet from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property
275 or less	5	5
276 to 750	10	5
751 to 12,000	15	5
12,001 to 30,000	20	5
30,001 to 50,000	30	10
50,001 to 100,000	50	15
100,001 to 500,000	80	25
500,001 to 1,000,000	100	35
1,000,001 to 2,000,000	135	45
2,000,001 to 3,000,000	165	55
3,000,001 or more	175	60

SI Units: 1 ft = 0.30 m; 1 gal = 3.8 L.

2-2.2.4 For unstable liquids, the distance between such tanks shall not be less than one-half the sum of their diameters.

2-2.2.5 When tanks are in a diked area containing Class I or Class II liquids, or in the drainage path of Class I or Class II liquids, and are compacted in three or more rows or in an irregular pattern, greater spacing or other means may be required by the authority having jurisdiction to make tanks in the interior of the pattern accessible for fire fighting purposes.

2-2.2.6 The minimum horizontal separation between an LP-Gas container and a Class I, Class II, or Class IIIA liquid storage tank shall be 20 ft (6 m), except in the case of Class I, Class II, or Class IIIA liquid tanks operating at pressures exceeding 2.5 psig (17.2 kPa) or equipped with emergency venting which will permit pressures to exceed 2.5 psig (17.2 kPa), in which case the provisions of 2-2.2.1 and 2-2.2.2 shall apply. Suitable measures shall be taken to prevent the accumulation of Class I, Class II, or Class IIIA liquids under adjacent LP-Gas containers such as by dikes, diversion curbs, or grading. When flammable or combustible liquid storage tanks are within a diked area, the LP-Gas containers shall be outside the diked area and at least 10 ft (3 m) away from the centerline of the wall of the diked area. The foregoing provisions shall not apply when LP-Gas containers of 125 gal (475 L) or less capacity are installed adjacent to fuel oil supply tanks of 660 gal (2498 L) or less capacity. No horizontal separation is required between aboveground LP-Gas containers and underground flammable and combustible liquid tanks installed in accordance with Section 2-3.

2-2.3 Control of Spillage from Aboveground Tanks.

2-2.3.1 Facilities shall be provided so that any accidental discharge of any Class I, II, or IIIA liquids will be prevented from endangering important facilities, and adjoining property, or reaching waterways, as provided for in 2-2.3.2 or 2-2.3.3. Tanks storing Class IIIB liquids do not require special drainage or diking provisions for fire protection purposes.

2-2.3.2 **Remote Impounding.** Where protection of adjoining property or waterways is by means of drainage to a remote impounding area, so that impounded liquid will not be held against tanks, such systems shall comply with the following:

(a) A slope of not less than 1 percent away from the tank shall be provided for at least 50 ft (15 m) toward the impounding area.

(b) The impounding area shall have a capacity not less than that of the largest tank that can drain into it.

(c) The route of the drainage system shall be so located that, if the liquids in the drainage system are ignited, the fire will not seriously expose tanks or adjoining property.

Table 2-7 Minimum Tank Spacing (Shell-to-Shell)

		Fixed or Horizontal Tanks	
	Floating Roof Tanks	Class I or II Liquids	Class IIIA Liquids
All tanks not over 150 feet in diameter	⅙ sum of adjacent tank diameters but not less than 3 feet	⅙ sum of adjacent tank diameters but not less than 3 feet	⅙ sum of adjacent tank diameters but not less than 3 feet
Tanks larger than 150 feet in diameter			
If remote impounding is in accordance with 2-2.3.2	⅙ sum of adjacent tank diameters	⅓ sum of adjacent tank diameters	⅙ sum of adjacent tank diameters
If impounding is around tanks in accordance with 2-2.3.3	⅓ sum of adjacent tank diameters	⅓ sum of adjacent tank diameters	⅓ sum of adjacent tank diameters

SI Units: 1 ft = 0.30 m.

(d) The confines of the impounding area shall be located so that, when filled to capacity, the liquid level will not be closer than 50 ft (15 m) from any property line that is or can be built upon, or from any tank.

2-2.3.3 Impounding Around Tanks by Diking. When protection of adjoining property or waterways is by means of impounding by diking around the tanks, such system shall comply with the following:

(a) A slope of not less than 1 percent away from the tank shall be provided for at least 50 ft (15 m) or to the dike base, whichever is less.

(b) The volumetric capacity of the diked area shall not be less than the greatest amount of liquid that can be released from the largest tank within the diked area, assuming a full tank. To allow for volume occupied by tanks, the capacity of the diked area enclosing more than one tank shall be calculated after deducting the volume of the tanks, other than the largest tank, below the height of the dike.

(c) To permit access, the outside base of the dike at ground level shall be no closer than 10 ft (3 m) to any property line that is or can be built upon.

(d) Walls of the diked area shall be of earth, steel, concrete, or solid masonry designed to be liquidtight and to withstand a full hydrostatic head. Earthen walls 3 ft (0.90 m) or more in height shall have a flat section at the top not less than 2 ft (0.60 m) wide. The slope of an earthen wall shall be consistent with the angle of repose of the material of which the wall is constructed. Diked areas for tanks containing Class I liquids located in extremely porous soils may require special treatment to prevent seepage of hazardous quantities of liquids to low-lying areas or waterways in case of spills.

(e) Except as provided in (f) below, the walls of the diked area shall be restricted to an average interior height of 6 ft (1.8 m) above interior grade.

(f) Dikes may be higher than an average of 6 ft (1.8 m) above interior grade where provisions are made for normal access and necessary emergency access to tanks, valves and other equipment, and safe egress from the diked enclosure.

1. Where the average height of the dike containing Class I liquids is over 12 ft (3.6 m) high, measured from interior grade, or where the distance between any tank and the top inside edge of the dike wall is less than the height of the dike wall, provisions shall be made for normal operation of valves and for access to tank roof(s) without entering below the top of the dike. These provisions may be met through the use of remote-operated valves, elevated walkways, or similar arrangements.

2. Piping passing through dike walls shall be designed to prevent excessive stresses as a result of settlement or fire exposure.

3. The minimum distance between tanks and toe of the interior dike walls shall be 5 ft (1.5 m).

(g) Each diked area containing two or more tanks shall be subdivided, preferably by drainage channels or at least by intermediate dikes in order to prevent spills from endangering adjacent tanks within the diked area as follows:

1. When storing normally stable liquids in vertical cone roof tanks constructed with weak roof-to-shell seam or floating roof tanks, or when storing crude petroleum in producing areas in any type of tank, one subdivision for each tank in excess of 10,000 bbls. and one subdivision for each group of tanks (no tank exceeding 10,000 bbls. capacity) having an aggregate capacity not exceeding 15,000 bbls.

2. When storing normally stable liquids in tanks not covered in subsection (1), one subdivision for each tank in excess of 2,380 bbls. (378,500 L) and one subdivision for each group of tanks [no tank exceeding 2,380 bbls. (378,500 L) capacity] having an aggregate capacity not exceeding 3,570 bbls. (567,750 L).

3. When storing unstable liquids in any type of tank, one subdivision for each tank except that tanks installed in accordance with the drainage requirements of NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, shall require no additional subdivision. Since unstable liquids will react more rapidly when heated than when at ambient temperatures, subdivision by drainage channels is the preferred method.

4. Whenever two or more tanks storing Class I liquids, any one of which is over 150 ft (45 m) in diameter, are located in a common diked area, intermediate dikes shall be provided between adjacent tanks to hold at least 10 percent of the capacity of the tank so enclosed, not including the volume displaced by the tank.

5. The drainage channels or intermediate dikes shall be located between tanks so as to take full advantage of the available space with due regard for the individual tank capacities. Intermediate dikes, where used, shall be not less than 18 in. (45 cm) in height.

(h) Where provision is made for draining water from diked areas, such drains shall be controlled in a manner so as to prevent flammable or combustible liquids from entering natural water courses, public sewers, or public drains, if their presence would constitute a hazard. Control of drainage shall be accessible under fire conditions from outside the dike.

(i) Storage of combustible materials, empty or full drums, or barrels, shall not be permitted within the diked area.

2-2.4 Normal Venting for Aboveground Tanks.

2-2.4.1 Atmospheric storage tanks shall be adequately vented to prevent the development of vacuum or pressure sufficient to distort the roof of a cone roof tank or exceeding the design pressure in the case of other atmospheric tanks, as a result of filling or emptying, and atmospheric temperature changes.

2-2.4.2 Normal vents shall be sized in accordance with either: (1) the American Petroleum Institute Standard No. 2000, *Venting Atmospheric and Low-Pressure Storage Tanks, 1982*, or (2) other accepted standard; or shall be at least as large as the filling or withdrawal connection, whichever is larger, but in no case less than 1¼ in. (3 cm) nominal inside diameter.

2-2.4.3 Low-pressure tanks and pressure vessels shall be adequately vented to prevent development of pressure or vacuum, as a result of filling or emptying and atmospheric temperature changes, from exceeding the design pressure of the tank or vessel. Protection shall also be provided to prevent overpressure from any pump discharging into the tank or vessel when the pump discharge pressure can exceed the design pressure of the tank or vessel.

2-2.4.4 If any tank or pressure vessel has more than one fill or withdrawal connection and simultaneous filling or withdrawal can be made, the vent size shall be based on the maximum anticipated simultaneous flow.

2-2.4.5 The outlet of all vents and vent drains on tanks equipped with venting to permit pressures exceeding 2.5 psig (17.2 kPa) shall be arranged to discharge in such a way as to prevent localized overheating of, or flame impingement on, any part of the tank, in the event vapors from such vents are ignited.

2-2.4.6 Tanks and pressure vessels storing Class IA liquids shall be equipped with venting devices that shall be normally closed except when venting to pressure or vacuum conditions. Tanks and pressure vessels storing Class IB and IC liquids shall be equipped with venting devices that shall be normally closed except when venting under pressure or vacuum conditions, or with listed flame arrestors. Tanks of 3,000 bbls. (476,910 L) capacity or less containing crude petroleum in crude-producing areas, and outside aboveground atmospheric tanks under 23.8 bbls. (3,785 L) capacity containing other than Class IA liquids may have open vents. (*See 2-2.6.2.*)

2-2.4.7 Flame arrestors or venting devices required in 2-2.4.6 may be omitted for IB and IC liquids where conditions are such that their use may, in case of obstruction, result in tank damage. Liquid properties justifying the omission of such devices include, but are not limited to, condensation, corrosiveness, crystallization, polymerization, freezing, or plugging. When any of these conditions exist, consideration may be given to heating, use of devices employing special materials of construction, the use of liquid seals, or inerting (*see NFPA 69, Standard on Explosion Prevention Systems*).

2-2.5 Emergency Relief Venting for Fire Exposure for Aboveground Tanks.

2-2.5.1 Except as provided in 2-2.5.2, every aboveground storage tank shall have some form of construction or device that will relieve excessive internal pressure caused by exposure fires.

2-2.5.2 Tanks larger than 285 bbls. (45,306 L) capacity storing Class IIIB liquids and not within the diked area or the drainage path of Class I or Class II liquids do not require emergency relief venting.

2-2.5.3 In a vertical tank, the construction referred to in 2-2.5.1 may take the form of a floating roof, lifter roof, a weak roof-to-shell seam, or other approved pressure-relieving construction. The weak roof-to-shell seam shall be constructed to fail preferential to any other seam. Design methods which will provide a weak roof-to-shell seam construction are contained in API 650, *Welded Steel Tanks for Oil Storage*, and UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids.*

2-2.5.4 Where entire dependence for emergency relief is placed upon pressure-relieving devices, the total venting capacity of both normal and emergency vents shall be enough to prevent rupture of the shell or bottom of the tank if vertical, or of the shell or heads if horizontal. If unstable liquids are stored, the effects of heat or gas resulting from polymerization, decomposition, condensation, or self-reactivity shall be taken into account. The total capacity of both normal and emergency venting devices shall be not less than that derived from Table 2-8 except as provided in 2-2.5.6 or 2-2.5.7. Such device may be a self-closing manhole cover, or one using long bolts that permit the cover to lift under internal pressure, or an additional or larger relief valve or valves. The wetted area of the tank shall be calculated on the basis of 55 percent of the total exposed area of a sphere or spheroid, 75 percent of the total exposed area of a horizontal tank, and the first 30 ft (9 m) above grade of the exposed shell area of a vertical tank. (*See Appendix B for the square footage of typical tank sizes.*)

2-2.5.5 For tanks and storage vessels designed for pressures over 1 psig (6.9 kPa), the total rate of venting shall be determined in accordance with Table 2-8, except that when the exposed wetted area of the surface is greater than 2,800 sq ft (260 m^2), the total rate of venting shall be in accordance with Table 2-9 or calculated by the following formula:

$$CFH = 1{,}107\ A^{0.82}$$

Where:

CFH = venting requirement, in cubic feet of free air per hour

A = exposed wetted surface, in square feet

The foregoing formula is based on $Q = 21{,}000\ A^{0.82}$

Table 2-8 Wetted Area Versus Cubic Feet Free Air per Hour* (14.7 psia and 60°F) (101.3 kPa and 15.6°C)

Sq Ft	CFH	Sq Ft	CFH	Sq Ft	CFH
20	21,100	200	211,000	1,000	524,000
30	31,600	250	239,000	1,200	557,000
40	42,100	300	265,000	1,400	587,000
50	52,700	350	288,000	1,600	614,000
60	63,200	400	312,000	1,800	639,000
70	73,700	500	354,000	2,000	662,000
80	84,200	600	392,000	2,400	704,000
90	94,800	700	428,000	2,800	742,000
100	105,000	800	462,000	and over	
120	126,000	900	493,000		
140	147,000	1,000	524,000		
160	168,000				
180	190,000				
200	211,000				

SI Units: 10 ft^2 = 0.93 m^2; 36 ft^3 = 1.0 m^3

*Interpolate for intermediate values.

Table 2-9 Wetted Area Over 2,800 sq ft and Pressures Over 1 psig

Sq Ft	CFH	Sq Ft	CFH
2,800	742,000	9,000	1,930,000
3,000	786,000	10,000	2,110,000
3,500	892,000	15,000	2,940,000
4,000	995,000	20,000	3,720,000
4,500	1,100,000	25,000	4,470,000
5,000	1,250,000	30,000	5,190,000
6,000	1,390,000	35,000	5,900,000
7,000	1,570,000	40,000	6,570,000
8,000	1,760,000		

SI Units: 10 ft^2 = 0.93 m^2; 36 ft^3 = 1.0 m^3
*Interpolate for intermediate values.

2-2.5.6 The total emergency relief venting capacity for any specific stable liquid can be determined by the following formula:

$$\text{Cubic feet of free air per hour} = V \frac{1{,}337}{L\sqrt{M}}$$

V = cubic feet of free air per hour from Table 2-8
L = latent heat of vaporization of specific liquid in Btu per pound
M = molecular weight of specific liquids

2-2.5.7 For tanks containing stable liquids, the required airflow rate of 2-2.5.4 or 2-2.5.6 may be multiplied by the appropriate factor listed in the following schedule when protection is provided as indicated. Only one factor can be used for any one tank.

0.5 for drainage in accordance with 2-2.3.2 for tanks over 200 sq ft (18.6 m^2) of wetted area

0.3 for water spray in accordance with NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, and drainage in accordance with 2-2.3.2

0.3 for insulation in accordance with 2-2.5.7(a)

0.15 for water spray with insulation in accordance with 2-2.5.7(a) and drainage in accordance with 2-2.3.2 (*see Appendix B*)

(a) Insulation systems for which credit is taken shall meet the following performance criteria:

1. Remain in place under fire exposure conditions.

2. Withstand dislodgment when subjected to hose stream impingement during fire exposure. This requirement may be waived where use of solid hose streams is not contemplated or would not be practical.

3. Maintain a maximum conductance value of 4.0 Btu per hour per square foot per degree Fahrenheit (Btu/hr/sq ft/°F) when the outer insulation jacket or cover is at a temperature of 1,660°F (904.4°C) and when the mean temperature of the insulation is 1,000°F (537.8°C).

2-2.5.8 The outlet of all vents and vent drains on tanks equipped with emergency venting to permit pressures exceeding 2.5 psig (17.2 kPa) shall be arranged to discharge in such a way as to prevent localized overheating of or flame impingement on any part of the tank, in the event vapors from such vents are ignited.

2-2.5.9 Each commercial tank venting device shall have stamped on it the opening pressure, the pressure at which the valve reaches the full open position and the flow capacity at the latter pressure. If the start to open pressure is less than 2.5 psig (17.2 kPa) and the pressure at full open position is greater than 2.5 psig (17.2 kPa), the flow capacity at 2.5 psig (17.2 kPa) shall also be stamped on the venting device. The flow capacity shall be expressed in cubic feet per hour of air at 60°F (15.6°C) and 14.7 psia (760 mm Hg).

(a) The flow capacity of tank venting devices under 8 in. (20 cm) in nominal pipe size shall be determined by actual test of each type and size of vent. These flow tests may be conducted by the manufacturer if certified by a qualified impartial observer, or may be conducted by a qualified, impartial outside agency. The flow capacity of tank venting devices 8 in. (20 cm) nominal pipe size and larger, including manhole covers with long bolts or equivalent, may be calculated provided that the opening pressure is actually measured, the rating pressure and corresponding free orifice area are stated, the word "calculated" appears on the nameplate, and the computation is based on a flow coefficient of 0.5 applied to the rated orifice area.

(b) A suitable formula for this calculation is:

$$CFH = 1{,}667\, C_f A \sqrt{P_t - P_a}$$

where CFH = venting requirement in cubic feet of free air per hour
C_f = 0.5 [the flow coefficient]
A = the orifice area in sq in.
P_t = the absolute pressure inside the tank in inches of water
P_a = the absolute atmospheric pressure outside the tank in inches of water

2-2.6 Vent Piping for Aboveground Tanks.

2-2.6.1 Vent piping shall be constructed in accordance with Chapter 3.

2-2.6.2 Where vent pipe outlets for tanks storing Class I liquids are adjacent to buildings or public ways, they shall be located so that the vapors are released at a safe point outside of buildings and not less than 12 ft (3.6 m) above the adjacent ground level. In order to aid their dispersion, vapors shall be discharged upward or horizontally away from closely adjacent walls. Vent outlets shall be located so that flammable vapors will not be trapped by eaves or other obstructions and shall be at least 5 ft (1.5 m) from building openings.

2-2.6.3 The manifolding of tank vent piping shall be avoided except where required for special purposes such as vapor recovery, vapor conservation, or air pollution control. When tank vent piping is manifolded, pipe sizes shall be such as to discharge, within the pressure limitations of the system, the vapors they may be required to handle when manifolded tanks are subject to the same fire exposure.

2-2.6.4 Vent piping for tanks storing Class I liquids shall not be manifolded with vent piping for tanks storing Class II or Class III liquids unless positive means are provided to prevent the vapors from Class I liquids from entering tanks storing Class II or Class III liquids, to prevent contamination (*see 1-1.2*) and possible change in classification of the less volatile liquid.

2-2.7 Tank Openings Other Than Vents for Aboveground Tanks.

2-2.7.1 Each connection to an aboveground tank through which liquid can normally flow shall be provided with an internal or an external valve located as close as practical to the shell of the tank.

2-2.7.2 Each connection below the liquid level through which liquid does not normally flow shall be provided with a liquidtight closure. This may be a valve, plug, or blind, or a combination of these.

2-2.7.3 Openings for gaging on tanks storing Class I liquids shall be provided with a vaportight cap or cover. Such covers shall be closed when not gaging.

2-2.7.4 For Class IB and Class IC liquids other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity. A fill pipe entering the top of a tank shall terminate within 6 in. (15 cm) of the bottom of the tank and shall be installed to avoid excessive vibration.

2-2.7.5 Filling and emptying connections for Class I, Class II, and Class IIIA liquids that are made and broken shall be located outside of buildings at a location free from any source of ignition and not less than 5 ft (1.5 m) away from any building opening. Such connections for any liquid shall be closed and liquidtight when not in use and shall be properly identified.

2-3 Installation of Underground Tanks.

2-3.1 Location. Excavation for underground storage tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks or tanks under buildings shall be so located with respect to existing building foundations and supports that the loads carried by the latter cannot be transmitted to the tank. The distance from any part of a tank storing Class I liquids to the nearest wall of any basement or pit shall be not less than 1 ft (0.30 m), and to any property line that can be built upon, not less than 3 ft (0.90 m). The distance from any part of a tank storing Class II or Class III liquids to the nearest wall of any basement, pit, or property line shall be not less than 1 ft (0.30 m).

2-3.2 Burial Depth and Cover.

2-3.2.1 All underground tanks shall be installed in accordance with the manufacturer's instructions, where available, and shall be set on firm foundations and surrounded with at least 6 in. (15 cm) of noncorrosive inert material such as clean sand or gravel well tamped in place. The tank shall be placed in the hole with care, since dropping or rolling the tank into the hole can break a weld, puncture or damage the tank, or scrape off the protective coating of coated tanks. (*See Petroleum Equipment Institute (PEI) RP-100-86, Recommended Practice for the Installation of Underground Liquid Storage Systems, for further information.*)

2-3.2.2 All underground tanks shall be covered with a minimum of 2 ft (0.60 m) of earth, or shall be covered with not less than 1 ft (0.30 m) of earth, on top of which shall be placed a slab of reinforced concrete not less than 4 in. (10 cm) thick. When they are, or are likely to be, subjected to traffic, they shall be protected against damage from vehicles passing over them by at least 3 ft (0.90 m) of earth cover, or 18 in. (45.7 cm) of well-tamped earth plus either 6 in. (15 cm) of reinforced concrete or 8 in. (20 cm) of asphaltic concrete. When asphaltic or reinforced concrete paving is used as part of the protection, it shall extend at least 1 ft (0.30 m) horizontally beyond the outline of the tank in all directions.

2-3.2.3 For underground tanks built in accordance with 2-1.3.1, the burial depth shall be such that the static head imposed at the bottom of the tank will not exceed 10 psig (68.9 kPa) if the fill or vent pipe are filled with liquid. If the depth of cover is greater than the tank diameter, the tank manufacturer shall be consulted to determine if reinforcement is required.

2-3.3 External Corrosion Protection. Tanks and their piping shall be protected by either:

(a) A properly engineered, installed, and maintained cathodic protection system in accordance with recognized standards of design, such as:

1) American Petroleum Institute Publication 1632-1983, *Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems.*

2) Underwriters Laboratories of Canada ULC-S603.1-M 1982, *Standard for Galvanic Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids.*

3) Steel Tank Institute Standard No. sti-P_3®, *Specifications for sti-P_3® System for External Corrosion Protection of Underground Steel Storage Tanks - 1983.*

4) National Association of Corrosion Engineers Standard RP-01-69 (1983 Rev.), Recommended Practice, *Control of External Corrosion of Underground or Submerged Metallic Piping Systems.*

5) National Association of Corrosion Engineers Standard RP-02-85, Recommended Practice, *Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems.*

(b) Approved or listed corrosion-resistant materials or systems, which may include special alloys, fiberglass reinforced plastic, or fiberglass reinforced plastic coatings.

2-3.3.1 Selection of the type of protection to be employed shall be based upon the corrosion history of the area and the judgement of a qualified engineer. The authority having jurisdiction may waive the requirements for corrosion protection where evi-

dence is provided that such protection is not necessary. (*See API Publication 1615-1979, Installation of Underground Petroleum Storage Systems, for further information.*)

2-3.4 Abandonment or Reuse of Underground Tanks.

2-3.4.1 Underground tanks taken out of service shall be safeguarded or disposed of in a safe manner. (*See Appendix C.*)

2-3.4.2 Only those used tanks that comply with the applicable sections of this Code and are approved by the authority having jurisdiction shall be installed for flammable or combustible liquids service.

2-3.5 Vents for Underground Tanks.

2-3.5.1 **Location and Arrangement of Vents for Class I Liquids.** Vent pipes from underground storage tanks storing Class I liquids shall be so located that the discharge point is outside of buildings, higher than the fill pipe opening, and not less than 12 ft (3.6 m) above the adjacent ground level. Vent pipes shall not be obstructed by devices provided for vapor recovery or other purposes unless the tank and associated piping and equipment are otherwise protected to limit back-pressure development to less than the maximum working pressure of the tank and equipment by the provision of pressure-vacuum vents, rupture discs, or other tank venting devices installed in the tank vent lines. Vent outlets and devices shall be protected to minimize the possibility of blockage from weather, dirt, or insect nests, and shall be so located and directed that flammable vapors will not accumulate or travel to an unsafe location, enter building openings, or be trapped under eaves, and shall be at least 5 feet from building openings. Tanks containing Class IA liquids shall be equipped with pressure and vacuum venting devices that shall be normally closed except when venting under pressure or vacuum conditions. Tanks storing Class IB or Class IC liquids shall be equipped with pressure-vacuum vents or with listed flame arrestors. Tanks storing gasoline are exempt from the requirements for pressure and vacuum venting devices, except as required to prevent excessive back pressure, or flame arrestors, provided the vent does not exceed 3 in. (7.6 cm) nominal inside diameter. (*See also 2-1.1 of NFPA 30A, Automotive and Marine Service Station Code.*)

2-3.5.2 **Vent Capacity.** Tank venting systems shall be provided with sufficient capacity to prevent blowback of vapor or liquid at the fill opening while the tank is being filled. Vent pipes shall not be less than 1¼ in. (3 cm) nominal inside diameter. The required venting capacity depends upon the filling or withdrawal rate, whichever is greater, and the vent line length. Unrestricted vent piping sized in accordance with Table 2-10 will prevent back-pressure development in tanks from exceeding 2.5 psig (17.2 kPa). Where tank venting devices are installed in vent lines, their flow capacities shall be determined in accordance with 2-2.5.9.

2-3.5.3 **Location and Arrangement of Vents for Class II or Class IIIA Liquids.** Vent pipes from tanks storing Class II or Class IIIA liquids shall terminate outside of the building and higher than the fill pipe opening. Vent outlets shall be above normal snow level. They may be fitted with return bends, coarse screens, or other devices to minimize ingress of foreign material.

Table 2-10 Vent Line Diameters

Maximum Flow GPM	Pipe Length* 50 Ft	100 Ft	200 Ft
100	1¼-inch	1¼-inch	1¼-inch
200	1¼-inch	1¼-inch	1¼-inch
300	1¼-inch	1¼-inch	1½-inch
400	1¼-inch	1½-inch	2-inch
500	1½-inch	1½-inch	2-inch
600	1½-inch	2-inch	2-inch
700	2-inch	2-inch	2-inch
800	2-inch	2-inch	3-inch
900	2-inch	2-inch	3-inch
1,000	2-inch	2-inch	3-inch

SI Units: 1 in. = 2.5 cm; 1 ft = 0.30 m; 1 gal = 3.8 L.
*Vent lines of 50 ft, 100 ft, and 200 ft of pipe plus 7 ells.

2-3.5.4 Vent piping shall be constructed in accordance with Chapter 3. Tank vent pipes and vapor return piping shall be installed without sags or traps in which liquid can collect. Condensate tanks, if utilized, shall be installed and maintained so as to preclude the blocking of the vapor return piping by liquid. The vent pipes and condensate tanks shall be located so that they will not be subjected to physical damage. The tank end of the vent pipe shall enter the tank through the top.

2-3.5.5 When tank vent piping is manifolded, pipe sizes shall be such as to discharge, within the pressure limitations of the system, the vapors they can be required to handle when manifolded tanks are filled simultaneously. Float-type check valves installed in tank openings connected to manifolded vent piping to prevent product contamination may be used provided that the tank pressure will not exceed that permitted by 2-3.2.4 when the valves close.

Exception: For service stations, the capacity of manifolded vent piping shall be sufficient to discharge vapors generated when two manifolded tanks are simultaneously filled.

2-3.5.6 Vent piping for tanks storing Class I liquids shall not be manifolded with vent piping for tanks storing Class II or Class III liquids unless positive means are provided to prevent the vapors from Class I liquids from entering tanks storing Class II or Class III liquids, to prevent contamination (*see 1-1.2*) and possible change in classification of the less volatile liquid.

2-3.6 Tank Openings Other Than Vents for Underground Tanks.

2-3.6.1 Connections for all tank openings shall be liquidtight.

2-3.6.2 Openings for manual gaging, if independent of the fill pipe, shall be provided with a liquidtight cap or cover. Covers shall be kept closed when not gaging. If inside a building, each such opening

shall be protected against liquid overflow and possible vapor release by means of a spring-loaded check valve or other approved device.

2-3.6.3 Fill and discharge lines shall enter tanks only through the top. Fill lines shall be sloped toward the tank. Underground tanks for Class I liquids having a capacity of more than 1,000 gal (3785 L) shall be equipped with a tight fill device for connecting the fill hose to the tank.

2-3.6.4 For Class IB and Class IC liquids other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within 6 in. (15 cm) of the bottom of the tank.

2-3.6.5 Filling and emptying and vapor recovery connections for Class I, Class II, or Class IIIA liquids that are made and broken shall be located outside of buildings at a location free from any source of ignition and not less than 5 ft (1.5 m) away from any building opening. Such connections shall be closed and liquidtight when not in use and shall be properly identified.

2-3.6.6 Tank openings provided for purposes of vapor recovery shall be protected against possible vapor release by means of a spring-loaded check valve or dry-break connection, or other approved device, unless the opening is pipe-connected to a vapor processing system. Openings designed for combined fill and vapor recovery shall also be protected against vapor release unless connection of the liquid delivery line to the fill pipe simultaneously connects the vapor recovery line. All connections shall be vaportight.

2-4 Installation of Tanks Inside of Buildings.

2-4.1 Location. Tanks shall not be permitted inside of buildings.

Exception: If the storage of liquids in outside aboveground or underground tanks is not practical because of government regulations, temperature considerations, or production considerations, tanks may be permitted inside of buildings or structures in accordance with the applicable provisions of Chapter 2, Tank Storage. Production considerations that may necessitate storage inside of buildings include but are not limited to high viscosity, purity, sterility, hydroscopicity, sensitivity to temperature change, and need to store temporarily pending completion of sample analysis.

2-4.1.1 Storage tanks inside of buildings shall be permitted only in areas at or above grade that have adequate drainage and are separated from other parts of the building by construction having a fire resistance rating of at least 2 hrs. Day tanks, running tanks, and surge tanks are permitted in process areas. Openings to other rooms or buildings shall be provided with noncombustible liquidtight raised sills or ramps at least 4 in. (10 cm) in height, or the floor in the storage area shall be at least 4 in. (10 cm) below the surrounding floor. As a minimum, each opening shall be provided with a listed, self-closing 1½-hr (B) fire door installed in accordance with NFPA 80, *Standard for Fire Doors and Windows*, or a listed fire damper installed where required by NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*, or NFPA 91, *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying*. The room shall be liquidtight where the walls join the floor.

2-4.2 Vents. Vents for tanks inside of buildings shall be as required in 2-2.4, 2-2.5, 2-2.6.2, and 2-3.5, except that emergency venting by the use of weak roof seams on tanks shall not be permitted. Automatic sprinkler systems designed in accordance with the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*, may be accepted by the authority having jurisdiction as equivalent to water spray systems for purposes of calculating the required airflow rates for emergency vents in 2-2.5.7. Except for tanks containing Class IIIB liquids, vents shall terminate outside the buildings.

2-4.3 Vent Piping. Vent piping shall be constructed in accordance with Chapter 3.

2-4.4 Tank Openings Other Than Vents for Tanks Inside Buildings. Connections for all tank openings shall be liquidtight.

2-4.4.2 Each connection to a tank inside of buildings through which liquid can normally flow shall be provided with an internal or an external valve located as close as practical to the shell of the tank.

2-4.4.3 Tanks for storage of Class I or Class II liquids inside buildings shall be provided with either:

(a) a normally closed remotely activated valve.

(b) an automatic-closing heat-activated valve, or

(c) another approved device on each liquid transfer connection below the liquid level, except for connections used for emergency disposal, to provide for quick cutoff of flow in the event of fire in the vicinity of the tank.

This function can be incorporated in the valve required in 2-4.4.2, and if a separate valve, shall be located adjacent to the valve required in 2-4.4.2.

2-4.4.4 Openings for manual gaging of Class I or Class II liquids, if independent of the fill pipe, shall be provided with a vaportight cap or cover. Openings shall be kept closed when not gaging. Each such opening for any liquid shall be protected against liquid overflow and possible vapor release by means of a spring-loaded check valve or other approved device. Substitutes for manual gaging include, but are not limited to, heavy-duty flat gage glasses, magnetic, hydraulic, or hydrostatic remote reading devices and sealed float gages.

2-4.4.5 For Class IB and Class IC liquids other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within 6 in. (15 cm) of the bottom of the tank.

2-4.4.6 The fill pipe inside of the tank shall be installed to avoid excessive vibration of the pipe.

2-4.4.7 The inlet of the fill pipe and the outlet of a vapor recovery line for which connections are made and broken shall be located outside of buildings at a location free from any source of ignition and not less than 5 ft (1.5 m) away from any building opening. Such connections shall be closed and tight when not in use and shall be properly identified.

2-4.4.8 Tanks storing Class I, Class II, and Class IIIA liquids inside buildings shall be equipped with a device, or other means shall be provided, to prevent overflow into the building. Suitable devices include, but are not limited to, a float valve, a preset meter on the fill line, a valve actuated by the weight of the tank contents, a low head pump incapable of producing overflow, or a liquidtight overflow pipe at least one pipe size larger than the fill pipe discharging by gravity back to the outside source of liquid or to an approved location.

2-4.4.9 Tank openings provided for purposes of vapor recovery shall be protected against possible vapor release by means of a spring-loaded check valve or dry-break connections, or other approved device, unless the opening is pipe-connected to a vapor processing system. Openings designed for combined fill and vapor recovery shall also be protected against vapor release unless connection of the liquid delivery line to the fill pipe simultaneously connects the vapor recovery line. All connections shall be vaportight.

2-5 Supports, Foundations, and Anchorage for All Tank Locations.

2-5.1 Tanks shall rest on the ground or on foundations made of concrete, masonry, piling, or steel. Tank foundations shall be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation. Appendix E of API Standard 650-1980, *Specification for Welded Steel Tanks for Oil Storage*, and Appendix B of API Standard 620-1982, *Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks*, provide information on tank foundations.

2-5.2 When tanks are supported above the foundations, tank supports shall be installed on firm foundations. Supports for tanks storing Class I, Class II, or Class IIIA liquids shall be of concrete, masonry, or protected steel. Single wood timber supports (not cribbing) laid horizontally may be used for outside aboveground tanks if not more than 12 in. (0.30 m) high at their lowest point.

2-5.3 Steel supports or exposed piling for tanks storing Class I, Class II, or Class IIIA liquids shall be protected by materials having a fire resistance rating of not less than 2 hrs, except that steel saddles need not be protected if less than 12 in. (0.30 m) high at their lowest point. At the discretion of the authority having jurisdiction, water spray protection in accordance with NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, or NFPA 13, *Standard for the Installation of Sprinkler Systems*, or equivalent may be used.

2-5.4 The design of the supporting structure for tanks such as spheres shall require special engineering consideration. Appendix N of the API Standard 620-1982, *Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks*, contains information regarding supporting structures.

2-5.5 Every tank shall be so supported as to prevent the excessive concentration of loads on the supporting portion of the shell.

2-5.6 Tanks in Areas Subject to Flooding.

2-5.6.1 Where a tank is located in an area subject to flooding, provisions shall be taken to prevent tanks, either full or empty, from floating during a rise in water level up to the established maximum flood stage.

2-5.6.2 Aboveground Tanks.

2-5.6.2.1 Each vertical tank shall be located so that its top extends above the maximum flood stage by at least 30 percent of its allowable storage capacity.

2-5.6.2.2 Horizontal tanks located so that more than 70 percent of the tank's storage capacity will be submerged at the established flood stage shall be anchored; attached to a foundation of concrete or of steel and concrete of sufficient weight to provide adequate load for the tank when filled with flammable or combustible liquid and submerged by flood water to the established flood stage; or adequately secured from floating by other means. Tank vents or other openings which are not liquidtight shall be extended above maximum flood stage water level.

2-5.6.2.3 A dependable water supply shall be available for filling an empty or partially filled tank, except that where filling the tank with water is impractical or hazardous because of the tank's contents, tanks shall be protected by other means against movement or collapse.

2-5.6.2.4 Spherical or spheroid tanks shall be protected by applicable methods as specified for either vertical or horizontal tanks.

2-5.6.3 Underground Tanks.

2-5.6.3.1 At locations where there is an ample and dependable water supply available, underground tanks containing flammable or combustible liquids, so placed that more than 70 percent of their storage capacity will be submerged at the maximum flood stage, shall be so anchored, weighted, or secured as to prevent movement when filled or loaded with water and submerged by flood water to the established flood stage. Tank vents or other openings that are not liquidtight shall be extended above maximum flood stage water level.

2-5.6.3.2 At locations where there is no ample and dependable water supply or where filling of underground tanks with water is impractical because of the contents, each tank shall be safeguarded against

movement when empty, and submerged by high ground water or flood water by anchoring or by securing by other means. Each such tank shall be so constructed and installed that it will safely resist external pressures if submerged.

2-5.6.4 Water Loading. The filling of a tank to be protected by water loading shall be started as soon as flood waters are predicted to reach a dangerous flood stage. Where independently fueled water pumps are relied upon, sufficient fuel shall be available at all times to permit continuing operations until all tanks are filled. Tank valves shall be locked in a closed position when water loading has been completed.

2-5.6.5 Operating Instructions.

2-5.6.5.1 Operating instructions or procedures to be followed in a flood emergency shall be readily available.

2-5.6.5.2 Personnel relied upon to carry out flood emergency procedures shall be informed of the location and operation of valves and other equipment necessary to effect the intent of these requirements.

2-5.7 In areas subject to earthquakes, the tank supports and connections shall be designed to resist damage as a result of such shocks.

2-6 Sources of Ignition. In locations where flammable vapors may be present, precautions shall be taken to prevent ignition by eliminating or controlling sources of ignition. Sources of ignition may include open flames, lightning, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical, and mechanical), spontaneous ignition, chemical and physical-chemical reactions, and radiant heat. NFPA 77, *Recommended Practice on Static Electricity*, and NFPA 78, *Lightning Protection Code*, provide information on such protection.

2-7 Testing.

2-7.1 All tanks, whether shop-built or field-erected, shall be tested before they are placed in service in accordance with the applicable paragraphs of the Code under which they were built. The ASME Code stamp or the Listing Mark of Underwriters Laboratories Inc. on a tank shall be evidence of compliance with this test. Tanks not marked in accordance with the above Codes shall be tested before they are placed in service in accordance with good engineering principles and reference shall be made to the sections on testing in the Codes listed in 2-1.3.1, 2-1.4.2, or 2-1.5.2.

2-7.2 When the vertical length of the fill and vent pipes is such that when filled with liquid the static head imposed on the bottom of the tank exceeds 10 psi (68.9 kPa), the tank and related piping shall be tested hydrostatically to a pressure equal to the static head thus imposed. In special cases where the height of the vent above the top of the tank is excessive, the hydrostatic test pressure shall be determined by using recognized engineering practice.

2-7.3 In addition to the test called for in 2-7.1 and 2-7.2, all tanks and connections shall be tested for tightness. Except for underground tanks, this tightness shall be made at operating pressure with air, inert gas, or water prior to placing the tank in service. In the case of field-erected tanks, the test called for in 2-7.1 or 2-7.2 may be considered to be the test for tank tightness. Underground tanks and piping, before being covered, enclosed, or placed in use, shall be tested for tightness hydrostatically, or with air pressure at not less than 3 psi (20.6 kPa) and not more than 5 psi (34.5 kPa). (*See 3-7.1 for testing pressure piping.*) Air pressure shall not be used to test tanks that contain flammable or combustible liquids or vapors.

2-7.4 Before the tank is initially placed in service, all leaks or deformations shall be corrected in an acceptable manner. Mechanical caulking is not permitted for correcting leaks in welded tanks except pinhole leaks in the roof.

2-7.5 Tanks to be operated at pressures below their design pressure may be tested by the applicable provisions of 2-7.1 or 2-7.2 based upon the pressure developed under full emergency venting of the tank.

2-7.6 Each underground tank that has been repaired or altered, or is suspected of leaking, shall be tested in a manner approved by the authority having jurisdiction. (See NFPA 329, *Recommended Practice for Handling Underground Leakage of Flammable and Combustible Liquids, for information on testing methods*).

2-8 Fire Protection and Identification.

2-8.1 A fire extinguishing system in accordance with an applicable NFPA standard shall be provided or be available for vertical atmospheric fixed roof storage tanks larger than 50,000 gal (189,250 L) capacity, storing Class I liquids, if located in a congested area where there is an unusual exposure hazard to the tank from adjacent property or to adjacent property from the tank. Fixed roof tanks storing Class II or III liquids at temperatures below their flash points and floating roof tanks storing any liquid generally do not require protection when installed in compliance with Section 2-2.

2-8.2 The application of NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials*, to storage tanks containing liquids shall not be required except when the contents have a health or reactivity degree of hazard of 2 or more or a flammability rating of 4. The marking need not be applied directly to the tank but located where it can readily be seen, such as on the shoulder of an accessway or walkway to the tank or tanks or on the piping outside of the diked area. If more than one tank is involved, the markings shall be so located that each tank can readily be identified.

2-9 Prevention of Overfilling of Tanks.

2-9.1 Terminals receiving transfer of Class I liquids from mainline pipelines or marine vessels shall follow formal written procedures to prevent overfilling of tanks utilizing one of the following methods of protection:

(a) Tanks gaged at frequent intervals by personnel continuously on the premises during product receipt with frequent acknowledged communication maintained with the supplier so that flow can be promptly shut down or diverted.

(b) Tanks equipped with a high-level detection device that is independent of any tank gaging equipment. Alarms shall be located where personnel who are on duty throughout product transfer can promptly arrange for flow stoppage or diversion.

(c) Tanks equipped with an independent high-level detection system that will automatically shut down or divert flow.

(d) Alternatives to instrumentation described in (b) and (c) where approved by the authority having jurisdiction as affording equivalent protection.

2-9.1.1 Instrumentation systems covered in 2-9.1(b) and (c) shall be electrically supervised or equivalent.

2-9.2 Formal written procedures required in 2-9.1 shall include:

(a) Instructions covering methods to check for proper line up and receipt of initial delivery to tank designated to receive shipment.

(b) Provision for training and monitoring the performance of operating personnel by terminal supervision.

(c) Schedules and procedures for inspection and testing of gaging equipment and high-level instrumentation and related systems. Inspection and testing intervals shall be acceptable to the authority having jurisdiction, but shall not exceed one year.

2-10 Leakage Detection and Inventory Records for Underground Tanks. Accurate inventory records or a leak detection program shall be maintained on all Class I Liquid Storage Tanks for indication of possible leakage from the tanks or associated piping. (*See NFPA 329, Recommended Practice for Handling Underground Leakage of Flammable and Combustible Liquids.*)

Chapter 3 Piping, Valves, and Fittings

3-1 General.

3-1.1 The design, fabrication, assembly, test, and inspection of piping systems containing liquids shall be suitable for the expected working pressures and structural stresses. Conformity with the applicable sections of ANSI B31, *American National Standard Code for Pressure Piping*, and the provisions of this chapter shall be considered prima facie evidence of compliance with the foregoing provisions.

3-1.2 This chapter does not apply to any of the following:

(a) Tubing or casing on any oil or gas wells and any piping connected directly thereto.

(b) Motor vehicle, aircraft, boat, or portable or stationary engine.

(c) Piping within the scope of any applicable boiler and pressure vessel code.

3-1.3 Piping systems consist of pipe, tubing, flanges, bolting, gaskets, valves, fittings, flexible connectors, the pressure containing parts of other components such as expansion joints and strainers, and devices that serve such purposes as mixing, separating, snubbing, distributing, metering, or controlling flow.

3-2 Materials for Piping, Valves, and Fittings.

3-2.1 Pipe, valves, faucets, fittings, and other pressure-containing parts as covered in 3-1.3 shall meet the material specifications and pressure and temperature limitations of ANSI B31.3-1980, *Petroleum Refinery Piping*, or ANSI B31.4-1979, *Liquid Petroleum Transportation Piping Systems*, except as provided by 3-2.2, 3-2.3, and 3-2.4. Plastic or similar materials, as permitted by 3-2.4, shall be designed to specifications embodying recognized engineering principles and shall be compatible with the fluid service.

3-2.2 Nodular iron shall conform to ASTM A395-80, *Ferritic Ductile Iron Pressure Retaining Castings for Use at Elevated Temperatures.*

3-2.3 Valves at storage tanks, as required by 2-2.7.1 and 2-4.4.2, and their connections to the tank, shall be of steel or nodular iron except as provided in 3-2.3.1 or 3-2.3.2.

3-2.3.1 Valves at storage tanks may be other than steel or nodular iron when the chemical characteristics of the liquid stored are not compatible with steel or when installed internally to the tank. When installed externally to the tank, the material shall have a ductility and melting point comparable to steel or nodular iron so as to withstand reasonable stresses and temperatures involved in fire exposure, or otherwise be protected such as by materials having a fire-resistance rating of not less than 2 hrs.

3-2.3.2 Cast iron, brass, copper, aluminum, malleable iron, and similar materials may be used on tanks described in 2-2.2.2 or for tanks storing Class IIIB liquids when the tank is located outdoors and not within a diked area or drainage path of a tank storing a Class I, Class II, or Class IIIA liquid.

3-2.4 Low melting point materials, such as aluminum, copper, and brass; or materials that soften on fire exposure, such as plastics; or nonductile material, such as cast iron, may be used underground for all liquids within the pressure and temperature limits of ANSI B31, *American National Standard Code for Pressure Piping*. If such materials are used outdoors in aboveground piping systems handling Class I, Class II, or Class IIIA liquids or within buildings handling any liquid, they shall be either: (a) suitably protected against fire exposure, or (b) so located that any leakage resulting from the failure would not unduly expose persons, important buildings, or structures, or (c) located where leakage can readily be controlled by operation of an accessible remotely located valve(s).

3-2.5 Piping, valves, and fittings may have combustible or noncombustible linings.

3-3 Pipe Joints.

3-3.1 Joints shall be made liquidtight and shall be either welded, flanged, or threaded, except that listed flexible connectors may be used when installed in accordance with 3-3.2. Threaded joints shall be made up tight with a suitable thread sealant or lubricant. Joints in piping systems handling Class I liquids shall be welded when located in concealed spaces within buildings.

3-3.2 Pipe joints dependent upon the friction characteristics or resiliency of combustible materials for mechanical continuity or liquidtightness of piping shall not be used inside buildings. They may be used outside of buildings above or below ground. If used aboveground outside of buildings, the piping shall either be secured to prevent disengagement at the fitting, or the piping system shall be so designed that any spill resulting from disengagement could not unduly expose persons, important buildings, or structures, and could be readily controlled by remote valves.

3-4 Supports. Piping systems shall be substantially supported and protected against physical damage and excessive stresses arising from settlement, vibration, expansion, or contraction. The installation of nonmetallic piping shall be in accordance with the manufacturer's instructions.

3-5 Protection Against Corrosion. All piping for liquids, both aboveground and underground, where subject to external corrosion, shall be painted or otherwise protected. (*See 2-3.3 for protection of piping connected to underground tanks.*)

3-6 Valves. Piping systems shall contain a sufficient number of valves to operate the system properly and to protect the plant. Piping systems in connection with pumps shall contain a sufficient number of valves to control properly the flow of liquid in normal operation and in the event of physical damage. Each connection to piping by which equipment such as tank cars, tank vehicles, or marine vessels discharge liquids into storage tanks shall be provided with a check valve for automatic protection against back-flow if the piping arrangement is such that back-flow from the system is possible. (*See also 2-2.7.1.*)

3-7 Testing. Unless tested in accordance with the applicable sections of ANSI B31, *American National Standard Code for Pressure Piping*, all piping, before being covered, enclosed, or placed in use, shall be hydrostatically tested to 150 percent of the maximum anticipated pressure of the system, or pneumatically tested to 110 percent of the maximum anticipated pressure of the system, but not less than 5 psi (34.5 kPa) gage at the highest point of the system. This test shall be maintained for a sufficient time to complete visual inspection of all joints and connections, but for at least 10 minutes.

3-8* Identification. Each loading and unloading riser for liquid storage shall be identified by color code or marking to identify the product for which the tank is used.

Chapter 4 Container and Portable Tank Storage

4-1 Scope.

4-1.1 This chapter shall apply to the storage of liquids, including flammable aerosols, in drums or other containers not exceeding 60 gal (227 L) individual capacity and portable tanks not exceeding 660 gal (2498 L) individual capacity and limited transfers incidental thereto. For portable tanks exceeding 660 gal (2498 L), Chapter 2 shall apply.

4-1.2 This chapter shall not apply to the following:

(a) Storage of containers in bulk plants, service stations, refineries, chemical plants, and distilleries.

(b) Liquids in the fuel tanks of motor vehicles, aircraft, boats, or portable or stationary engines.

(c) Beverages, when packaged in individual containers not exceeding a capacity of one gallon.

(d) Medicines, foodstuffs, cosmetics, and other consumer products containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solution not being flammable when packaged in individual containers not exceeding one gallon in size.

(e) The storage of liquids that have no fire point when tested by ASTM D 92-78, the Cleveland Open Cup Test Method, up to the boiling point of the liquid, or up to a temperature at which the sample being tested shows an obvious physical change.

(f) The storage of distilled spirits and wines in wooden barrels or casks.

4-1.3 For the purpose of this chapter, unstable liquids and flammable aerosols shall be treated as Class IA liquids.

4-2 Design, Construction, and Capacity of Containers.

4-2.1 Only approved containers and portable tanks shall be used. Metal containers and portable tanks meeting the requirements of, and containing products authorized by, Chapter I, Title 49 of the *Code of Federal Regulations* (DOT Regulations), or NFPA 386, *Standard for Portable Shipping Tanks for Flammable and Combustible Liquids*, shall be acceptable. Polyethylene containers meeting the requirements of, and containing products authorized by, DOT Specification 34, and polyethylene drums authorized by DOT Exemption Procedures, shall be acceptable. Plastic containers meeting the requirements of ANSI/ASTM D 3435-80, *Plastic Containers (Jerry Cans) for Petroleum Products*, used for petroleum products within the scope of that specification shall be acceptable.

4-2.2 Each portable tank shall be provided with one or more devices installed in the top with sufficient emergency venting capacity to limit internal pressure under fire exposure conditions to 10 psig (68.9 kPa), or 30 percent of the bursting pressure of the tank, whichever is greater. The total venting capacity shall be not less than that specified in 2-2.5.4 or 2-2.5.6. At least one pressure-actuated vent having a minimum capacity of 6,000 cu ft (170 m^3) of free air per hour

[14.7 psia (760 mm Hg) and 60°F (15.6°C)] shall be used. It shall be set to open at not less than 5 psig (34.5 kPa). If fusible vents are used, they shall be actuated by elements that operate at a temperature not exceeding 300°F (148.9°C). When used for paints, drying oils, and similar materials where plugging of the pressure-actuated vent can occur, fusible vents or vents of the type that soften to failure at a maximum of 300°F (148.9°C) under fire exposure may be used for the entire emergency venting requirement.

4-2.3 Containers and portable tanks for liquids shall conform to Table 4-2.3 except as provided in 4-2.3.1 or 4-2.3.2.

4-2.3.1 Medicines, beverages, foodstuffs, cosmetics, and other common consumer products, when packaged according to commonly accepted practices for retail sales, shall be exempt from the requirements of 4-2.1 and 4-2.3.

4-2.3.2 DOT Type III polyethylene nonreusable containers, constructed and tested in accordance with DOT specification 2U, treated if necessary to prevent permeation, may be used for storage of Class II and Class III liquids, in all capacities not to exceed 2½ gal.

4-2.3.3 Class IA and Class IB liquids may be stored in glass containers of not more than one gallon capacity if the required liquid purity (such as ACS analytical reagent grade or higher) would be affected by storage in metal containers or if the liquid would cause excessive corrosion of the metal container.

4-3 Design, Construction, and Capacity of Storage Cabinets.

4-3.1 Not more than 120 gal (454 L) of Class I, Class II, and Class IIIA liquids may be stored in a storage cabinet. Of this total, not more than 60 gal (227 L) may be of Class I and Class II liquids and not more than three (3) such cabinets may be located in a single fire area, except that, in an industrial occupancy, additional cabinets may be located in the same fire area if the additional cabinet, or group of not more than three (3) cabinets, is separated from other cabinets or group of cabinets by at least 100 ft (30 m).

Table 4-2.3 Maximum Allowable Size of Containers and Portable Tanks

	Flammable Liquids			Combustible Liquids	
Container Type	Class IA	Class IB	Class IC	Class II	Class III
Glass	1 pt	1 qt	1 gal	1 gal	5 gal
Metal (other than DOT drums) or approved plastic	1 gal	5 gal	5 gal	5 gal	5 gal
Safety Cans	2 gal	5 gal	5 gal	5 gal	5 gal
Metal Drum (DOT Spec.)	60 gal	60 gal	60 gal	60 gal	60 gal
Approved Portable Tanks	660 gal	660 gal	660 gal	660 gal	660 gal
Polyethylene DOT Spec. 34, or as authorized by DOT Exemption	1 gal	5 gal	5 gal	60 gal	60 gal

SI Units: 1 pt = 0.473 L; 1 qt = 0.95 L; 1 gal = 3.8 L.

4-3.2* Storage cabinets shall be designed and constructed to limit the internal temperature at the center, 1 in. (2.5 cm) from the top to not more than 325°F (162.8°C) when subjected to a 10-minute fire test with burners simulating a room fire exposure using the standard time-temperature curve as given in ASTM E 152-81a. All joints and seams shall remain tight and the door shall remain securely closed during the fire test.

The cabinet is not required to be vented for fire protection purposes; however, the following shall apply:

(a) If the cabinet is vented for other reasons, the cabinet shall be vented outdoors in such a manner that will not compromise the specified performance of the cabinet, as acceptable to the authority having jurisdiction.

(b) If the cabinet is not vented, the vent openings shall be sealed with a properly fitted metal bung.

4-3.2.1 Metal cabinets constructed in the following manner are acceptable. The bottom, top, door, and sides of cabinet shall be at least No. 18 gage sheet steel and double walled with 1½ in. (3.8 cm) air space. Joints shall be riveted, welded, or made tight by some equally effective means. The door shall be provided with a three-point latch arrangement and the door sill shall be raised at least 2 in. (5 cm) above the bottom of the cabinet to retain spilled liquid within the cabinet.

4-3.2.2 Wooden cabinets constructed in the following manner are acceptable. The bottom, sides, and top shall be constructed of exterior grade plywood at least 1 in. (2.5 cm) in thickness, which shall not break down or delaminate under fire conditions. All joints shall be rabbetted and shall be fastened in two directions with wood screws. When more than one door is used, there shall be a rabbetted overlap of not less than 1 in. (2.5 cm). Doors shall be equipped with a means of latching and hinges shall be constructed and mounted in such a manner as to not lose their holding capacity when subjected to fire exposure. A raised sill or pan capable of containing a 2-in. (5-cm) depth of liquid shall be provided at the bottom of the cabinet to retain spilled liquid within the cabinet.

4-3.2.3 Listed cabinets that have been constructed and tested in accordance with 4-3.2 shall be acceptable.

4-4 Design, Construction, and Operation of Separate Inside Storage Areas. (*See Section 1-2, Definitions.*) (For additional information, see Appendix C.)

4-4.1 Inside Rooms.

4-4.1.1 Inside rooms shall be constructed to meet the selected fire-resistance rating as specified in 4-4.1.4. Such construction shall comply with the test specifications given in NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials.* Except for drains, floors shall be liquidtight and the room shall be liquidtight where the walls join the floor. Where an automatic fire protection system is provided, as indicated in 4-4.1.4, the system shall be designed and installed in accordance with the appropriate NFPA standard for the type of system selected.

4-4.1.2 Openings in interior walls to adjacent rooms or buildings shall be provided with:

(a) Normally closed, listed 1½ hr (B) fire doors for interior walls with fire-resistance rating of 2 hr or less. Where interior walls are required to have greater than 2 hr fire-resistance rating, the listed fire doors shall be compatible with the wall rating. Doors may be arranged to stay open during material handling operations if doors are designed to close automatically in a fire emergency by provision of listed closure devices. Fire doors shall be installed in accordance with NFPA 80, *Standard for Fire Doors and Windows.*

(b) Noncombustible liquidtight raised sills or ramps at least 4 in. (10 cm) in height or otherwise designed to prevent the flow of liquids to the adjoining areas. A permissible alternative to the sill or ramp is an open-grated trench, which drains to a safe location, across the width of the opening inside of room.

4-4.1.3 Wood at least 1 in. (2.5 cm) nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.

4-4.1.4 Storage in inside rooms shall comply with the following:

Automatic Fire Protection* Provided	Fire Resistance	Maximum Floor Area	Total Allowable Quantities—Gallons/ Sq Ft/Floor Area
YES	2 hr	500 sq ft	10
NO	2 hr	500 sq ft	4**
YES	1 hr	150 sq ft	5
NO	1 hr	150 sq ft	2

SI Units: 1 sq ft = 0.09 m²; 1 gal = 3.8 L.

*Fire protection system shall be sprinkler, water spray, carbon dioxide, dry chemical, halon, or other approved system.

**Total allowable quantities of Class IA and IB Liquids shall not exceed that permitted in Table 4-4.2.7 and the provisions of 4-4.2.10.

4-4.1.5 Electrical wiring and equipment located in inside rooms used for Class I liquids shall be suitable for Class I, Division 2 classified locations; for Class II and Class III liquids, shall be suitable for general use. NFPA 70, *National Electrical Code®*, provides information on the design and installation of electrical equipment.

4-4.1.6 Every inside room shall be provided with either a gravity or a continuous mechanical exhaust ventilation system. Mechanical ventilation shall be used if Class I liquids are dispensed within the room.

(a) Exhaust air shall be taken from a point near a wall on one side of the room and within 12 in. (30 cm) of the floor with one or more make-up inlets located on the opposite side of the room within 12 in. (30 cm) from the floor. The location of both the exhaust and inlet air openings shall be arranged to provide, as far as practicable, air movements across all portions of the floor to prevent accumulation of flammable vapors. Exhaust from the room shall be directly to the exterior of the building without recirculation.

Exception: Recirculation is permitted where it is monitored continuously using a fail-safe system that is designed to automatically sound an alarm, stop recirculation, and provide full exhaust to the outside in the event that vapor-air mixtures in concentration over one-fourth of the lower flammable limit are detected.

If ducts are used, they shall not be used for any other purpose and shall comply with NFPA 91, *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying.* If make-up air to a mechanical system is taken from within the building, the opening shall be equipped with a fire door or damper, as required in NFPA 91, *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying.* For gravity systems, the make-up air shall be supplied from outside the building.

(b) Mechanical ventilation systems shall provide at least one cubic foot per minute of exhaust per square foot of floor area (1 m^3 per 3 m^2), but not less than 150 cfm (4 m^3). The mechanical ventilation system for dispensing areas shall be equipped with an airflow switch or other equally reliable method that is interlocked to sound an audible alarm upon failure of the ventilation system.

4-4.1.7 In every inside room, an aisle at least 3 ft (0.90 m) wide shall be maintained so that no container is more than 12 ft (3.6 m) from the aisle. Containers over 30 gal (113.5 L) capacity storing Class I or Class II liquids shall not be stored more than one container high.

4-4.1.8 Where dispensing is being done in inside rooms, operations shall comply with the provisions of Chapter 5.

4-4.1.9 **Basement Storage Areas.** Class I liquids shall not be permitted in inside storage rooms in basement areas.

4-4.2 Cutoff Rooms and Attached Buildings.

4-4.2.1 Construction design of exterior walls shall provide ready accessibility for fire fighting operations through provision of access openings, windows, or lightweight noncombustible wall panels. Where Class IA or IB liquids are dispensed, or where Class IA liquids are stored in containers larger than one gallon, the exterior wall or roof construction shall be designed to include explosion-venting features, such as lightweight wall assemblies, lightweight roof assemblies, roof hatches, or windows of the explosion-venting type. NFPA 68, *Guide for Explosion Venting*, provides information on this subject.

4-4.2.2 Where other portions of buildings or other properties are exposed, each opening in the exposing wall shall be protected with a listed 1½ hr (D) fire door installed in accordance with NFPA 80, *Standard for Fire Doors and Windows*, and the walls shall have a fire-resistance rating of not less than 2 hrs.

4-4.2.3 Except as noted in 4-4.2.6, interior walls, ceiling, and floors shall have a fire-resistance rating of not less than 2 hrs where floor area of the room or

building exceeds 300 sq ft (27 m^2) or a fire-resistance rating of not less than one hour for a floor area of 300 sq ft (27 m^2) or less. Such construction shall comply with the test specifications given in NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*. Walls shall be liquidtight at the floor level.

4-4.2.4 Openings in interior walls to adjacent rooms or buildings shall be in accordance with 4-4.1.2 (a).

4-4.2.5 Curbs, scuppers, special drains, or other suitable means shall be provided to prevent the flow of liquids under emergency conditions into adjacent building areas except where the individual container capacity is 5 gal (18.9 L) or less or if the liquids stored are only Class III liquids. The drainage system, if used, shall have sufficient capacity to carry off expected discharge of water from fire protection systems and hose streams.

4-4.2.6 Roofs of attached buildings, one story in height, may be lightweight noncombustible construction if the separating interior wall as specified in 4-4.2.3 has a minimum 3-ft (0.90-m) parapet.

4-4.2.7 Unprotected storage in cutoff rooms and attached buildings shall comply with Table 4-4.2.7. (*See 4-4.2.10 for mixed storage of liquids.*)

4-4.2.8 Protected storage in cutoff rooms and attached buildings shall comply with Section 4-6 as applicable. (*See 4-4.2.10 for mixed storage of liquids.*)

4-4.2.9 Wood at least 1-in. (2.5-cm) nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.

4-4.2.10 Where two or more classes of liquids are stored in a single pile or rack section, the maximum quantities and height of storage permitted in that pile or rack section shall be the smallest of the two or more separate quantities and heights. The maximum total quantities permitted shall be limited to a sum of proportional amounts that each class of liquid present bears to the maximum total permitted for its respective class; sum of proportional amounts not to exceed 100 percent.

4-4.2.11 Dispensing operations of Class I or Class II liquids are not permitted in cutoff rooms or attached buildings exceeding 1000 sq ft (93 m^2) floor area. In rooms where dispensing of Class I liquids is permitted, electrical systems shall comply with 4-4.1.5, except that within 3 ft (0.90 m) of a dispensing nozzle area, the electrical system shall be suitable for Class I, Division 1; ventilation shall be provided per 4-4.1.6; and operations shall comply with the provisions of Chapter 5.

4-4.2.12 Basement Storage Areas. Class I liquids shall not be permitted in the basement areas of cutoff rooms and attached buildings. Class II and Class IIIA liquids may be stored in basements provided that automatic sprinkler protection and other fire protection facilities are provided in accordance with Section 4-6.

4-5 Indoor Storage.

4-5.1 Basic Conditions.

4-5.1.1 The storage of any liquids shall not physically obstruct a means of egress. Class I liquids in other than separate inside storage areas or warehouses shall be so placed that a fire in the liquid storage would not preclude egress from the area.

4-5.1.2 The storage of liquids in containers or portable tanks shall comply with 4-5.2 through 4-5.7, as applicable. Where separate inside storage areas are required, they shall conform to Section 4-4. Where other factors substantially increase or decrease the hazard, the authority having jurisdiction may modify the quantities specified.

4-5.1.3 Liquids used for building maintenance painting or other similar infrequent maintenance purposes may be stored temporarily in closed containers outside of storage cabinets or separate inside storage areas, if limited in amount, not to exceed a 10-day supply at anticipated rates of consumption.

4-5.1.4 Class I liquids shall not be stored in a basement, except as provided in 4-5.5.

4-5.2 Dwellings and Residential Buildings Containing Not More Than Three Dwelling Units and Accompanying Attached and Detached Garages. Storage in excess of 25 gal (94.6 L) of Class I and Class II liquids combined shall be prohibited. In addition, storage in excess of 60 gal (227 L) of Class IIIA liquid shall be prohibited.

Table 4-4.2.7 Indoor Unprotected Storage of Liquids in Containers and Portable Tanks

	Container Storage			Portable Tank Storage		
Class	Max. Pile Height (ft)	Max. Quant. per Pile (gal)	Max. Total Quant. (gal)	Max. Pile Height (ft)	Max. Quant. per Pile (gal)	Max. Total Quant. (gal)
IA	5	660	660	—	Not Permitted	—
IB	5	1,375	1,375	7	2,000	2,000
IC	5	2,750	2,750	7	4,000	4,000
II	10	4,125	8,250	7	5,500	11,000
IIIA	15	13,750	27,500	7	22,000	44,000
IIIB	15	13,750	55,000	7	22,000	88,000

SI Units: 1 ft = 0.30 m; 1 gal = 3.8 L.

4-5.3 Assembly Occupancies, Buildings Containing More Than Three Dwelling Units, and Hotels. Storage in excess of 10 gal (37.8 L) of Class I and Class II liquids combined or 60 gal (227 L) of Class IIIA liquids shall be in containers stored in storage cabinets, in safety cans, or in a separate inside storage area not having an opening communicating with that portion of the building used by the public.

4-5.4 Office, Educational, and Institutional Occupancies. Storage shall be limited to that required for operation of office equipment, maintenance, demonstration, and laboratory work. This storage shall comply with the provisions of 4-5.4.1 through 4-5.4.4 except that the storage for industrial and educational laboratory work shall comply with NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals.*

4-5.4.1 Containers for Class I liquids outside of a separate inside storage area shall not exceed a capacity of 1 gal (3.8 L) except that safety cans can be of 2 gal (7.6 L) capacity.

4-5.4.2 Not more than 10 gal (37.8 L) of Class I and Class II liquids combined shall be stored in a single fire area outside of a storage cabinet or a separate inside storage area unless in safety cans.

4-5.4.3 Not more than 25 gal (94.6 L) of Class I and Class II liquids combined shall be stored in a single fire area in safety cans outside of a separate inside storage area or storage cabinet.

4-5.4.4 Not more than 60 gal (227 L) of Class IIIA liquids shall be stored outside of a separate inside storage area or storage cabinet.

4-5.5 Mercantile Occupancies, Retail Stores, and Other Related Areas Accessible to the Public.

4-5.5.1* In display areas that are accessible to the public, the storage of Class I, Class II, and Class IIIA liquids shall be limited to quantities needed for display and normal merchandising purposes but shall not exceed the limits as given by the following (*also see Table A-4-5.5.1*):

(a) In protected display areas, the total aggregate quantity of Class I, II, and IIIA liquids shall not exceed 2 gal per sq ft (81 L per m^2) of gross floor area, but, except for basement display areas, the quantity of Class IA liquids shall not exceed 1 gal per sq ft (40 L per m^2) of gross floor area. In basement display areas, the storage of Class IA liquids shall be prohibited.

(b) In unprotected display areas on other than the ground floor, the total aggregate quantity of Class IB, IC, II, and IIIA liquids shall not exceed 1 gal per sq ft (40 L per m^2) of gross floor area, and the storage of Class IA liquids shall be prohibited. In unprotected ground floor display areas, the total aggregate quantity of Class I, II, and IIIA liquids shall not exceed 2 gal per sq ft (81 L per m^2) of gross floor area, but the quantity of Class IA liquids shall not exceed 1 gal per sq ft (40 L per m^2) of gross floor area.

"Protected" shall mean protected with automatic sprinklers installed at least in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, requirements for Ordinary Hazard Group 2 Occupancies. The gross floor area used for computing the maximum quantity permitted shall be considered as that portion of the floor actually being used for merchandising liquids and immediately adjacent aisles.

4-5.5.2 The aggregate quantity of additional stock in areas not accessible to the public shall not exceed the greater of that which would be permitted if the area were accessible to the public, or 60 gal (227 L) of Class IA, 120 gal (454 L) of Class IB, 180 gal (681 L) of Class IC, 240 gal (908 L) of Class II, or 660 gal (2498 L) of Class IIIA liquids, or 240 gal (908 L) in any combination of Class I and Class II liquids subject to the limitations of the individual class. These quantities may be doubled for areas protected as defined in 4-5.5.1. Storage of Class IA liquids shall be prohibited in basement storage areas.

4-5.5.3 Quantities in excess of those permitted in 4-5.5.2 shall be stored in accordance with other appropriate sections of this code.

4-5.5.4 Containers shall not be stacked more than 3 ft (0.90 m) or 2 containers high, whichever is the greater, unless on fixed shelving or otherwise satisfactorily secured.

4-5.5.5 Shelving shall be of stable construction, of sufficient depth and arrangement such that containers displayed thereon shall not easily be displaced.

4-5.5.6 Leaking containers shall be removed immediately to an adequately ventilated area, and the contents transferred to an undamaged container.

4-5.6 General-Purpose Warehouses. (*See 1-2, Definitions.*)

4-5.6.1 General-purpose warehouses shall be separate, detached buildings or shall be separated from other type occupancies by a standard 4-hr fire wall, or, if approved, a fire partition having a fire-resistance rating of not less than 2 hr. Each opening in a fire wall shall be protected with an automatic-closing, listed 3-hr (A) fire door with the fusible link or other automatic actuating mechanism located in the opening or on both sides of the opening. Each opening in a fire partition shall be protected with an automatic-closing, listed 1½-hr (B) fire door. The doors shall be installed in accordance with NFPA 80, *Standard for Fire Doors and Windows.*

4-5.6.2 Warehousing operations that involve storage of liquids shall be restricted to separate inside storage areas or to liquid warehouses in accordance with Section 4-4 or 4-5.7, as applicable, except as provided in 4-5.6.3.

4-5.6.3 Class IB and IC liquids in containers of 1 gal (3.8 L) or less capacity, Class II liquids in containers of 5 gal (18.9 L) or less capacity, and Class III liquids in containers of 60 gal (227 L) or less capacity may be stored in warehouses handling combustible commod-

ities, as defined in the scope of NFPA 231, *Standard for General Storage*, provided that the storage area is protected with automatic sprinklers in accordance with the provisions of this standard for 20 ft (6 m) storage of Class IV commodities and the quantities and height of liquid storage are limited to:

(a) Class IA liquids—not permitted

(b) Class IB & IC 660 gal (2498 L)—5 ft (1.5 m) high

(c) Class II 1375 gal (5204 L)—5 ft (1.5 m) high

(d) Class IIIA 2750 gal (10409 L)—10 ft (3.0 m) high

(e) Class IIIB 13,750 gal (52044 L)—15 ft (4.6 m) high

The liquid storage shall also conform to 4-5.6.4, 4-5.6.5, 4-5.6.6, 4-5.6.7, and 4-5.6.8.

4-5.6.4 Liquids in Plastic Containers. Effective September 1, 1990, Class I and Class II liquids in plastic containers shall not be stored in general-purpose warehouses, but shall be stored in separate inside rooms or liquid warehouses in accordance with Section 4-4 or 4-5.7, as applicable.

Exception No. 1: Liquids in plastic containers may be stored in general-purpose warehouses in accordance with protection and storage limitations specified in 4-5.6.3 as follows:

(a) products containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solution being not flammable when packaged in individual containers,

(b) water-miscible liquids containing more than 50 percent by volume in individual containers not exceeding 16 oz. capacity.

Exception No. 2: Class I and Class II liquids in plastic containers may be stored in a general-purpose warehouse if in containers approved and fire-tested for use with these materials.

4-5.6.5 Basement Storage Areas. Class I liquids shall not be permitted in the basement areas of buildings. Class II and Class IIIA liquids may be stored in basements provided that automatic sprinkler protection and other fire protection facilities are provided in accordance with Section 4-6.

4-5.6.6 Palletized, Solid Pile, or Rack Storage. Liquids in containers may be stored on pallets, in solid piles or on racks subject to the quantities and heights limits of 4-5.6.3 provided the protection is in accordance with Section 4-6, as applicable.

4-5.6.7 Separation and Aisles. Palletized or solid pile storage shall be arranged so that piles permitted in 4-5.6.3 are separated from each other by at least 4-ft (1.2-m) aisles. Aisles shall be provided so that no container is more than 12 ft (3.6 m) from an aisle. Where liquids are stored on racks, a minimum 4-ft (1.2-m) wide aisle shall be provided between adjacent rows of racks and adjacent storage of liquids. Main aisles shall be a minimum of 8 ft (2.4 m) wide. Where ordinary combustible commodities are stored in the same area as liquids in containers, the minimum distance between the two types of storage shall be 8 ft (2.4 m).

4-5.6.8 Mixed Storage. Liquids shall not be stored in the same pile or in the same rack sections as ordinary combustible commodities. Where liquids are packaged together with ordinary combustibles, as in kits, the storage shall be considered on the basis of whichever commodity predominates. When two or more classes of liquids are stored in a single pile or single rack section, the maximum quantities permitted in the pile or rack section shall be the smallest of the two or more separate maximum quantities, and the height of storage permitted in that pile or rack section shall be the least of the two or more separate heights. The maximum total quantities permitted shall be limited to the sum of proportional amounts that each class of liquid present bears to the maximum total permitted for its respective class. The sum of proportional amounts shall not exceed 100 percent.

4-5.7 Liquid Warehouses. (*See 1-2 Definitions.*)

4-5.7.1 Liquid warehouses shall be separate, detached buildings or shall be separated from other type occupancies by standard 4-hr fire walls, with communicating openings protected on each side of the wall with automatic-closing, listed 3-hr (A) fire doors. Fire doors shall be installed in accordance with NFPA 80, *Standard for Fire Doors and Windows.*

4-5.7.2 If the warehouse building is located more than 10 ft (3 m) but less than 50 ft (15 m) from an important building or line of adjoining property that can be built upon, the exposing wall shall have a fire-resistance rating of at least 2 hrs with each opening protected with a listed 1½-hr (D) fire door.

4-5.7.3 If the warehouse is located 10 ft (3 m) or less from an important building or line of adjoining property that can be built upon, the exposing wall shall have a fire-resistance rating of 4 hrs with each opening protected with a listed 3-hr (A) fire door.

4-5.7.4 An attached warehouse, having communicating openings in the required 4-hr fire wall separation from the adjacent building area, shall have these openings protected by:

(a) Normally closed, listed 3-hr (A) fire doors on each side of the wall. These doors may be arranged to stay open during material handling operations, only if the doors are designed to close automatically in a fire emergency by provision of listed closure devices.

(b) Noncombustible, liquidtight raised sills or ramps, at least 4 in. (10 cm) in height, or other design features to prevent flow of liquids to the adjoining area.

4-5.7.5 Fire doors shall be installed in accordance with NFPA 80, *Standard for Fire Doors and Windows.*

4-5.7.6 The total quantity of liquids within a liquid warehouse shall not be restricted. The maximum pile heights and maximum quantity per pile, arranged as palletized and/or solid pile storage, shall comply with

Table 4-4.2.7, if unprotected, or Table 4-6.1(a) if protected, in accordance with Section 4-6. The storage heights of containers on protected racks shall comply with Table 4-6.1(b), as applicable.

Exception: An unprotected liquid warehouse located a minimum of 100 ft (30 m) from exposed buildings or adjoining property that can be built upon is not required to conform to Table 4-4.2.7, if there is protection for exposures. Where protection for exposures is not provided, a minimum 200 ft (61 m) distance is required.

4-5.7.7 Class I liquids shall not be permitted in the basement areas of liquid warehouses. Class II and Class IIIA liquids may be stored in basements provided that automatic sprinkler protection and other fire protection facilities are provided in accordance with Section 4-6.

4-5.7.8 Limited amounts of combustible commodities, as defined in the scope of NFPA 231, *Standard for General Storage*, and NFPA 231C, *Standard for Rack Storage of Materials*, may be stored in liquid warehouses if protection is provided in accordance with Section 4-6, and the ordinary combustibles, other than those used for packaging the liquids, are separated a minimum of 8 ft (2.4 m) horizontally, by aisles or open racks, from the liquids in storage.

4-5.7.9 Empty or idle combustible pallet storage shall be limited to a maximum pile size of 2500 sq ft (232 m^2) and to a maximum storage height of 6 ft (1.8 m). Idle pallet storage shall be separated from liquids by at least 8-ft (2.4-m) wide aisles. However, pallet storage in accordance with NFPA 231, *Standard for General Storage*, shall be acceptable.

4-5.7.10 Containers in piles shall be separated by pallets or dunnage to provide stability and to prevent excessive stress on container walls. Portable tanks stored over one tier high shall be designed to nest securely, without dunnage. (*See NFPA 386, Standard for Portable Shipping Tanks for Flammable and Combustible Liquids, for information on portable tank design.*) Materials handling equipment shall be suitable to handle containers and tanks safely at the upper tier level.

4-5.7.11 No container or portable tank shall be stored closer than 36 in. (0.90 m) to the nearest beam, chord, girder, or other roof member in an unprotected warehouse.

4-5.7.12 Solid pile and palletized storage shall be arranged so that piles are separated from each other by at least 4 ft (1.2 m). Aisles shall be provided so that no container or tank is more than 12 ft (3.6 m) from an aisle. Where storage on racks exists as permitted in this Code, a minimum 4-ft (1.2-m) wide aisle shall be provided between adjacent rows of racks and any adjacent storage of liquids. Main aisles shall be a minimum of 8 ft (2.4 m) wide, and access shall be maintained to all doors required for egress.

4-5.7.13 Mixed Storage. When two or more classes of liquids are stored in a single pile, the maximum quantity permitted in that pile shall be the smallest of the two or more separate maximum quantities and the heights of storage permitted in that pile shall be the least of the two or more separate heights as given in Tables 4-4.2.7 or 4-6.1(a), as applicable. When two or more classes of liquids are stored in the same racks as permitted in this Code, the maximum height of storage permitted shall be the least of the two or more separate heights given in Table 4-6.1(b).

4-6 Protection Requirements for Protected Storage of Liquids.

4-6.1 Containers and portable tanks storing flammable and combustible liquids may be stored in the quantities and arrangements specified in Tables 4-6.1(a) and 4-6.1(b), provided the storage is pro-

Table 4-6.1(a) Storage Arrangements for Protected Palletized or Solid Pile Storage of Liquids in Containers and Portable Tanks

Class	Storage Level	Max. Stge. Height (ft.)		Max. Quantity per Pile (gal.)		Max. Quantity (gal.)	
		Containers	Port. Tanks	Containers	Port. Tanks	Containers	Port. Tanks
IA	Ground Floor	5	—	3,000	—	12,000	—
	Upper Floors	5	—	2,000	—	8,000	—
	Basements	——Not Permitted——		—	—	—	—
IB	Ground Floor	6½	7	5,000	20,000	15,000	40,000
	Upper Floors	6½	7	3,000	10,000	12,000	20,000
	Basements	——Not Permitted——		—	—	—	—
IC	Ground Floor	*6½	7	5,000	20,000	15,000	40,000
	Upper Floors	*6½	7	3,000	10,000	12,000	20,000
	Basements	——Not Permitted——		—	—	—	—
II	Ground Floor	10	14	10,000	40,000	25,000	80,000
	Upper Floors	10	14	10,000	40,000	25,000	80,000
	Basements	5	7	7,500	20,000	7,500	20,000
III	Ground Floor	20	14	15,000	60,000	50,000	100,000
	Upper Floors	20	14	15,000	60,000	50,000	100,000
	Basements	10	7	10,000	20,000	25,000	40,000

SI Units: 1 ft = 0.30 m; 1 gal = 3.8 L.
* These height limitations may be increased to 10 ft for containers of 5 gal or less in capacity.
NOTE: See Section 4-6 for protection requirements as applicable to this type of storage.

Table 4-6.1(b) Storage Arrangements for Protected Rack Storage of Liquids in Containers

Class	Type Rack	Storage Level	Max. Stge. Height (ft) Containers	Max. Quantity (gal) Containers
IA	Double Row or Single Row	Ground Floor	25	7,500
		Upper Floor	15	4,500
		Basements	Not Permitted	—
IB	Double Row or Single Row	Ground Floor	25	15,000
		Upper Floor	15	9,000
IC		Basements	Not Permitted	—
II	Double Row or Single Row	Ground Floor	25	24,000
		Upper Floor	25	24,000
		Basements	15	9,000
III	Multi-Row Double Row or Single Row	Ground Floor	40	48,000
		Upper Floor	20	48,000
		Basements	20	24,000

SI Units: 1 ft = 0.30 m; 1 gal = 3.8 L.

NOTE: See Section 4-6 for protection requirements as applicable to this type of storage.

tected in accordance with 4-6.2 and 4-6.5, as applicable.

4-6.1.1 Other quantities and arrangements may be used where suitably protected and approved by the authority having jurisdiction.

4-6.2 Where automatic sprinklers are used, they shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, and approved by the authority having jurisdiction. (*For additional information, see Appendix D.*)

4-6.2.1 Other systems such as automatic foam-water systems, automatic water-spray systems, or other combinations of systems may be considered acceptable if approved by the authority having jurisdiction. (*For additional information, see Appendix D.*)

4-6.3 Racks storing Class I or Class II liquids shall be either single-row or double-row as described in NFPA 231C, *Standard for Rack Storage of Materials.*

4-6.4 Ordinary combustibles other than those used for packaging the liquids shall not be stored in the same rack section as liquids, and shall be separated a minimum of 8 ft (2.4 m) horizontally, by aisles or open racks, from liquids stored in racks.

4-6.5 In-rack sprinklers shall be installed in accordance with the provisions of NFPA 231C, *Standard for Rack Storage of Materials*, except as modified by 4-6.2. Alternate lines of in-rack sprinklers shall be staggered. Multiple levels of in-rack sprinkler heads shall be provided with water shields unless otherwise separated by horizontal barriers, or unless the sprinkler heads are listed for such installations.

4-7 Fire Control.

4-7.1 Suitable fire extinguishers or preconnected hose lines, either 1½-in. (3.8-cm) lined or 1-in. (2.5-cm) hard rubber, shall be provided where liquids are stored. Where 1½-in. (3.8-cm) fire hose is used, it shall be installed in accordance with NFPA 14, *Standard for the Installation of Standpipe and Hose Systems.*

4-7.1.1 At least one portable fire extinguisher having a rating of not less than 20-B shall be located outside of, but not more than 10 ft (3 m) from, the door opening into any separate inside storage area.

4-7.1.2 At least one portable fire extinguisher having a rating of not less than 20-B shall be located not less than 10 ft (3 m), nor more than 50 ft (15 m), from any Class I or Class II liquid storage area located outside of a separate inside storage area.

4-7.1.3 In protected general purpose and liquid warehouses, hand hose lines shall be provided in sufficient number to reach all liquid storage areas.

4-7.1.4 The water supply shall be sufficient to meet the fixed fire protection demand, plus a total of at least 500 gal (1892 L) per minute for inside and outside hose lines. (*See C-4-6.2.*)

4-7.2 Control of Ignition Sources. Precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include but are not limited to: open flames; lightning; smoking; cutting and welding; hot surfaces; frictional heat; static, electrical, and mechanical sparks; spontaneous ignition, including heat-producing chemical reactions; and radiant heat.

4-7.3 Dispensing of Class I and Class II liquids in general-purpose or liquid warehouses shall not be permitted unless the dispensing area is suitably cut off from other ordinary combustible or liquid storage areas, as specified in Section 4-4, and otherwise conforms with the applicable provisions of Section 4-4.

4-7.4 Materials with a water reactivity degree of 2 or higher as outlined in NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials*, shall not be stored in the same area with other liquids.

4-8 Outdoor Storage.

4-8.1 Outdoor storage of liquids in containers and portable tanks shall be in accordance with Table 4-8, as qualified by 4-8.1.1 through 4-8.1.4 and 4-8.2, 4-8.3, and 4-8.4.

4-8.1.1 When two or more classes of materials are stored in a single pile, the maximum gallonage in that pile shall be the smallest of the two or more separate gallonages.

4-8.1.2 No container or portable tank in a pile shall be more than 200 ft (60 m) from a 12-ft (3.6-m) wide access way to permit approach of fire control apparatus under all weather conditions.

4-8.1.3 The distances listed in Table 4-8 apply to properties that have protection for exposures as defined. If there are exposures, and such protection for exposures does not exist, the distances in column 4 shall be doubled.

Table 4-8 Outdoor Liquid Storage in Containers and Portable Tanks

	1		2		3	4	5
Class	Container Storage-Max. per Pile		Portable Tank Storage Max. per Pile Gallons (1)		Distance Between Piles or Racks (ft)	Distance to Property Line That Can Be Built Upon (ft)(2)(3)	Distance to Street, Alley, or a Public Way (ft)(3)
	Gallons (1) (4)	Height (ft)	Gallons (1) (4)	Height (ft)			
IA	1,100	10	2,200	7	5	50	10
IB	2,200	12	4,400	14	5	50	10
IC	4,400	12	8,800	14	5	50	10
II	8,800	12	17,600	14	5	25	5
III	22,000	18	44,000	14	5	10	5

SI Units: 1 ft = 0.30 m; 1 gal = 3.8 L.

NOTES: (1) See 4-8.1.1 regarding mixed class storage.
(2) See 4-8.1.3 regarding protection for exposures.
(3) See 4-8.1.4 for smaller pile sizes.
(4) For storage in racks, the quantity limits per pile do not apply, but the rack arrangement shall be limited to a maximum of 50 feet in length and two rows or 9 feet in depth.

4-8.1.4 When total quantity stored does not exceed 50 percent of maximum per pile, the distances in columns 4 and 5 may be reduced 50 percent, but to not less than 3 ft (0.90 m).

4-8.2 A maximum of 1,100 gal (4163 L) of liquids in closed containers and portable tanks may be stored adjacent to a building located on the same premises and under the same management provided that:

(a) The building is limited to a one-story building of fire-resistive or noncombustible construction and is devoted principally to the storage and handling of liquids, or

(b) The building has an exterior wall with a fire-resistance rating of not less than 2 hr and having no opening to above grade areas within 10 ft (3 m) horizontally of such storage and no openings to below grade areas within 50 ft (15 m) horizontally of such storage.

4-8.2.1 The quantity of liquids stored adjacent to a building protected in accordance with 4-8.2(b) may exceed that permitted in 4-8.2, provided the maximum quantity per pile does not exceed 1,100 gal (4163 L) and each pile is separated by a 10-ft (3-m) minimum clear space along the common wall.

4-8.2.2 Where the quantity stored exceeds the 1,100 gal (4163 L) permitted adjacent to the building given in 4-8.2(a), or the provisions of 4-8.2(b) cannot be met, a minimum distance in accordance with column 4 of Table 4-8 shall be maintained between buildings and the nearest container or portable tank.

4-8.3 The storage area shall be graded in a manner to divert possible spills away from buildings or other exposures or shall be surrounded by a curb at least 6 in. (15 cm) high. When curbs are used, provisions shall be made for draining of accumulations of ground or rain water or spills of liquids. Drains shall terminate at a safe location and shall be accessible to operation under fire conditions.

4-8.4 The storage area shall be protected against tampering or trespassers where necessary and shall be kept free of weeds, debris, and other combustible materials not necessary to the storage.

Chapter 5 Operations

(See Appendix F for Cross-Reference Tables)

5-1 Scope.

5-1.1 This chapter applies to operations involving the use or handling of liquids either as a principal or incidental activity, except as covered elsewhere in this Code or in other NFPA Standards.

5-1.2 The provisions of this chapter relate to the control of hazards of fire involving liquids. These provisions may not provide adequate protection for operations involving hazardous materials or chemical reactions nor do they consider health hazards resulting from exposure to such materials.

5-2 General. Liquid processing operations shall be located and operated so that they do not constitute a significant fire or explosion hazard to life, to property of others, or to important buildings or facilities within the same plant. Specific requirements are dependent on the inherent risk in the operations themselves, including the liquids being processed, operating temperatures and pressures, and the capability to control any liquid or vapor releases or fire incidents that might occur. The interrelationship of the many factors involved must be based on good engineering and management practices to establish suitable physical and operating requirements. (*See 5-5.1.3.*)

5-3 Facility Design.

5-3.1 Location.

5-3.1.1 The minimum distance of a processing vessel to adjoining property or to the nearest important building on the same property shall be based on the stability of the liquid and vessel capacity and shall be in accordance with Table 5-3.1.1, except as modified in 5-3.1.2.

5-3.1.2 Where process vessels are located in a building and the exterior wall facing the exposure (line of adjoining property that can be built upon or nearest important building on the same property) is greater than 25 ft (7.6 m) from the exposure and is a blank wall having a fire-resistance rating of not less than 2 hrs, any greater distances required in Table 5-3.1.1 may be waived. Where a blank wall having a fire-resistance rating of not less than 4 hrs is provided, distance requirements may be waived. In addition, when Class IA or unstable liquids are handled, the wall shall have explosion resistance in accordance with good engineering practice. (*See 5-3.2.7 relative to explosion relief of other walls of this building*).

5-3.1.3 Other liquid processing equipment, such as pumps, heaters, filters, exchangers, etc., shall not be located closer than 25 feet (7.6 m) to property lines where the adjoining property is or can be built upon, or to the nearest important building on the same property that is not an integral part of the process. This spacing requirement may be waived where exposures are protected as outlined in 5-3.1.2.

NOTE: Equipment operated at pressures over 1000 psig (7000 kPa) may require greater spacing.

5-3.1.4 Processing equipment in which unstable liquids are handled shall be separated from unrelated plant facilities that use or handle liquids by either 25-ft (7.6-m) clear spacing or a wall having a fire-resistance rating of not less than 2 hrs. The wall shall also have explosion resistance in accordance with good engineering practice.

5-3.1.5 Each process unit or building containing liquid-processing equipment shall be accessible from at least one side for fire fighting and fire control.

5-3.2 Construction.

5-3.2.1 Processing buildings or structures shall be of fire-resistive or noncombustible construction, except that combustible construction may be used when automatic sprinklers or equivalent protection is provided, subject to approval of the authority having jurisdiction. (*See NFPA 220, Standard on Types of Building Construction.*)

5-3.2.2 Where walls are required for separation of processing operations from other occupancies or property lines, they shall have a fire-resistance rating of at least 2 hrs. In addition, when Class IA or unstable liquids are being stored or processed, the separating wall shall have explosion resistance in accordance with good engineering practice. (*See 5-3.2.7 relative to explosion relief of other walls of this building or area.*)

5-3.2.3 Class I liquids shall not be handled or used in basements. Where Class I liquids are handled or used above grade within buildings with basements or closed pits into which flammable vapors may travel, such below grade areas shall be provided with mechanical ventilation designed to prevent the accumulation of flammable vapors. Means shall be provided to prevent liquid spills from running into basements.

5-3.2.4 Provision for smoke and heat venting may be desirable to assist access for fire fighting. NFPA 204M, *Guide for Smoke and Heat Venting*, provides information on this subject.

5-3.2.5 Areas shall have exit facilities arranged to prevent occupants from being trapped in the event of fire. NFPA *101, Code for Safety to Life from Fire in Buildings and Structures*, provides information on the design of exit facilities. Exits shall not be exposed by the drainage facilities described in 5-3.4.

5-3.2.6 Adequate aisles shall be maintained for unobstructed movement of personnel and fire protection equipment.

5-3.2.7 Areas where Class IA or unstable liquids are processed shall have explosion venting through one or more of the following methods: (a) open air construction; (b) lightweight walls and/or roof; (c) lightweight wall panels and roof hatches; (d) windows of explosion-venting type. NFPA 68, *Guide for Explosion Venting*, provides information on this subject.

Table 5-3.1.1 Location of Processing Vessels from Property Lines and Nearest Important Building on the Same Property Where Protection for Exposures is Provided

Vessel Maximum Operating Liquid Capacity (gal)	Minimum Distance from Property Line that Is or Can Be Built Upon, Including Opposite Side of Public Way (ft)				Minimum Distance from Nearest Side of Any Public Way or from Nearest Important Building on Same Property that Is Not an Integral Part of the Process (ft)			
	Stable Liquid Emergency Relief		*Unstable Liquid Emergency Relief*		*Stable Liquid Emergency Relief*		*Unstable Liquid Emergency Relief*	
	Not Over 2.5 psig	Over 2.5 psig	Not Over 2.5 psig	Over 2.5 psig	Not Over 2.5 psig	Over 2.5 psig	Not Over 2.5 psig	Over 2.5 psig
275 or less	5	10	15	20	5	10	15	20
276 to 750	10	15	25	40	5	10	15	20
751 to 12,000	15	25	40	60	5	10	15	20
12,001 to 30,000	20	30	50	80	5	10	15	20
30,001 to 50,000	30	45	75	120	10	15	25	40
50,001 to 100,000	50	75	125	200	15	25	40	60
Over 100,000	80	120	200	300	25	40	65	100

NOTE: Double all of above distances where protection for exposures is not provided.

5-3.3 Ventilation.

5-3.3.1 Enclosed processing areas handling or using Class I liquids, or Class II or Class III liquids above their flash points, shall be ventilated at a rate of not less than 1 cu ft per minute per sq ft (0.3 m^3 per min per m^2) of solid floor area. This shall be accomplished by natural or mechanical ventilation with discharge or exhaust to a safe location outside the building without recirculation.

Exception: Recirculation is permitted where it is monitored continuously using a fail-safe system that is designed to automatically sound an alarm, stop recirculation, and provide full exhaust to the outside in the event that vapor-air mixtures in concentration over one-fourth of the lower flammable limit are detected.

Provision shall be made for introduction of make-up air in such a manner as to avoid short-circuiting the ventilation. Ventilation shall be arranged to include all floor areas or pits where flammable vapors may collect. Where natural ventilation is inadequate, mechanical ventilation shall be provided and shall be kept in operation while flammable liquids are being handled. Local or spot ventilation may be needed for the control of special fire or health hazards. Such ventilation, if provided, can be utilized for up to 75 percent of the required ventilation. NFPA 91, *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying*, and NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*, provide information on this subject.

5-3.3.2 Equipment used in a building and the ventilation of the building shall be designed to limit flammable vapor-air mixtures under normal operating conditions to the interior of equipment, and to not more than 5 ft (1.5 m) from equipment that exposes Class I liquids to the air. Examples of such equipment are dispensing stations, open centrifuges, plate and frame filters, open vacuum filters, and surfaces of open equipment.

5-3.4 Drainage.

5-3.4.1 Emergency drainage systems shall be provided to direct flammable or combustible liquid leakage and fire protection water to a safe location. This may require curbs, scuppers, or special drainage systems to control the spread of fire (*see 2-2.3*). Appendix A of NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, provides information on this subject.

5-3.4.2 Emergency drainage systems, if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators.

5-3.4.3 A facility shall be designed and operated to prevent the normal discharge of flammable or combustible liquids to public waterways, public sewers, or adjoining property.

5-3.5 Electrical Equipment.

5-3.5.1 This section shall apply to areas where Class I liquids are stored or handled and to areas where Class II or Class III liquids are stored or handled at a temperature above their flash points (*see 1-1.3*).

5-3.5.2 All electrical equipment and wiring shall be of a type specified by, and installed in accordance with, NFPA 70, *National Electrical Code*.

5-3.5.3 So far as it applies, Table 5-3.5.3 shall be used to delineate and classify areas for the purpose of installation of electrical equipment under normal conditions. In the application of classified areas, a classified area shall not extend beyond an unpierced floor, wall, roof, or other solid partition. The designation of classes and divisions is defined in Chapter 5, Article 500, of NFPA 70, *National Electrical Code*. [*See NFPA 497A, Recommended Practice for Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas, and 497M, Manual for Classification of Gases, Vapors, and Dusts for Electrical Equipment in Hazardous (Classified) Locations, for guidance*].

5-3.5.4 The area classifications listed in Table 5-3.5.3 are based on the premise that the installation meets the applicable requirements of this code in all respects. Should this not be the case, the authority having jurisdiction shall have the authority to classify the extent of the area.

5-3.5.5 Where the provisions of 5-3.5.1, 5-3.5.2, 5-3.5.3, and 5-3.5.4 require the installation of electrical equipment suitable for Class I, Division 1 or Division 2 locations, ordinary electrical equipment including switchgear may be used if installed in a room or enclosure that is maintained under positive pressure with respect to the classified area. Ventilation make-up air shall not be contaminated. NFPA 496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*, provides details for these types of installations.

5-3.5.6 For marine terminals handling flammable liquids, Figure 5-3.5.6 shall be used as a minimum basis to delineate and classify areas for the purpose of installation of electrical equipment.

5-4 Liquid Handling, Transfer, and Use.

5-4.1 General.

5-4.1.1 Class I liquids shall be kept in closed tanks or containers when not actually in use. Class II and Class III liquids shall be kept in closed tanks or containers when ambient or process temperature is at or above their flash point.

5-4.1.2 Where liquids are used or handled, provisions shall be made to promptly and safely dispose of leakage or spills.

5-4.1.3 Class I liquids shall not be used outside closed systems where there are open flames or other ignition sources within the classified areas as set forth in Table 5-3.5.3.

5-4.1.4 Transferring liquids by means of pressurizing the container with air is prohibited. Transferring

Table 5-3.5.3 Electrical Area Classifications

Location	NEC Class I Division	Extent of Classified Area
Indoor equipment installed in accordance with 5-3.3.2 where flammable vapor-air mixtures may exist under normal operation	1	Area within 5 feet of any edge of such equipment, extending in all directions.
	2	Area between 5 feet and 8 feet of any edge of such equipment, extending in all directions. Also, area up to 3 feet above floor or grade level within 5 feet to 25 feet horizontally from any edge of such equipment.*
Outdoor equipment of the type covered in 5-3.3.2 where flammable vapor-air mixtures may exist under normal operation	1	Area within 3 feet of any edge of such equipment, extending in all directions.
	2	Area between 3 feet and 8 feet of any edge of such equipment, extending in all directions. Also area up to 3 feet above floor or grade level within 3 feet to 10 feet horizontally from any edge of such equipment.
Tank—Aboveground	1	Area inside dike where dike height is greater than the distance from the tank to the dike for more than 50 percent of the tank circumference.
Shell, Ends, or Roof and Dike Area	2	Within 10 feet from shell, ends, or roof of tank. Area inside dikes to level of top of dike.
Vent	1	Within 5 feet of open end of vent, extending in all directions.
	2	Area bertween 5 feet and 10 feet from open end of vent, extending in all directions.
Floating Roof	1	Area above the roof and within the shell.
Underground Tank Fill Opening	1	Any pit, box, or space below grade level, if any part is within a Division 1 or 2 classified area.
	2	Up to 18 inches above grade level, within a horizontal radius of 10 feet from a loose fill connection, and within a horizontal radius of 5 feet from a tight fill connection.
Vent—Discharging Upward	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 5 feet of open end of vent, extending in all directions.
Drum and Container Filling Outdoors, or Indoors with Adequate Ventilation	1	Within 3 feet of vent and fill openings, extending in all directions.
	2	Area between 3 feet and 5 feet from vent or fill opening, extending in all directions. Also, up to 18 inches above floor or grade level within a horizontal radius of 10 feet from vent or fill openings.
Pumps, Bleeders, Withdrawal Fittings, Meters and Similar Devices		
Indoors	2	Within 5 feet of any edge of such devices, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of such devices.
Outdoors	2	Within 3 feet of any edge of such devices, extending in all directions. Also up to 18 inches above grade level within 10 feet horizontally from any edge of such devices.
Pits		
Without Mechanical Ventilation	1	Entire area within pit if any part is within a Division 1 or 2 classified area.
With Adequate Mechanical Ventilation	2	Entire area within pit if any part is within a Division 1 or 2 classified area.
Containing Valves, Fittings, or Piping, and not within a Division 1 or 2 Classified Area	2	Entire pit.
Drainage Ditches, Separators, Impounding Basins		
Outdoor	2	Area up to 18 inches above ditch, separator, or basin. Also up to 18 inches above grade within 15 feet horizontally from any edge.
Indoor		Same as pits.

*The release of Class I liquids may generate vapors to the extent that the entire building, and possibly a zone surrounding it, should be considered a Class I, Division 2 location.

Table 5-3.5.3, cont.

Location	NEC Class I Division	Extent of Classified Area
Tank Vehicle and Tank Car* Loading Through Open Dome	1	Within 3 feet of edge of dome, extending in all directions.
	2	Area between 3 feet and 15 feet from edge of dome, extending in all directions.
Loading Through Bottom Connections With Atmospheric Venting	1	Within 3 feet of point of venting to atmosphere, extending in all directions.
	2	Area between 3 feet and 15 feet from point of venting to atmosphere, extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of loading connection.
Office and Rest Rooms	Ordinary	If there is any opening to these rooms within the extent of an indoor classified area, the room shall be classified the same as if the wall, curb, or partition did not exist.
Loading Through Closed Dome With Atmospheric Venting	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 15 feet from open end of vent, extending in all directions. Also within 3 feet of edge of dome, extending in all directions.
Loading Through Closed Dome With Vapor Control	2	Within 3 feet of point of connection of both fill and vapor lines, extending in all directions.
Bottom Loading With Vapor Control Any Bottom Unloading	2	Within 3 feet of point of connections, extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of connections.
Storage and Repair Garage for Tank Vehicles	1	All pits or spaces below floor level.
	2	Area up to 18 inches above floor or grade level for entire storage or repair garage.
Garages for Other Than Tank Vehicles	Ordinary	If there is any opening to these rooms within the extent of an outdoor classified area, the entire room shall be classified the same as the area classification at the point of the opening.
Outdoor Drum Storage	Ordinary	
Indoor Warehousing Where There is No Flammable Liquid Transfer	Ordinary	If there is any opening to these rooms within the extent of an indoor classified area, the room shall be classified the same as if the wall, curb, or partition did not exist.
Piers and Wharves		See Figure 5-3.5.6.

*When classifying extent of area, consideration shall be given to fact that tank cars or tank vehicles may be spotted at varying points. Therefore, the extremities of the loading or unloading positions shall be used.

liquids by pressure of inert gas is permitted only if controls, including pressure-relief devices, are provided to limit the pressure so it cannot exceed the design pressure of the vessel, tank, container, and piping system.

5-4.1.5 Positive displacement pumps shall be provided with pressure relief discharging back to the tank, pump suction, or other suitable location, or shall be provided with interlocks to prevent overpressure.

5-4.1.6 Piping, valves, and fittings shall be in accordance with Chapter 3, "Piping, Valves, and Fittings."

5-4.1.7 Listed flexible connectors may be used where vibration exists. Approved hose may be used at transfer stations.

5-4.2 Equipment. Equipment shall be designed and arranged to prevent the unintentional escape of liquids and vapors and to minimize the quantity escaping in the event of accidental release.

5-4.3 Incidental Use of Liquids.

5-4.3.1 This section shall be applicable where the use and handling of liquids is only incidental to the principal business, such as automobile assembly, construction of electronic equipment, furniture manufacturing, or other similar activities.

5-4.3.2 Class I and Class II liquids shall be drawn from or transferred into vessels, containers, or portable tanks in the following manner only:

(a) from original shipping containers with a capacity of 5 gal (19 L) or less,

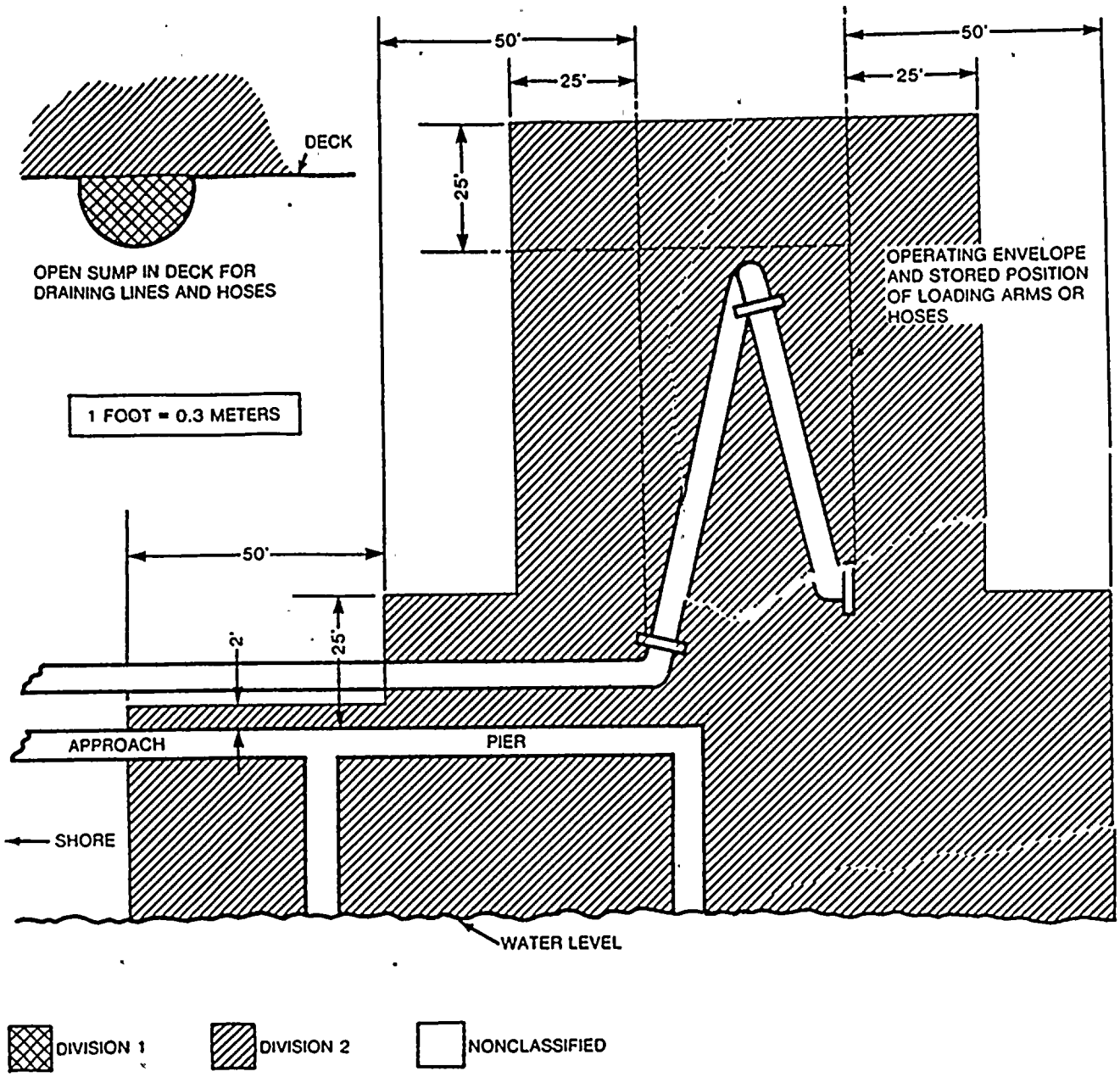
(b) from safety cans,

(c) through a closed piping system,

(d) from portable tanks or containers by means of a device drawing through an opening in the top of the tank or container, or,

(e) by gravity through a listed self-closing valve or self-closing faucet, or

(f) if hose is used in the transfer operation, it shall be equipped with a self-closing valve without a hold-



NOTES:

(1) The "source of vapor" shall be the operating envelope and stored position of the outboard flange connection of the loading arm (or hose).
(2) The berth area adjacent to tanker and barge cargo tanks is to be Division 2 to the following extent:
a. 25 ft (7.6 m) horizontally in all directions on the pier side from that portion of the hull containing cargo tanks.
b. From the water level to 25 ft (7.6 m) above the cargo tanks at their highest position.
(3) Additional locations may have to be classified as required by the presence of other sources of flammable liquids on the berth, or by Coast Guard or other regulations.

Figure 5-3.5.6 Marine Terminal Handling Flammable Liquids.

open latch in addition to the outlet valve. Only listed or approved hose shall be used.

5-4.3.3 Except as provided in 5-4.3.4 and 5-4.3.5, all storage shall comply with Chapter 4, "Container Storage."

5-4.3.4 The quantity of liquid that may be located outside of storage cabinets, inside storage rooms, cut-off rooms and attached buildings, general purpose warehouses, liquid warehouses, or other specific processing areas that are cut off by at least a 2-hr fire-rated separation from the general plant area shall

not exceed the greater of the quantity in either (a) or the sum of (b), (c), (d), and (e) below:

(a) A supply for one day, or

(b) 25 gal (95 L) of Class IA liquids in containers,

(c) 120 gal (454 L) of Class IB, IC, II, or III, liquids in containers,

(d) Two portable tanks each not exceeding 660 gal (2498 L) of Class IB, IC, Class II, or Class IIIA liquids, and

(e) 20 portable tanks each not exceeding 660 gal (2498 L) of Class IIIB liquids.

5-4.3.5 Where quantities of liquids in excess of the limits in 5-4.3.4 are necessary, storage shall be in tanks, which shall comply with the applicable requirements of Chapter 2, "Tank Storage," and Sections 5-3, 5-4.1, and 5-4.2.

5-4.3.6 Areas in which liquids are transferred from one tank or container to another container shall be separated from other operations that might represent an ignition source by distance or by fire-resistant construction. Drainage or other means shall be provided to control spills. Natural or mechanical ventilation shall be provided in accordance with 5-3.3, "Ventilation." NFPA 91, *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying*, provides information on the design and installation of mechanical ventilation.

5-4.4 Loading and Unloading Operations.

5-4.4.1 Tank Vehicles and Tank Cars.

5-4.4.1.1 Tank vehicle and tank car loading or unloading facilities shall be separated from aboveground tanks, warehouses, other plant buildings, or the nearest line of adjoining property that can be built upon by a distance of at least 25 ft (7.6 m) for Class I liquids and at least 15 ft (4.6 m) for Class II and Class III liquids, measured from the nearest fill spout or (liquid or vapor) transfer connection. These distances may be reduced by utilizing fixed fire protection systems, dikes, fire-rated barriers, or combinations of any of these. Buildings for pumps or shelters for personnel may be a part of the facility.

5-4.4.1.2 Static Protection. Bonding facilities for protection against static sparks during the loading of tank vehicles through open domes shall be provided (a) where Class I liquids are loaded, or (b) where Class II or Class III liquids are loaded into vehicles that may contain vapors from previous cargoes of Class I liquids.

5-4.4.1.3 Protection as required in 5-4.4.1.2 shall consist of a metallic bond wire permanently electrically connected to the fill stem or to some part of the rack structure in electrical contact with the fill stem. The free end of such wire shall be provided with a clamp or equivalent device for convenient attachment to some metallic part in electrical contact with the cargo tank of the tank vehicle.

5-4.4.1.4 Such bonding connection shall be made to the vehicle or tank before dome covers are raised and shall remain in place until filling is completed and all dome covers have been closed and secured.

5-4.4.1.5 Bonding, as specified in 5-4.4.1.2, 5-4.4.1.3, and 5-4.4.1.4, is not required:

(a) where vehicles are loaded exclusively with products not having a static accumulating tendency, such as asphalts, including cutback asphalts, most crude oils, residual oils, and water-soluble liquids;

(b) where no Class I liquids are handled at the loading facility and the tank vehicles loaded are used exclusively for Class II and Class III liquids;

(c) where vehicles are loaded or unloaded through closed-bottom or -top connections whether the hose or pipe is conductive or nonconductive.

5-4.4.1.6 Filling through open domes into the tanks of tank vehicles or tank cars that contain vapor-air mixtures within the flammable range, or where the liquid being filled can form such a mixture, shall be by means of a downspout that extends near the bottom of the tank. This precaution is not required when loading liquids that are nonaccumulators of static charges. NFPA 77, *Recommended Practice on Static Electricity*, provides additional information on static electricity protection.

5-4.4.1.7 Stray Currents. To protect against stray currents, tank car facilities where flammable and combustible liquids are loaded or unloaded through open domes shall be protected by permanently bonding the fill pipe to at least one rail and to the rack structure, if of metal. Multiple pipes entering the rack area shall be permanently bonded together. In addition, in areas where excessive stray currents are known to exist, all pipes entering the rack area shall be provided with insulating sections to electrically isolate the rack piping from the pipelines. These precautions are not necessary where Class II or Class III liquids are handled exclusively and there is no probability that tank cars will contain vapors from previous cargoes of Class I liquids.

5-4.4.1.8 Equipment such as piping, pumps, and meters used for the transfer of Class I liquids between storage tanks and the fill stem of the loading rack shall not be used for the transfer of Class II or Class III liquids.

Exception No. 1: This provision shall not apply to water-miscible liquids when the class is determined by the concentration of liquid in water.

Exception No. 2: This provision shall not apply where the equipment is cleaned between transfers.

5-4.4.1.9 Remote pumps located in underground tanks shall have a listed leak-detection device installed on the pump discharge side that will indicate if the piping system is not essentially liquid-tight. This device shall be checked and tested at least annually according to the manufacturer's specifications to insure proper installation and operation.

5-4.4.1.10 When top loading a tank vehicle with Class I or Class II liquids without a vapor control

system, valves used for the final control of flow shall be of the self-closing type and shall be manually held open except where automatic means are provided for shutting off the flow when the vehicle is full. Automatic shutoff systems shall be provided with a manual shutoff valve located at a safe distance from the loading nozzle to stop the flow if the automatic system fails. When top loading a tank vehicle with vapor control, flow control shall be in accordance with 5-4.4.1.11 and 5-4.4.1.12.

5-4.4.1.11 When bottom loading a tank vehicle with or without vapor control, a positive means shall be provided for loading a predetermined quantity of liquid, together with a secondary automatic shutoff control to prevent overfill. The connecting components between the loading rack and the tank vehicle required to operate the secondary control shall be functionally compatible. The connection between the liquid loading hose or pipe and the truck piping shall be by means of a dry disconnect coupling.

5-4.4.1.12 When bottom loading a tank vehicle that is equipped for vapor control, but when vapor control is not used, the tank shall be vented to the atmosphere, at a height not lower than the top of the cargo tank of the vehicle, to prevent pressurization of the tank. Connections to the plant vapor control system shall be designed to prevent the escape of vapor to the atmosphere when not connected to a tank vehicle.

5-4.4.2 Wharves.

5-4.4.2.1 This section shall apply to all wharves, except marine service stations as covered in NFPA 30A, *Automotive and Marine Service Station Code.* If liquids are handled in bulk quantities across general purpose piers or wharves, NFPA 307, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves,* shall be followed.

5-4.4.2.2 Handling packaged cargo of liquids, including full and empty drums, bulk fuel, and stores over a wharf during cargo transfer shall be subject to the approval of the wharf supervisor and the senior deck officer on duty.

5-4.4.2.3 Wharves at which liquid cargoes are to be transferred in bulk quantities to or from tank vessels shall be at least 100 ft (30 m) from any bridge over a navigable waterway, or from an entrance to or superstructure of any vehicular or railroad tunnel under a waterway. The termination of the wharf loading or unloading fixed piping shall be at least 200 ft (60 m) from a bridge or from an entrance to or superstructure of a tunnel.

5-4.4.2.4 Substructure and deck shall be substantially designed for the use intended. Deck may employ any material that will afford the desired combination of flexibility, resistance to shock, durability, strength, and fire resistance. Heavy timber construction is acceptable.

5-4.4.2.5 Tanks used exclusively for ballast water or Class II or Class III liquids may be installed on suitably designed wharves.

5-4.4.2.6 Loading pumps capable of building up pressures in excess of the safe working pressure of cargo hose or loading arms shall be provided with bypasses, relief valves, or other arrangements to protect the loading facilities against excessive pressure. Relief devices shall be tested at least annually to determine that they function satisfactorily at their set pressure.

5-4.4.2.7 All pressure hoses and couplings shall be inspected at intervals appropriate to the service. With the hose extended, the hose and couplings shall be tested using the in-service maximum operating pressure. Any hose showing material deterioration, signs of leakage, or weakness in its carcass or at the couplings shall be withdrawn from service and repaired or discarded.

5-4.4.2.8 Piping, valves, and fittings shall be in accordance with Chapter 3, with the following exceptions and additions.

(a) Flexibility of piping shall be assured by appropriate layout and arrangement of piping supports so that motion of the wharf structure resulting from wave action, currents, tides, or the mooring of vessels will not subject the pipe to excessive strain.

(b) Pipe joints that depend on the friction characteristics of combustible materials or on the grooving of pipe ends for mechanical continuity of piping shall not be permitted.

(c) Swivel joints may be used in piping to which hoses are connected, and for articulated swivel-joint transfer systems, provided the design is such that the mechanical strength of the joint will not be impaired if the packing materials should fail, as by exposure to fire.

(d) In addition to the requirements of 3-6.1, each line conveying Class I or Class II liquids leading to a wharf shall be provided with a readily accessible block valve located on shore near the approach to the wharf and outside of any diked area. Where more than one line is involved, the valves shall be grouped in one location.

(e) Means shall be provided for easy access to cargo line valves located below the wharf deck.

5-4.4.2.9 Pipelines on wharves shall be adequately bonded and grounded if Class I or Class II liquids are handled. If excessive stray currents are encountered, insulating joints shall be installed. Bonding and grounding connections on all pipelines shall be located on the wharf side of hose riser insulating flanges, if used, and shall be accessible for inspection.

5-4.4.2.10 Hose or articulated swivel-joint pipe connections used for cargo transfer shall be capable of accommodating the combined effects of change in draft and maximum tidal range, and mooring lines shall be kept adjusted to prevent surge of the vessel from placing stress on the cargo transfer system. Hose shall be supported to avoid kinking and damage from chafing.

5-4.4.2.11 Material shall not be placed on wharves in such a manner as to obstruct access to fire fighting

equipment or important pipeline control valves. Where the wharf is accessible to vehicle traffic, an unobstructed roadway to the shore end of the wharf shall be maintained for access of fire fighting apparatus.

5-4.4.2.12 Loading or unloading shall not commence until the wharf supervisor and the person in charge of the tank vessel agree that the tank vessel is properly moored and all connections are properly made.

5-4.4.2.13 Mechanical work shall not be performed on the wharf during cargo transfer, except under special authorization based on a review of the area involved, methods to be employed, and precautions necessary.

5-5 Fire Prevention and Control.

5-5.1 General.

5-5.1.1 This section covers the commonly recognized management control systems and methods used to prevent or minimize the loss from fire or explosion in liquid processing facilities.

NOTE: Other recognized factors of fire prevention and control, involving construction, location, separation, etc., are covered elsewhere in this chapter.

5-5.1.2 The wide range in size, design, and location of liquid processing facilities precludes the inclusion of detailed fire prevention and control systems and methods applicable to all such facilities. The authority having jurisdiction may be consulted on specific cases, where applicable; otherwise, qualified engineering judgment shall be exercised per 5-5.1.3.

5-5.1.3 The extent of fire prevention and control provided for the liquid-processing facility shall be determined by an engineering evaluation of the operation, followed by the application of sound fire protection and process engineering principles. The evaluation shall include, but not be limited to:

(a) analysis of fire and explosion hazards of the liquid operations,

(b) analysis of hazardous materials, hazardous chemicals, or hazardous reactions in the operations and the safeguards taken to control such materials, chemicals, or reactions,

(c) analysis of facility design requirements in Section 5-3 of this chapter,

(d) analysis of the liquid handling, transfer, and use requirements in Section 5-4 of this chapter,

(e) analysis of local conditions, such as exposure to and from adjacent properties, flood potential, or earthquake potential,

(f) consideration of fire department or mutual aid response.

5-5.2 Control of Ignition Sources.

5-5.2.1 Precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include, but are not limited to:

(a) open flames
(b) lightning
(c) hot surfaces
(d) radiant heat
(e) smoking
(f) cutting and welding
(g) spontaneous ignition
(h) frictional heat or sparks
(i) static electricity
(j) electrical sparks
(k) stray currents
(l) ovens, furnaces, and heating equipment.

5-5.2.2 Smoking shall be permitted only in designated and properly identified areas.

5-5.2.3 Welding, cutting, and similar spark-producing operations shall not be permitted in areas containing flammable liquids until a written permit authorizing such work has been issued. The permit shall be issued by a person in authority following his/her inspection of the area to assure that proper precautions have been taken and will be followed until the job is completed. (*See NFPA 51B, Standard for Fire Prevention in Use of Cutting and Welding Processes.*)

5-5.2.4 **Static Electricity.** All equipment such as tanks, machinery, and piping where an ignitable mixture may be present shall be bonded or connected to a ground. The bond or ground or both shall be physically applied or shall be inherently present by the nature of the installation. Electrically isolated sections of metallic piping or equipment shall be bonded to the other portions of the system or individually grounded to prevent hazardous accumulations of static electricity. NFPA 77, *Recommended Practice on Static Electricity*, provides information on this subject.

5-5.3 Inspection and Maintenance.

5-5.3.1 All fire protection equipment shall be properly maintained and periodic inspections and tests shall be done in accordance with both standard practice and equipment manufacturer's recommendations.

5-5.3.2 Maintenance and operating practices shall control leakage and prevent spillage of flammable liquids.

5-5.3.3 Combustible waste material and residues in operating areas shall be kept to a minimum, stored in covered metal containers, and disposed of daily.

5-5.3.4 Ground areas around facilities where liquids are stored, handled, or used shall be kept free of weeds, trash, or other unnecessary combustible materials.

5-5.3.5 Aisles established for movement of personnel shall be maintained clear of obstructions to permit orderly evacuation and ready access for manual fire-fighting activities.

5-5.4 Emergency Planning and Training.

5-5.4.1 An emergency action plan, consistent with the available equipment and personnel, shall be established to respond to fire or other emergencies. This plan shall include the following:

(a) Procedures to be used in case of fire, such as sounding the alarm, notifying the fire department, evacuating personnel, and controlling and extinguishing the fire.

(b) Appointment and training of persons to carry out firesafety duties.

(c) Maintenance of fire protection equipment.

(d) Holding fire drills.

(e) Shutdown or isolation of equipment to reduce the escape of liquid.

(f) Alternate measures for the safety of occupants while any fire protection equipment is shut down.

5-5.4.2 Personnel responsible for the use and operation of fire protection equipment shall be trained in the use of that equipment. Refresher training shall be conducted at least annually.

5-5.4.3 Planning of effective fire control measures shall be coordinated with local emergency response agencies.

5-5.4.4 Procedures shall be established to provide for safe shutdown of operations under emergency conditions. Provisions shall be made for periodic training, inspection, and testing of associated alarms, interlocks, and controls.

5-5.4.5 The emergency procedure shall be kept readily available in an operating area and updated regularly.

5-5.4.6 Where premises are likely to be unattended for considerable periods of time, a summary of the emergency plan shall be posted or located in a strategic and accessible location.

5-5.5 Detection and Alarm.

5-5.5.1 An approved means for prompt notification of fire or emergency to those within the plant and to the available public or mutual aid fire department shall be provided.

5-5.5.2 Those areas, including buildings, where a potential exists for a flammable liquid spill, shall be monitored as appropriate. Some methods may include:

(a) Personnel observation or patrol;

(b) Process monitoring equipment that would indicate a spill or leak may have occurred;

(c) Provision of gas detectors to continuously monitor the area where facilities are unattended.

5-5.6 Portable Fire-Control Equipment.

5-5.6.1 Listed portable fire extinguishers shall be provided for facilities in such quantities, sizes, and types as may be needed for the special hazards of operation and storage as determined per 5-5.1.3. NFPA 10, *Standard for Portable Extinguishers*, provides information on the suitability of various types of extinguishers.

5-5.6.2 When the need is indicated per 5-5.1.3, water may be utilized through standpipe and hose systems (*see NFPA 14, Standard for the Installation of Standpipe and Hose Systems*), or through hose connections from sprinkler systems using combination spray and straight stream nozzles to permit effective fire control (*see NFPA 13, Standard for the Installation of Sprinkler Systems*).

5-5.6.3 When the need is indicated per 5-5.1.3, mobile foam apparatus shall be provided. NFPA 11C, *Standard for Mobile Foam Apparatus*, provides information on the subject.

5-5.6.4 Automotive and trailer-mounted fire apparatus, where determined necessary, shall not be used for any purpose other than fire fighting.

5-5.7 Fixed Fire Control Equipment.

5-5.7.1 A reliable water supply or other suitable fire control agent shall be available in pressure and quantity to meet the fire demands indicated by the special hazards of operation, storage, or exposure as may be determined by 5-5.1.3.

5-5.7.2 Hydrants, with or without fixed monitor nozzles, shall be provided in accordance with accepted practice. The number and placement will depend on the hazard of the liquid-processing facility, storage, or exposure as may be determined by 5-5.1.3 See NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, for information on this subject.

5-5.7.3 Where the need is indicated by the hazards of liquid processing, storage, or exposure as determined by 5-5.1.3, fixed protection may be required utilizing approved sprinkler systems, water spray systems, deluge systems, fire resistive materials, or a combination of these. See NFPA 13, *Standard for the Installation of Sprinkler Systems*, and NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, for information on these subjects.

5-5.7.4 The following fire control systems may be appropriate for the protection of specific hazards as determined per 5-5.1.3 If provided, such systems shall be designed, installed, and maintained in accordance with the following NFPA standards:

(a) NFPA 11, *Standard for Low Expansion Foam and Combined Agent Systems*,

(b) NFPA 11A, *Standard for Medium and High Expansion Foam Systems*,

(c) NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*,

(d) NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*,

(e) NFPA 12B, *Standard on Halon 1211 Fire Extinguishing Systems*,

(f) NFPA 16, *Standard on Deluge Foam-Water Sprinkler and Foam-Water Spray Systems*,

(g) NFPA 17, *Standard for Dry Chemical Extinguishing Systems*.

Chapter 6 Referenced Publications

6-1 The following documents or portions thereof are referenced within this document and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document. These references are listed separately to facilitate updating to the latest edition by the user.

6-1.1 NFPA Publications. The following publications are available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 10-1984, *Standard for Portable Fire Extinguishers*

NFPA 11-1983, *Standard for Low Expansion Foam and Combined Agent Systems*

NFPA 11A-1983, *Standard for Medium and High Expansion Foam Systems*

NFPA 11C-1986, *Standard for Mobile Foam Apparatus*

NFPA 12-1985, *Standard on Carbon Dioxide Extinguishing Systems*

NFPA 12A-1987, *Standard on Halon 1301 Fire Extinguishing Systems*

NFPA 12B-1985, *Standard on Halon 1211 Fire Extinguishing Systems*

NFPA 13-1987, *Standard for the Installation of Sprinkler Systems*

NFPA 15-1985, *Standard for Water Spray Fixed Systems for Fire Protection*

NFPA 16-1986, *Standard on Deluge Foam-Water Sprinkler and Foam-Water Spray Systems*

NFPA 17-1985, *Standard for Dry Chemical Extinguishing Systems*

NFPA 24-1987, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*

NFPA 30A-1987, *Automotive and Marine Service Station Code*

NFPA 45-1986, *Standard on Fire Protection for Laboratories Using Chemicals*

NFPA 51B-1984, *Standard for Fire Prevention in Use of Cutting and Welding Process*

NFPA 69-1986, *Standard on Explosion Prevention Systems*

NFPA 70-1987, *National Electrical Code*

NFPA 77-1983, *Recommended Practice on Static Electricity*

NFPA 80-1986, *Standard for Fire Doors and Windows*

NFPA 90A-1985, *Standard for the Installation of Air Conditioning and Ventilating Systems*

NFPA 91-1983, *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying*

NFPA 99-1987, *Standard for Health Care Facilities*

NFPA *101*-1985, *Life Safety Code*

NFPA 220-1985, *Standard on Types of Building Construction*

NFPA 231-1987, *Standard for General Storage*

NFPA 231C-1986, *Standard for Rack Storage of Materials*

NFPA 251-1985, *Standard Methods of Fire Tests of Building Construction and Materials*

NFPA 302-1984, *Fire Protection Standard for Pleasure and Commercial Motor Craft*

NFPA 303-1984, *Fire Protection Standard for Marinas and Boatyards*

NFPA 307-1985, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*

NFPA 321-1987, *Standard on Basic Classification of Flammable and Combustible Liquids*

NFPA 329-1987, *Recommended Practice for Handling Underground Leakage of Flammable and Combustible Liquids*

NFPA 385-1985, *Standard for Tank Vehicles for Flammable and Combustible Liquids*

NFPA 386-1985, *Standard for Portable Shipping Tanks for Flammable and Combustible Liquids*

NFPA 496-1986, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*

NFPA 497A-1986, *Recommended Practice for Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*

NFPA 497M-1986, *Manual for Classification of Gases, Vapors and Dusts for Electrical Equipment in Hazardous (Classified) Locations*

NFPA 704-1985, *Standard System for the Identification of the Fire Hazards of Materials.*

6-1.2 Other Publications.

ASTM Publications are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM A 395-82, *Ferritic Ductile Iron Pressure Retaining Castings for Use at Elevated Temperatures*

ASTM D 86-82, *Standard Method of Test for Distillation of Petroleum Products*

ASTM D 56-79, *Standard Method of Test for Flash Point by the Tag Closed Cup Tester*

ASTM D 93-80, *Standard Method of Test for Flash Point by the Pensky-Martens Closed Tester*

ASTM D 3828-81, *Standard Methods of Tests for Flash Point of Petroleum and Petroleum Products by Setaflash Closed Tester*

ASTM D 3278-82, *Standard Method of Tests for Flash Point of Liquids by Setaflash Closed Tester*

ASTM D 5-73(1978), *Test for Penetration for Bituminous Materials*

ASTM D 323-82, *Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)*

ASTM D 92-78, *Cleveland Open Cup Test Method*

ASTM/ANSI D 3435-80, *Plastic Containers (Jerry Cans) for Petroleum Products*

ANSI B31, *American National Standard Code for Pressure Piping*, American Society of Mechanical Engineers, United Engineering Center, 345 East 47 Street, NY 10017.

ASME, *Boiler and Pressure Vessel Code*, American Society of Mechanical Engineers, United Engineering Center, 345 East 47th St., New York, NY 10017.

API Publications are available from the American Petroleum Institute, 1220 L Street, N.W., Washington, DC 20005.

API 650, *Welded Steel Tanks for Oil Storage*, Sixth Edition, 1980

API Specifications 12B, *Bolted Tanks for Storage of Production Liquids*, Twelfth Edition, January, 1977
API 12D, *Field Welded Tanks for Storage of Production Liquids, Eighth Edition*, January, 1982
API 12F, *Shop Welded Tanks for Storage of Production Liquids*, Seventh Edition, January, 1982
API 620, *Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks*, Fifth Edition, 1982
API 2000, *Venting Atmospheric and Low Pressure Storage Tanks*, 1982
API 1615, *Installation of Underground Petroleum Storage Systems*, 1979
API 1621, *Recommended Practice for Bulk Liquid Stock at Retail Outlets*, 1977

UL Publications are available from Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 142-1981, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*
UL 80-1980, *Standard for Steel Inside Tanks for Oil Burner Fuel*
UL 842-1980, *Standard for Valves for Flammable Fluids*

sti-P_3-1983, *Specifications for sti-P_3 System for External Corrosion Protection of Underground Steel Storage Tanks*, available from Steel Tank Institute, 666 Dundee Road, Suite 705, Northbrook, IL 60062.

Appendix A Additional Explanatory Material

A-3-8 Where loading and unloading risers for Class II or Class IIIA liquids are located in the same immediate area as loading and unloading risers for Class I liquids, consideration should be given to providing positive means, such as different pipe sizes, connection devices, special locks, or other methods designed to prevent the erroneous transfer of Class I liquids into or from any container or tank used for Class II or Class IIIA liquids.

Exception No. 1: This provision need not apply to water-miscible liquids when the class is determined by the concentration of liquid in water.

Exception No. 2: This provision need not apply where the equipment is cleaned between transfers.

A-4-3.2 Venting of storage cabinets has not been demonstrated to be necessary for fire protection purposes. Additionally, venting a cabinet could compromise the ability of the cabinet to adequately protect its contents from involvement in a fire since cabinets are not generally tested with any venting. Therefore, venting of storage cabinets is not recommended.

However, it is recognized that some jurisdictions may require storage cabinets to be vented and that venting may also be desirable for other reasons, such as health and safety. In such cases, the venting system should be installed so as to not affect substantially the desired performance of the cabinet during a fire. Means of accomplishing this may include thermally actuated dampers on the vent openings or sufficiently insulating the vent piping system to prevent the internal temperature of the cabinet from rising above that specified. Any make-up air to the cabinet should also be arranged in a similar manner.

If vented, the cabinet should be vented from the bottom with makeup air supplied to the top. Also, mechanical exhaust ventilation is preferred and should comply with NFPA 91, *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying*. Manifolding the vents of multiple storage cabinets should be avoided.

A-4-5.5.1 The following table can be consulted for guidance in determining amounts of storage permitted in mercantile establishments.

Allowable Storage Amounts, Gallons Per Sq Ft

	IA	IB	IC	II	IIIA
Protected					
Basement	0	2	2	2	2
Ground Floor	1	2	2	2	2
Other Floors	1	2	2	2	2
Unprotected					
Basement	0	1	1	1	1
Ground Floor	1	2	2	2	2
Other Floors	0	1	1	1	1

Maximum total quantities permitted shall be limited to the sum of proportional amounts that each class of liquid present bears to the maximum total permitted for its respective class. The sum of proportional amounts shall not exceed 100 percent.

A-5-4.2 Where the vapor space of equipment is usually within the flammable range, the probability of explosion damage to the equipment can be limited by inerting, by providing an explosion suppression system, or by designing the equipment to contain the peak explosion pressure that can be modified by explosion relief. Where the special hazards of operation, sources of ignition, or exposures indicate a need, consideration should be given to providing protection by one or more of the above means.

See NFPA 68, *Guide for Explosion Venting*, and NFPA 69, *Standard on Explosion Prevention Systems*, for additional information on various methods of mitigating losses from explosions.

Appendix B Emergency Relief Venting for Fire Exposure for Aboveground Tanks

This Appendix is not a part of the requirements of this NFPA document but is included for information purposes only.

The requirements for emergency venting given in Table 2-8 and the modification factors in 2-2.5.7 are derived from a consideration of:

1. Probable maximum rate of heat transfer per unit area;

2. Size of tank and the percentage of total area likely to be exposed;

3. Time required to bring tank contents to boil;

4. Time required to heat unwet portions of the tank shell or roof to a temperature where the metal will lose strength;

5. Effect of drainage, insulation, and the application of water in reducing fire exposure and heat transfer.

Table 2-8 is based on a composite curve that is considered to be composed of three straight lines when plotted on log-log paper. The curve may be defined in the following manner:

The first straight line is drawn on log-log paper between the point 400,000 Btu/hr, at 20 sq ft (1.858 m^2) exposed surface area and the point 4,000,000 Btu/hr, at 200 sq ft (18.58 m^2) exposed surface area. The equation for this portion of the curve is $Q = 20{,}000A$.

The second straight line is drawn on log-log graph paper between the points 4,000,000 Btu/hr, at 200 sq ft (18.58 m^2) exposed surface area and 9,950,000 Btu/hr, at 1,000 sq ft (92.9 m^2) exposed surface area. The equation for this portion of the curve is $Q = 199.300A^{0.566}$.

The third straight line is plotted on log-log graph paper between the points 9,950,000 Btu/hr, at 1,000 sq ft (92.9 m^2) exposed surface area and 14,090,000 Btu/hr, at 2,800 sq ft (260.12 m^2) exposed surface area. The equation for this portion of the curve is $Q = 963{,}400A^{0.338}$.

$Q = 20{,}000\ A$		$Q = 199{,}300\ A^{0.566}$		$Q = 963{,}400\ A^{0.338}$	
A	Q	A	Q	A	Q
20	400,000	200	4,000,000	1,000	10,000,000
30	600,000	250	4,539,000	1,200	10,593,000
40	800,000	300	5,032,000	1,400	11,122,000
50	1,000,000	350	5,491,000	1,600	11,601,000
60	1,200,000	400	5,922,000	1,800	12,040,000
70	1,400,000	500	6,719,000	2,000	12,449,000
80	1,600,000	600	7,450,000	2,400	13,188,000
90	1,800,000	700	8,129,000	2,800	14,000,000
100	2,000,000	800	8,768,000	and over	
120	2,400,000	900	9,372,000		
140	2,800,000	1,000	10,000,000		
160	3,200,000				
180	3,600,000				
200	4,000,000				

For areas exceeding 2,800 sq ft (260.12 m^2) it has been concluded that complete fire involvement is unlikely, and loss of metal strength from overheating will cause failure in the vapor space before development of maximum possible vapor evolution rate. Therefore, additional venting capacity beyond the vapor equivalent of 14,090,000 Btu/hr will not be effective or required.

For tanks and storage vessels designed for pressures over 1 psig, additional venting for exposed surfaces beyond 2,800 sq ft (260.12 m^2) is believed to be desirable because, under these storage conditions, liquids are stored close to their boiling points. Therefore, the time to bring the container contents to boiling conditions may not be significant. For these situations a heat input value should be determined on the basis of

$$Q = 21{,}000\ A^{0.82}$$

The flow capacities are based on the assumption that the stored liquid will have the characteristics of hexane, and the vapor liberated has been transposed to equivalent free air at 60°F (15.6°C) and 14.7 psia (101.3 kPa) by using appropriate factors in:

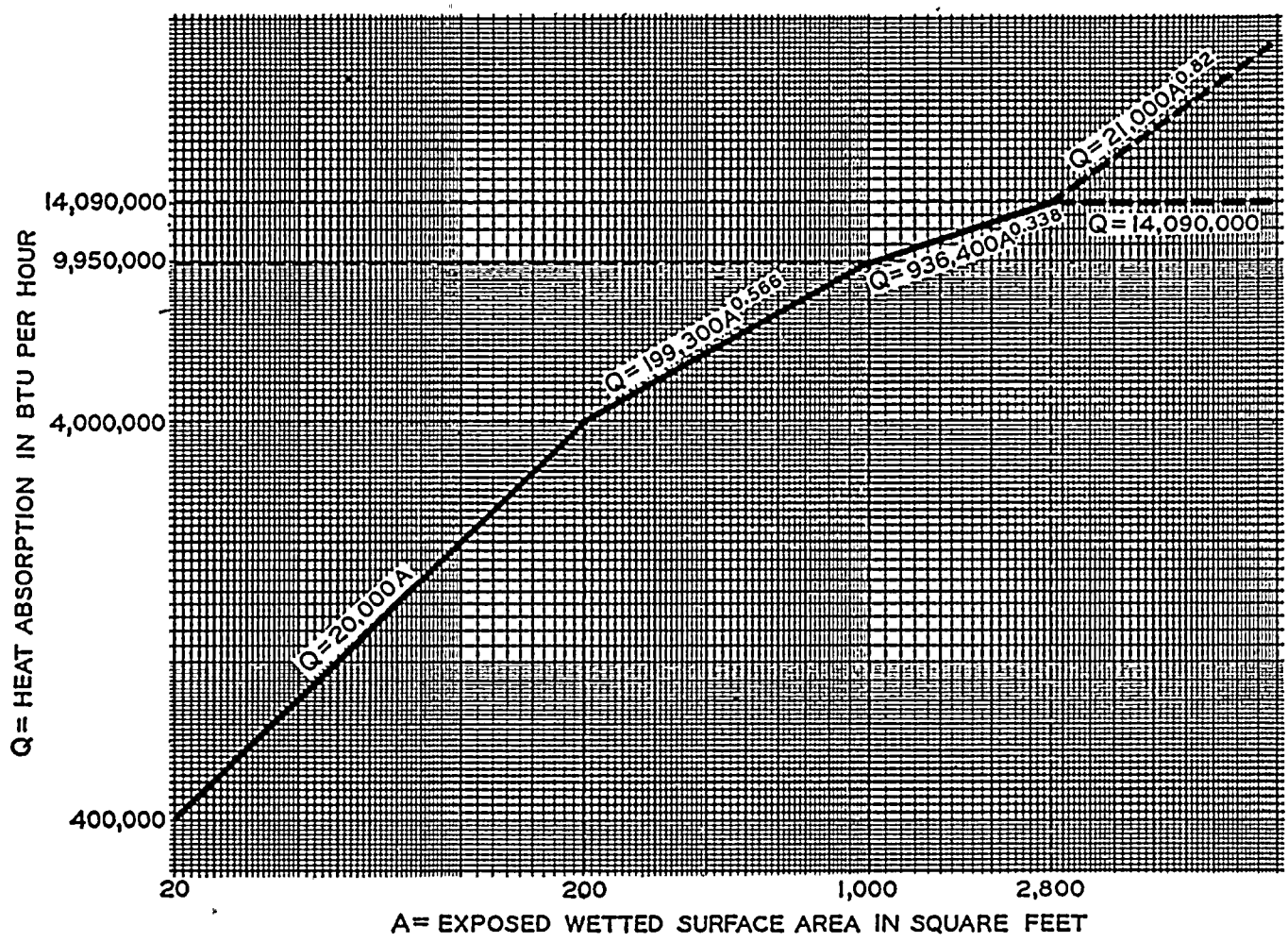
$$CFH = \frac{70.5Q}{L\sqrt{M}}$$

where 70.5 is the factor for converting pounds of gas to cubic feet of air; Q = the total heat input per hour expressed in Btu; L = latent heat of vaporization; and M = molecular weight.

No consideration has been given to possible expansion from the heating of the vapor above the boiling point of the liquid, its specific heat, or the difference in density between the discharge temperature and 60°F (15.6°C), since some of these changes are compensating.

Since tank vent valves are ordinarily rated in CFH standard air, the figures derived from Table 2-8 may be used with the appropriate tank pressure as a basis for valve selection.

Table B-2 gives for a variety of chemicals the constants which can be used to compute the vapor generated and equivalent free air for liquids other than hexane, where greater exactness is desired. Inspections of the table will show that the use of hexane in deriving Table 2-8 provides results which are within an acceptable degree of accuracy for the listed liquids.



NOTE: See Table B-1 for approximate wetted area for horizontal tanks.

Figure B-1 Curve for Determining Requirements for Emergency Venting During Fire Exposure.

Table B-1 Approximate Wetted Areas For Horizontal Tanks

(Wetted Area Equals 75 Percent Total Area)

Tank Diameter, Feet	3	4	5	6	7	8	9	10	11	12
Tank Length, Feet	APPROXIMATE WETTED AREA OF TANKS WITH FLAT HEADS									
3	32									
4	39	55								
5	46	65	88							
6	53	74	100	128						
7	60	84	112	142	173					
8	67	93	124	156	190	226				
9	74	102	136	170	206	245	286			
10	81	112	147	184	223	264	308	353		
11	88	121	159	198	239	283	329	377	428	
12	95	131	171	213	256	301	350	400	454	509
13	102	140	183	227	272	320	371	424	480	537
14	109	150	194	241	289	339	393	447	506	565
15	116	159	206	255	305	358	414	471	532	594
16	123	169	218	269	322	377	435	495	558	622
17	130	178	230	283	338	395	456	518	584	650
18	137	188	242	298	355	414	477	542	610	678
19		197	253	312	371	433	499	565	636	707
20		206	265	326	388	452	520	589	662	735
21		216	277	340	404	471	541	612	688	763
22		225	289	354	421	490	562	636	714	792
23		235	300	368	437	508	584	659	740	820
24		244	312	383	454	527	605	683	765	848
25			324	397	470	546	626	706	791	876
26			336	411	487	565	647	730	817	905
27			347	425	503	584	668	754	843	933
28			359	440	520	603	690	777	869	961
29			371	454	536	621	711	801	895	989
30			383	468	553	640	732	824	921	1018
31			395	482	569	659	753	848	947	1046
32				496	586	678	775	871	973	1074
33				510	602	697	796	895	999	1103
34				524	619	715	817	918	1025	1131
35				539	635	734	838	942	1051	1159
36				553	652	753	860	966	1077	1187
37				567	668	772	881	989	1103	1216

Tank Diameter, Feet	3	4	5	6	7	8	9	10	11	12
Tank Length, Feet	APPROXIMATE WETTED AREA OF TANKS WITH FLAT HEADS									
38					685	791	902	1013	1129	1244
39					701	810	923	1036	1155	1272
40					718	828	944	1060	1181	1301
41					734	847	966	1083	1207	1329
42					751	866	987	1107	1233	1357
43					767	885	1008	1130	1259	1385
44						904	1029	1154	1284	1414
45						923	1051	1178	1310	1442
46						941	1072	1201	1336	1470
47						960	1093	1225	1362	1498
48						979	1114	1248	1388	1527
49						998	1135	1272	1414	1555
50							1157	1295	1440	1583
51							1178	1319	1466	1612
52							1199	1342	1492	1640
53							1220	1366	1518	1668
54							1246	1389	1544	1696
55							1263	1413	1570	1725
56								1437	1593	1753
57								1460	1622	1781
58								1484	1648	1809
59								1507	1674	1839
60								1531	1700	1866
61									1726	1894
62									1752	1923
63									1778	1951
64									1803	1979
65									1829	2007
66									1855	2036
67										2064
68										2092
69										2120
70										2149
71										2177
72										2205

SI Units: 1 ft = 0.30 m; 1 sq ft = 0.09 m^2.

Table B-2 Values of $L\sqrt{M}$ for Various Flammable Liquids

Chemical	$L\sqrt{M}$	Molecular Weight	Heat of Vaporization Btu per lb at Boiling Point
Acetaldehyde	1673	44.05	252
Acetic acid	1350	60.05	174
Acetic anhydride	1792	102.09	177
Acetone	1708	58.08	224
Acetonitrile	2000	41.05	312
Acrylonitrile	1930	53.05	265
n-Amyl alcohol	2025	88.15	216
iso-Amyl alcohol	1990	88.15	212
Aniline	1795	93.12	186
Benzene	1493	78.11	169
n-Butyl acetate	1432	116.16	133
n-Butyl alcohol	2185	74.12	254
iso-Butyl alcohol	2135	74.12	248
Carbon disulfide	1310	76.13	150
Chlorobenzene	1422	112.56	134
Cyclohexane	1414	84.16	154
Cyclohexanol	1953	100.16	195
Cyclohexanone	1625	98.14	164
o-Dichlorobenzene	1455	147.01	120
cis-Dichloroethylene	1350	96.95	137
Diethyl amine	1403	73.14	164
Dimethyl acetamide	1997	87.12	214
Dimethyl amine	1676	45.08	250
Dimethyl formamide	2120	73.09	248
Dioxane (diethylene ether)	1665	88.10	177
Ethyl acetate	1477	88.10	157
Ethyl alcohol	2500	46.07	368
Ethyl chloride	1340	64.52	167
Ethylene dichloride	1363	98.97	137
Ethyl ether	1310	74.12	152
Furan	1362	68.07	165
Furfural	1962	96.08	200
Gasoline	1370-1470	96.0	140-150
n-Heptane	1383	100.20	138
n-Hexane	1337	86.17	144
Hydrogen cyanide	2290	27.03	430
Methyl alcohol	2680	32.04	474
Methyl ethyl ketone	1623	72.10	191
Methyl methacrylate	1432	100.14	143
n-Octane	1412	114.22	132
n-Pentane	1300	72.15	153
n-Propyl acetate	1468	102.13	145
n-Propyl alcohol	2295	60.09	296
iso-Propyl alcohol	2225	60.09	287
Tetrahydro furan	1428	72.10	168
Toluene	1500	92.13	156
Vinyl acetate	1532	86.09	165
o-Xylene	1538	106.16	149

NOTE: For data on other chemicals, see chemistry handbook.

Appendix C Abandonment or Removal of Underground Tanks

This Appendix is not a part of the requirements of this NFPA document but is included for information purposes only.

C-1 Introduction.

C-1-1 Care is required not only in the handling and use of flammable or combustible liquids, but also in abandoning tanks that have held flammable or combustible liquids. This is particularly true of underground service station tanks that are most frequently used for the storage of motor fuel and occasionally for the storage of other flammable or combustible liquids, such as crankcase drainings (which may contain some gasoline). Through carelessness, explosions have occurred because flammable or combustible liquid tanks had not been properly conditioned before being abandoned.

C-1-2 In order to prevent accidents caused by improper conditioning, it is recommended that the procedures outlined below be followed when underground tanks are removed, abandoned, or temporarily taken out of service.

C-1-3 Underground tanks taken out of service may be safeguarded or disposed of by any one of the three following means:

(a) Placed in a "temporarily out of service" condition. Tanks should be rendered "temporarily out of service" only when it is planned that they will be returned to active service within a reasonable period or pending removal or abandonment within 90 days.

(b) Abandoned in place, with proper safeguarding.

(c) Removed.

C-1-4 In cases where tanks are either rendered "temporarily out of service" or permanently abandoned, records should be kept of tank size, location, date of abandonment, and method used for placing the abandoned tank in a safe condition.

C-1-5 Procedures for carrying out each of the above methods of disposing of underground tanks are described in the following sections. No cutting torch or other flame or spark-producing equipment shall be used until the tank has been completely purged or otherwise rendered safe. In each case, the numbered steps given shall be carried out successively.

C-2 Rendering Tanks "Temporarily Out of Service."

C-2-1 Cap or plug all lines such as fill line, gage opening, pump suction, and vapor return. Secure against tampering.

C-2-2 Disconnect piping at all tank openings.

C-3 Abandoning Underground Tanks in Place.

C-3-1 Remove all flammable or combustible liquid from the tank and from all connecting lines.

C-3-2 Disconnect the suction, inlet, gage, and vent lines.

C-3-3 Fill the tank completely with an inert solid material. Cap remaining undergound piping.

C-4 Removal of Underground Tanks.

C-4-1 Remove all flammable or combustible liquids from tank and from connecting lines.

C-4-2 Disconnect piping at all tank openings. Remove sections of connecting lines that are not to be used further and cap or plug all tank openings. After removal, the tank may be gas freed on the premises if it can be done safely at that location, or may be transported to an area not accessible to the public and the gas freeing completed at that location.

C-5 Disposal of Tanks.

C-5-1 If a tank is to be disposed of as junk, it should be retested for flammable vapors and, if necessary, rendered gas-free. After junking and before releasing to junk dealer, a sufficient number of holes or openings should be made in it to render it unfit for further use. NFPA 327, *Standard Procedures for Cleaning or Safeguarding Small Tanks and Containers*, provides information on safe procedures for such operations.

Appendix D

This Appendix is not a part of the requirements of this NFPA document but is included for information purposes only.

The following contains additional information and recommendations relating to the requirements in Chapter 4. The individual items bear the same number as the text of Chapter 4 to which they apply.

D-4-4 The preferred method of storage of liquids in buildings is in cutoff rooms or in attached buildings rather than in inside rooms because of fire department accessibility and the advantages of providing explosion venting where needed.

Table D-4-6.2(a) Automatic Sprinkler Protection for Solid Pile and Palletized Storage of Liquids in Containers and Portable Tanks (Flammable Aerosols Not Included)

Storage Conditions		Ceiling Sprinkler Design and Demand					
			Area (sq ft)				
Class Liquid	Container Size and Arrangement	Density gpm/ sq ft	High Temp.	Ord. Temp.	Maximum Spacing	Minimum Hose Stream Demand (gpm)	Minimum Duration Sprinklers & Hose Streams
IA	5 gal. or less, with/without cartons, palletized or solid pile	0.30	3000	5000	100 sq ft	750	2 hrs
	containers greater than 5 gal., on end or side, palletized or solid pile	0.60	5000	8000	80 sq ft	750	
IB,* IC,* & II*	5 gal. or less, with/without cartons, palletized or solid pile	0.30	3000	5000	100 sq ft	500	2 hrs
	containers greater than 5 gal., on pallets or solid pile, one high	0.25	5000	8000	100 sq ft		
II	containers greater than 5 gal., on pallets or solid pile, more than one high on end or side	0.60	5000	8000	80 sq ft	750	2 hrs
IB,* IC,* II*	portable tanks, one high	0.30	3000	5000	100 sq ft	500	2 hrs
II	portable tanks, two high	0.60	5000	8000	80 sq ft	750	2 hrs
III	5 gal. or less, with/without cartons, palletized or solid pile	0.25	3000	5000	120 sq ft	500	1 hr
	container greater than 5 gal., on pallets or solid pile, on end or sides, up to three high	0.25	3000	5000	120 sq ft	500	1 hr
	container greater than 5 gal., on pallets or solid pile, on end or sides, up to 18 feet high	0.35	3000	5000	100 sq ft	750	2 hrs
	portable tanks, one high	0.25	3000	5000	120 sq ft	500	1 hr
	portable tanks, two high	0.50	3000	5000	80 sq ft	750	2 hrs

* See Appendix E, introductory paragraphs.

NOTES: (1) See Table 4-6.1(a) and Section 4-6 for additional information pertaining to protected palletized or solid piling of liquids.
(2) Minimum hose stream demand includes small hand hose (1½ inches) required in 4-7.1.3.
(3) The design area contemplates the use of wet pipe systems. Where dry pipe systems are required, it introduces a possible delay which needs to be compensated for by increased areas of application (plus 30 percent).

SI Units: 1 gal = 3.8 L; 1 sq ft = 0.09 m²; 1 ft = 0.30 m.

Table D-4-6.2(b) Automatic Sprinkler Protection Requirements for Rack Storage of Liquids in Containers of Five Gallon Capacity or Less,* in Cartons on Conventional Wood Pallets or Without Cartons but Strapped to Pallets (*Flammable Aerosols Not Included)

	Ceiling Sprinkler Design & Demand				In-Rack Sprinkler Arrangement and Demand				Minim. Hose Stream Demand (gpm)	Minim. Duration Sprinkler & Hose Stream
Class Liquid	Density gpm/ sq ft	Area (sq ft) High Temp.	Area (sq ft) Ord. Temp.	Max. Spacing	Racks up to 9 ft (2.7 m) deep	Racks over 9 ft (2.7 m) to 12 ft (3.7 m) deep	Minim Nozzle Pressure	Number of Sprinklers Operating		
I (Max. 25′ height)	0.40	3000	5000	80 sq ft/hd.	a) ord. temp. sprinklers 8 feet apart horizontally b) one line sprinklers above each level of storage c) locate in longitudinal flue space, staggered vertically d) shields req'd. where multilevel	a) ord. temp. sprinklers 8 feet apart horizontally b) two lines sprinklers above each level of storage c) locate in transverse flue spaces, staggered vertically and within 20 in. of aisle d) shields required where multilevel	30 psi.	a) 8 sprinklers if only one level b) 6 sprinklers ea. on two levels, if only two levels c) 6 sprinklers ea. on top 3 levels, if 3 or more levels d) hydraulically most remote	750	2 hrs
II (max. 25′ height)	0.30	3000	5000	100 sq ft/hd.	a) ord. temp. sprinklers 8 feet apart horizontally b) one line sprinklers betw. levels at nearest 10 foot vertical intervals c) locate in longitudinal flue space, staggered vertically d) shields required where multilevel	a) ord. temp. sprinklers 8 feet apart horizontally b) two lines betw. levels at nearest 10 foot vertical intervals c) locate in transverse flue spaces, staggered vertically and within 20 in. of aisle d) shields required where multilevel	30 psi.	a) hydraulically most remote—6 sprinklers at each level, up to max. of three levels	750	2 hrs
III max.	0.25	3000	5000	120 sq ft/hd.	Same as Class II	Same as Class II	30 psi.	Same as Class II	500	2 hrs

NOTES: (1) See Table 4-6.1(b) and Section 4-6 for additional information pertaining to protected rack storage.
(2) Additional in-rack protection required for solid shelves, as indicated in D-4-6.2(d).
(3) See 4-6.3 for types of racks permitted.
(4) See 4-6.5 for additional information pertaining to in-rack sprinklers.
(5) Minimum hose stream demand includes small hand hose (1½ inches) required in 4-7.1.3.
(6) The design area contemplates the use of wet pipe systems. Where dry pipe systems are required, it introduces a possible delay which needs to be compensated for by increased areas of application (plus 30 percent).

SI Units: 1 gal = 3.8 L; 1 sq ft = 0.09 m^2; 1 ft = 0.30 m; 1 in. = 2.5 cm.

Table D-4-6.2(c) Automatic Sprinkler Protection for Rack Storage of Liquids in Containers Greater Than Five Gallon Capacity

	Ceiling Sprinkler Design & Demand				In-Rack Sprinkler Arrangement and Demand				Minim. Hose Stream Demand (gpm)	Minim. Duration Sprinkler & Hose Stream
Class Liquid	Density gpm/ sq ft	Area (sq ft) High Temp.	Area (sq ft) Ord. Temp.	Max. Spacing	On-Side Storage Racks up to 9 ft	On-End Storage (on pallets) up to 9 ft deep racks	Minim. Nozzle Pressure	Number of Sprinklers Operating		
IA (max. 25′ height)	0.60	3000	5000	80 sq ft/hd.	a) ord. temp. sprinklers 8 feet apart horizontally b) one line sprinklers above each tier of storage c) locate in longitudinal flue space, staggered vertically d) shields required where multilevel	a) ord. temp. sprinklers 8 feet apart horizontally b) one line sprinklers above each tier of storage c) locate in longitudinal flue space, staggered vertically d) shields required where multilevel	30 psi.	a) hydraulically most remote—6 sprinklers at each level	1000	2 hrs
IB, IC & II (max. 25′ height)	0.60	3000	5000	100 sq ft/hd.	a) see a) above b) one line sprinklers every three tiers of storage c) see c) above d) see d) above	a) see a) above b) see b) above c) see c) above d) see d) above	30 psi.	a) see a) above	750	2 hrs
III (max. 40′ height)	0.25	3000	5000	120 sq ft/hd.	a) see a) above b) one line sprinklers every sixth level (maximum) c) see c) above d) see d) above	a) see a) above b) one line sprinklers every third level (maximum) c) see c) above d) see d) above	15 psi.	a) see a) above	500	1 hr

NOTES: (1) See Table 4-6.1(b) and D-4-6.2(b) for additional information pertaining to protected rack storage.
(2) Additional in-rack protection required for solid shelves, as indicated in D-4-6.2(d).
(3) See 4-6.3 for types of racks permitted.
(4) See 4-6.5 for additional information pertaining to in-rack sprinklers.
(5) Minimum hose stream demand includes small hand hose (1½ inches) required in 4-7.1.3.
(6) The design area contemplates the use of wet pipe systems. Where dry pipe systems are required, it introduces a possible delay which needs to be compensated for by increased areas of application (plus 30 percent).
(7) Where there is only one tier of drums above the highest line of in-rack sprinklers, the ceiling water demand density may be reduced to 0.25 gpm/sq ft over 5000 sq ft.

SI Units: 1 gal = 3.8 L; 1 sq ft = 0.09 m^2; 1 ft = 0.30 m; 1 in. = 2.5 cm.

Table D-4-6.2.1 Automatic AFFF-Water Protection (1) Requirements for Rack Storage of Liquids* in Containers (*Flammable Aerosols Not Included)

	Ceiling Sprinklers Design & Demand			In-Rack Sprinkler Arrangement and Demand (4)					
		Area (sq ft)							
Class Liquid	Density gpm/sq ft	High Temp.	Ord. Temp.	On-End Storage, of drums (on pallets) up to 25 ft	Minimum Nozzle Pressure	Number of Sprinklers Operating	Hose Stream Demand (3)	Duration AFFF Supply	Duration Water Supply
IA, IB IC, II	0.30	1500	2550	a) ord. temp. sprinkler up to 10 feet apart horizontally b) one line sprinklers above each level of storage c) locate in longitudinal flue space, staggered vertically d) shields required for multilevel	30 psi.	3 sprinklers per level	500	15 min	2 hrs

NOTES: (1) System shall be a closed head wet system with approved devices for proportioning AFFF.
(2) Except as modified herein, in-rack sprinklers shall be installed in accordance with NFPA 231C, *Standard for Rack Storage of Materials.*
(3) Hose stream demand includes inside hand hose (1½ inches) required in 4-7.1.3.
(4) Maximum height of storage should be limited to 25 feet.

SI Units: 1 gal = 3.8 L; 1 sq ft = 0.09 m²; 1 ft = 0.30 m; 1 in. = 2.5 cm

D-4-6.2

(a) Sprinkler system densities and areas of application presented in this appendix are based upon limited test data and fire experience. Design criteria in this appendix do not apply to storage in plastic drums. (*See Appendix E for additional information on this subject.*)

(b) For design criteria for specific installations, insurance engineers, fire protection consultants, and other knowledgeable persons should be consulted.

(c) **Palletized and Solid Pile Storage.** For protected storage of liquids, as specified in Table 4-6.1(a), automatic sprinkler protection should be provided in accordance with Table D-4-6.2(a).

(d) **Rack Storage.** In protected storage of liquids arranged, as specified in Table 4-6.1(b), automatic sprinkler protection should be provided in accordance with Tables D-4-6.2(b) and D-4-6.2(c), as applicable, except that racks with solid shelves should be provided with in-rack sprinklers at every tier or level.

D-4-6.2.1

(a) Automatic aqueous film-forming foam (AFFF)-water sprinkler systems for container storage of liquids has been shown to be an acceptable method for providing fixed protection. (*See Appendix E for additional information on this subject.*)

(b) For design criteria for specific installations, insurance engineers, fire protection consultants, and other knowledgeable persons should be consulted.

(c) Rack storage of liquids in containers [drums of 55 gal (208 L) capacity] stored on-end on wood pallets on conventional double-row racks to a maximum height of storage of 25 ft (7.6 m) should be provided protection in accordance with Table D-4-6.2.1.

Appendix E

This Appendix is not a part of the requirements of this NFPA document but is included for information purposes only.

SI Units: 1 gal = 3.8 L; 1 ft = 0.30 m; 1 sq ft = 0.09 m²

Appendix D explains fire test data and loss experience that were used to help promulgate protection tables that are presented in Appendix C. While these data are limited, they do illustrate the seriousness of a potential drum rupture in a fire and the primary failure mode of built-up internal pressure in combination with the weakening of the rim joint, due to localized overheating. The possibility of a BLEVE-type explosion (Boiling Liquid Expanding Vapor Explosion) is also demonstrated. Due to the many unknowns, conservative practice would be to limit all Class I liquids stored in drums to not over one drum high, since protection tables were developed with this philosophy.

Very limited fire tests and fire experience, relative to flammable aerosols, indicate the serious problem they present to the fire protection engineer. Exploding pressurized aerosol cans are to be expected, together with the flaming fireball and rocketing action, spreading fire to a potentially larger area. The protection philosophy expressed is primarily to limit storage heights and to contemplate a larger area of application. Use of pressure-relieving can designs

would be expected to affect favorably the design considerations for fixed protection.

E-4-6(a) Fire Tests—Drum Storage:

(1) 1949 Fire Tests. A series of fire tests were made in 1949 at the Factory Mutual test center in Norwood, Massachusetts. The tests were conducted in the 15-ft-high section of the fire test building used at that time. The tests used ICC Specification 5 drums, which were 14 gage compared with the 16 gage Specification 17C drums and 18 gage Specification 17E drums used more commonly today.

The tests involved storage horizontally on metal racks up to four drums high, and palletized upright, three drums high. Test drums contained either water, gasoline, or benzene, located in the first or second tier and equipped with pressure- and temperature-sensing connections. The gasoline and benzene drums were piped to manual vents so that pressure could be relieved before the drums ruptured. Other drums in the array contained water or were empty.

Sprinkler protection consisted of open, old-type sprinklers, which could be manually turned on, either at the start of the fire (short preburn) or at a time simulating the first sprinkler operation (long preburn). Sprinklers were spaced either at 100 sq ft/head with a flow rate of 0.22 or 0.28 gpm/sq ft or spaced at 50 sq ft/head with a flow rate of 0.44 or 0.56 gpm/sq ft.

Gasoline was pumped through piping to designated discharge points in or near the pile at flow rates from 1 to 15 gpm. In some tests, 5 or 10 gal of fuel were poured on the floor below the drums and ignited. Duration of flows were the length of time required to empty a single drum at the rate of flow used.

When sprinkler discharge was turned on immediately, the pressure that developed in the test drums was due almost entirely to the vapor pressure as the body of liquid increased in temperature. When sprinkler discharge was started, simulating normal sprinkler operation, there was a rapid pressure increase due to heating of the vapor space. This usually dropped when cooling by sprinkler discharge started.

Early tests showed that 100 sq ft spacing of sprinklers and densities of 0.22 and 0.28 gpm/sq ft would not prevent excessive temperature and pressure increases in drums. Spacing of 50 sq ft per sprinkler was used in subsequent tests. Test measurement and visual observation indicated that 0.56 gpm/sq ft provided considerably better cooling and flushing away of fuel than the 0.44 gpm/sq ft sprinkler density.

When fuel was discharged on the floor, only the bottom tier of storage was severely exposed. When fuel was discharged at a higher level, simulating a leaking drum, those drums in the immediate vicinity in upper tiers were severely exposed.

The rate of fuel flow had very little effect on the heating of any particular drum. The lower rates, 1 to 2 gpm, had a much longer duration and resulting exposure was greater before the 55-gal duration supply was used up.

With on-side drum storage in racks, the rate of temperature rise in the test drum on the lowest tier was 3 to 5 times as high with storage more than one drum high than it was with one-high storage. Tests with on-end palletized storage were only conducted three-high.

When 5 or 10 gal of gasoline were spilled on the floor and then ignited, the 5-gal spill gave a more severe exposure to drums because of the longer time before sprinklers would have operated. The 10-gal spill exposed more drums, but the exposure to any one drum was no more severe.

A very small leak from a drum filled with gasoline gave a very severe exposure, because of the localized exposure to the leaking drum and insufficient heat at the ceiling to operate the sprinklers.

Drums containing benzene heated much more rapidly than drums containing water because of the lower specific heat of benzene. Early pressure build-up in the vapor space is more pronounced with water, possibly because of more film vaporization on the early stages of the fire.

(2) 1967 Fire Tests. A series of fire tests were made to compare the effects of severe fire exposure to water- and heptane-filled drums. The tests were carried out in the Factory Mutual explosion tunnel, using new ICC-17E (18 gage) 55-gal drums.

A single drum was encircled with a ring of oil burners. Temperatures were measured at various points in the drum. The fuel rate to the oil burners was about 1 gpm. There was no cooling applied to the drum.

Using heptane, the drum ruptured at about 17 psig, at a drum rim temperature of 1190°F (643.4°C). The cover seam unrolled and a BLEVE-type explosion resulted, after a fire exposure of 3 to 4 minutes.

On similar tests using water, failure occurred at 40 psig after 10 minutes.

The tests indicated that the heptane-filled drum will rupture much sooner and at a much lower internal pressure than a water-filled drum. This is attributed to the fact that drums were found to leak around the joint of the rim before the rupture. The small leakage of heptane vapor through the rim joint causes a localized flame at this already weakened location on the rim, whereas steam issuing from a similar leak in a water-filled drum tends to cool the metal at this point.

(3) 1974 Fire Tests. A series of fire tests were made to evaluate protection of on-end drum storage with AFFF foam discharging from a standard sprinkler system. The tests were conducted in the 30-foot high area of the Factory Mutual test center in Rhode Island.

Based on the 1967 tests, a standard for success was that no drum should exceed 15 psig pressure.

Tests were made with water-filled drums, palletized, 2, 3, and 4 pallets high, and on racks, 5 tiers high.

Fuel was heptane, piped to the base of the top tier of storage, with a 10-gal floor spill in each case. Sprinklers were automatic, 286°F (141.1°C) heads.

Test 1: In this test, storage was 4 pallet-loads high. Fuel discharge rate was 2 gpm. Sprinkler discharge density was 0.30 gpm/sq ft. The first sprinkler opened at 34 sec. Only 4 sprinklers operated, but the three-dimensional fire in the pile continued strong. Several drums bulged, 2 ruptured, and 6 exceeded 15 psig pressure.

Test 2: In this test, storage was 3 tiers high, sprinkler density was 0.60 gpm/sq ft. Other conditions were the same as Test 1.

Two sprinklers opened at about 1 minute 20 sec. A considerable number of drums were deformed. Four of the 8 monitored drums exceeded 15 psig pressure.

Test 3: This test was rack storage with 160°F (71.1°C) automatic sprinklers in each tier except the bottom. Fuel rate was 2 gpm. Ceiling protection was 0.30 gpm/sq ft.

Five in-rack sprinklers and one ceiling sprinkler opened. One drum in the first tier, which had no in-rack sprinklers, reached a pressure of 16 psig. Two drums fell from the fifth tier, due to burning away of a pallet.

Test 4: Test 4 was a repeat of Test 3, except the fuel flow rate was 15 gpm.

Eight ceiling sprinklers and 5 in-rack sprinklers operated. Ceiling temperatures reached 1665°F (909.5°C). One monitored drum in the first tier reached 20 psig. Several drums were bulged.

Test 5: Test 5 was a repeat of Test 2, except storage was 2 tiers high.

The fuel was a greater distance from the ceiling so sprinklers did not operate until 3½ to 4 minutes after ignition. Damage to drums was severe, with many rupturing and all eight monitored drums going over 15 psig.

Generally, results were good in rack storage, where in-rack sprinklers were provided at each tier. For palletized storage, the AFFF protection controlled the floor fire, although pallets hindered spread of foam. Ceiling sprinklers only did not adequately protect palletized storage where an elevated spill resulted in a three-dimensional fire within the pile.

Most of the ruptured drums failed at the top chime, but one drum developed a slow leak at a bottom chime. In Test 5, several drums were heated by a localized fire which did not open sprinklers at the roof. This slow overpressurization can lead to superheated liquid release and a resulting severe BLEVE when the drum eventually ruptures.

E-4-6(b) Fire Tests—Small Containers.

(1) 1957 Fire Test (Nonpressurized Smaller Containers). A fire test was made on 10½-ft high storage of paint in 1-gal cans in cartons. The storage was palletized, but the pallets were fire-stopped, so it was equivalent to solid piled storage. The paint varied in flash point from 105 to 170°F (40.5 to 76.7°C) (Class II and IIIA). Sprinkler protection was 160°F (71.1°C) heads, 10 × 10 ft, with a density of 0.23 gpm/sq ft. Ceiling height was 15 ft.

Six sprinklers operated and controlled the fire. Temperatures over the fire reached a maximum of 1100°F (593.3°C) and dropped below 500°F (260°C) after 10 minutes. Five hundred and three cans had their covers blown off and 20 cans had burst seams. The paint released from the cans was slight, but it would be much more significant if a pile had toppled over or if cans had not all been stored cover-side up.

(2) 1970 Fire Test (Pressurized Containers). A fire test was made in the 30-ft high section of the Factory Mutual Rhode Island test facility. The storage was 13 and 16-oz cans of lacquer in shipping cartons stored 2 pallet by 2 pallet by 2 pallet high on racks. Storage height was 9 ft 9 in. Protection was by twelve 160°F (71.1°C) sprinklers spaced 10 × 10 ft providing a discharge density of 0.30 gpm/sq ft.

Fifty seconds after ignition, containers began to burst. At 62 sec, 3 sprinklers operated. The fire became more and more intense and with all 12 sprinklers operating, there was no suppressing effect. The discharge was increased to 0.50 gpm/sq ft without effect. After about 5 minutes, the fuel was nearly exhausted. Containers were thrown to every corner of the test building.

Temperatures over the fire were over 1000°F (537.8°C) for 3½ minutes and over 1700°F (926.6°C) for 2 minutes.

E-4-6(c) Fire experience examples involving flammable and combustible liquids in containers stored in buildings.

(1) 1951 Fire. Drums of petroleum naphtha were stored temporarily in a general purpose warehouse used mainly for storing can ends in wood boxes. Storage was 1 drum high on pallets.

Two drums had small punctures and leaks near the bottom, caused either maliciously or by moving equipment. The leak was ignited, and one drum ruptured at the bottom seam. A drum rupture resulted which opened 272 sprinklers. The fire department was called promptly and they and sprinklers were able to contain the fire, helped by the low combustible concentration in the warehouse and by failure of any other drums to rupture.

Forty-two million can ends were wet down, but fire damage was limited. No explosion damage was reported. (The intensity of the BLEVE may have been limited by much of the liquid leaking from the drum before it ruptured.) Total damage was about $200,000.

(2) 1965 Fire. Pressurized containers of paint were stored 15 ft high on racks. A fire started in the top tier from a gas-fired radiant heater. Bursting containers spread burning paint over a large area, opening one hundred eighty-eight 165°F (73.9°C) sprinklers. The fire spread 25 ft along a rack but was slowed by aisles and inert material. A portion of the roof over the fire area collapsed.

(3) 1966 Fire. Pressurized containers of alcohol-base hair spray and deodorant were stored palletized, 17 ft high. The fire was contained within a 1,200 sq ft pile by 107 operating sprinklers. Damage exceeded $400,000.

(4) 1971 Distribution Warehouse Fire. A sprinklered 67,000 sq ft, one-story, noncombustible warehouse for automotive equipment and supplies was destroyed by fire from undetermined cause. Storage consisted of various metal, plastic and rubber parts in cardboard cartons, plus flammable and combustible liquids in containers ranging from 1 pt aerosol cans up to, and including, 55-gal metal drums. Method of storage was mostly on wooden pallets on open metal racks, double row, with 3 and 4 tiers to a total storage height of 15 to 17 ft. A considerable portion of the racks were used for storage of flammable and combustible liquids in 5-gal and 55-gal metal containers on wooden pallets, 4 tiers

high. Both flammable and nonflammable aerosols in pint cans in cartons were palletized and stored in portions of the racks. Ceiling sprinkler design was wet pipe, extra-hazardous schedule, using 17/32 orifice, 165°F (73.9°C) heads, supplied from a fairly strong city water supply (52 psi static, 38 psi residual, with 1,580 gpm flowing). A review of the hydraulics indicates system was capable of supplying a density of 0.20 gpm/sq ft for the most remote 2,000 sq ft area.

Despite immediate fire department response to a central station water flow alarm and use of a fire department siamese connection, the fire spread beyond the capability of the sprinkler system and the system was soon overtaxed, resulting in early roof collapse and breaking of sprinkler piping, and thus requiring closing of the main control valve. Numerous "fireball" explosions of aerosol cans and ruptures of 55-gal drums were reported, several affecting manual fire fighting operations, requiring about 5 hrs for control.

(5) 1975 Fire. About one hundred 55-gal drums of Class IB and IC liquids were stored palletized, 3 drums high, in a corner of a general-purpose warehouse, together with ordinary combustible commodities up to 11 ft high in racks. The roof was Class II steel deck, 15 ft high.

Sprinklers were on an ordinary hazard system, 160°F (71.1°C) heads.

Employees discovered a large fire in progress in the drum storage area. Shortly after the public fire department arrived, drums started to rupture, creating large fireballs. One drum failed at the bottom and rocketed through the roof, landing 750 ft from the building. The roof partially collapsed and one system was then shut off. Most of the building and contents were severely damaged.

The fire probably started in an open waste pail near the drum storage. Total loss was about $3,300,000.

Appendix F

Chapter 5 Source Tables

The following tables may be used as a cross-reference between individual paragraphs in Chapter 5, *Operations*, and the source paragraphs in the 1984 Edition of NFPA 30.

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5-3.1.4	5-3.3
5-3.1.5	7-8.2 (In Concept)/ 8-3.1 (In Part)
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5-3.5.4	5-7.4, 6-5.4, 7-7.3.4
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5-3.5.6 Figure	Figure 6-5.3
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5-4.3.3	5-2.2.1, 7-4.1.4
5-4.3.4(a)-(e)	5-2.2.2
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Appendix G Referenced Publications

G-1 The following documents or portions thereof are referenced within this standard for informational purposes only and thus should not be considered part of the requirements of this document. The edition indicated for each reference is current as of the date of the NFPA issuance of this document. These references are listed separately to facilitate updating to the latest edition by the user.

G-1.1 NFPA Publications. National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 10-1984, *Standard for Portable Fire Extinguishers*

NFPA 14-1986, *Standard for the Installation of Standpipe and Hose Systems*

NFPA 24-1987, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*

NFPA 31-1987, *Standard for the Installation of Oil Burning Equipment*

NFPA 32-1985, *Standard for Drycleaning Plants*

NFPA 33-1985, *Standard for Spray Application Using Flammable and Combustible Materials*

NFPA 34-1987, *Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids*

NFPA 35-1987, *Standard for the Manufacture of Organic Coatings*

NFPA 36-1985, *Standard for Solvent Extraction Plants*

NFPA 37-1984, *Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines*

NFPA 51-1987, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*

NFPA 68-1987, *Guide for Explosion Venting*

NFPA 71-1987, *Standard for the Installation, Maintenance, and Use of Signaling Systems for Central Station Service*

NFPA 72A-1987, *Standard for the Installation, Maintenance, and Use of Local Protective Signaling Systems for Guard's Tour, Fire Alarm, and Supervisory Service*

NFPA 72B-1986, *Standard for the Installation, Maintenance, and Use of Auxiliary Protective Signaling Systems for Fire Alarm Service*

NFPA 72C-1986, *Standard for the Installation, Maintenance, and Use of Remote Station Protective Signaling Systems*

NFPA 72D-1986, *Standard for the Installation, Maintenance, and Use of Proprietary Protective Signaling Systems*

NFPA 77-1983, *Recommended Practice on Static Electricity*

NFPA 78-1986, *Lightning Protection Code*

NFPA 204M-1985, *Guide for Smoke and Heat Venting*

NFPA 327-1987, *Standard Procedures for Cleaning or Safeguarding Small Tanks and Containers*

NFPA 395-1984, *Standard for the Storage of Flammable and Combustible Liquids on Farms and Isolated Construction Projects*

NFPA 1221-1987, *Standard for the Installation, Maintenance, and Use of Public Fire Service Communications*

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Attachment 6.3

NFPA 30 Walkdown Checklist

NFPA 30 Code Compliance Evaluation

For

Donald C. Cook Nuclear Plant

Units 1 and 2

Indiana Michigan Power Company

FLAMMABLE LIQUIDS STORAGE ROOM

WALKDOWN CHECKLIST

CONDUCTED BY: P.J. RUSSELL

NFPA 30 - 1987
FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE
CODE COMPLIANCE WALKDOWN CHECKLIST

I = Information Only
CN = Can not verify by walkdown
N/A = Not Applicable
✓ = Compliance
(X) = Non Compliance

Code Section No.	Code Section	Walkdown Remarks
CHAPTER 1	GENERAL PROVISIONS	
1-1	Scope and Application	
1-1.1	This code applies to all flammable and combustible liquids except those that are solid at 100°F (37.8°C) or above.	I
1-1.2	Requirements for the safe storage and use of the great variety of flammable and combustible liquids commonly available depend primarily on their fire characteristics, particularly the flash point, which is the basis for the several classifications of liquids as defined in Section 1-2. It should be noted that the classification of a liquid can be changed by contamination. For example, filling a Class II liquid into a tank which last contained a Class I liquid can alter its classification, as can exposing a Class II liquid to the vapors of a Class I liquid via an interconnecting vapor line (see 2-2.6.4 and 2-3.5.6). Care shall be exercised in such cases to apply the requirements appropriate to the actual classification.	I

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CODE COMPLIANCE WALKDOWN CHECKLIST

Code Section No.	Code Section	Walkdown Remarks
1-1.3	The volatility of liquids is increased by heating. When Class II or Class III liquids are exposed to storage conditions, use conditions or process operations where they are naturally or artificially heated to or above their flash points, additional requirements may be necessary. These requirements include consideration for such items as ventilation, exposure to ignition sources, diking, and electrical area classification.	I
1-1.4	Additional requirements may be necessary for the safe storage and use of liquids that have unusual burning characteristics, that are subject to self-ignition when exposed to the air, that are highly reactive with other substances, that are subject to explosive decomposition, or have other special properties that dictate safeguards over and above those specified for a normal liquid of similar flash point classification.	I
1-1.5	In certain installations the provisions of this code may be altered at the discretion of the authority having jurisdiction after consideration of the special features such as topographical conditions, barricades, walls, adequacy of building exists, nature of	I

Code Section No.	Code Section	Walkdown Remarks
1-1.5 Cont'd	occupancies, proximity of buildings or adjoining property and character of construction of such buildings, capacity and construction of proposed tanks and character of liquids to be stored, nature of process, degree of private fire protection to be provided, and the adequacy of facilities of the fire department to cope with flammable or combustible liquid fires.	
1-1.6	Existing plants, equipment, buildings, structures, and installations for storage, handling, or use of flammable or combustible liquids that are not in strict compliance with the terms of this code may be continued in use at the discretion of the authority having jurisdiction provided they do not constitute a recognized hazard to life or adjoining property. The existence of a situation that might result in an explosion or sudden escalation of a fire, such an inadequate ventilation or confined spaces, lack of adequate emergency venting of a tank, failure to fireproof the supports of elevated tanks, or lack of drainage or dikes to control spills may constitute such a hazard.	I

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CODE COMPLIANCE WALKDOWN CHECKLIST

Code Section No.	Code Section	Walkdown Remarks
1-1.7	This code shall not apply to:	
1-1.7.1	Transportation of flammable and combustible liquids. These requirements are contained in the U.S. Department of Transportation regulations or in NFPA 385, "Standard for Tank Vehicles for Flammable and Combustible Liquids."	I
1-1.7.2	Storage, handling, and use of fuel oil tanks and containers connected with oil burning equipment. These requirements are covered separately in NFPA 31, "Standard for the Installation of Oil Burning Equipment."	I
1-1.7.3	Storage of flammable and combustible liquids on farms and isolated construction projects. These requirements are covered separately in NFPA 395, "Standard for the Storage of Flammable and Combustible Liquids on Farms and Isolated Construction Projects."	I
1-1.7.4	Liquids without flash points that can be flammable under some conditions, such as certain halogenated hydrocarbons and mixtures containing halogenated hydrocarbons. (See NFPA 321, "Standard on Basic Classification of Flammable and Combustible Liquids.")	I

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FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE
CODE COMPLIANCE WALKDOWN CHECKLIST

Code Section No.	Code Section	Walkdown Remarks
1-1.7.5	Mists, sprays, or foams. (Except flammable aerosols in containers, which are included in Chapter 4.)	I
1-1.8	Installations are made in accordance with the applicable requirements of standards of the National Fire Protection Association: NFPA 32, "Standard for Drycleaning Plants;" NFPA 33, "Standard for Spray Application Using Flammable or Combustible Materials;" NFPA 34, "Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids;" NFPA 35, "Standard for the Manufacture of Organic Coatings;" NFPA 36, "Standard for Solvent Extraction Plants;" NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines;" NFPA 45, "Standard for Fire Protection for Laboratories Using Chemicals; and Chapter 10 of NFPA 99, "Standard for Health Care Facilities," shall be deemed to be in compliance with this code.	N/A
1-1.9	Metrication. If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is regarded as the requirement. The given equivalent value may be approximate.	I

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Code Section No.	Code Section	Walkdown Remarks
1-2	Definitions The scope of this chapter is not included in this report. Definitions are placed within NFPA 30 for information purposes only.	I
1-3	Storage Liquids shall be stored in tanks or in containers in accordance with Chapter 2 or Chapter 4.	Refer to Chapters 2 & 4
1.4	Pressure Vessel All new pressure vessels containing liquids shall comply with 1-4.1, 1-4.2, or 1-4.3, as applicable.	N/A
1-4.1	Fired pressure vessels shall be designed and constructed in accordance with Section 1 (Power Boilers), or Section VIII, Division 1 or Division 2 (Pressure Vessels), as applicable, of the 1983 ASME Boiler and Pressure Vessel Code.	N/A
1-4.2	Unfired pressure vessels shall be designed and constructed in accordance with Section VIII, Division 1 or Division 2, of the 1983 ASME Boiler and Pressure Vessel Code.	N/A

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Code Section No.	Code Section	Walkdown Remarks
1-4.3	Fired and unfired pressure vessels that do not conform to 1-4.1 or 1-4.2 may be used provided approval has been obtained from the state or other governmental jurisdiction in which they are to be used. Such pressure vessels are generally referred to as "State Special."	N/A
1.5	Exits Egress from buildings and areas covered by this code shall be in accordance with NFPA 101, "Life Safety Code."	✓
Chapter 2	Tank Storage The scope of this entire chapter is not included in this report. No permanent flammable liquid tanks exist within the security fence.	N/A
Chapter 3	Piping, Valves, and Fittings The scope of this entire chapter is not included in this report. No flammable liquid piping systems are installed within the Donald C. Cook Nuclear Plant.	N/A
Chapter 4	Container and Portable Tank Storage	
4.1	Scope	

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Code Section No.	Code Section	Walkdown Remarks
4-1.1	This chapter shall apply to the storage of liquids, including flammable aerosols, in drums or other containers not exceeding 60 gal (227 L) individual capacity and portable tanks not exceeding 660 gal (2498 L) individual capacity and limited transfers incidental thereto. For portable tanks exceeding 660 gal (2498 L), Chapter 2 shall apply.	I
4-1.2	This chapter shall not apply to the following:	
	(a) Storage of containers in bulk plants, service stations, refineries, chemical plants, and distilleries.	I
	(b) Liquids in the fuel tanks of motor vehicles, aircraft, boats, or portable or stationary engines.	I
	(c) Beverages, when packaged in individual containers not exceeding a capacity of one gallon.	I

Code Section No.	Code Section	Walkdown Remarks
4-1.2 Cont'd	(d) Medicines, foodstuffs, cosmetics, and other consumer products containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solution not being flammable when packaged in individual containers not exceeding one gallon in size.	I
	(e) The storage of liquids that have no fire point when tested by ASTM D 92-78, the Cleveland Open Cup Test Method, up to the boiling point of the liquid, or up to a temperature at which the sample being tested shows an obvious physical change.	I
	(f) The storage of distilled spirits and wines in wooden barrels or casks.	I
4-1.3	For the purpose of this chapter, unstable liquids and flammable aerosols shall be treated as Class IA liquids.	I
4-2	Design, Construction, and Capacity of Containers	

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Code Section No.	Code Section	Walkdown Remarks
4-2.1	Only approved containers and portable tanks shall be used. Metal containers and portable tanks meeting the requirements of, and containing products authorized by, Chapter I, Title 49 of the "Code of Federal Regulations" (DOT Regulations), or NFPA 386, "Standard for Portable Shipping Tanks for Flammable and Combustible Liquids," shall be acceptable. Polyethylene containers meeting the requirements of, and containing products authorized by, DOT Specification 34, and polyethylene drums authorized by DOT Exemption Procedures, shall be acceptable. Plastic containers meeting the requirements of ANSI/ASTM D 3435-80, "Plastic Containers (Jerry Cans) for Petroleum Products," used for petroleum products within the scope of that specification shall be acceptable.	✓ - This Author did not notice any unapproved containers. All liquids were contained in their shipping containers or they were transferred into approved containers.
4-2.2	Each portable tank shall be provided with one or more devices installed in the top with sufficient emergency venting capacity to limit internal pressure under fire exposure conditions to 10 psig (68.9 kPa), or 30 percent of the bursting pressure of the tank, whichever is greater. The total venting capacity shall be not less than that specified in 2-2.5.4 or 2-2.5.6. At least one pressure-	N/A - no portable tanks

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4-2.2 Cont'd	actuated vent having a minimum capacity of 6.000 cu ft (170 m^3) of free air per hour (14.7 psia (760 mm Hg) and 60°F (15.6°C) shall be used. It shall be set to open at not less than 5 psig (34.5 kPa). If fusible vents are used, they shall be actuated by elements that operate at a temperature not exceeding 300°F (148.9°C). When used for paints, drying oils, and similar materials where plugging of the pressure-actuated vent can occur, fusible vents or vents of the type that soften to failure at a maximum of 300°F (148.9°C) under fire exposure may be used for the entire emergency venting requirement.	
4-2.3	Containers and portable tanks for liquids shall conform to Table 4-2.3 except as provided in 4-2.3.1 or 4-2.3.2.	✓ (visual inspection). All containers under 5 gallons contain liquids of Class IB or IC. All other liquids are stored in 5 or 60 gallon containers. In fact, this author could find no Class IA liquids stored w/in this room.
4-2.3.1	Medicines, beverages, foodstuffs, cosmetics, and other common consumer products, when packaged according to commonly accepted practices for retail sales, shall be exempt from the requirements of 4.2.1 and 4.2.3.	→ N/A

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Code Section No.	Code Section	Walkdown Remarks
4-2.3.2	DOT Type III polyethylene nonreusable containers, constructed and tested in accordance with DOT specification 2U, treated if necessary to prevent permeation, may be used for storage of Class II and Class III liquids, in all capacities not to exceed 2 1/2 gal.	N/A
4-2.3.3	Class IA and Class IB liquids may be stored in glass containers of not more than one gallon capacity if the required liquid purity (such as ACS analytical reagent grade or higher) would be affected by storage in metal containers of if the liquid would cause excessive corrosion of the metal container.	N/A
4.3	Design, Construction, and Capacity of Storage Cabinets	
4.3-1	Not more than 120 gal (454 L) of Class I, Class II, and Class IIIA liquids may be stored in a storage cabinet. Of this total, not more than 60 gal (227 L) may be of Class I and Class II liquids and not more than three (3) such cabinets may be located in a single fire area, except that, in all industrial occupancy, additional cabinets may be located in the same fire area if the additional cabinet, or group of not more than three (3) cabinets, is separated from other cabinets or group of cabinets by at least 100 ft (30 m).	SEE "Portable Flammable liquids Cabinet" Walkdown.

Code Section No.	Code Section	Walkdown Remarks
4-3.2	Storage cabinets shall be designed and constructed to limit the internal temperature at the center, 1 in. (2.5 cm) from the top to not more than 325°F (162.8°C) when subjected to a 10-minute fire test with burners simulating a room fire exposure using the standard time-temperature curve as given in ASTM E 152-81a. All joints and seams shall remain tight and the door shall remain securely closed during the fire test. The cabinet is not required to be vented for fire protection purposes; however, the following shall apply: (a) If the cabinet is vented for other reasons, the cabinet shall be vented outdoors in such a manner that will not compromise the specified performance of the cabinet, as acceptable to the authority having jurisdiction. (b) If the cabinet is not vented, the vent openings shall be sealed with properly fitted metal bung.	See "Portable flammable liquids Cabinet" walkdown

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Code Section No.	Code Section	Walkdown Remarks
4-3.2.1	Metal cabinets constructed in the following manner are acceptable. The bottom, top, door, and sides of cabinet shall be at least No. 18 gage sheet steel and double walled with 1 1/2 in. (3.8 cm) air space. Joints shall be riveted, welded, or made tight by some equally effective means. The door shall be provided with a three-point latch arrangement and the door sill shall be raised at least 2 in. (5 cm) above the bottom of the cabinet to retain spilled liquid within the cabinet.	See 'Portable Flammable Liquids' Walkdown
4-3.2.2	Wooden cabinets constructed in the following matter are acceptable. The bottom, sides, and top shall be constructed of exterior grade plywood at least 1 in. (2.5 cm) in thickness, which shall not break down or delaminate under fire conditions. All joints shall be rabbetted and shall be fastened in two directions with wood screws. When more than one door is used, there shall be a rabbetted overlap of not less than 1 in. (2.5 cm). Doors shall be equipped with a means of latching and hinges shall be constructed and mounted in such a manner as to not lose their holding capacity when subjected to fire exposure. A raised sill or pan capable of containing a 2 in. (5 cm) depth of liquid shall be provided at the bottom of the cabinet to retain spilled liquid within the cabinet.	

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Code Section No.	Code Section	Walkdown Remarks
4-3.2.3	Listed cabinets that have been constructed and tested in accordance with 4-3.2 shall be acceptable.	See "Portable Flammable Liquids Cabinets" walkdown.
4-4	Design, Construction, and Operation of Separate Inside Storage Areas (See Section 1-2, "Definitions.) (For additional information, see Appendix C.)	
4-4.1	Inside Rooms	
4-4.1.1	Inside rooms shall be constructed to meet the selected fire-resistance rating as specified in 4-4.1.4. Such construction shall comply with the test specifications given in NFPA 251, "Standard Methods of Fire Tests of Building Construction and Materials." Except for drains, floors shall be liquidtight and the room shall be liquidtight where the walls join the floor. Where an automatic fire protection system is provided, as indicated in 4-4.1.4, the system shall be designed and installed in accordance with the appropriate NFPA standard for the type of system selected.	✓ (visual inspection) Room appears to be of sound construction.

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Code Section No.	Code Section	Walkdown Remarks
4-4.1.2	Openings in interior walls to adjacent rooms or buildings shall be provided with: (a) Normally closed, listed 1 1/2 hr (B) fire doors for interior walls with fire-resistance rating of 2 hr or less. Where interior walls are required to have greater than 2 hr fire-resistance rating, the listed fire doors shall be compatible with the wall rating. Doors may be arranged to stay open during material handling operations if doors are designed to close automatically in a fire emergency by provision of listed closure devices. Fire doors shall be installed in accordance with NFPA 80, "Standard for Fire Doors and Windows." (b) Noncombustible liquidtight raised sills or ramps at least 4 in. (10 cm) in height or otherwise designed to prevent the flow of liquids to the adjoining areas. A permissible alternative to the sill or ramp is an open-grated trench, which drains to a safe location, across the width of the opening inside of room.	✓ Class "A" rated fire door to adjacent corridor. Back door (non listed) leads to outside ✓ Ramps are approximately 6" in height.

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Code Section No.	Code Section	Walkdown Remarks
4-4.1.3	Wood at least 1 in. (2.5 cm) nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.	✓ Two 2"x4" boards were being used as scuffboards at the time of this inspection.
4-4.1.4	Storage in inside rooms shall comply with the following:	(X) Floor Area ≈ 800 ft Quantity of liquids is w/in compliance of 10 gallons/ft/floor area requirement.

Automatic Fire Protection* Provided	Fire Resistance	Maximum Floor Area	Total Allowable Quantities-- Gallons/Sq Ft/ Floor Area
YES	2 hr	500 sq ft	10
NO	2 hr	500 sq ft	4**
YES	1 hr	150 sq ft	5
NO	1 hr	150 sq ft	2

SI Units: 1 sq ft = 0.09 m^2, 1 gal - 3.8 L.
*Fire protection system shall be sprinkler, water spray, carbon dioxide, dry chemical, halon, or other approved system.
**Total allowable quantities of Class IA and 1B Liquids shall not exceed that permitted in Table 4-4.2.7 and the provisions of 4-4.2.10.

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Code Section No.	Code Section	Walkdown Remarks
4-4.1.5	Electrical wiring and equipment located in inside rooms used for Class I liquids shall be suitable for Class I, Division 2 classified locations; for Class II and Class III liquids, shall be suitable for general use. NFPA 70, "National Electrical Code," provides information on the design and installation of electrical equipment.	✓ field verified as w/in Class I, Division 2 requirements. * verified by this author as well as J.D. Markham (AEPSC - NED, I&C)
4-4.1.6	Every inside room shall be provided with either a gravity or a continuous mechanical exhaust ventilation system. Mechanical ventilation shall be used if Class I liquids are dispensed within the room.	
	(a) Exhaust air shall be taken from a point near a wall on one side of the room and within 12 in. (30 cm) of the floor with one or more make-up inlets located on the opposite side of the room within 12 in. (30 cm) from the floor. The location of both the exhaust and inlet air openings shall be arranged to provide, as far as practicable, air movements across all portions of the floor to prevent accumulation of flammable vapors. Exhaust from the room shall be directly to the exterior of the building without recirculation.	(X) Make up inlet is located well above 12" from the floor

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Code Section No.	Code Section	Walkdown Remarks
4-4.1.6 Cont'd	Exception: Recirculation is permitted where it is monitored continuously using a fail-safe system that is designed to automatically sound an alarm, stop recirculation, and provide full exhaust to the outside in the event that vapor-air mixtures in concentration over one-fourth of the lower flammable limit are detected. If ducts are used, they shall not be used for any other purpose and shall comply with NFPA 91, "Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying." If make-up air to a mechanical system is taken from within the building, the opening shall be equipped with a fire door or damper, as required in NFPA 91, "Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying." For gravity systems, the make-up air shall be supplied from outside the building.	(X) No Airflow switches are on this system.

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Code Section No.	Code Section	Walkdown Remarks
4-4.1.6 Cont'd	(b) Mechanical ventilation systems shall provide at least one cubic foot per minute of exhaust per square foot of floor area (1 m^3 per 3 m^2), but not less than 150 cfm (4 m^3). The mechanical ventilation system for dispensing areas shall be equipped with an air flow switch or other equally reliable method that is interlocked to sound an audible alarm upon failure of the ventilation system.	See previous page
4-4.1.7	In every inside room, an aisle at least 3 ft (0.90 m) wide shall be maintained so that no container is more than 12 ft (3.6 m) from the aisle. Containers over 30 gal (113.5 L) capacity storing Class I or Class II liquids shall not be stored more than one container high.	✓
4-4.1.8	Where dispensing is being done in inside rooms, operations shall comply with the provisions of Chapter 5.	See Chapter 5
4-4.1.9	Basement Storage Areas. Class I liquids shall not be permitted in inside storage rooms in basement areas.	N/A (ground floor)
4-4.2	Cutoff Rooms and Attached Buildings	

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Code Section No.	Code Section	Walkdown Remarks
4-4.2.1	Construction design of exterior walls shall provide ready accessibility for fire fighting operations through provision of access openings, windows, or lightweight non-combustible wall panels. Where Class IA or IB liquids are dispensed, or where Class IA liquids are stored in containers larger than one gallon, the exterior wall or roof construction shall be designed to include explosion-venting features, such as light-weight wall assemblies, lightweight roof assemblies, roof hatches, or windows of the explosion-venting type. NFPA 68, "Guide for Explosion Venting," provides information on this subject.	CN, Although this author notes that the building appears to be of sound construction. ✓ exterior door allows for accessibility.
4-4.2.2	Where other portions of buildings or other properties are exposed, each opening in the exposing wall shall be protected with a listed 1 1/2 hr (D) fire door installed in accordance with NFPA 80, "Standard for Fire Doors and Windows," and the walls shall have a fire-resistance rating of not less than 2 hrs.	CN, Although this author notes that the building appears to be of sound construction.

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Code Section No.	Code Section	Walkdown Remarks
4-4.2.3	Except as noted in 4-4.2.6, interior walls, ceiling, and floors shall have a fire-resistance rating of not less than 2 hrs where floor area of the room or building exceeds 300 sq ft (27 m^2) or a fire-resistance rating of not less than one hour for a floor area of 300 sq ft (27 m^2) or less. Such construction shall comply with the test specifications given in NFPA 251, "Standard Methods of Fire Tests of Building Construction and Materials." Walls shall be liquidtight at the floor level.	CW, Although this author notes that the building appears to be of sound construction.
4-4.2.4	Openings in interior walls to adjacent rooms or buildings shall be in accordance with 4-4.1.2(a).	✓ Class "A" fire door
4-4.2.5	Curbs, scuppers, special drains, or other suitable means shall be provided to prevent the flow of liquids under emergency conditions into adjacent building areas except where the individual container capacity is 5 gal (18.9 L) or less or if the liquids stored are only Class III liquids. The drainage system, if used, shall have sufficient capacity to carry off expected discharge of water from fire protection systems and hose streams.	(X) Drain appears plugged

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Code Section No.	Code Section	Walkdown Remarks
4-4.2.6	Roofs of attached buildings, one story in height, may be lightweight noncombustible construction if the separating interior wall as specified in 4-4.2.3 has a minimum 3 ft (0.90-m) parapet.	N/A
4-4.2.7	Unprotected storage in cutoff rooms and attached buildings shall comply with Table 4-4.2.7. (See 4-4.2.10 for mixed storage of liquids.)	N/A
4-4.2.8	Protected storage in cutoff rooms and attached buildings shall comply with Section 4-6 as applicable. (See 4-4.2.10 for mixed storage of liquids.)	See Applicable sections
4-4.2.9	Wood at least 1 in (2.5 cm) nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.	✓ Two 2"x4" boards were being used as scuffboards at the time of this inspection.
4-4.2.10	Where two or more classes of liquids are stored in a single pile or rack section, the maximum quantities and height of storage permitted in that pile or rack section shall be the smallest of the two or more separate quantities and heights. The maximum total	✓

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Code Section No.	Code Section	Walkdown Remarks
4-4.2.10 Cont'd	quantities permitted shall be limited to a sum of proportional amounts that each class of liquid present bears to the maximum total permitted for its respective class; sum of proportional amounts not to exceed 100 percent.	
4-4.2.11	Dispensing operations of Class I or Class II liquids are not permitted in cutoff rooms or attached buildings exceeding 1000 sq ft (93 m^2) floor area. In rooms where dispensing of Class I liquids is permitted, electrical systems shall comply with 4-4.1.5, except that within 3 ft (0.90 m) of a dispensing nozzle area, the electrical system shall be suitable for Class I, Division I; ventilation shall be provided per 4-4.1.6; and operations shall comply with the provisions of Chapter 5.	✓ ≈ 800 ft & no dispensing of Class I liquids w/in 3 ft of the electrical system. All electrics meet 4-4.1.5. (X) ventilation
4-4.2.12	Basement Storage Areas. Class I liquids shall not be permitted in the basement areas of cut-off rooms and attached buildings. Class II and Class IIIA liquids may be stored in basements provided that automatic sprinkler protection and other fire protection facilities are provided in accordance with Section 4-6.	N/A, Storage area is on ground floor
4.5	Indoor Storage	

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Code Section No.	Code Section	Walkdown Remarks
4-5.1	Basic Conditions	TITLE
4-5.1.1	The storage of any liquids shall not physically obstruct a means of egress. Class I liquids in other than separate inside storage areas or warehouses shall be so placed that a fire in the liquid storage would not preclude egress from the area.	✓ two exits & adequate aisle space is available w/in this 800 ft facility.
4-5.1.2	The storage of liquids in containers or portable tanks shall comply with 4-5.2 through 4-5.7, as applicable. Where separate inside storage areas are required, they shall conform to Section 4.4. Where other factors substantially increase or decrease the hazard, the authority having jurisdiction may modify the quantities specified.	See Applicable Sections
4-5.1.3	Liquids used for building maintenance painting or other similar infrequent maintenance purposes may be stored temporarily in closed containers outside of storage cabinets or separate inside storage areas, if limited in amount, not to exceed a 10-day supply at anticipated rates of consumption.	N/A, This storage area is for the purpose of storing various liquids. Liquids removed from this room are under control of plant procedure PMI-2270
4-5.1.4	Class I liquids shall not be stored in a basement, except as provided in 4-5.5.	✓ ground floor storage area

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Code Section No.	Code Section	Walkdown Remarks
4-5.2	Dwellings and Residential Buildings Containing Not More Than Three Dwelling Units and Accompanying Attached and Detached Garages. This chapter is not applicable to the Donald C. Cook Nuclear Plant.	N/A
4-5.3	Assembly Occupancies, Buildings Containing More Than Three Dwelling Units, and Hotels. This chapter is not applicable to the Donald C. Cook Nuclear Plant.	N/A
4-5.4	Office, Educational, and Institutional Occupancies. This chapter is not applicable to the Donald C. Cook Nuclear Plant.	N/A
4-5.5	Mercantile Occupancies, Retail Stores, and Other Related Areas Accessible to the Public. This chapter is not applicable to the Donald C. Cook Nuclear Plant.	N/A
4-5.6	General Purpose Warehouses. (See 1-2, Definitions.) This chapter is not applicable to the Donald C. Cook Nuclear Plant.	N/A
4-5.7	Liquid Warehouses. (See 1-2, Definitions.)	TITLE

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Code Section No.	Code Section	Walkdown Remarks
4-5.7.1	Liquid warehouses shall be separate, detached buildings or shall be separated from other type occupancies by standard 4-hr fire walls, with communicating openings protected on each side of the wall with automatic-closing, listed 3-hr (A) fire doors. Fire doors shall be installed in accordance with NFPA 80, "Standard for Fire Doors and Windows."	CN, Although this author notes that the walls appear to be of solid construction √, 3-hr. rated fire door - listed by U.L.
4-5.7.2	If the warehouse building is located more than 10 ft (3 m) but less than 50 ft (15 m) from an important building or line of adjoining property that can be built upon, the exposing wall shall have a fire-resistance rating of at least 2 hrs with each opening protected with a listed 1 1/2-hr (D) fire door.	N/A (see 4-5.7.1)
4-5.7.3	If the warehouse is located 10 ft (3 m) or less from an important building or line of adjoining property that can be built upon, the exposing wall shall have a fire-resistance rating of 4 hrs with each opening protected with a listed 3-hr (A) fire door.	N/A (see 4-5.7.1)

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Code Section No.	Code Section	Walkdown Remarks
4-5.7.4	An attached warehouse, having communicating openings in the required 4-hr fire wall separation from the adjacent building area, shall have these openings protected by:	
	(a) Normally closed, listed 3-hr (A) fire doors on each side of the wall. These doors may be arranged to stay open during material handling operations, only if the doors are designed to close automatically in a fire emergency by provision of listed closure devices.	√, 3-hr. rated, UL listed fire door
	(b) Noncombustible, liquidtight raised sills or ramps, at least 4 in. (10 cm) in height, or other design features to prevent flow of liquids to the adjoining area.	√, ramps
4-5.7.5	Fire doors shall be installed in accordance with NFPA 80, "Standard for Fire Doors and Windows."	CN
4-5.7.6	The total quantity of liquids within a liquid warehouse shall not be restricted. The maximum pile heights and maximum quantity per pile, arranged as palletized and/or solid pile storage, shall comply with Table 4-4.2.7, if	√, no solid pile storage greater than 5 ft. in height at the time of this inspection.

Code Section No.	Code Section	Walkdown Remarks
4-5.7.6 Cont'd	unprotected, or Table 4-6.1(a) if protected, in accordance with Section 4-6. The storage heights of containers on protected racks shall comply with Table 4-6.1(b), as applicable.	
	Exception: An unprotected liquid warehouse located a minimum of 100 ft (30 m) from exposed buildings or adjoining property that can be built upon is not required to conform to Table 4-4.2.7, if there is protection for exposures. Where protection for exposures is not provided, a minimum 200 ft (61 m) distance is required.	N/A
4-5.7.7	Class I liquids shall not be permitted in the basement areas of liquid warehouses. Class II and Class IIIA liquids may be stored in basements provided that automatic sprinkler protection and other fire protection facilities are provided in accordance with Section 4-6.	N/A, ground floor storage area
4-5.7.8	Limited amounts of combustible commodities, as defined in the scope of NFPA 231, "Standard for General Storage," and NFPA 231C, "Standard for Rack Storage of Materials," may be stored in liquid warehouses if protection is provided	✓ no ordinary combustibles are stored w/in this area.

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Code Section No.	Code Section	Walkdown Remarks
4-5.7.8 Cont'd	in accordance with Section 4-6, and the ordinary combustibles, other than those used for packaging the liquids, are separated a minimum of 8 ft (2.4 m) horizontally, by aisles or open racks, from the liquids in storage.	
4-5.7.9	Empty or idle combustible pallet storage shall be limited to a maximum pile size of 2500 sq ft (232 m^2) and to a maximum storage height of 6 ft (1.8 m). Idle pallet storage shall be separated from liquids by at least 8 ft (2.4 m) wide aisles. However, pallet storage in accordance with NFPA 231, "Standard for General Storage," shall be acceptable.	√, no pallet storage is needed for this area.
4-5.7.10	Containers in piles shall be separated by pallets or dunnage to provide stability and to prevent excessive stress on container walls. Portable tanks stored over one tier high shall be designed to nest securely, without dunnage. (See NFPA 386, "Standard for Portable Shipping Tanks for Flammable and Combustible Liquids," for information on portable tank design.) Materials handling equipment shall be suitable to handle containers and tanks safety at the upper tier level.	√, all pile storage appears to be stable. No visual excessive stress was evident on container walls.

Code Section No.	Code Section	Walkdown Remarks
5-3.2.7 Cont'd	walls and/or roof; (c) lightweight wall panels and roof hatches; (d) windows of explosion-venting type. NFPA 68, "Guide for Explosion Venting," provides information on this subject.	
5-3.3	Ventilation	TITLE
5-3.3.1	Enclosed processing areas holding or using Class II liquids, or Class II or Class III liquids above their flash points, shall be ventilated at a rate of not less than 1 cu ft per minute per sq ft ($0.3\ m^3$) per min per m^2) of solid floor area. This shall be accomplished by natural or mechanical ventilation with discharge or exhaust to a safe location outside the building without recirculation.	N/A, no processing activities
	Exception: Recirculation is permitted where it is monitored continuously using a fail-safe system that is designed to automatically sound an alarm, stop recirculation, and provide full exhaust to the outside in the event that vapor-air mixtures in concentration over one-fourth of the lower flammable limit are detected.	N/A

Code Section No.	Code Section	Walkdown Remarks
5-3.3.1 Cont'd	Provision shall be made for introduction of make-up air in such a manner as to avoid short-circuiting the ventilation. Ventilation shall be arranged to include all floor areas or pits where flammable vapors may collect. Where natural ventilation is inadequate, mechanical ventilation shall be provided and shall be kept in operation while flammable liquids are being handled. Local or spot ventilation may be needed for the control of special fire or health hazards. Such ventilation, if provided, can be utilized for up to 75 percent of the required ventilation. NFPA 91, "Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying," and NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," provide information on this subject.	
5-3.3.2	Equipment used in a building and the ventilation of the building shall be designed to limit flammable vapor-air mixtures under normal operating conditions to the interior of equipment, and to not more than 5 ft (1.5 m) from equipment that exposes Class I liquids to the air. Examples of such equipment are dispensing stations, open centrifuges, plate and frame filters, open vacuum filters, and surfaces of open equipment.	

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Code Section No.	Code Section	Walkdown Remarks
5-3.4	Drainage	TITLE
5-3.4.1	Emergency drainage systems shall be provided to direct flammable or combustible liquid leakage and fire protection water to a safe location. This may require curbs, scuppers, or special drainage systems to control the spread of fire (see 2-2.3). Appendix A of NFPA 15, "Standard for Water Spray Fixed Systems for Fire Protection," provides information on this subject.	CK, drains do appear to be plugged
5-3.4.2	Emergency drainage systems, if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators.	CK
5-3.4.3	A facility shall be designed and operated to prevent the normal discharge of flammable or combustible liquids to public waterways, public sewers, or adjoining property.	CK
5-3.5	Electrical Equipment	TITLE
5-3.5.1	This section shall apply to areas where Class I liquids are stored or handled and to areas where Class II or Class III liquids are stored or handled at a temperature above their flash points (see 1-1.3).	[illegible]

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Code Section No.	Code Section	Walkdown Remarks
5-3.5.2	All electrical equipment and wiring shall be of a type specified by, and installed in accordance with, NFPA 70, "National Electrical Code."	N/A, This section does not apply to this storage area per 5-3.5.1
5-3.5.3	So far as it applies, Table 5-3.5.3 shall be used to delineate and classify areas for the purpose of installation of electrical equipment under normal conditions. In the application of classified areas, a classified area shall not extend beyond an unpierced floor, wall, roof, or other solid partition. The designation of classes and divisions is defined in Chapter 5, Article 500, of NFPA 70, "National Electrical Code. (See NFPA 497A, "Recommended Practice for Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas," and 497M, Manual for Classification of Gases, Vapors, and Dusts for Electrical Equipment in Hazardous (Classified) Locations," for guidance.)	N/A, This section does not apply to this storage area per 5-3.5.1.
5-3.5.4	The area classifications listed in Table 5-3.5.3 are based on the premise that the installation meets the applicable requirements of this code in all respects. Should this not be the case, the authority having jurisdiction shall have the authority to classify the extent of the area.	?

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Code Section No.	Code Section	Walkdown Remarks
5-3.5.5	Where the provisions of 5-3.5.1, 5-3.5.2, 5-3.5.3, and 5-3.5.4 require the installation of electrical equipment suitable for Class I, Division 1 or Division 2 locations, ordinary electrical equipment including switchgear may be used if installed in a room or enclosure that is maintained under positive pressure with respect to the classified area. Ventilation make-up air shall not be contaminated. NFPA 496, "Standard for Purged and Pressurized Enclosures for Electrical Equipment," provides details for these types of installations.	N/A, This section does not apply to this storage area per 5-3.5.1
5-3.5.6	For marine terminals handling flammable liquids, Figure 5-3.5.6 shall be used as a minimum basis to delineate and classify areas for the purpose of installation of electrical equipment.	N/A This section does not apply to D.C. Cook Nuclear Plant
5.4	Liquid Handling, Transfer, and Use	TITLE
5.4.1	General	TITLE
5.4.1.1	Class I liquids shall be kept in closed tanks or containers when not actually in use. Class II and Class III liquids shall be kept in closed tanks or containers when ambient or process temperature is at or above their flash point.	

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Code Section No.	Code Section	Walkdown Remarks
5-4.1.2	Where liquids are used or handled, provisions shall be made to promptly and safely dispose of leakage or spills.	√, visual inspection
5-4.1.3	Class I liquids shall not be used outside closed systems where there are open flames or other ignition sources within the classified areas as set forth in Table 5-3.5.3.	√, no Class I liquids
5-4.1.4	Transferring liquids by means of pressurizing the container with air is prohibited. Transferring liquids by pressure of inert gas is permitted only if controls, including pressure-relief devices, are provided to limit the pressure so it cannot exceed the design pressure of the vessel, tank, container, and piping system.	N/A
5-4.1.5	Positive displacement pumps shall be provided with pressure relief discharging back to the tank, pump suction, or other suitable location, or shall be provided with interlocks to prevent overpressure.	N/A
5-4.1.6	Piping, valves, and fittings shall be in accordance with Chapter 3, "Piping, Valves, and Fittings."	N/A

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Code Section No.	Code Section	Walkdown Remarks
5-4.1.7	Listed flexible connectors may be used where vibration exists. Approved hose may be used at transfer stations.	N/A
5-4.2	Equipment. Equipment shall be designed and arranged to prevent the unintentional escape of liquids and vapors and to minimize the quantity escaping in the event of accidental release.	✓, visual inspection
5.4.3	Incidental Use of Liquids	
5.4.3.1	This section shall be applicable where the use and handling of liquids is only incidental to the principal business, such as automobile assembly, construction of electronic equipment, furniture manufacturing, or other similar activities.	I
5.4.3.2	Class I and Class II liquids shall be drawn from or transferred into ~~two~~ vessels, containers, or portable tanks in the following manner only:	N/A, Class II liquids are [illegible]
	(a) from original shipping containers with a capacity of 5 gal (19 L) or less,	N/A [illegible]

Code Section No.	Code Section	Walkdown Remarks
5-4.3.2 Cont'd	(b) from safety cans,	N/A (see 5.4.3.2)
	(c) through a closed piping system,	
	(d) from portable tanks or containers by means of a device drawing through an opening in the top of the tank or container, or,	
	(e) by gravity through a listed self-closing valve or self-closing faucet, or	
	(f) if hose is used in the transfer operation, it shall be equipped with a self-closing valve without a hold-open latch in addition to the outlet valve. Only listed or approved hose shall be used.	V
5-4.3.3	Except as provided in 5-4.3.4 and 5-4.3.5, all storage shall comply with Chapter 4, "Container Storage."	see applicable sections
5-4.3.4	The quantity of liquid that may be located outside of storage cabinets, inside storage rooms, cut-off rooms and attached buildings, general purpose warehouses, liquid warehouses, or other specific processing areas that are	

Code Section No.	Code Section	Walkdown Remarks
5-4.3.4 Cont'd	cut off by at least a 2-hr fire-rated separation from the general plant area shall not exceed the greater of the quantity in either (a) or the sum of (b), (c), (d), and (e) below: (a) A supply for one day, or (b) 25 gal (95 L) of Class IA liquids in containers, (c) 120 gal (454 L) of Class IB, IC, II, or III, liquids in containers, (d) Two portable tanks each not exceeding 660 gal (2498 L) of Class IB, IC, Class II, or Class IIIA liquids, and (e) 20 portable tanks each not exceeding 660 gal (2498 L) of Class IIIB liquids.	
5-4.3.5	Where quantities or liquids in excess of the limits in 5-4.3.4 are necessary, storage shall be in tanks, which shall comply with the applicable requirements of Chapter 2, "Tank Storage," and Section 5.3, 5-4.1, and 5-4.2.	

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Code Section No.	Code Section	Walkdown Remarks
5-4.3.6	Areas in which liquids are transferred from one tank or container to another container shall be separated from other operations that might represent an ignition source by distance or by fire-resistant construction. Drainage or other means shall be provided to control spills. Natural or mechanical ventilation shall be provided in accordance with 5-3.3, "Ventilation." NFPA 91, "Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying," provides information on the design and installation of mechanical ventilation.	✓, by visual inspection
5-4.4	Loading and Unloading Operations.	This chapter is not applicable to the Donald C. Cook Nuclear Plant.
5-4.4.2	Wharves.	This chapter is not applicable to the Donald C. Cook Nuclear Plant.
5-5	Fire Prevention and Control	TITLE
5-5.1	General	TITLE

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Code Section No.	Code Section	Walkdown Remarks
5-5.1.1	This section covers the commonly recognized management control systems and methods used to prevent or minimize the loss from fire or explosion in liquid processing facilities. NOTE: Other recognized factors of fire prevention and control, involving construction, location, separation, etc., are covered elsewhere in this chapter.	I
5-5.1.2	The wide range in size, design, and location of liquid processing facilities precludes the inclusion of detailed fire prevention and control systems and methods applicable to all such facilities. The authority having jurisdiction may be consulted on specific cases, where applicable; otherwise, qualified engineering judgment shall be exercised per 5-5.1.3.	N/A, not a liquid processing facility
5-5.1.3	The extent of fire prevention and control provided for the liquid-processing facility shall be determined by an engineering evaluation of the operation, followed by the application of sound fire protection and process engineering principles. The evaluation shall include, but not be limited to:	N/A, not a liquid processing facility

Code Section No.	Code Section	Walkdown Remarks
5-5.1.3 Cont'd	(a) analysis of fire and explosion hazards of the liquid operations, (b) analysis of hazardous materials, hazardous chemicals, or hazardous reactions in the operations and the safeguards taken to control such materials, chemicals, or reactions, (c) analysis of facility design requirements in Section 5-3 of this chapter, (d) analysis of the liquid handling, transfer, and use requirements in Section 5-4 of this chapter, (e) analysis of local conditions, such as exposure to and from adjacent properties, flood potential, or earthquake potential, (f) consideration of fire department or mutual aid response.	N/A, not a liquid processing facility
5-5.2	Control of Ignition Sources	TITLE
5-5.2.1	Precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include, but are not limited to:	

Code Section No.	Code Section	Walkdown Remarks
5-5.2.1 Cont'd	(a) open flames (b) lightning (c) hot surfaces (d) radiant heat (e) smoking (f) cutting and welding (g) spontaneous ignition (h) frictional heat or sparks (i) static electricity (j) electrical sparks (k) stray currents (l) ovens, furnaces, and heating equipment	✓
5-5.2.2	Smoking shall be permitted only in designated and properly identified areas.	
5-5.2.3	Welding, cutting, and similar spark-producing operations shall not be permitted in areas containing flammable liquids until a written permit authorizing such work has been issued. The permit shall be issued by a person in authority following his/her inspection of the area to assure that proper precautions have been taken and will be followed until the job is completed. (See NFPA 51B, "Standard for Fire Prevention in Use of Cutting and Welding Processes.")	✓

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Code Section No.	Code Section	Walkdown Remarks
5-5.2.4	Static Electricity. All equipment such as tanks, machinery, and piping where an ignitable mixture may be present shall be bonded or connected to a ground. The bond or ground or both shall be physically applied or shall be inherently present by the nature of the installation. Electrically isolated sections of metallic piping or equipment shall be bonded to the other portions of the system or individually grounded to prevent hazardous accumulations of static electricity. NFPA 77, "Recommended Practice on Static Electricity," provides information on this subject.	V
5-5.3	Inspection and Maintenance	TITLE
5-5.3.1	All fire protection equipment shall be properly maintained and periodic inspections and tests shall be done in accordance with both standard practice and equipment manufacturer's recommendations.	V
5-5.3.2	Maintenance and operating practices shall control leakage and prevent spillage of flammable liquids.	V
5-5.3.3	Combustible waste material and residues in operating areas shall be kept to a minimum, stored in covered metal containers, and disposed of daily.	

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Code Section No.	Code Section	Walkdown Remarks
5-5.3.4	Ground areas around facilities where liquids are stored, handled, or used shall be kept free of weeds, trash, or other unnecessary combustible materials.	✓
5-5.3.5	Aisles established for movement of personnel shall be maintained clear of obstruction to permit orderly evacuation and ready access for manual fire fighting activities.	✓
5-5.4	Emergency Planning and Training	TITLE
5.5.4.1	An emergency action plan, consistent with the available equipment and personnel, shall be established to respond to fire or other emergencies. This plan shall include the following:	✓
	(a) Procedures to be used in case of fire, such as sounding the alarm, notifying the fire department, evacuating personnel, and controlling and extinguishing the fire.	✓
	(b) Appointment and training of persons to carry out fire safety duties.	✓
	(c) Maintenance of fire protection equipment.	✓
	(d) Holding fire drills.	✓

Code Section No.	Code Section	Walkdown Remarks
5-5.4.1 Cont'd	(e) Shutdown or isolation of equipment to reduce the escape of liquid.	✓
	(f) Alternate measures for the safety of occupants while any fire protection equipment is shut down.	✓
5-5.4.2	Personnel responsible for the use and operation of fire protection equipment shall be trained in the use of that equipment. Refresher training shall be conducted at least annually.	✓
5-5.4.3	Planning of effective fire control measures shall be coordinated with local emergency response agencies.	✓
5-5.4.4	Procedures shall be established to provide for safe shutdown of operations under emergency conditions. Provisions shall be made for periodic training, inspection, and testing of associated alarms, interlocks, and controls.	✓
5-5.4.5	The emergency procedure shall be kept readily available in an operating area and updated regularly.	✓

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Code Section No.	Code Section	Walkdown Remarks
5-5.4.6	Where premises are likely to be unattended for considerable periods of time, a summary of the emergency plan shall be posted or located in a strategic and accessible location.	✓
5-5.5	Detection and Alarm	TITLE
5-5.5.1	An approved means for prompt notification of fire or emergency to those within the plant and to the available public or mutual aid fire department shall be provided.	✓
5-5.5.2	Those areas, including buildings, where a potential exists for a flammable liquid spill, shall be monitored as appropriate. Some methods may include: (a) Personnel observation or patrol; (b) Process monitoring equipment that would indicate a spill or leak may have occurred; (c) Provision of gas detectors to continuously monitor the area where facilities are unattended.	N/A: flammable liquids stored in this area.
5-5.6	Portable Fire-Control Equipment	TITLE

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Code Section No.	Code Section	Walkdown Remarks
5-5.6.1	Listed portable fire extinguishers shall be provided for facilities in such quantities, sizes, and types as may be needed for the special hazards of operation and storage as determined per 5-5.1.3. NFPA 10, "Standard for Portable Extinguishers," provides information on the suitability of various types of extinguishers.	✓, an extinguisher is located outside but ≈25' away (X) could possibly need an extinguisher INSIDE
5-5.6.2	When the need is indicated per 5-5.1.3, water may be utilized through standpipe and hose systems (see NFPA 14, "Standard for the Installation of Standpipe and Hose Systems"), or through hose connections from sprinkler systems using combination spray and straight steam nozzles to permit effective fire control (see NFPA 13, "Standard for the Installation of Sprinkler Systems").	✓
5-5.6.3	When the need is indicated per 5-5.1.3, mobile foam apparatus shall be provided. NFPA 11C, "Standard for Mobile Foam Apparatus," provides information on the subject.	
5-5.6.4	Automotive and trailer-mounted fire apparatus, where determined necessary, shall not be used for any purpose other than fire fighting.	

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Code Section No.	Code Section	Walkdown Remarks
5-5.7	Fixed Fire Control Equipment	TITLE
5-5.7.1	A reliable water supply or other suitable fire control agent shall be available in pressure and quantity to meet the fire demands indicated by the special hazards of operation, storage, or exposure as may be determined by 5-5.1.3.	√
5-5.7.2	Hydrants, with or without fixed monitor nozzles, shall be provided in accordance with accepted practice. The number and placement will depend on the hazard of the liquid-processing facility, storage, or exposure as may be determined by 5-5.3.1. See NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances," for information on this subject.	√
5-5.7.3	Where the need is indicated by the hazards of liquid processing, storage, or exposure as determined by 5-5.1.3, fixed protection may be required utilizing approved sprinkler systems, water spray systems, deluge systems, fire resistive materials, or a combination of these. See NFPA 13, "Standard for the Installation of Sprinkler Systems," and NFPA 15, "Standard for Water Spray Fixed Systems for Fire Protection," for information on these subject.	

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Code Section No.	Code Section	Walkdown Remarks
5-5.7.4	The following fire control systems may be appropriate for the protection of specific hazards as determined per 5-5.1.3. If provided, such systems shall be designed, installed, and maintained in accordance with the following NFPA standards: (a) NFPA 11, "Standard for Low Expansion Foam and Combined Agent Systems," (b) NFPA 11A, "Standard for Medium and High Expansion Foam Systems," (c) NFPA 12, "Standard on Carbon Dioxide Extinguishing Systems," (d) NFPA 12A, "Standard on Halon 1301 Fire Extinguishing Systems," (e) NFPA 12B, "Standard on Halon 1211 Fire Extinguishing Systems," (f) NFPA 16, "Standard on Deluge Foam-Water Sprinkler and Foam Water Spray Systems," (g) NFPA 17, "Standard for Dry Chemical Extinguishing Systems."	N/A

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Code Section No.	Code Section	Walkdown Remarks
Chapter 6	Referenced Publications	This chapter is for information purposes only. Therefore, it is removed from this report.

PORTABLE FLAMMABLE LIQUID CABINETS

WALKDOWN CHECKLIST

CONDUCTED BY: D.P. RITZENTHALER

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
1-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
3-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
6M-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
31-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
31-2	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
32-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
33-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
34-1		
	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
43-1	4-3.1	⊗ Note: 4 cabinets found in this area
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
43-2	4-3.1	⊗ Note: 4 cabinets found in
	4-3.2	✓ this area.
	4-3.2.1	✓
43-3	4-3.1	⊗ Note: 4 cabinets found in
	4-3.2	✓ this area
	4-3.2.1	✓
43-4	4-3.1	⊗ Note: 4 cabinets found in this area.
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
44N-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	⊗
44N-2	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
44S-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks	
51-1	4-3.1	⊘	Note: 6 cabinets were found in this zone
	4-3.2	✓	
	4-3.2.1	✓	
51-2	4-3.1	⊘	Note: 6 cabinets were found in this zone.
	4-3.2	✓	
	4-3.2.1	✓	
51-3	4-3.1	⊘	Note: 6 cabinets were found in this zone.
	4-3.2	✓	
	4-3.2.1	✓	

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks	
51-4	4-3.1	✓	Note: 6 cabinets were found in this area.
	4-3.2	✓	
	4-3.2.1	✓	
51-5	4-3.1	✓	Note: 6 cabinets were found in this area.
	4-3.2	✓	
	4-3.2.1	✓	
51-6	4-3.1	✓	Note: 6 cabinets were found in this area.
	4-3.2	✓	
	4-3.2.1	✓	

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
52-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
52-2	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
52-3	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
52-4	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
108-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
109-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
90-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
91-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
91-2	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
96-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
131-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
131-2	4-3.1	✓
	4-3.2	⊗ Handle is broken
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
131-3	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
131-4	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
77-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
98-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
80-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
82-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
129 - 1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
129-2	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
129-3	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

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Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
129-4	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
129-5	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
84-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

NFPA 30-1987
Flammable And Combustible Liquids Code
Code Compliance Walkdown Checklist

Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
80-2	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
80-3	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
2-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

NFPA 30-1987
Flammable And Combustible Liquids Code
Code Compliance Walkdown Checklist

Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
2-2	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
129-7	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
129-8	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓

NFPA 30-1987
Flammable And Combustible Liquids Code
Code Compliance Walkdown Checklist

Fire Zone - Cabinet No.	Code Section	Walkdown Remarks
445 -2	4-3.1	✓
	4-3.2	✓
	4-3.2.1	✓
69-1	4-3.1	✓
	4-3.2	✓
	4-3.2.1	⊗ DOES Not Always Close, Latch Catches.
	4-3.1	
	4-3.2	
	4-3.2.1	

Attachment 6.4

NFPA 30 Compliance Evaluation

NFPA 30 Code Compliance Evaluation

For

Donald C. Cook Nuclear Plant

Units 1 and 2

Indiana Michigan Power Company

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 30 - 1987
FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
	GENERAL PROVISIONS		Title
1-1	Scope and Application		Title
1-1.1	This code applies to all flammable and combustible liquids except those that are solid at 100°F (37.8°C) or above.		Information Only
1-1.2	Requirements for the safe storage and use of the great variety of flammable and combustible liquids commonly available depend primarily on their fire characteristics, particularly the flash point, which is the basis for the several classifications of liquids as defined in Section 1-2. It should be noted that the classification of a liquid can be changed by contamination. For example, filling a Class II liquid into a tank which last contained a Class I liquid can alter its classification, as can exposing a Class II liquid to the vapors of a Class I liquid via an interconnecting vapor line (see 2-2.6.4 and 2-3.5.6). Care shall be exercised in such cases to apply the requirements appropriate to the actual classification.		Information Only

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
1-1.3	The volatility of liquids is increased by heating. When Class II or Class III liquids are exposed to storage conditions, use conditions or process operations where they are naturally or artificially heated to or above their flash points, additional requirements may be necessary. These requirements include consideration for such items as ventilation, exposure to ignition sources, diking, and electrical area classification.		Information Only
1-1.4	Additional requirements may be necessary for the safe storage and use of liquids that have unusual burning characteristics, that are subject to self-ignition when exposed to the air, that are highly reactive with other substances, that are subject to explosive decomposition, or have other special properties that dictate safeguards over and above those specified for a normal liquid of similar flash point classification.		Information Only
1-1.5	In certain installations the provisions of this code may be altered at the discretion of the authority having jurisdiction after consideration of the special features such as topographical conditions, barricades, walls, adequacy of building exists, nature of		Information Only

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
1-1.5 Cont'd	occupancies, proximity of buildings or adjoining property and character of construction of such buildings, capacity and construction of proposed tanks and character of liquids to be stored, nature of process, degree of private fire protection to be provided, and the adequacy of facilities of the fire department to cope with flammable or combustible liquid fires.		
1-1.6	Existing plants, equipment, buildings, structures, and installations for storage, handling, or use of flammable or combustible liquids that are not in strict compliance with the terms of this code may be continued in use at the discretion of the authority having jurisdiction provided they do not constitute a recognized hazard to life or adjoining property. The existence of a situation that might result in an explosion or sudden escalation of a fire, such as inadequate ventilation or confined spaces, lack of adequate emergency venting of a tank, failure to fireproof the supports of elevated tanks, or lack of drainage or dikes to control spills may constitute such a hazard.		Information Only

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
1-1.7	This code shall not apply to:		Title
1-1.7.1	Transportation of flammable and combustible liquids. These requirements are contained in the U.S. Department of Transportation regulations or in NFPA 385, "Standard for Tank Vehicles for Flammable and Combustible Liquids."		Information Only
1-1.7.2	Storage, handling, and use of fuel oil tanks and containers connected with oil burning equipment. These requirements are covered separately in NFPA 31, "Standard for the Installation of Oil Burning Equipment."		Information Only
1-1.7.3	Storage of flammable and combustible liquids on farms and isolated construction projects. These requirements are covered separately in NFPA 395, "Standard for the Storage of Flammable and Combustible Liquids on Farms and Isolated Construction Projects."		Information Only
1-1.7.4	Liquids without flash points that can be flammable under some conditions, such as certain halogenated hydrocarbons and mixtures containing halogenated hydrocarbons. (See NFPA 321, "Standard on Basic Classification of Flammable and Combustible Liquids.")		Information Only

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
1-1.7.5	Mists, sprays, or foams. (Except flammable aerosols in containers, which are included in Chapter 4.)		Information Only
1-1.8	Installations are made in accordance with the applicable requirements of standards of the National Fire Protection Association: NFPA 32, "Standard for Drycleaning Plants;" NFPA 33, "Standard for Spray Application Using Flammable or Combustible Materials;" NFPA 34, "Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids;" NFPA 35, "Standard for the Manufacture of Organic Coatings;" NFPA 36, "Standard for Solvent Extraction Plants;" NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines;" NFPA 45, "Standard for Fire Protection for Laboratories Using Chemicals; and Chapter 10 of NFPA 99, "Standard for Health Care Facilities," shall be deemed to be in compliance with this code.		Not Applicable to the Donald C. Cook Nuclear Plant
1-1.9	Metrication. If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is regarded as the requirement. The given equivalent value may be approximate.		Information Only

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
1-2	Definitions		The scope of this chapter is not included in this report. Definitions are placed within NFPA 30 for information purposes only.
1-3	Storage Liquids shall be stored in tanks or in containers in accordance with Chapter 2 or Chapter 4.		Refer to applicable chapters for compliance/noncompliance
1.4	Pressure Vessel All new pressure vessels containing liquids shall comply with 1-4.1, 1-4.2, or 1-4.3, as applicable.		This chapter is not included in this report. Pressure vessels are not used for the purpose of storing flammable/combustible liquids.
1.5	Exits Egress from buildings and areas covered by this code shall be in accordance with NFPA 101, "Life Safety Code."	W, D	Comply: The Flammable Liquid Storage Room has two exits. Does Not Comply: The Misc. Oil Storage Room has insufficient exits. An investigation is ongoing to determine the upgrades necessary for code compliance. Technical Data #1, 2.
Ch 2.	Tank Storage		This entire chapter is not included in this report. No permanent flammable liquid tanks exist within the security fence.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
Ch 3	Piping, Valves, and Fittings		This entire chapter is not included in this report. No flammable liquid piping systems are installed within the Donald C. Cook Nuclear Plant.
Ch 4	Container and Portable Tank Storage		Title
4.1	Scope		Title
4-1.1	This chapter shall apply to the storage of liquids, including flammable aerosols, in drums or other containers not exceeding 60 gal (227 L) individual capacity and portable tanks not exceeding 660 gal (2498 L) individual capacity and limited transfers incidental thereto. For portable tanks exceeding 660 gal (2498 L), Chapter 2 shall apply.		Information Only
4-1.2	This chapter shall not apply to the following:		
	(a) Storage of containers in bulk plants, service stations, refineries, chemical plants, and distilleries.		Information Only
	(b) Liquids in the fuel tanks of motor vehicles, aircraft, boats, or portable or stationary engines.		Information Only

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-1.2 Cont'd	(c) Beverages, when packaged in individual containers not exceeding a capacity of one gallon.		Information Only
	(d) Medicines, foodstuffs, cosmetics, and other consumer products containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solution not being flammable when packaged in individual containers not exceeding one gallon in size.		Information Only
	(e) The storage of liquids that have no fire point when tested by ASTM D 92-78, the Cleveland Open Cup Test Method, up to the boiling point of the liquid, or up to a temperature at which the sample being tested shows an obvious physical change.		Information Only
	(f) The storage of distilled spirits and wines in wooden barrels or casks.		Information Only
4-1.3	For the purpose of this chapter, unstable liquids and flammable aerosols shall be treated as Class IA liquids.		Information Only
4-2	Design, Construction, and Capacity of Containers		Title

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-2.1	Only approved containers and portable tanks shall be used. Metal containers and portable tanks meeting the requirements of, and containing products authorized by, Chapter I, Title 49 of the "Code of Federal Regulations" (DOT Regulations), or NFPA 386, "Standard for Portable Shipping Tanks for Flammable and Combustible Liquids," shall be acceptable. Polyethylene containers meeting the requirements of, and containing products authorized by, DOT Specification 34, and polyethylene drums authorized by DOT Exemption Procedures, shall be acceptable. Plastic containers meeting the requirements of ANSI/ASTM D 3435-80, "Plastic Containers (Jerry Cans) for Petroleum Products," used for petroleum products within the scope of that specification shall be acceptable.	W,D	Comply: Liquids are kept in their shipping containers within the dedicated liquid storage rooms, or are stored within approved containers (no portable tanks exist). Approved containers are U/L or FM approved, with self closing lids and an interior flame arrester. Technical data; 9.
4-2.2	Each portable tank shall be provided with one or more devices installed in the top with sufficient emergency venting capacity to limit internal pressure under fire exposure conditions to 10 psig (68.9 kPa), or 30 percent of the bursting pressure of the tank, whichever is greater. The total venting capacity shall be not less than that specified in 2-2.5.4 or 2-2.5.6. At least one pressure-		Not applicable to the Donald C. Cook Nuclear Plant as there are no portable tanks in use.

Code Section No.	Code Section	Information Obtained By: W=Walkdown D=Document	Summary of Results
4-2.2 Cont'd	actuated vent having a minimum capacity of 6.000 cu ft (170 m^3) of free air per hour (14.7 psia (760 mm Hg) and 60°F (15.6°C) shall be used. It shall be set to open at not less than 5 psig (34.5 kPa). If fusible vents are used, they shall be actuated by elements that operate at a temperature not exceeding 300°F (148.9°C). When used for paints, drying oils, and similar materials where plugging of the pressure-actuated vent can occur, fusible vents or vents of the type that soften to failure at a maximum of 300°F (148.9°C) under fire exposure may be used for the entire emergency venting requirement.		
4-2.3	Containers and portable tanks for liquids shall conform to Table 4-2.3 except as provided in 4-2.3.1 or 4-2.3.2.	W	Comply: A visual walkdown (performed by this author) verified compliance with this paragraph.
4-2.3.1	Medicines, beverages, foodstuffs, cosmetics, and other common consumer products, when packaged according to commonly accepted practices for retail sales, shall be exempt from the requirements of 4.2.1 and 4.2.3.		Not applicable to the Donald C. Cook Nuclear Plant.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-2.3.2	DOT Type III polyethylene nonreusable containers, constructed and tested in accordance with DOT specification 2U, treated if necessary to prevent permeation, may be used for storage of Class II and Class III liquids, in all capacities not to exceed 2 1/2 gal.		Not applicable to the Donald C. Cook Nuclear Plant. Note: This section of the code is considered a recommendation.
4-2.3.3	Class IA and Class IB liquids may be stored in glass containers of not more than one gallon capacity if the required liquid purity (such as ACS analytical reagent grade or higher) would be affected by storage in metal containers of if the liquid would cause excessive corrosion of the metal container.		Not applicable to the Donald C. Cook Nuclear Plant. Note: This section of the code is considered a recommendation.
4.3	Design, Construction, and Capacity of Storage Cabinets		Title
4.3-1	Not more than 120 gal (454 L) of Class I, Class II, and Class IIIA liquids may be stored in a storage cabinet. Of this total, not more than 60 gal (227 L) may be of Class I and Class II liquids and not more than three (3) such cabinets may be located in a single fire area, except that, in all industrial occupancy, additional cabinets may be located in the same fire area if the additional cabinet, or group of not more than three (3) cabinets, is separated from other cabinets or group of cabinets by at least 100 ft (30 m).	W	Comply: All portable storage cabinets (with the exception of Fire Zones 43 and 51) meet the requirements of this paragraph. Does Not Comply: Excessive cabinets stored within Fire Zones 43 and 51 will be removed. Currently six cabinets exist within Fire Zone 51 and four cabinets exist in Fire Zone 43.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-3.2	Storage cabinets shall be designed and constructed to limit the internal temperature at the center, 1 in. (2.5 cm) from the top to not more than 325°F (162.8°C) when subjected to a 10-minute fire test with burners simulating a room fire exposure using the standard time-temperature curve as given in ASTM E 152-81a. All joints and seams shall remain tight and the door shall remain securely closed during the fire test.	W,D	Comply: All cabinets (with the exception of 131-2) were visually inspected and found to be of sound design. All vents were plugged. All cabinets were purchased to be approved per UL or FM guidelines. Technical Data; 9.
	The cabinet is not required to be vented for fire protection purposes; however, the following shall apply:	W	Does Not Comply: Cabinet 131-2 will not remain securely closed during a fire due to a broken handle.
	(a) If the cabinet is vented for other reasons, the cabinet shall be vented outdoors in such a manner that will not compromise the specified performance of the cabinet, as acceptable to the authority having jurisdiction.		
	(b) If the cabinet is not vented, the vent openings shall be sealed with properly fitted metal bung.		

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-3.2.3	Listed cabinets that have been constructed and tested in accordance with 4-3.2 shall be acceptable.		See Section 4-3.2
4-4	Design, Construction, and Operation of Separate Inside Storage Areas (See Section 1-2, "Definitions.) (For additional information, see Appendix C.)		Title
4-4.1	Inside Rooms		Title Note: This chapter is not applicable to the Donald C. Cook Nuclear Plant since the storage areas are "Cutoff Rooms" and not "Inside Rooms" per the definitions contained in Section 1.2 of this code.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-4.2	Cutoff Rooms and Attached Buildings		Title
4-4.2.1	Construction design of exterior walls shall provide ready accessibility for fire fighting operations through provision of access openings, windows, or lightweight non-combustible wall panels. Where Class IA or IB liquids are dispensed, or where Class IA liquids are stored in containers larger than one gallon, the exterior wall or roof construction shall be designed to include explosion-venting features, such as light-weight wall assemblies, lightweight roof assemblies, roof hatches, or windows of the explosion-venting type. NFPA 68, "Guide for Explosion Venting," provides information on this subject.	W, D	Does Not Comply: The Miscellaneous Oil Storage Room does not provide ready access for fire fighting. An investigation is ongoing to determine the upgrades necessary for code compliance. Technical Data; 2, 3, 7.
		W, D	Comply With Intent: The Flammable Liquid Storage Room does have an exit to the outside. This exit is equipped with a window that does provide explosion venting features. Technical Data; 1, 3, 7.
4-4.2.2	Where other portions of buildings or other properties are exposed, each opening in the exposing wall shall be protected with a listed 1 1/2 hr (D) fire door installed in accordance with NFPA 80, "Standard for Fire Doors and Windows," and the walls shall have a fire-resistance rating of not less than 2 hrs.	W, D	Does Not Apply: These rooms are positioned in locations where they do not pose an exposure to other portions of buildings or other properties.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-4.2.3	Except as noted in 4-4.2.6, interior walls, ceiling, and floors shall have a fire-resistance rating of not less than 2 hrs where floor area of the room or building exceeds 300 sq ft (27 m^2) or a fire-resistance rating of not less than one hour for a floor area of 300 sq ft (27 m^2) or less. Such construction shall comply with the test specifications given in NFPA 251, "Standard Methods of Fire Tests of Building Construction and Materials." Walls shall be liquidtight at the floor level.	W, D	Comply: Fire Doors are three hour rated, fire dampers are 1 1/2 hour (for FZ 89) and fabricated to 3-hour construction (see SSCA, Rev. 1, Section 9.7) for FZ 131. The walls have a fire resistant rating of at least 2 hours. All penetrations are sealed. Technical Data; 1, 2, 3, 4, 5, 6, 13
4-4.2.4	Openings in interior walls to adjacent rooms or buildings shall be in accordance with 4-4.1.2(a).	W, D	Comply: Fire doors are Class A rated doors. Technical Data; 1, 2, 3, 4, 5, 6.
4-4.2.5	Curbs, scuppers, special drains, or other suitable means shall be provided to prevent the flow of liquids under emergency conditions into adjacent building areas except where the individual container capacity is 5 gal (18.9 L) or less or if the liquids stored are only Class III liquids. The drainage system, if used, shall have sufficient capacity to carry off expected discharge of water from fire protection systems and hose streams.	W, D	Does Not Comply: The drainage system is plugged in both rooms. Hence, liquid would back up in the room during a fire and overflow the curbs (which do comply with this code). Technical Data; 10, 11, 12.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-4.2.6	Roofs of attached buildings, one story in height, may be lightweight noncombustible construction if the separating interior wall as specified in 4-4.2.3 has a minimum 3 ft (0.90-m) parapet.		Not applicable to the Donald C. Cook Nuclear Plant since these storage rooms are not "attached buildings".
4-4.2.7	Unprotected storage in cutoff rooms and attached buildings shall comply with Table 4-4.2.7. (See 4-4.2.10 for mixed storage of liquids.)		Not applicable to the Donald C. Cook Nuclear Plant since these storage rooms are "protected".
4-4.2.8	Protected storage in cutoff rooms and attached buildings shall comply with Section 4-6 as applicable. (See 4-4.2.10 for mixed storage of liquids.)		See Section 4-6 for compliance/ non-compliance.
4-4.2.9	Wood at least 1 in (2.5 cm) nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.	W	Comply: Some minor amounts of wood was being used as scuffboards in both areas (FZ 89 and FZ 131). This wood was at least 1" thick.
4-4.2.10	Where two or more classes of liquids are stored in a single pile or rack section, the maximum quantities and height of storage permitted in that pile or rack section shall be the smallest of the two or more separate quantities and heights. The maximum total	W	Comply: The single pile or rack storage contained within these rooms complies with this paragraph.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-4.2.10 Cont'd	quantities permitted shall be limited to a sum of proportional amounts that each class of liquid present bears to the maximum total permitted for its respective class; sum of proportional amounts not to exceed 100 percent.		
4-4.2.11	Dispensing operations of Class I or Class II liquids are not permitted in cutoff rooms or attached buildings exceeding 1000 sq ft (93 m^2) floor area. In rooms where dispensing of Class I liquids is permitted, electrical systems shall comply with 4-4.1.5, except that within 3 ft (0.90 m) of a dispensing nozzle area, the electrical system shall be suitable for Class I, Division I; ventilation shall be provided per 4-4.1.6; and operations shall comply with the provisions of Chapter 5.	W, D W W, D	Comply: Both storage rooms are less than 1000 sq. ft. Technical Data; 1, 2, 3. Comply: Field verified to be within electrical requirements stated in this code. Verified by this author as well as J.D. Markum (NED, I&C Section). Does Not Comply: Make up inlet is located well above 12" from floor (both rooms). No air flow switches are on this system (both rooms). Technical Data; 25
4-4.2.12	Basement Storage Areas. Class I liquids shall not be permitted in the basement areas of cut-off rooms and attached buildings. Class II and Class IIIA liquids may be stored in basements provided that automatic sprinkler protection and other fire protection facilities are provided in accordance with Section 4-6.	W, D	Comply: These rooms are not considered to be in a "basement." Technical Data; 1, 2, 3.
4.5	Indoor Storage		Title

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-5.1	Basic Conditions		Title
4-5.1.1	The storage of any liquids shall not physically obstruct a means of egress. Class I liquids in other than separate inside storage areas or warehouses shall be so placed that a fire in the liquid storage would not preclude egress from the area.	W	Comply: Liquids are stored in such a manner that adequate aisle space is maintained for exits.
4-5.1.2	The storage of liquids in containers or portable tanks shall comply with 4-5.2 through 4-5.7, as applicable. Where separate inside storage areas are required, they shall conform to Section 4.4. Where other factors substantially increase or decrease the hazard, the authority having jurisdiction may modify the quantities specified.		See applicable sections for compliance/non-compliance
4-5.1.3	Liquids used for building maintenance painting or other similar infrequent maintenance purposes may be stored temporarily in closed containers outside of storage cabinets or separate inside storage areas, if limited in amount, not to exceed a 10-day supply at anticipated rates of consumption.	D	Comply: Liquids removed from their dedicated storage rooms are under the control of plant procedure PMI-2270. Technical Data; 9.
4-5.1.4	Class I liquids shall not be stored in a basement, except as provided in 4-5.5.	W, D	Comply: The Class I liquid storage room is not in a basement Technical Data; 2, 3.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-5.2	Dwellings and Residential Buildings Containing Not More Than Three Dwelling Units and Accompanying Attached and Detached Garages.		Not applicable to the Donald C. Cook Nuclear Plant.
4-5.3	Assembly Occupancies, Buildings Containing More Than Three Dwelling Units, and Hotels.		Not applicable to the Donald C. Cook Nuclear Plant.
4-5.4	Office, Educational, and Institutional Occupancies.		Not applicable to the Donald C. Cook Nuclear Plant.
4-5.5	Mercantile Occupancies, Retail Stores, and Other Related Areas Accessible to the Public.		Not applicable to the Donald C. Cook Nuclear Plant.
4-5.6	General Purpose Warehouses. (See 1-2, Definitions.)		Not applicable to the Donald C. Cook Nuclear Plant.
4-5.7	Liquid Warehouses. (See 1-2, Definitions.) Note: By strict definition these plant areas do not meet the NFPA 30 requirements of a liquid warehouse. However, we will conservatively consider these areas liquid warehouses and evaluated them to the requirements of Chapter 4-5.7 of NFPA 30.		Title

Code Section No.	Code Section	Information Obtained By: W=Walkdown D=Document	Summary of Results
4-5.7.1	Liquid warehouses shall be separate, detached buildings or shall be separated from other type occupancies by standard 4-hr fire walls, with communicating openings protected on each side of the wall with automatic-closing, listed 3-hr (A) fire doors. Fire doors shall be installed in accordance with NFPA 80, "Standard for Fire Doors and Windows."	D	Comply With Intent: The Flammable Liquids Storage Room does comply with this section. The Misc. Oil Storage Room is separated from other occupancies by 3 hour fire walls. However, the Misc. Oil Storage Room as well as the adjacent areas have combustible loadings of less than 3 hours. In addition, sprinklers exist in all of these areas for added protection. Technical Data; 1, 2, 3, 4, 5.
4-5.7.2	If the warehouse building is located more than 10 ft (3 m) but less than 50 ft (15 m) from an important building or line of adjoining property that can be built upon, the exposing wall shall have a fire-resistance rating of at least 2 hrs with each opening protected with a listed 1 1/2-hr (D) fire door.		Not applicable to the Donald C. Cook Nuclear Plant since the exterior walls are not within 50 ft. from an important building or property line.
4-5.7.3	If the warehouse is located 10 ft (3 m) or less from an important building or line of adjoining property that can be built upon, the exposing wall shall have a fire-resistance rating of 4 hrs with each opening protected with a listed 3-hr (A) fire door.		Not applicable to the Donald C. Cook Nuclear Plant since the exterior walls are not within 10 ft. from an important building or property line.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-5.7.4	An attached warehouse, having communicating openings in the required 4-hr fire wall separation from the adjacent building area, shall have these openings protected by: (a) Normally closed, listed 3-hr (A) fire doors on each side of the wall. These doors may be arranged to stay open during material handling operations, only if the doors are designed to close automatically in a fire emergency by provision of listed closure devices. (b) Noncombustible, liquidtight raised sills or ramps, at least 4 in. (10 cm) in height, or other design features to prevent flow of liquids to the adjoining area.	W, D	Not applicable to the Donald C. Cook Nuclear Plant since neither of the two liquid storage rooms is an "attached warehouse". Technical Data; 1, 2.
4-5.7.5	Fire doors shall be installed in accordance with NFPA 80, "Standard for Fire Doors and Windows."	W, D	Comply: Fire Doors are "A" rated. Technical Data; 3, 4, 5.
4-5.7.6	The total quantity of liquids within a liquid warehouse shall not be restricted. The maximum pile heights and maximum quantity per pile, arranged as palletized and/or solid pile storage, shall comply with Table 4-4.2.7, if	W	Comply: No solid pile storage greater than 5 ft. in height was noted at the time of this inspection.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-5.7.6 Cont'd	unprotected, or Table 4-6.1(a) if protected, in accordance with Section 4-6. The storage heights of containers on protected racks shall comply with Table 4-6.1(b), as applicable. Exception: An unprotected liquid warehouse located a minimum of 100 ft (30 m) from exposed buildings or adjoining property that can be built upon is not required to conform to Table 4-4.2.7, if there is protection for exposures. Where protection for exposures is not provided, a minimum 200 ft (61 m) distance is required.		
4-5.7.7	Class I liquids shall not be permitted in the basement areas of liquid warehouses. Class II and Class IIIA liquids may be stored in basements provided that automatic sprinkler protection and other fire protection facilities are provided in accordance with Section 4-6.	W,D	Not applicable to the Donald C. Cook Nuclear Plant since storage areas are not in the basement. Technical Data; 1, 2, 3.
4-5.7.8	Limited amounts of combustible commodities, as defined in the scope of NFPA 231, "Standard for General Storage," and NFPA 231C, "Standard for Rack Storage of Materials," may be stored in liquid warehouses if protection is provided	W	Comply: No ordinary combustible storage is stored within either the Flammable Liquids Storage Room or the Misc. Oil Storage Room.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-5.7.8 Cont'd	in accordance with Section 4-6, and the ordinary combustibles, other than those used for packaging the liquids, are separated a minimum of 8 ft (2.4 m) horizontally, by aisles or open racks, from the liquids in storage.		
4-5.7.9	Empty or idle combustible pallet storage shall be limited to a maximum pile size of 2500 sq ft (232 m^2) and to a maximum storage height of 6 ft (1.8 m). Idle pallet storage shall be separated from liquids by at least 8 ft (2.4 m) wide aisles. However, pallet storage in accordance with NFPA 231, "Standard for General Storage," shall be acceptable.	W	Comply: No pallet storage is needed for these storage areas. Hence, no storage was noted at the time of the inspections.
4-5.7.10	Containers in piles shall be separated by pallets or dunnage to provide stability and to prevent excessive stress on container walls. Portable tanks stored over one tier high shall be designed to nest securely, without dunnage. (See NFPA 386, "Standard for Portable Shipping Tanks for Flammable and Combustible Liquids," for information on portable tank design.) Materials handling equipment shall be suitable to handle containers and tanks safety at the upper tier level.	W	Comply: All pile storage appears to be stable (engineering judgement). No visual excessive stress was evident on container walls.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-5.7.11	No container or portable tank shall be stored closer than 36 in. (0.90 m) to the nearest beam, chord, girder, or other roof member in an unprotected warehouse.		Not applicable to the Donald C. Cook Nuclear Plant since these warehouses are protected by wet pipe sprinkler systems.
4-5.7.12	Solid pile and palletized storage shall be arranged so that piles are separated from each other by at least 4 ft (1.2 m). Aisles shall be provided so that no container or tank is more than 12 ft (3.6 m) from an aisle. Where storage on racks exists as permitted in this Code, a minimum 4 ft (1.2 m) wide aisle shall be provided between adjacent rows of racks and any adjacent storage of liquids. Main aisles shall be a minimum of 8 ft (2.4 m) wide, and access shall be maintained to all doors required for egress.	W	Comply: Both storage areas are well maintained and have adequate aisle space. Both rooms have but one rack available for rack storage. Doors and accessways are well maintained for egress.
4-5.7.13	Mixed Storage. When two or more classes of liquids are stored in a single pile, the maximum quantity permitted in that pile shall be the smallest of the two or more separate maximum quantities and the heights of storage permitted in that pile shall be the least of the two or more separate heights as given in Tables 4-4.2.7 or 4-6.1(a), as applicable.	W	Comply: The liquid storage contained within these rooms complies with this paragraph.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-5.7.13 Cont'd	When two or more classes of liquids are stored in the same racks as permitted in this Code, the maximum height of storage permitted shall be the least of the two or more separate heights given in Table 4.6.1(b).		
4-6	Protection Requirements for Protected Storage of Liquids		Title
4-6.1	Containers and portable tanks storing flammable and combustible liquids may be stored in the quantities and arrangements specified in Tables 4-6.1(a) and 4-6.1(b), provided the storage is protected in accordance with 4-6.2 and 4-6.5, as applicable.		Recommendation Only.
4-6.1.1	Other quantities and arrangements may be used where suitably protected and approved by the authority having jurisdiction.		Recommendation Only.
4-6.2	Where automatic sprinklers are used, they shall be installed in accordance with NFPA 13, "Standard for the Installation of Sprinkler Systems," and approved by the authority having jurisdiction. (For additional information, see Appendix D.)	W	Comply: A walkdown (performed by this author) of the sprinklers installed within these rooms was conducted and it was found that the systems meet the intent of NFPA 13.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-6.2.1	Other systems such as automatic foam-water systems, automatic water-spray systems, or other combinations of systems may be considered acceptable if approved by the authority having jurisdiction. (For additional information, see Appendix D.)		Not applicable to the Donald C. Cook Nuclear Plant since these areas are protected with wet pipe sprinkler systems.
4-6.3	Racks storing Class I or Class II liquids shall be either single-row or double-row as described in NFPA 231C, "Standard for Rack Storage of Materials."	W	Comply: The one rack in each room is considered a single row rack. No in-rack sprinklers are required for these 8' high racks.
4-6.4	Ordinary combustibles other than those used for packaging the liquids shall not be stored in the same rack section as liquids, and shall be separated a minimum of 8 ft (2.4 m) horizontally, by aisles or open racks, from liquids stored in racks.	W	Comply: These areas are utilized for the sole purpose of storing combustible and flammable liquids. No ordinary combustibles are stored in these rooms.
4-6.5	In-rack sprinklers shall be installed in accordance with the provisions of NFPA 231C, "Standard for Rack Storage of Materials," except as modified by 4-6.2. Alternate lines of in-rack sprinklers shall be staggered. Multiple levels of in-rack sprinkler heads shall be provided with water shields unless otherwise separated by horizontal barriers, or unless the sprinkler heads are listed for such installations.	W	Not applicable to the Donald C. Cook Nuclear Plant since these areas do not need in-rack sprinklers.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-7	Fire Control		Title
4-7.1	Suitable fire extinguishers or preconnected hose lines, either 1 1/2 in. (3.8 cm) lined or 1 in. (2.5 cm) hard rubber, shall be provided where liquids are stored. Where 1 1/2 in. (3.8 cm) fire hose is used, it shall be installed in accordance with NFPA 14, "Standard for the Installation of Standpipe and Hose Systems."	W, D	Comply: Fire extinguishers are stored outside of rooms. Hose lines are also stored outside of rooms. A cursory review of NFPA 14 (performed by this author) verified compliance with this code. Technical Data; 14, 15, 3, 18.
4-7.1.1	At least one portable fire extinguisher having a rating of not less than 20-B shall be located outside of, but not more than 10 ft (3 m) from, the door opening into any separate inside storage area.	W, D	Comply With Intent: The fire extinguisher to the Misc. Oil Storage Room is greater than 10 ft from the door. However, the plant fire brigade is well trained and location of extinguishers are kept on fire pre-plans. No problems with locating extinguishers are expected. Technical Data; 3, 7, 14.
4-7.1.2	At least one portable fire extinguisher having rating of not less than 20-B shall be located not less than 10 ft (3 m), nor more than 50 ft (15 m), from any Class I or Class II liquid storage area located outside of a separate inside storage area.	W, D	Comply With Intent: The portable fire extinguishers may not always fall within the distance requirements since the cabinets are also portable. However, the plant fire brigade is well trained and location of extinguishers are kept on fire pre-plans. No problems with locating extinguishers are expected. Technical Data; 3, 7.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-7.1.3	In protected general purpose and liquid warehouses, hand hose lines shall be provided in sufficient number to reach all liquid storage areas.	W, D	Comply: Hand hose lines are provided in sufficient number to reach all liquid storage areas. Note: See comment for Chapter 4-5.7. Technical Data; 3, 14, 16.
4-7.1.4	The water supply shall be sufficient to meet the fixed fire protection demand, plus a total of at least 500 gal (1892 L) per minute for inside and outside hose lines. (See C-4-6.2.)	W,D	Comply: The fire protection water supply is adequate to meet this requirement. Technical Data; 16.
4-7.2	Control of Ignition Sources. Precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include but are not limited to: open flames; lightning; smoking; cutting and welding; hot surfaces; frictional heat; static, electrical, and mechanical sparks; spontaneous ignition, including heat-producing chemical reactions; and radiant heat.	W,D	Comply: Ignition sources are controlled by plant procedures. No flammable vapors were noted at the time of this inspection. Technical Data; 9.
4-7.3	Dispensing of Class I and Class II liquids in general-purpose or liquid warehouses shall not be permitted unless the dispensing area is suitably cut off from other ordinary combustible or liquid storage areas, as specified in Section 4-4, and otherwise conforms with the applicable provisions of Section 4-4.	W,D	Comply: No ordinary combustibles are stored within areas dispensing Class I and Class II liquids. These rooms are suitably cut off from other ordinary combustibles. Note: See comment for Chapter 4-5.7. Technical Data; 1, 2, 3.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
4-7.4	Materials with a water reacticity degree of 2 or higher, as outlined in NFPA 704, shall not be stored in the same area with other liquids.	W,D	Comply: No materials with a water reacticity of 2 or higher were noted at the time of this inspection. A request has been made to include this requirement within PMI-2270. Technical Data; 24.
4-8	Outdoor Storage		Title NOTE: This chapter is not applicable to the Donald C. Cook Nuclear Plant since the storage areas are considered "cut off rooms" and not "outdoor storage." No outdoor storage exists.
CHAPTER 5	OPERATIONS (See Appendix F for Cross-Reference Tables)		Title
5-1	Scope		Title
5-1.1	This chapter applies to operations involving the use or handling of liquids either as a principal or incidental activity, except as covered elsewhere in this Code or in other NFPA Standards.		Information Only

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-1.2	The provisions of this chapter relate to the control of hazards of fire involving liquids. These provisions may not provide adequate protection for operations involving hazardous materials or chemical reactions nor do they consider health hazards resulting from exposure to such materials.		Information Only
5-2	General Liquid processing operations shall be located and operated so that they do not constitute a significant fire or explosion hazard to life, to property of others, or to important buildings or facilities within the same plant. Specific requirements are dependent on the inherent risk in the operations themselves, including the liquids being processed, operating temperatures and pressures, and the capability to control any liquid or vapor releases or fire incidents that might occur. The interrelationship of the many factors involved must be based on good engineering and management practices to establish suitable physical and operating requirements. (See 5-5.1.3.)		Not applicable to the Donald C. Cook Nuclear Plant since this is not considered a "liquid processing operation."
5.3	Facility Design		Title
5-3.1	Location		Title

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-3.1.1	The minimum distance of a processing vessel to adjoining property or to the nearest important building on the same property shall be based on the stability of the liquid and vessel capacity and shall be in accordance with Table 5-3.1.1, except as modified in 5-3.1.2.		Not applicable to the Donald C. Cook Nuclear Plant.
5-3.1.2	Where process vessels are located in a building and the exterior wall facing the exposure (line of adjoining property that can be built upon or nearest important building on the same property) is greater than 25 ft (7.6 m) from the exposure and is a blank wall having a fire-resistance rating of not less than 2 hrs, any greater distances required in Table 5-3.1.1 may be waived. Where a blank wall having a fire-resistance rating of not less than 4 hrs is provided, distance requirements may be waived. In addition, when Class IA or unstable liquids are handled, the wall shall have explosion resistance in accordance with good engineering practice. (See 5-3.2.7 relative to explosion relief of other walls of this building.)		Not applicable to the Donald C. Cook Nuclear Plant.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-3.1.3	Other liquid processing equipment, such as pumps, heaters, filters, exchangers, etc., shall not be located closer than 25 ft (7.6 m) to property lines where the adjoining property is or can be built upon, or to the nearest important building on the same property that is not an integral part of the process. This spacing requirement may be waived where exposures are protected as outlined in 5-3.1.2. NOTE: Equipment operated at pressures over 1000 psig (7000 kPa) may require greater spacing.		Not applicable to the Donald C. Cook Nuclear Plant.
5-3.1.4	Processing equipment in which unstable liquids are handled shall be separated from unrelated plant facilities that use or handle liquids by either 25 ft (7.6 m) clear spacing or a wall having a fire-resistance rating of not less than 2 hrs. The wall shall also have explosion resistance in accordance with good engineering practice.		Not applicable to the Donald C. Cook Nuclear Plant.
5-3.1.5	Each process unit or building containing liquid-processing equipment shall be accessible from at least one side for fire fighting and fire control.		Not applicable to the Donald C. Cook Nuclear Plant.
5-3.2	Construction		Title

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-3.2.1	Processing buildings or structures shall be of fire-resistive or noncombustible construction, except that combustible construction may be used when automatic sprinklers or equivalent protection is provided, subject to approval of the authority having jurisdiction. (See NFPA 220, "Standard on Types of Building Construction.")		Not applicable to the Donald C. Cook Nuclear Plant.
5-3.2.2	Where walls are required for separation of processing operations from other occupancies or property lines, they shall have a fire-resistance rating of at least 2 hrs. In addition, when Class IA or unstable liquids are being stored or processed, the separating wall shall have explosion resistance in accordance with good engineering practice. (See 5-3.2.7 relative to explosion relief of other walls of this building or area.)	W	Comply: The door to the exterior of the building is equipped with a window which would provide some explosion relief. Due to the limited amount of flammable liquids being stored here, this window provides adequate protection against explostion. This statement is based on this author's engineering judgement. Note: The first sentence of this requirement does not apply since no liquid processing occurs at the Cook Nuclear Plant.
5-3.2.3	Class I liquids shall not be handled or used in basements. Where Class I liquids are handled or used above grade within buildings with basements or closed pits into which flammable vapors may travel, such below grade areas shall be provided with mechanical ventilation designed to prevent the accumulation of flammable vapors. Means shall be provided to prevent liquid spills from running into basements.	W,D	Comply: Class I liquids are stored on the ground floor within a building that has no basement. Four inch ramps are provided to keep liquids from spilling to the outside. Technical Data; 1, 3.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-3.2.4	Provision for smoke and heat venting may be desirable to assist access for fire fighting. NFPA 204M, "Guide for Smoke and Heat Venting," provides information on this subject.	W,D	Comply with intent; Although no specific fire pre-plan exists for this area at this time, the fire brigade is well trained in manual venting of areas (by the use of collapsible duct tubing). In addition, we expect natural smoke and heat venting to occur through the glass window installed on the exterior door. In addition, this section of the code is only a recommendation. Technical Data; 7.
5-3.2.5	Areas shall have exit facilities arranged to prevent occupants from being trapped in the event of fire. NFPA 101, "Code for Safety to Life from Fire in Buildings and Structures," provides information on the design of exit facilities. Exits shall not be exposed by the drainage facilities described in 5-3.4.	W,D	Does not comply; The Miscellaneous Oil Storage Room does not meet the exit requirements required by NFPA 101. Comply: The Flammable Liquids Storage Room has adequate exits. Technical Data; 1,2
5-3.2.6	Adequate aisles shall be maintained for unobstructed movement of personnel and fire protection equipment.	W	Comply: Adequate aisle space was evident during these code compliance walkdowns.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-3.2.7	Areas where Class IA or unstable liquids are processed shall have explosion venting through one or more of the following methods: (a) open air construction; (b) lightweight walls and/or roof; (c) lightweight wall panels and roof hatches; (d) windows of explosion-venting type. NFPA 68, "Guide for Explosion Venting," provides information on this subject.		Not applicable to the Donald C. Cook Nuclear Plant.
5-3.3	Ventilation		Title
5-3.3.1	Enclosed processing areas holding or using Class II liquids, or Class II or Class III liquids above their flash points, shall be ventilated at a rate of not less than 1 cu ft per minute per sq ft (0.3 m^3) per min per m^2) of solid floor area. This shall be accomplished by natural or mechanical ventilation with discharge or exhaust to a safe location outside the building without recirculation. Exception: Recirculation is permitted where it is monitored continuously using a fail-safe system that is designed to automatically sound an alarm, stop recirculation, and provide full exhaust to the outside in the event that vapor-air mixtures in concentration over one-fourth of the lower flammable limit are detected.		Not applicable to the Donald C. Cook Nuclear Plant since these rooms are not processing areas.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-3.3.1 Cont'd	Provision shall be made for introduction of make-up air in such a manner as to avoid short-circuiting the ventilation. Ventilation shall be arranged to include all floor areas or pits where flammable vapors may collect. Where natural ventilation is inadequate, mechanical ventilation shall be provided and shall be kept in operation while flammable liquids are being handled. Local or spot ventilation may be needed for the control of special fire or health hazards. Such ventilation, if provided, can be utilized for up to 75 percent of the required ventilation. NFPA 91, "Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying," and NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," provide information on this subject.		
5-3.3.2	Equipment used in a building and the ventilation of the building shall be designed to limit flammable vapor-air mixtures under normal operating conditions to the interior of equipment, and to not more than 5 ft (1.5 m) from equipment that exposes Class I liquids to the air. Examples of such equipment are dispensing stations, open centrifuges, plate and frame filters, open vacuum filters, and surfaces of open equipment.	W	Comply: No open Class I liquids were found. Dispensing of Class I liquids is done by pouring or pumping. The pumping equipment used is of the type that would limit the flammable vapor-air mixtures (pump from the top of the barrels, thus the heavier flammable vapors would stay within the barrels).

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-3.4	Drainage		Title
5-3.4.1	Emergency drainage systems shall be provided to direct flammable or combustible liquid leakage and fire protection water to a safe location. This may require curbs, scuppers, or special drainage systems to control the spread of fire (see 2-2.3). Appendix A of NFPA 15, "Standard for Water Spray Fixed Systems for Fire Protection," provides information on this subject.	W,D	Does not comply; The drainage system for the Miscellaneous Oil Storage Room and Flammable Liquids Storage Room is plugged. Technical Data; 10, 11.
5-3.4.2	Emergency drainage systems, if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators.	W	Not applicable to the Cook Plant since no drainage system exists for these rooms (see 5-3.4.1).
5-3.4.3	A facility shall be designed and operated to prevent the normal discharge of flammable or combustible liquids to public waterways, public sewers, or adjoining property.	W	Comply: Flammable and combustible liquids are not normally discharged into public waterways, sewers or adjoining property.
5-3.5	Electrical Equipment		Title
5-3.5.1	This section shall apply to areas where Class I liquids are stored or handled and to areas where Class II or Class III liquids are stored or handled at a temperature above their flash points (see 1-1.3).		Information Only NOTE: By this paragraph this chapter applies to the Flammable Liquid Storage Room and does not apply to the Miscellaneous Oil Storage Room.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-3.5.2	All electrical equipment and wiring shall be of a type specified by, and installed in accordance with, NFPA 70, "National Electrical Code."	W	Comply: Field verified to be within electrical requirements stated in this code. Verified by this author as well as J.D. Markum (NED, I&C Section).
5-3.5.3	So far as it applies, Table 5-3.5.3 shall be used to delineate and classify areas for the purpose of installation of electrical equipment under normal conditions. In the application of classified areas, a classified area shall not extend beyond an unpierced floor, wall, roof, or other solid partition. The designation of classes and divisions is defined in Chapter 5, Article 500, of NFPA 70, "National Electrical Code. (See NFPA 497A, "Recommended Practice for Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas," and 497M, Manual for Classification of Gases, Vapors, and Dusts for Electrical Equipment in Hazardous (Classified) Locations," for guidance.)	W	Comply: Field verified to be within electrical requirements stated in Table 5-3.5.3. Verified by this author as well as J.D. Markum (NED, I&C Section).
5-3.5.4	The area classifications listed in Table 5-3.5.3 are based on the premise that the installation meets the applicable requirements of this code in all respects. Should this not be the case, the authority having jurisdiction shall have the authority to classify the extent of the area.		Information Only

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-3.5.5	Where the provisions of 5-3.5.1, 5-3.5.2, 5-3.5.3, and 5-3.5.4 require the installation of electrical equipment suitable for Class I, Division 1 or Division 2 locations, ordinary electrical equipment including switchgear may be used if installed in a room or enclosure that is maintained under positive pressure with respect to the classified area. Ventilation make-up air shall not be contaminated. NFPA 496, "Standard for Purged and Pressurized Enclosures for Electrical Equipment," provides details for these types of installations.		Not applicable to the Donald C. Cook Nuclear Plant's flammable liquid storage area.
5-3.5.6	For marine terminals handling flammable liquids, Figure 5-3.5.6 shall be used as a minimum basis to delineate and classify areas for the purpose of installation of electrical equipment.		Not applicable to the Donald C. Cook Nuclear Plant.
5.4	Liquid Handling, Transfer, and Use		Title
5.4.1	General		Title
5.4.1.1	Class I liquids shall be kept in closed tanks or containers when not actually in use. Class II and Class III liquids shall be kept in closed tanks or containers when ambient or process temperature is at or above their flash point.	W,D	Comply: No open pools of Class 1 liquids were found at the time of this inspection. Control of flammable and combustible liquids is assured by PMI-2270. Technical Data; 9.
5-4.1.2	Where liquids are used or handled, provisions shall be made to promptly and safely dispose of leakage or spills.	W	Comply: Good cleanliness was noted by area walkdowns.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-4.1.3	Class I liquids shall not be used outside closed systems where there are open flames or other ignition sources within the classified areas as set forth in Table 5-3.5.3.	W,D	Comply: Plant procedures control the use of flammable liquids, open flames and other ignition sources. Technical Data; 9
5-4.1.4	Transferring liquids by means of pressurizing the container with air is prohibited. Transferring liquids by pressure of inert gas is permitted only if controls, including pressure-relief devices, are provided to limit the pressure so it cannot exceed the design pressure of the vessel, tank, container, and piping system.	W	Comply: Liquids are transferred by hand pumps or by gravity (pouring).
5-4.1.5	Positive displacement pumps shall be provided with pressure relief discharging back to the tank, pump suction, or other suitable location, or shall be provided with interlocks to prevent overpressure.		Not applicable to the Donald C. Cook Nuclear Plant.
5-4.1.6	Piping, valves, and fittings shall be in accordance with Chapter 3, "Piping, Valves, and Fittings."		Refer to Chapter 3.
5-4.1.7	Listed flexible connectors may be used where vibration exists. Approved hose may be used at transfer stations.		Not applicable to the Donald C. Cook Nuclear Plant.
5-4.2	Equipment. Equipment shall be designed and arranged to prevent the unintentional escape of liquids and vapors and to minimize the quantity escaping in the event of accidental release.	W	Comply; equipment is designed and arranged to prevent escape of liquids and vapors.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5.4.3	Incidental Use of Liquids		Title
5.4.3.1	This section shall be applicable where the use and handling of liquids is only incidental to the principal business, such as automobile assembly, construction of electronic equipment, furniture manufacturing, or other similar activities.		Information Only
5.4.3.2	Class I and Class II liquids shall be drawn from or transferred into vessels, containers, or portable tanks in the following manner only:		
	(a) from original shipping containers with a capacity of 5 gal (19 L) or less,	W	Comply
	(b) from safety cans,	W	Comply
	(c) through a closed piping system,		Not applicable to the Donald C. Cook Nuclear Plant.
	(d) from portable tanks or containers by means of a device drawing through an opening in the top of the tank or container, or,	W	Comply
	(e) by gravity through a listed self-closing valve or self-closing faucet, or	W	Comply

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-4.3.2 Cont'd	(f) if hose is used in the transfer operation, it shall be equipped with a self-closing valve without a hold-open latch in addition to the outlet valve. Only listed or approved hose shall be used.		Not applicable to the Donald C. Cook Nuclear Plant.
5-4.3.3	Except as provided in 5-4.3.4 and 5-4.3.5, all storage shall comply with Chapter 4, "Container Storage."		Refer to applicable sections
5-4.3.4	The quantity of liquid that may be located outside of storage cabinets, inside storage rooms, cut-off rooms and attached buildings, general purpose warehouses, liquid warehouses, or other specific processing areas that are cut off by at least a 2-hr fire-rated separation from the general plant area shall not exceed the greater of the quantity in either (a) or the sum of (b), (c), (d), and (e) below: (a) A supply for one day, or (b) 25 gal (95 L) of Class IA liquids in containers, (c) 120 gal (454 L) of Class IB, IC, II, or III, liquids in containers,	W,D	Comply With Exception; as stated in PMI-2270, flammable liquids are returned to the storage room and/or storage cabinets at the completion of each job or whenthe liquids must be left unattended. The combustible liquid requirement is not as restrictive. However, this procedure does require that the Shift Supervisor be made aware of any required temporary storage areas. By plant walkdown, this author noted that no combustible or flammable liquids were found outside of their dedicated storage rooms or portable flammable liquid cabinets. Technical Data; 9

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5.4.3.4 Cont'd	(d) Two portable tanks each not exceeding 660 gal (2498 L) of Class IB, IC, Class II, or Class IIIA liquids, and (e) 20 portable tanks each not exceeding 660 gal (2498 L) of Class IIIB liquids.		
5-4.3.5	Where quantities of liquids in excess of the limits in 5-4.3.4 are necessary, storage shall be in tanks, which shall comply with the applicable requirements of Chapter 2, "Tank Storage," and Section 5.3, 5-4.1, and 5-4.2.	W,D	Comply with exception; In certain instances a temporary combustible oil storage location may be set up outside of dedicated storage rooms. No tanks are used for these instances. However, these locations are temporary and under the control of the Shift Supervisor. Technical Data; 9.
5-4.3.6	Areas in which liquids are transferred from one tank or container to another container shall be separated from other operations that might represent an ignition source by distance or by fire-resistant construction. Drainage or other means shall be provided to control spills. Natural or mechanical ventilation shall be provided in accordance with 5-3.3, "Ventilation." NFPA 91, "Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying," provides information on the design and installation of mechanical ventilation.	W,D	Comply; liquids are transferred in either the Miscellaneous Oil Storage Room or the Flammable Liquids Storage Room. These rooms are separted from the plant by substantial fire walls. Refer to Section 5-3.3 for HVAC compliance/non-compliance. Refer to Section 5-3.4 for drainage compliance/non-compliance. Technical Data; 1,2,3,4,5.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-4.4	Loading and Unloading Operations.		This chapter is not applicable to the Donald C. Cook Nuclear Plant.
5-4.4.2	Wharves.		This chapter is not applicable to the Donald C. Cook Nuclear Plant.
5-5	Fire Prevention and Control		Title
5-5.1	General		Title
5-5.1.1	This section covers the commonly recognized management control systems and methods used to prevent or minimize the loss from fire or explosion in liquid processing facilities. NOTE: Other recognized factors of fire prevention and control, involving construction, location, separation, etc., are covered elsewhere in this chapter.		Information only Note: Since no liquid processing facilities exist at this facility this entire section does not apply.
5-5.2	Control of Ignition Sources		Title
5-5.2.1	Precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include, but are not limited to:	W,D	Comply; fire prevention practices are strictly enforced by plant procedure PMI-2270. Technical Data; 9

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-5.2.1 Cont'd	(a) open flames (b) lightning (c) hot surfaces (d) radiant heat (e) smoking (f) cutting and welding (g) spontaneous ignition (h) frictional heat or sparks (i) static electricity (j) electrical sparks (k) stray currents (l) ovens, furnaces, and heating equipment		
5-5.2.2	Smoking shall be permitted only in designated and properly identified areas.	W,D	Comply; oil storage areas are designated "No Smoking" areas by PMI-2270 Technical Data; 9
5-5.2.3	Welding, cutting, and similar spark-producing operations shall not be permitted in areas containing flammable liquids until a written permit authorizing such work has been issued. The permit shall be issued by a person in authority following his/her inspection of the area to assure that proper precautions have been taken and will be followed until the job is completed. (See NFPA 51B, "Standard for Fire Prevention in Use of Cutting and Welding Processes.")	W,D	Comply; A welding, burning and grinding permit is required before starting any of these activities. These permits are issued by the Plant Fire Protection Coordinator. Technical Data; 9

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-5.2.4	Static Electricity. All equipment such as tanks, machinery, and piping where an ignitable mixture may be present shall be bonded or connected to a ground. The bond or ground or both shall be physically applied or shall be inherently present by the nature of the installation. Electrically isolated sections of metallic piping or equipment shall be bonded to the other portions of the system or individually grounded to prevent hazardous accumulations of static electricity. NFPA 77, "Recommended Practice on Static Electricity," provides information on this subject.	W,D	Comply; When transferring liquids from bulk storage to approved containers, the two containers are required to be grounded per PMI-2270. Technical Data; 9
5-5.3	Inspection and Maintenance		Title
5-5.3.1	All fire protection equipment shall be properly maintained and periodic inspections and tests shall be done in accordance with both standard practice and equipment manufacturer's recommendations.	W,D	Comply with exception; Sprinkler alarms are tested annually by Ops. Surveillance Test Procedures. Pumps are tested on an eighteen month testing cycle. These tests do not follow standard practice cycles. However, the equipment is well maintained and combined with the defense-in-depth fire protection redundancy, we feel confident that the fire protection features of these rooms will perform when needed. Technical Data; 17
5-5.3.2	Maintenance and operating practices shall control leakage and prevent spillage of flammable liquids.	W	Comply; A field walkdown of these areas verified compliance with this paragraph.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-5.3.3	Combustible waste material and residues in operating areas shall be kept to a minimum, stored in covered metal containers, and disposed of daily.	W	Comply; Both of the liquid stoarge areas were free of combustible waste material.
5-5.3.4	Ground areas around facilities where liquids are stored, handled, or used shall be kept free of weeds, trash, or other unnecessary combustible materials.	W	Comply; ground areas were clear of unnecessary combustible material.
5-5.3.5	Aisles established for movement of personnel shall be maintained clear of obstruction to permit orderly evacuation and ready access for manual fire fighting activities.	W	Comply; adequate aisle space was evident during this author's walkdown.
5-5.4	Emergency Planning and Training		Title
5.5.4.1	An emergency action plan, consistent with the available equipment and personnel, shall be established to respond to fire or other emergencies. This plan shall include the following: (a) Procedures to be used in case of fire, such as sounding the alarm, notifying the fire department, evacuating personnel, and controlling and extinguishing the fire. (b) Appointment and training of persons to carry out fire safety duties. (c) Maintenance of fire protection equipment.	D	Does not comply; while a fire pre-plan exists for the Miscellaneous Oil Storage Room, no pre-plan exists for the Flammable Liquids Storage Room. Cook Nuclear Plant pre-plans do not cover all of the requirements stated in this section, however, all requirements are met by the following: a) pre-plans b) pre-plans & training procedures c) plant procedures d) plant procedures e) pre-plans & training procedures f) plant procedures

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-5.4.1 Cont'd	(d) Holding fire drills. (e) Shutdown or isolation of equipment to reduce the escape of liquid. (f) Alternate measures for the safety of occupants while any fire protection equipment is shut down.		Technical Data; 7.
5-5.4.2	Personnel responsible for the use and operation of fire protection equipment shall be trained in the use of that equipment. Refresher training shall be conducted at least annually.	D	Comply; The fire brigade is trained by approved fire brigade training procedures. Technical Data; 26.
5-5.4.3	Planning of effective fire control measures shall be coordinated with local emergency response agencies.	D	Comply; The fire brigade is responsible for fire fighting within the power block. Coordination with local emergency response agencies is controlled by PMI-2270. Technical Data; 9
5-5.4.4	Procedures shall be established to provide for safe shutdown of operations under emergency conditions. Provisions shall be made for periodic training, inspection, and testing of associated alarms, interlocks, and controls.	D	Comply; Safe shutdown of the plant is assured by ECA 4023.001.001 Operators are being periodically trained on this procedure. Technical Data; 12
5-5.4.5	The emergency procedure shall be kept readily available in an operating area and updated regularly.		Comply; emergency procedures are kept in the Control Room.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-5.4.6	Where premises are likely to be unattended for considerable periods of time, a summary of the emergency plan shall be posted or located in a strategic and accessible location.		Not applicable to the Donald C. Cook Nuclear Plant.
5-5.5	Detection and Alarm		Title
5-5.5.1	An approved means for prompt notification of fire or emergency to those within the plant and to the available public or mutual aid fire department shall be provided.	W, D	Comply: Annunciator Response Procedures will assure prompt notification. Technical Data; 19, 20
5-5.5.2	Those areas, including buildings, where a potential exists for a flammable liquid spill, shall be monitored as appropriate. Some methods may include: (a) Personnel observation or patrol; (b) Process monitoring equipment that would indicate a spill or leak may have occurred; (c) Provision of gas detectors to continuously monitor the area where facilities are unattended.	W	Comply: The Operation Department makes daily tours of the plant, including the flammable and combustible liquids rooms.
5-5.6	Portable Fire-Control Equipment		Title

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-5.6.1	Listed portable fire extinguishers shall be provided for facilities in such quantities, sizes, and types as may be needed for the special hazards of operation and storage as determined per 5-5.1.3. NFPA 10, "Standard for Portable Extinguishers," provides information on the suitability of various types of extinguishers.	W, D	Comply: Fire extinguishers are stored outside of rooms. A cursory review of NFPA 10 (performed by this author) verified that we meet the intent of with this code. Technical Data; 3, 14, 18
5-5.6.2	When the need is indicated per 5-5.1.3, water may be utilized through standpipe and hose systems (see NFPA 14, "Standard for the Installation of Standpipe and Hose Systems"), or through hose connections from sprinkler systems using combination spray and straight steam nozzles to permit effective fire control (see NFPA 13, "Standard for the Installation of Sprinkler Systems").	W, D	Comply: Fire hose stations are provided outside of rooms. A cursory review of NFPA 14 (performed by this author) verified compliance with this code. Note: We use spray nozzles due to the affects that straight stream nozzles could have on high voltage equipment. Technical Data; 3, 14, 15
5-5.6.3	When the need is indicated per 5-5.1.3, mobile foam apparatus shall be provided. NFPA 11C, "Standard for Mobile Foam Apparatus," provides information on the subject.		Not applicable to the Donald C. Cook Nuclear Plant since 5-5.1.3 does not apply to this facility.
5-5.6.4	Automotive and trailer-mounted fire apparatus, where determined necessary, shall not be used for any purpose other than fire fighting.	D	Comply; Fire Protection equipment is restricted to its intended purpose per PMI-2270. Technical Data; .9

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-5.7	Fixed Fire Control Equipment		Title
5-5.7.1	A reliable water supply or other suitable fire control agent shall be available in pressure and quantity to meet the fire demands indicated by the special hazards of operation, storage, or exposure as may be determined by 5-5.1.3.	W,D	Comply: A more than suitable water supply is available. Technical Data; 16
5-5.7.2	Hydrants, with or without fixed monitor nozzles, shall be provided in accordance with accepted practice. The number and placement will depend on the hazard of the liquid-processing facility, storage, or exposure as may be determined by 5-5.1.3. See NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances," for information on this subject.	W, D	Comply with exception: Hydrants are available for these areas. However, the yard hydrants are approximately 300 ft. apart rather than 250 ft apart. The increase in spacing does not affect these storage areas since both rooms are within 250 ft. of a hydrant. Technical Data; 16, 22
5-5.7.3	Where the need is indicated by the hazards of liquid processing, storage, or exposure as determined by 5-5.1.3, fixed protection may be required utilizing approved sprinkler systems, water spray systems, deluge systems, fire resistive materials, or a combination of these. See NFPA 13, "Standard for the Installation of Sprinkler Systems," and NFPA 15, "Standard for Water Spray Fixed Systems for Fire Protection," for information on these subject.	W, D	Comply: A fixed pipe, automatic sprinkler system exists for this area. A cursory review of NFPA 13 (performed by this author) verified that we meet the intent of this code. Technical Data; 23

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
5-5.7.4	The following fire control systems may be appropriate for the protection of specific hazards as determined per 5-5.1.3. If provided, such systems shall be designed, installed, and maintained in accordance with the following NFPA standards: (a) NFPA 11, "Standard for Low Expansion Foam and Combined Agent Systems," (b) NFPA 11A, "Standard for Medium and High Expansion Foam Systems," (c) NFPA 12, "Standard on Carbon Dioxide Extinguishing Systems," (d) NFPA 12A, "Standard on Halon 1301 Fire Extinguishing Systems," (e) NFPA 12B, "Standard on Halon 1211 Fire Extinguishing Systems," (f) NFPA 16, "Standard on Deluge Foam-Water Sprinkler and Foam Water Spray Systems," (g) NFPA 17, "Standard for Dry Chemical Extinguishing Systems."		Recommendation Only. Not applicable to the Donald C. Cook Nuclear Plant since these type systems are not installed in either the Flammable Liquids or Combustible Oil Storage Rooms.

Code Section No.	Code Section	Information Obtained By: W-Walkdown D-Document	Summary of Results
Chapter 6	Referenced Publications		This chapter is for information purposes only. Therefore, it is removed from this report.

References
(Technical Data)

1.	Drawing #2-4047	Turbine and Heater Bay Areas Basement Plan	6-29-81
2.	Drawing #1-4045	Turbine and Heater Bay Areas El. 591'-0" and 595'-0" Basement Plan	1-26-86
3.		Fire Hazards Analysis Rev. 4	1-31-90
4.	Drawing #12-4018-A	Door Schedule	7-16-87
5.	Drawing #12-4019	Door Schedule	1-16-87
6.		Safe Shutdown Capability Assessment	12-86
7.		Fire Pre-Plans	9-20-85
8.	Drawing #12-5681-A	New Oil Storage Room Turbine Building Unit 2	6-5-81
9.	PMI-2270	Fire Protection	4-24-89
10.	Drawing 1-5179	Station Drainage	5-26-83
11.	Drawing 2-5179	Station Drainage	
12.	OHP 4023.001.001	Emergency Remote Shutdown	
13.	DCC-FP101-QCN	Material and Application Spec Initial and Repair Installation	Rev 11
14.	Drawing #12-5267-4	Fire Facilities Basement Plan	5-17-88
15.	NFPA-14	Standpipe and Hose Stations	1990
16.	SD-DCC-FP101	Fire Protection System-Water	10-10-88
17.	12-THP.6040.PER.001	Performance Test Procedure	7-30-87
18.	NFPA 10	Standard for Portable Fire Extinguishers	1988
19.	1-OHP.4024.101	Plant Fire System Annunciator	4-27-82
20.	2-OHP.4024.201	Plant Fire System Annunciator	4-27-82
21.	NFPA 24	Standard for the Installation of Private Fire Service Mains and their Appurtenances	1987

22. 12-5152-4	Fire Protection Flow Diagram	7-25-89
23. NFPA 13	Standard for Installation of Automatic Sprinkler Systems	1989
24. Correspondence	Memo, "Flammable and Combustible Liquid Storage Rooms", P.J. Russell to P.H. Jacques, dated 6-20-90	6-20-90
25. 12-5756-8	Heating & Ventilating Service Bay Area	8-20-85
26. TAM Section 5.02	Fire Brigade Training	12-22-89

#9201080214

CALCULATION/DESIGN COVER SHEET

Calculation/Design No 0120-108-006

Title: NFPA 15-CODE COMPLIANCE VERIFICATION CHECKLIST

Client: AEP Project: CODE COMPLIANCE REVIEWS

Job No: 0120-108-1375

Design Input/References: SEE SECTION 5.0.

Assumptions: SEE PI-FP-01, REVISION 1 CONDUCTING AND DOCUMENTING NFPA CODE COMPLIANCE REVIEWS. SEE IMPELL REPORT 09-0120-0123 CODE COMPLIANCE SUMMARY REPORT. SEE SECTION 2.0.

Method: SEE PI-FP-01, REVISION 1.
SEE SECTION 3.0.

Remarks: SEE PAGE 9 FOR THE AREAS/ZONES EVALUATED UNDER THE REQUIREMENTS OF THIS CODE.

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	David E. Lyjak	8/14/92

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

For the purpose of this report, it is assumed that under most conditions the authority having jurisdiction was the architect/engineer (A/E) for the plant who is American Electric Power Service Corporation (AEPSC) unless other wise incicated.

3.0 METHODOLOGY

3.1 Reference Section 2.1.1 of Impell Project Instruction PI-FP-01, Revision 1.

3.2 An item identified in the Code Compliance Verification Checklist which "Does Not Comply" or is shown as an "Open Item" is further discussed in the Code Compliance Summary Report, Impell Report Number 09-0120-0123.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

5.0 REFERENCES

References

Ref No.	Document Number	Title	Rev. No.	Date
		Walkdown Verification Checklists		
1	0120-108-006C	Impell Calculation, NFPA 15 Code Compliance Walkdown Verification Checklist Charcoal Filters/Zones 33A,34A)	0	11/20/87
2	0120-108-006D	Impell Calculation, NFPA 15 Code Compliance Walkdown Verification Checklist (Charcoal Filters/Zones 69, 70, 73)	0	11/20/87
3	0120-108-006E	Impell Calculation, NFPA 15 Code Compliance Walkdown Verification Checklist (Aux. H_2 Storage Tank/Yard)	0	11/20/87
4	0120-108-006F	Impell Calculation, NFPA 15 Code Compliance Walkdown Verification Checklist (Charcoal Filter/Zone 49)	0	11/20/87
5	0120-108-006G	Impell Calculation, NFPA 15 Code Compliance Walkdown Verification Checklist (Charcoal Filter/Zone 50)	0	11/20/87
6	0120-108-006H	Impell Calculation, NFPA 15 Code Compliance Walkdown Verification Checklist (Charcoal Filter/Zone 5)	0	11/20/87
		Procedures		
1	PO-050-508	Fire Protection-Water Preoperational Test Procedure	0	07/03/74
2	12 MHP 4030.STP.020	Inspection of the Fire Protection System Deluge and Preaction Spray Headers in the Auxiliary Building	3	03/06/86
3	12 THP 4030.STP.223	Fire Protection Water System Test	6	09/11/87

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
4	12 OHP 4030.STP.120	Fire Protection System - Water and Carbon Dioxide	11	01/30/87
		Technical Data		
1		Letter From: R.J. Daley To: R.W. Jurgensen Instruction Book, "Grinnel and Star Fire Systems Equipment"		07/15/74
2	SD-DCC-FP101	System Description, Fire Protection System-Water	2	Draft
3		Specification for Fire Protection Systems of D.C. Cook Nuclear Plant	0	04/02/71
4	DCCPM104QCS	Piping Specification	4	11/09/72
5	DCCPM102QCS	Shop and Field Fabrication and Erection	4	05/24/73
6	RFC DC-01-2680	Appendix R Sprinkler System Modification Packet	0	09/17/85
7		Instruction Manual for Appendix "R" Sprinkler Additions - RFC's 01-2680 and 02-2695 (Phoenix Contractors)		
8	DCCFP109QCS	Fabrication and Installation of Appendix R Sprinkler Systems, Specification for RFC's DC-02-2695 and DC-01-2680 PSI (Power Systems Inc.)	0	02/10/84
9	RFC #02-2695 RFCDL REF #52	Hydraulic Calculations (Phoenix Contractors)		08/--/84
10	DCCFP108QCS	Design of App. R Sprinkler Systems, Specification for RFC's DC-02-2695 and DC-01-2680 (Phoenix Contractors)	2	02/10/84

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
11	0120-108-007	Impell Calculation, NFPA 72D Code Compliance Verification Checklist	0	05/16/88
12	0120-108-008	Impell Calculation, NFPA 72E Code Compliance Verification Checklist	0	05/16/88
13		Telecopy from Al Hall to D. Hoover		12/14/87
14		ANI's Recommendations for Carbon Filters		09/--/77
15	ROC from D. Kipley to B. Gerwe	Ambient Conditions of Plant		12/03/87
16		Hydraulic Calculation for "The Hydrogen Bulk Storage Tanks" (Grinnell)	1	12/18/71
17	RFC #12-2231 RFCDL REF #53	Hydraulic Calculations (Phoenix Contractors)		04/26/79
18	0120-108-006	Impell Calculation, NFPA 15 Code Compliance Verification Checklist	0	04/22/88
19	DCC-FP-103	Fire Protection Systems - Miscellaneous	3	08/26/87
		Licensing Documents		
1	DRP No. 74	Donald C. Cook, FHA Docket No. 50-316	1	01/30/87
		Drawings		
1	Hodgman DWG 127-1	Control Room Cable Vault Sprinkler Piping Planview	2	06/18/75
2	DWG 46-032-71H-18	High Roof Area Sprinkler Piping Planview (Grinnell)	5	03/03/72

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
3	DHG 46-032-71M-16	Drumming Area Sprinkler Piping Planview (Grinnell)	5	02/28/72
4	DHG 12-5152M-2	Flow Diagram Fire Protection - Water System Details - Yard Piping	2	07/01/87
5	DHG 12-5152L-2	Flow Diagram Fire Protection - Water System Details - Turbine Bldg.	2	02/25/87
6	DHG 12-5152A-1	Flow Diagram Fire Protection - Water Piping at Pumps	1	01/22/87
7	DHG HB-1181	Filter Unit Fire Hose Connection RFC-12-2463, 2465	A	08/20/81
8	DHG 46-032-71M-17	"Hydrogen Storage Tanks and Valve Header for High Roof, Drumming Area, and Outside Tanks" (Grinnell)	4	12/17/71
9	DHG DC 1 & 2-HFP-PHX-FILE-015000	DHG DC 1 & 2-HFP-PHX-FILE-015000 Contractor's Access Sprinkler Drawing from RFC-12-1437	2	12/07/81
10	DHG DC-2-HFP-RD22695-009-002 (AEPSC No.)	Elev. 633'-0 Aux. Bldg. East Piping Corridor (Phoenix DHG)	7	06/19/84
11	DHG DC-2-HFP-RD22695-010-002 (AEPSC No.)	Elev. 633'-0 Aux. Bldg. North Piping Corridor (Phoenix DHG)	8	06/19/84
12	DHG DC-2-HFP-RD22695-008-001 (AEPSC No.	Elev. 633'-0 Aux. Bldg. South Piping Corridor (Phoenix DHG)	8	06/11/84
13	DHG DC-2-HFP-RD22695-025-000 (AEPSC No.)	Inspectors Test Detail Elev. 633'-0 Aux. Bldg. N. Corridor (Phoenix DHG)	2	06/13/84
14	DHG DC-2-HFP-RD22695-017-001 (AEPSC No.)	Details & Sections Elev. 633'-0 Bldg N. Corridor (Phoenix DHG)	2	06/14/84
15	DHG DC-2-HFP-RD22695-007-001 (AEPSC No.)	Elev. 633'-0 Turbine Bldg. Supply Piping Details (Phoenix DHG)	2	06/04/84

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
16	DHG DC-2-MFP-RD22695-023-001 (AEPSC No.)	Elev. 620'-6 Aux. Bldg. HVAC Room Unit #1 (Phoenix DHG)	2	06/13/84
17	DHG DC-2-MFP-RD22695-022-002 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. - Fire Protection Piping	8	07/02/86
18	DHG DC-2-MFP-RD22695-022-001 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. - Fire Protection Piping (Phoenix DHG)	6	06/19/84
19	DHG DC-2-MFP-RD22695-024-001 (AEPSC No.)	RFC-02-2695 Elevation 609 Turbine Bldg. Riser Diagram (Phoenix DHG)	3	06/15/84
20	DHG DC-2-MFP-RD22695-020-001 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. Section Views (Phoenix DHG)	6	06/19/84
21	DHG DC-2-MFP-RD22695-006-002 (AEPSC No.)	Elev. 609'-0 Turbine Bldg. Supply Piping Details (Phoenix DHG)	4	06/05/84
22	DHG DC-1 & 2-MFP-RFC-RFC-2621-001-001 (AEPSC No.)	As-Built for Aux. Bldg. 587' & 609'	2	———
23	DHG DC-2-MFP-RD22695-021-002 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. East/West Piping Corridors (Phoenix DHG)	3	07/02/86
24	DHG DC-2-MFP-RD22695-019-001 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. - CCW Fire Protection - Sidewall Sprinklers (Phoenix DHG)	7	06/19/84
25	DHG DC-2-MFP-RD22695-005-004 (AEPSC No.)	Units 1 & 2 Aux. Feed Pump Corridor Sprinkler System (Phoenix DHG)	6	06/13/84
26	DHG DC-2-MFP-RD22695-004-004 (AEPSC No.)	Unit 2 Emerg. DG Pump/Corridor Sprinkler System (Phoenix DHG)	6	06/13/84
27	DHG DC-2-MFP-RD22695-003-004 (AEPSC No.)	South Stair of Aux. Bldg. Elev. 587'-0 Sprinkler Water Curtain (Phoenix DHG)	4	05/14/84
28	DHG DC-2-MFP-RD22695-016-003 (AEPSC No.)	RFC-02-2695 Elev. 587'-Inspection Test Conn. (Phoenix DHG)	4	06/13/84
29	DHG DC-2-MFP-RD22695-002-004 (AEPSC No.)	North Stair of Aux. Bldg. Elev. 587'-0 Sprinkler Water Curtain (Phoenix DHG)	6	06/10/84

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
30	DHG DC-1 & 2-MFP-RFC-2621-002-001 (AEPSC No.)	As-Builts for Aux. Bldg. 587' & 609' (Phoenix DHG)	3	———
31	DHG DC-1 & 2-MFP-RFC-2621-003-001 (AEPSC No.)	As-Builts for Aux. Bldg. 587' & 609' (Phoenix DHG)	2	———
32	DHG DC-1 & 2-MFP-RFC-2621-004-001 (AEPSC No.)	As-Builts for Aux. Bldg. 587' & 609' (Phoenix DHG)	2	———
33	DHG DC-1 & 2-MFP-RFC-2621-005-001 (AEPSC No.)	As-Builts fo Aux. Bldg. 537' & 609' (Phoenix DHG)	4	06/01/84
34	DHG DC-2-MFP-RD22695-001-004 (AEPSC No.)	East Stair of Aux. Bldg. Elev. 573'-0 & 587'-0 Sprinkler Hater Curtain (Phoenix DHG)	6	06/13/84
35	DHG 2-5152K-1	Flow Diagram, Fire Protection - Hater System Details - Turbine Bldg. & Screen House	1	02/25/87
36	DHG 12-5152E-2	Flow Diagram, Fire Protection - Hater Charcoal Filters	2	07/07/87
37	DHG 12-5401-7	Aux. Bldg. Fire Protection Piping to Charcoal Filters	6	01/22/86
38	DHG 12-5401A-6	Aux. Bldg. Fire Protection Piping to Charcoal Filters	5	01/10/78
39	DHG 1-5152J	Flow Diagram, Fire Protection - Hater System Details - Turbine Bldg. & Screen House	0	10/06/86
40	DHG 46-032-71H-15	Grinnell Sprinkler Drawing for Unit 1 Auxiliary Feed Pump Room	0	09/24/71
41	DHG Phoenix T-591-H	Unit 1 Emergency DG Ramp	0	03/08/84
42	Hodgman DHG 121-15	Unit 2 AFH Pump Initial Installation DHG	1	05/01/75
43	DHG 12-5152D	Flow Diagram, Fire Protection Hater Aux. and Containment Buildings	0	10/6/86

The water spray systems evaluated for the D. C. Cook Nuclear Plant are limited to the systems protecting the charcoal filters and the auxiliary building hydrogen cylinder storage tanks. These systems were evaluated using the requirements of the 1973 edition of NFPA 15 which was the current edition during system installation. These systems are located as follows:

Zone 5	Unit 12-HV-SATFU
Zone 33A	Unit 1-HV-CIPX-1
Zone 34A	Unit 2-HV-CIPX-1
Zone 49	Unit 1-HV-AES-1
Zone 49	Unit 1-HV-AES-2
Zone 49	Unit 12-HV-AFX
Zone 50	Unit 2-HV-AES-1
Zone 50	Unit 2-HV-AES-2
Zone 69	Unit 1-HV-CPR-1
Zone 69	Unit 2-HV-CPR-1
Zone 70	Unit 1-HV-ACRF-1
Zone 73	Unit 2-HV-ACRF-1
Yard	Aux. Bldg. H_2 Tube Racks

Due to ALARA (high radiation) concerns, only one charcoal filter unit was made accessible during the walkdowns. Therefore, the water spray nozzle arrangements within the filtration units are assumed similar for all units.

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 15-1973
STANDARD FOR WATER SPRAY FIXED SYSTEMS FOR FIRE PROTECTION

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 1. GENERAL PROVISIONS		Title
1010	Scope		Title
1011	This standard is a minimum standard for the design, installation, maintenance, and test of water spray fixed systems, for fire protection service.		Information Only
1020	Definitions		Information Only: This entire section has been omitted.
1030	Applicability		Title
1031	Water spray is applicable for protection of specific hazards and equipment, and may be installed independently of or supplementary to other forms of fire protection systems or equipment.		Information Only
1032	Hazards. Water spray protection is acceptable for the protection of hazards involving: (a) Gaseous and liquid flammable materials. (b) Electrical hazards such as transformers, oil switches, and motors. (c) Ordinary combustibles such as paper, wood, and textiles. (d) Certain hazardous solids.		Information Only
1033	Purposes. In general, water spray may be used effectively for any one or a combination of the following purposes: (a) Extinguishment of fire. (b) Control of burning. (c) Exposure protection. (d) Prevention of fire.		Information Only

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1040	Limitations		Title
1041	There are limitations to the use of water spray which shall be recognized. Such limitations involve the nature of the equipment to be protected, the physical and chemical properties of the materials involved and the environment of the hazard.	W	Not applicable: The systems which constitute this review are confined to charcoal filters and hydrogen storage tanks. Water spray systems are recognized as acceptable means of suppression for these Class A combustible hazards. Ref: Walkdown Checklist No. 1-6.
	Other standards also consider limitations to the application of water (slop-over, frothing, electrical clearances, etc.) (see "Hazardous Chemicals Data", NFPA No. 49, 1973 and "Fire Hazard Properties of Flammable Liquids, Gases, Volatile Solids", NFPA No. 325M, 1969.)		
1042	Materials Involved		Title
	(a) A careful study shall be made of the physical and chemical properties of the materials for which water spray protection is being considered, in order to determine the advisability of its use. The flash point, specific gravity, viscosity, miscibility and solubility of the material, temperature of the water spray and the normal temperature of the hazard to be protected are among the factors which must be given consideration.	W	Not Applicable: The water spray systems for which this review is performed are confined to charcoal filter and hydrogen storage tanks systems. This type of analysis is not necessary since water is considered a well suited agent for this Class A combustible: Ref: Walkdown Checklist No. 1-6.
	(b) The slop-over or frothing hazard shall be considered where water spray may encounter confined materials at a high temperature or having a wide distillation range.	W	Not Applicable: This requirement discusses Class B combustibles. There are no systems subject to this evaluation protecting Class B combustibles in safety related areas. Ref: Walkdown Checklist No. 1-6.

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	(c) Water soluble materials, such as alcohol, require special consideration. Fires involving spills of such materials may usually be controlled, until extinguished by dilution, and in some cases the surface fire may be extinguished by an adequate application rate and coverage. Each water soluble material shall be tested under the conditions of use to determine the applicability of a water spray system, unless sufficient supportive data is already available.	W	Not Applicable: This requirement discusses Class B combustibles. There are no systems subject to this evaluation protecting Class B combustibles in safety related areas. Ref: Walkdown Checklist No. 1-6.
	(d) Water spray shall not be used for direct application to materials which react with water, such as metallic sodium or calcium carbide, which produce violent reactions or increased hazardous products as a result of heated vapor emission; or for liquefied gases at cryogenic temperatures, such as liquified natural gas, which boil violently when heated by water.	W	Not Applicable: There are no hazards of the type described in this requirement which are protected with water spray systems in safety related areas. Ref: Walkdown Checklist No. 1-6.
1043	Equipment Involved. Consideration shall be given to the possibility of damage, distortion, or failure of equipment operating at high surface temperatures.	W	Not Applicable: There are no hazards of the type described in this requirement which are protected with water spray systems in safety related areas. Ref: Walkdown Checklist No. 1-6.
1044	Clearance to Live Electrical Apparatus		Title
	(a) General. The clearances given are for altitudes of 3,300 feet or less. At altitudes in excess of 3,300 feet, the clearance shall be increased at the rate of one percent for each 330-foot increase in altitude above 3,300 feet.	D	Not applicable: The plant is below the specified altitude. Ref: Licensing Document No. 1.

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	(b) Clearance		
	(1) Clearance between any portion of water spray equipment and unenclosed or uninsulated live electrical components, at other than ground potential, shall not be less than that given in Table 1044(b) or Figure 1044(b).	W	Not Applicable: There are no hazards of the type described in this requirement. Ref: Walkdown Checklist No. 1-6.
	(2) The clearances are based upon minimum general practices related to design BIL (Basic Insulation Level) values. To coordinate the required clearance with the electrical design, the design BIL of the equipment being water spray protected shall be used as a basis, if available. Where the design BIL is not available, the voltage may be used as a basis. However, in either event, the clearance between uninsulated energized parts of the electrical system equipment and any portion of the water spray system shall not be less than the minimum clearances provided elsewhere for electrical system insulation on any individual component (the minimum unshielded straight line distance from the exposed electrical parts to nearby grounded objects). BIL values are expressed as KV (kilovolts), the number being the crest value of the full wave impulse test.	W	Not Applicable: There are no hazards of the type described in this requirement. Ref: Walkdown Checklist No. 1-6.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1050	System Design		Title
1051	Water spray system design shall be entrusted only to responsible persons fully experienced in this field (see 4010).		Information Only: Verification of the referenced code section and Chapter 7 will demonstrate compliance with this requirement.
1060	Certification of Water Spray Systems		Title
1061	The contractor shall prepare and submit a description and diagram of the system and its purpose, maintenance and instruction bulletins, and the applicable parts of the Sprinkler Contractors Certificate covering material and tests (see "Standard for the Installation of Sprinkler Systems", NFPA 13, 1973) certifying that the work has been completed and tested in accordance with plans and specifications; before requesting final approval of the water spray system.	D	Open Item: No documentation provided for verification of this code section.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 2. SYSTEM COMPONENTS		Title
2010	Component Parts		Title
2011	All component parts shall be coordinated to provide complete system. Systems shall be operable by automatic means with supplementary manual tripping means. Manual operation, only, is acceptable where: (1) Automatic operation of the system presents a hazard to personnel, or (2) A system is isolated and is attended by trained personnel at all times.	W, D	Comply: For the manual hose hook-up system in zone 5, the thermistor heat detector which alarms in the control room will satisfy the requirement that trained personnel attend the system at all times. Ref: Walkdown Checklist No. 6; Technical Data No. 2 Chapters 9 & 10; Drawing No. 7.
2012	Only listed new materials and devices shall be employed in the installation of systems except that, where age and condition permit, listed devices such as special system water control valves and their accessories, circuit closers, water motor alarm devices, nonautomatic pattern spray nozzles, etc., may be reused, but if reused they shall be reconditioned by the original manufacturer. The original manufacturer shall furnish a certificate, stating that such specified devices have been reconditioned and tested and are considered satisfactory for reuse.	D	Open Item: No documentation provided for verification of this code section.
2020	Corrosion Protection		Title
2021	System components installed out of doors, or in the presence of a corrosive atmosphere, shall be constructed of materials which will resist corrosion or be covered with	W, D	Comply: All piping for the hydrogen cylinder tank water spray system is of galvanized steel, and is covered with a protective coating.

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	protective coatings. The threaded ends of galvanized pipe, after installation, shall be protected against corrosion.		Ref: Walkdown Checklist No. 3; Technical Data No. 4.
		W	Not Applicable: The remaining water spray systems are not installed out of doors. Ref: Walkdown Checklist 1, 2, 4, 5, & 6.
2030	Spray Nozzles		Title
2031	Care shall be taken in the application of nozzle types. Distance of "throw" or location of nozzle from surface shall be limited by the nozzle's discharge characteristics (see 4070).	W	Does Not Comply. A walkdown shows that the support plates for the filters will obstruct the water discharge to all the filters. Ref: Walkdown Checklist No. 1, 2, 4, 5, & 6.
	Care shall also be taken in the selection of nozzles to obtain waterways which are not easily obstructed by debris, sediment, sand, etc., in the water. Requirements for stainers and their replacement are described in 2110 and 4110.		A walkdown of the hydrogen cylinder system shows the pilot line will interfere with the discharge pattern of the north nozzle. Ref: Walkdown Checklist No. 3.
2040	Piping		Title
2041	Pipe and tube used in water spray systems shall be of the materials listed in Table No. 2041. The chemical properties, physical properties and dimensions of the materials listed in Table No. 2041 shall conform at least to the standards cited in the table. Pipe and tube used in water spray systems shall be designed to withstand a working pressure of not less than 175 psi. Whenever the word "pipe" is used, it shall be understood to also mean "tube".	D	Comply: Piping specifications and drawings show all piping material to be of ASTM A-53 carbon steel or galvanized steel. Ref: Technical Data No. 4; Drawing No. 7 & 8.

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2042	Galvanized pipe shall be used except that; where corrosion of galvanized pipe may be caused by corrosive atmospheres or the water, or by additives to the water, other suitable coatings shall be provided.	W, D	Comply: See response to code section 2021.
2043	The galvanizing of galvanized pipe shall be in accordance with specifications of the above standards.	D	Comply: The pipe specifications meet the requirements of Table No. 2041 and are implemented per drawigns. Ref: Technical Data No. 4.
2044	Other pipe or tubing which has been investigated and listed for this service by a nationally recognized testing and inspection agency may be used. The use of such tubing shall involve careful consideration of the following factors: (1) Pressure rating. (2) Beam strength (hangers and spacing). (3) Corrosion (chemical and electrolytic). (4) Methods of joining (strength, performance, fire endurance). (5) Availability of fittings (for water spray nozzle outlets and proper routing). (6) Resistance of limited exposure time without water and resistance to rapid temperature change and steam pressure generated upon the admittance of water.	D	Comply: All piping materials are approved by the owner, or is in accordance with the owner's pipe specifications. Ref: Technical Data No. 5 Section 4.0.

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2050	Fittings		Title
2051	All fittings shall be of a type specifically approved for fire protection systems and of a design suitable for the working pressures involved, but not less than 175 psi cold water pressures. Ferrous fittings shall be of steel, malleable iron or ductile iron in dry sections of the piping exposed to possible fire or in self-supporting systems. Galvanized fittings shall be used where galvanized pipe is required.	W, D	Comply: All fittings are of standard malleable iron and/or butt welds. Ref: Walkdown Checklist No. 1-6; Technical Data No. 4 & 5; Drawing No. 2, 3, & 7.
2052	Rubber gasketed fittings subject to direct fire exposure are generally not suitable. Where necessary for piping flexibility, or for locations subject to earthquake, explosion, or similar hazards, such installations are acceptable. In such cases special hanging or bracing may be necessary.	W	Not Applicable: Walkdowns show that there are no rubber gasketed fittings used. Ref: Walkdown Checklist No. 1-6.
2060	Hangers		Title
2061	Hangers shall be of a type approved for use with the piping involved (see 4100).	D	Comply: All pipe supports and hangers are approved by N.E.P.I.A. Ref: Technical Data No. 3 Section 1:08.1.
2070	Valves		Title
2071	All valves shall be of a type approved for the purpose. Manual shutoff or control valves shall be of the indicated type.	W, D	Comply: Grinnell model "B" deluge valve, used for the hydrogen cylinder tank water spray system is U.L. listed and F.M. approved. The manual shutoff valves are of the indicating type. Ref: Walkdown Checklist No. 1-6; Technical Data No. 1.

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2080	Control Equipment		Title
2081	Automatic valves shall be special system water control valves approved for the use intended.	W, D	Comply: See response to code section 2071.
2082	Control of automatic valves shall be by means of approved accessories for special systems.	W, D	Comply: Dry pilot actuators are used for the hydrogen storage tanks. Ref: Walkdown Checklist No. 3; Technical Data No. 1 page 12 of 20 and No. 2 sections 9.2.3 and 10.1.
		D	Does Not Comply: ASCO SOL #HT 8300861F and J 830081F for the thermistor wires of the charcoal filters are not approved. Ref: Technical Data No. 11 Code Section 2212.
		W	Not Applicable: A walkdown shows that there are no automatic valves for the manual hose hook-up system (unit 12-HV-SATFU). Ref: Walkdown Checklist No. 6.
2083	Manual devices may actuate the automatic control valves by mechanical, hydraulic, pneumatic, electrical, or other approved means. The manual device shall be amply strong to prevent breakage. Manual controls Technical. shall not require a pull of more than 40 pounds (force) nor a movement of more than 14 inches to secure operation.	W, D	Comply: Remote push buttons are provided for the charcoal filters and the hose hookup system can be manually actuated. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Section 10.2.7.
		W	Not Applicable: The dry pilot system for the hydrogen storage tanks does not have a manual actuation device, but can be actuated at the riser. Ref: Walkdown Checklist No. 3.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2084	Automatic detection equipment shall be of a type listed by a nationally recognized testing laboratory for use with special system water control valves.	W, D	Comply: The automatic detection equipment is F.M. approved. Ref: Walkdown Checklist No. 1-6; Technical Data No. 11 Code Section 2212.
2100	Pressure Gages		Title
2101	Required pressure gages shall be of approved type and shall have a maximum limit not less than twice the normal working pressure when installed. They shall be so installed as to permit easy removal, and shall be located where they will not be subject to freezing.	W	Not Applicable: Walkdowns show that there are no pressure gauges used for water spray systems. Ref: Walkdown Checklist No. 1-6.
2110	Strainers		Title
2111	Pipeline strainers shall be specifically approved for use in water supply connections. Strainers shall be capable of removing from the water all solids of sufficient size to obstruct the spray nozzles (normally 1/8 in. perforations are suitable). In addition, the strainer shall be capable of continued operation without serious increase in head loss, for a period estimated to be ample when considering the type of protection provided, the condition of the water, and similar local circumstances (see 4113).	W, D	Comply: Each of the control valve manifolds for the charcoal filters are provided with a 3" eaton manually operated strainer. Strainers are also provided at the pumps. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Sections 10.2.3 & 4.2.1.1.
		W	Does Not Comply: There are no strainers provided for the system protecting the hydrogen storage tanks. Ref: Walkdown Checklist No. 3.
2112	Pipeline strainer designs shall incorporate a flushout connection.	W, D	Comply: The strainers for the charcoal filters are provided with flushout connections. See response to code section 2111. Ref: Technical Data No. 13.

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2113	Individual strainers for spray nozzles, where required, shall be of approved type capable of removing from the water all solids of sufficient size to obstruct the spray nozzle they serve.	W, D	Not Applicable: All spray nozzles used for water spray systems are larger than 1/8 inch. Therefore, individual strainers are not required. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Section 10.2.1; Drawing No. 7 & 8.
2120	Alarms		Title
2121	The location, purpose, and type of system shall determine the alarm service to be provided.		Information Only
2122	Electrical fittings and devices designed for use in hazardous locations shall be used where required by the National Electrical Code, NFPA No. 70.	W	Not Applicable: The water spray systems providing protection in safety related areas are not located in the locations described in this requirement. Ref: Walkdown Checklist No. 1-6.
2130	Fire Department Connections		Title
2131	Fire Department connections, where used, shall be of a type approved for the purpose (see 3022).	W	Not Applicable: There are no fire department connections in safety-related areas. Ref: Walkdown Checklist No. 1-6.
2140	Flushing Connections		Title
2141	A suitable flushing connection shall be incorporated in the design of the system to facilitate routine flushing as required by 6019.	W, D	Comply: The manual hose hookup can be flushed at the hose connection. Drawings show that a flushing connection is provided for the dry pilot water spray system protecting the hydrogen cylinder tanks. 1 1/2 inch flushout valves are provided for the charcoal filter systems. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Section 10.2.3; Drawing No. 8.

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	CHAPTER 3. WATER SUPPLIES		Title
3000	General		Title
3001	It is of vital importance that water supplies be selected which provide water as free as possible from foreign materials.		Information Only
3010	Volume and Pressure		Title
3011	The water supply flow rate and pressure shall be capable of maintaining water discharge at the design rate and duration for all systems designed to operate simultaneously.	D	Comply: The low demand pumps are designed to provide 500 gpm @ 152 psi and are backed by the 2000 gpm high demand pumps. Ref: Technical Data No. 2 Sections 1.2 & 3.4.
3012	For water supply distribution systems, an allowance for the flow rate of hose streams or other fire protection water requirements shall be made in determining the maximum demand. Sectional control shutoff valves shall be located with particular care so that they will be accessible during an emergency.	W, D	Comply: See response to code section 3011.
3013	When only a limited water source is available, sufficient water for a second operation shall be provided so that the protection can be re-established without waiting for the supply to be replenished.	D	Not Applicable: Since Lake Michigan is the water source, there is no limit to the supply. Ref: Technical Data No. 2.
3020	Sources		Title
3021	The water supply for water spray systems shall be from reliable fire protection water supplies, such as: (a) Connections to waterworks systems,	D	Comply: The fire pumps receive water from Lake Michigan. Ref: Technical Data No. 2.

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	(b) Gravity tanks (in special cases pressure tanks), and/or (c) Fire pumps and suction supply.		
3022	Fire Department Connections One or more Fire Department connections shall be provided in all cases where water supply is marginal and/or where auxiliary or primary water supplies may be augmented by the response of suitable pumper apparatus responding to the emergency. Fire department connections are valuable only when fire department pumping capacities can equal maximum demand flow rate. Careful consideration shall be given to such factors as the purpose of the system, reliability, and capacity and pressure of the water system. The possibility of serious exposure fires and similar local conditions shall be considered. A pipe line strainer in the Fire Department connection shall be provided if indicated by 4110. Where a Fire Department connection is required, suitable suction provisions for the responding pumper apparatus shall be provided.	D	Title Not Applicable: Fire department connections are not required for safety related areas since an ample water supply is available. Ref: Technical Data No. 2.

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	CHAPTER 4. SYSTEM DESIGN AND INSTALLATION		Title
4000	Workmanship		Title
4001	Water spray system design, layout, and installation shall be entrusted to none but fully experienced and responsible parties. Water spray system installation is a specialized field of sprinkler system installation which is a trade in itself.		Information Only
4010	Plans, Specifications, and Hydraulic Calculations		Title
4011	Before a water spray system is installed or existing equipment remodeled, complete working plans, specifications and hydraulic calculations shall be prepared and made available to interested parties. For details concerning plans, specifications and hydraulic calculations, see Chapter 7.	D	Comply: All required documents are provided for the hydrogen cylinder tank system. Ref: Technical Data No. 3 & 16; Drawing No. 8.
		D	Open Item: No documents were provided for review for the charcoal filter systems.
4020	Design Guides		Title
4021	Water spray system designs shall conform to the applicable requirements of the following Standards of the National Fire Protection Association, except where otherwise specified.		Information Only
4030	Density and Application		Title
4031	Extinguishment		Title
	(a) Extinguishment of fires by water spray may be accomplished by surface cooling, by smothering from steam produced, by emulsification, by dilution, or by various combinations thereof. Systems shall be	W, D	Comply: Extinguishment of fires is accomplished using the principles of cooling, smothering, diluting, and emulsifying properties of water.

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	designed so that, within a reasonable period of time, extinguishment shall be accomplished and all surfaces shall be cooled sufficiently to prevent "flashback" occurring after the system is shut off.		See response to code section 1041. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Sections 8, 9 & 10.
(b)	The design density for extinguishment shall be based upon test data or knowledge concerning conditions similar to those that will apply in the actual installation. A general range of water spray application rates that will apply to most ordinary combustible solids or flammable liquids is from 0.2 gpm per sq. ft. to 0.5 gpm per sq. ft. of protected surface.	D	Comply: Charcoal filters; each nozzle has a flow rate of 6.3 gpm @ 100 psi, and the timed water discharge is set to repeat if the temperature sensors have not cleared. Hydrogen Cylinders; the system requires 120 gpm @ 138 psi and the low demand pumps can provide 500 gpm @ 152 psi. Ref: Technical Data No. 2 Sections 3.4.2, 10.1, & 10.2; Drawing No. 8.
(c)	Each of the following methods or a combination of them shall be considered when designing a water spray system for extinguishment purposes:	D	Comply: See response to code 4031a.
	(1) Surface Cooling.		
	(2) Smothering by Steam Produced.		
	(3) Emulsification.		
	(4) Dilution.		
	(5) Other Factors.		

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4032	Control of Burning		Title
	(a) A system for the control of burning shall function at full effectiveness until there has been time for the flammable materials to be consumed, for steps to be taken to shut off the flow leaking material, for the assembly of repair forces, etc. System operation for hours may be required.	D	Comply: See response to code section 4031.
	(b) Nozzles shall be installed to impinge on the areas of the source of fire, and where spills may travel or accumulate. The water application rate on the probable surface of the spill shall be at the rate of not less than 0.50 gpm per sq. ft.	W, D W, D	Does Not Comply: See response to code section 2031. Open Item. The interiors of the charcoal filters were not accessible, nor were drawings for the nozzle configuration available. See response to Code Section 2113 and 2031. Ref: Walkdown Checklist No. 1-6.
	(c) Pumps or other devices which handle flammable liquids or gases shall have the shafts, packing glands, connections, and other critical parts enveloped in directed water spray at a density of not less than 0.50 gpm per sq. ft. of projected surface area.	W	Not Applicable: There are no systems of this type in the safety related areas. Ref: Walkdown Checklist No. 1-6.
4033	Exposure Protection		Title
	(a) General		
	(1) The system shall be able to function effectively for the duration of the exposure fire which is estimated from a knowledge of the nature and quantities of the combustables and the probable effect of fire-fighting	W	Not Applicable: There are no systems of the type (providing exposure protection) described in this requirement providing protection for safety related areas. Ref: Walkdown Checklist No. 1-6.

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	equipment and materials. System operation for hours may be required.		
	(2) Automatic water spray systems for exposure protection shall be designed to operate before the information of carbon deposits on the surfaces to be protected and before the possible failure of any containers of flammable liquids or gases because of the temperature rise. The system and water supplies shall, therefore, be designed to discharge effective water spray from all nozzles within 30 seconds following operation of the detection system.	W	Not Applicable: There are no systems of the type described in this requirement providing protection for safety related areas. Ref: Walkdown Checklist No. 1-6.
	(3) The densities specified for exposure protection contemplate minimal wastage of 0.05 gpm per sq. ft. (see 4070).		Information Only.
	(b) Vessels	W	Not Applicable: Section (b) of this requirement addresses components which are not provided with water spray systems in safety related areas. Ref: Walkdown Checklist No. 1-6.
	(1) These rules for exposure protection contemplate emergency relieving capacity of vessels, based upon a maximum allowable heat input of 6,000 Btu per hour per sq. ft. of exposed surface area. The density shall be increased to limit the heat absorption to a safe level in the event required emergency relieving capacity is not provided.		
	(2) Water shall be applied to vertical or inclined vessel surfaces at a net rate of not less than 0.25 gallons per minute per sq. ft. of		

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exposed uninsulated surface. Individual nozzle water application rates shall be increased to provide for any run-down or slippage allowances. Where run-down is contemplated, the vertical distance between nozzles shall not exceed twelve feet. The horizontal extremities of spray patterns shall be at least meet.

(3) Spherical or horizontal cylindrical surfaces below the vessel equator cannot be considered wettable from run-down, unless engineering data to the contrary is available.

(4) Where projections (manhole flanges, pipe flanges, support brackets, etc.) will obstruct water spray coverage, including run-down or slippage on vertical surfaces, additional nozzles shall be installed around the projections to maintain the wetting pattern which otherwise would be seriously interrupted.

(5) Bottom and top surfaces of vertical vessels shall be completely covered by directed water spray at an average rate of not less than 0.25 gallons per minute per sq. ft. of exposed uninsulated surface. Consideration may be given to slippage but on the bottom surfaces the horizontal extremities of spray patterns shall at least meet.

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	(6) Special attention shall be given to distribution of water spray around relief valves and around supply piping and valve connection projections.		
	(7) Uninsulated skirts shall have water spray applied on one exposed (uninsulated) side, either inside or outside, at a net rate of not less than 0.10 gpm per sq. ft.		
	(c) Structures & Miscellaneous Equipment		
	(1) Horizontal, stressed (primary) structural steel members shall be protected by nozzles spaced not greater than ten feet on centers (preferably on alternate sides) and of such size and arrangement as to discharge not less than 0.10 gpm per sq. ft. over the wetted area.	W	Not Applicable: Section (c) of this requirement addresses components which are not provided with water spray in safety related areas. Ref: Walkdown Checklist No. 1-6.
	(2) Vertical structural steel members shall be protected by nozzles spaced not greater than ten feet on centers (preferably on alternate sides) and of such size and arrangement as to discharge not less than 0.25 gpm per sq. ft. over the wetted area.		
	(3) Metal pipe, tubing and conduit runs shall be protected by water spray at a basic rate of 0.10 gpm per sq. ft. of aggregate pipe wall area. Structural supports shall be protected as indicated in 4033(c)(1) and (2). This rate may be reduced if the cumulative discharge over all areas exceeds 0.50 gallons per minute per		

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	sq. ft. of projected grade area. Nozzles shall be located to cause water spray to directly impinge on surfaces of pipe and supporting structure. Factors to be considered when designing water spray protection for pipe racks include the number of levels of pipe, the spacing between pipes, and the general configurations of the pipe rack.		
	(4) If spill-fire exposure protection is desired for nonmetallic sheathed insulated electrical cable and/or nonmetallic tubing runs in open trays, see Appendix.		
	(d) Transformers	W	Not Applicable: The equipment addressed in (d) are not provided with water spray systems in safety related areas. Ref: Walkdown Checklist No. 1-6.
	(1) Transformers protection shall essentially complete impingement on all contemplate exterior surfaces, except underneath surfaces which in lieu thereof may be protected by horizontal projection. The water shall be applied at a rate not less than 0.25 gpm per sq. ft. of projected area of rectangular prism envelope for the transformer and its appurtenances and not less than 0.15 gpm per sq. ft. on the expected nonabsorbing ground surface area of exposure. Additional application is needed for special configurations, conservator tanks, pumps, etc. Spaces greater than twelve inches in width between radiators, etc., shall be individually protected.		

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	(2) Water spray piping shall not be carried across the top of the transformer tank, unless impingement cannot be accomplished with any other configuration and provided the required distance from the live electrical components is maintained (see 1044).		
	(3) In order to prevent damage to energized bushings or lightning arrestors, water spray shall not envelop this equipment by direct impingement, unless so authorized by the manufacturer or his literature, and the owner.		
	(e) Belt Conveyors		
	(1) The Drive Unit: Water spray system shall be installed to protect the drive rolls, the take-up rolls, the power units and the hydraulic-oil unit. The rate of water application shall be 0.25 gallons per minute per sq. ft. of roll and belt.	W	Not Applicable: There are no components of this type installed in safety related areas protected by water spray systems. Ref: Walkdown Checklist No. 1-6.
	(2) The Conveyor Belt: Water spray system shall be installed to automatically wet the top belt, its contents, and the bottom return belt. Discharge patterns of water spray nozzles shall envelop, at a rate of 0.25 gallons per minute per sq. ft. of top and bottom belt area, the structural parts and the idler-rolls supporting the belt. Water spray system protection shall be extended onto transfer belts, transfer equipment and transfer buildings beyond each transfer		

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	point. Or, systems for the protection of adjacent belts or equipment shall be interlocked in such a manager that the feeding belt water spray system will automatically actuate the water spray system protecting the first segment of the down-stream equipment. Special consideration shall be given to the interior protection of the building, gallery, or tunnel housing the belt conveyor equipment. Also, the exterior structural supports for galleries shall be protected from exposure such as fires in flammables located adjacent to the galleries. The effectiveness of belt conveyor protection is dependent upon rapid detection and appropriate interlocks between the detection system and the machinery.		
4034	Fire Prevention (a) The system shall be able to function effectively for a sufficient time to dissolve, dilute, disperse, or cool flammable or hazardous materials. The possible duration of release of the materials shall be considered in the selection of duration times. (b) The rate of application for fire prevention shall be based upon experience with the product or upon test.	D	Title Comply: See response to code section 4031.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4040	Size of System		Title
4041	Separate fire areas shall be protected by separate systems. Single systems shall be kept as small as practicable, giving consideration to the water supplies and other factors affecting reliability of the protection. A design discharge rate of 3,000 gpm shall not be exceeded for a single system (see Chapter 3).	W, D	Comply: The nozzles for the charcoal filters protect the individual units, and the hydrogen cylinder tanks are protected by its individual system as verified by walkdowns. The systems description shows that the pumps provide 500 gpm (maximum) to each of the water spray systems. These pumps are backed up by the 2000 gpm high demand pumps. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 sections 1.2, 3.4 & 3.4.2.
4050	Separation of Fire Areas		Title
4051	Separation of fire areas shall be by space, fire barriers, diking, special drainage, or by combination of these. In the separation of fire areas consideration shall be given to the possible flow of burning liquids before or during operation of the water spray systems.	D	Not Applicable: The FHA submittal addresses the separation of fire areas. This criteria takes precidence over NFPA criteria. Ref: Licensing Document No. 1.
4052	Area Drainage		Title
	(a) Adequate provisions shall be made to promptly and effectively dispose of all liquids from the fire area during operation of all systems in the fire area. Such provisions shall be adequate for:	D	Open Item: There is no documentation showing that adequate provisions for drainage is provided.
	(1) Water discharged from fixed fire protection systems at maximum flow conditions.		
	(2) Water likely to be discharged by hose streams.		

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	(3) Surface water.		
	(4) Cooling water normally discharged to the system.		
	(b) There are four methods of disposal or containment:		
	(1) Grading.		
	(2) Diking.		
	(3) Trenching.		
	(4) Underground or enclosed drains.		
	The method used shall be determined by:		
	(1) The extent of the hazard.		
	(2) The clear space available.		
	(3) The protection required.		
	Where the hazard is low, the clear space is adequate, and the degree of protection required is not great, grading is acceptable. Where these conditions are not present, consideration shall be given to dikes, trenching, or underground or enclosed drains.		
	(c) For the methods of drainage or diking, see Standard for Flammable and Combustible Liquids, NFPA No. 30, 1973.		

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4060	Valves		Title
4061	Shutoff Valves. Each system shall be provided with a shutoff valve so located as to be readily accessible during a fire in the area the system protects or adjacent areas, or, for systems installed for fire prevention, during the existence of the contingency for which the system is installed.	W, D	Comply: Manual shutoff valves are provided for all systems. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Sections 9 and 10.
4062	Automatically Controlled Valves		Title
	(a) Automatically controlled valves shall be as close to the hazard protected as accessibility during the emergency will permit, so that a minimum of piping is required between the automatic valves and the spray nozzles.	W	Comply: The piping between the automatic valves and the spray nozzles is minimized and the valves are accessable during an emergency caused by the hazard. Ref: Walkdown Checklist No. 1-6.
	(b) Remote manual tripping devices, where required, shall be conspicuously located where readily accessible during the emergency and adequately identified as to the system controlled.	W, D	Comply: For the charcoal filter systems, the automatic valves, as well as the remote tripping devices are readily accessible from the hazards. Ref: Walkdown Checklist No. 1-6; Drawing No. 37 & 38.
4063	Drain Valves. Readily accessible drains shall be provided for low points in underground and aboveground piping.	W, D	Comply: Drawings show that the hose hookup and the hydrogen cylinder systems are provided with drains. Ref: Walkdown Checklist No. 3 & 6; Drawing No. 7 page 3 and No. 8.
		W, D	Does Not Comply: The details on the drawings for the charcoal filter systems show that no drains are provided at the elbows entering the filter units. Ref: Walkdown Checklist No. 1, 2, 4 & 5; Drawing No. 37 & 38.

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4070	Spray Nozzles		Title
4071	Selection. The selection of the type and size of spray nozzles shall be made with proper consideration given to such factors as physical character of the hazard involved, draft or wind conditions, material likely to be burning, and the general purpose of the system (see 2031).	D	Comply: The following documents show the types of nozzles used for each of the systems: Ref: Technical Data No. 2 Section 10.2.1 for charcoal filters; Drawing No. 7 for the hose hookup; Drawing No. 8 for the hydrogen cylinder system.
4072	Position. Spray nozzles may be placed in any position necessary to obtain proper coverage of the protected area. Positioning of nozzles with respect to surfaces to be protected, or to fires to be controlled or extinguished, shall be guided by the particular nozzles design and the character of water spray produced. The effect of wind and fire draft on very small drop sizes or on larger drop sizes with little initial nozzle velocity shall be considered, since these factors will limit the distance between nozzle and surface, and will limit the effectiveness of exposure protection, fire control or extinguishment. Care shall be taken in positioning nozzles that water spray does not miss the target surface and reduce the efficiency or calculated discharge rate (gpm/ft^3). Care shall also be exercised in placement of spray nozzles protecting pipe lines handling flammable liquids under pressure, where such protection is intended to extinguish or control fires resulting from leaks or ruptures.	W, D	Comply: Hydrogen cylinder - see response to code section 2031.
		W, D	Does Not Comply: Charcoal filters - see response to code section 2031.

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4080	Piping		Title
4081	Size. As effective protection is dependent on having adequate pressure and quantity of water available at all spray nozzles, each system requires individual consideration as to the size of the piping. This requires that the size of the piping be based upon hydraulic computations (see Chapter 7). However, piping shall not be less than one-inch nominal diameter.	D	Comply: Drawing shows that all pipe sizes are adequate for the hydrogen storage tanks. Ref: Drawing No. 8.
		D	Does Not Comply: Walkdowns and sketches for the hose hookup system show that 3/4" pipe is used for the system. Ref: Drawing No. 7.
		D	Open Item: There are no drawings which show the pipe or nozzle arrangements for the charcoal filters.
4082	Installation		Title
	(a) The installation standards for water spray system piping shall be applicable sections of the Standard for the Installation of Sprinkler Systems, NFPA 13, 1973, except as herein modified.		Information Only
	(b) Welding is permissible. Welding shall be conducted in accordance with the Code for Pressure Piping, ANSI B31.1 - 1973 and Supplements, where applicable. This may require galvanizing of sections involving welded parts after fabrication. Special care shall be taken to insure that the openings are fully cut out and that no obstructions remain in the waterway. Safe welding or cutting practices shall be followed.	D	Comply: Specifications require all welds to be in accordance with ANSI B31.1.0-1967 or GEM-1427 [for butt weld joints of carbon steel]. Ref: Technical Data No. 5 Sections 3.1 & 3.2.

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	(c) All underground supply piping after the automatic control valve shall be pitched 1/2 inch in ten feet to drain in the same manner as the above mentioned Standards specify for aboveground piping. Provisions shall be made to drain underground and overhead piping.	W	Not Applicable: Walkdowns show that there are no underground piping as described in this code section. Ref: Walkdown Checklist No. 1-6.
	(d) Provision shall be made for test gages at or near the highest or most remote nozzle on each major separate section of the system. At least one gage, connection shall be provided at or near the nozzle calculated as having the least pressure under normal flow conditions.	D	Comply: Drawing for the hydrogen storage tanks shows that provisions for test gages are provided. Ref: Drawing No. 8.
		D	Does Not Comply: Sketches for the hose hook up system does not show provisions for the test gages. Ref: Drawing No. 7.
		D	Open Item: There are no documents available to verify this code section for the charcoal filter units.
4100	Hangers		Title
4101	System piping shall be adequately supported. All supports in the fire area should be protected by the system. In any area where possibility of explosion may be recognized, special care shall be taken to support the piping from portions of the structure least liable to disruption.	D	Comply: Pipe supports and hangers approved by N.E.P.I.A. Ref: Technical Data No. 3 & 4.
		W, D	Open Item: A walkdown showed that a hanger rod is welded to the top of a pipe supplying water to 1-HV-CIPX-1. No approval or evaluation could be found for this assembly. Ref: Walkdown Checklist No. 1-6; NFPA 13 (1983) Section 3-15.
		D	Open Item: There are no documents available to verify this code section for the charcoal filter systems.

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4102	Tapping or drilling of load-bearing structural members is not permitted unless the design of the structural members contemplates this feature or their design is such that the additional load can be safely tolerated, and no other arrangement is feasible.. Attachments may be made to existing steel or concrete structures and in some cases to equipment and its supports. Where welding of supports directly to vessels or equipment is necessary, it shall be done in a safe manner in conformation with the provisions of all safety, structural, and fire codes and standards.	D	Comply: See response to Code Section 4101.
		W, D	Open Item: See response to Code Section 4101.
		D	Open Item: See response to Code Section 4101.
4103	Where the usual methods of supporting piping for the fire protection purposes cannot be used, the piping shall be supported in such a manner as to produce the strength equivalent to that afforded by such usual means of support. In such cases, piping arrangements which are essentially self-supporting may be employed together with such hangers as are necessary.	D	Comply: See response to Code Section 4101.
		W, D	Open Item: See response to Code Section 4101.
		D	Open Item: See response to Code Section 4101.
4110	Strainers		Title
4111	Main pipeline strainers shall be provided for all systems utilizing nozzles with waterways less than 3/8 inch and for any system where the water is likely to contain obstructive material.	W, D	Comply: Strainers are provided at the pumps and at each of the control valve manifolds. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Sections 4.2.1.1 and 10.2.3; Drawing No. 37 & 38.
4112	Pipeline strainers shall be installed so as to be accessible for cleaning during the emergency.	W	Comply: See response to code section 4111.

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4113	Care shall be taken in the selection of strainers, particularly where nozzle waterways are less than 1/4 inch in least dimension. Individual strainers shall be provided at each nozzle where water passageways are smaller than 1/8 inch. Consideration must be given to size of screen perforation, to volume available for accumulation without excessive friction loss and the facility for inspection and cleaning.	W, D	Not Applicable: All nozzles used for water spray systems are larger than 1/8 inch. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Section 10.2.1; Drawing No. 7 & 8.
4120	Gages		Title
4121	Gages shall be installed as follows: (a) Below the seat of the automatic valve and arranged so as to indicate the residual pressure in the riser with the test pipe valve wide open. (b) At each independent pipe from an air supply to an automatic valve. (c) On the water supply connection to hydraulically controlled automatic valves. (d) At the air pump supplying an air receiver. (e) At an air receiver.	W	Does Not Comply: Walkdowns revealed that no pressure gages were installed for the water spray systems. Ref: Walkdown Checklist No. 1-6.

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	CHAPTER 5. ACCEPTANCE TESTS		Title
5000	Flushing of Piping		Title
5001	Supply Piping. Underground mains and lead-in connections to system risers shall be flushed thoroughly before connection is made to system piping, in order to remove foreign materials which may have entered the underground during the course of the installation or which may have been present in existing piping. The minimum rate of flow shall be not less than the water demand rate of the system which is determined by the system design, or not less than that necessary to provide a velocity of ten feet per second, whichever is greater. For all systems the flushing operations shall be continued for a sufficient time to insure thorough cleaning. When planning the flushing operations consideration shall be given to disposal of the water issuing from the test outlets.	D	Comply: All systems contain provisions for flushing; including mechanical connections and written procedures. Ref: Procedure No. 1 Section 9.11, Appendix 3 & 4 and No. 4 Section 7; Drawing No. 8, 37 & 38.
5002	System Piping. All system piping shall be flushed where practicable; otherwise, cleanliness shall be determined by visual examination.	D	Comply: See response to code section 5001.
5010	Hydrostatic Pressure Tests		Title
5011	Hyrdostatic Tests. All new system piping shall be hydrostatically tested in accordance with the provisions of the Standard for Installation of Sprinkler Systems, NFPA No. 13, 1973.	D	Comply: All systems were tested as required per this code section [except for the hose hookup system] and documented as follows: Ref: Procedure No. 1 Sections 9.8 & 9.11.
		D	Open Item: There is no documentation to verify that the hose hookup system was tested.

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5020	Water Discharge Test		Title
5021	When practicable, full flow tests with water shall be made of system piping as a means of checking the nozzle layout, discharge pattern, any obstructions and determination of relation between design criteria and actual performance, and to insure against clogging of the smaller piping and the discharge devices by foreign matter carried by the water.	D	Not Applicable: The systems protecting the charcoal filters were air flow tested to prevent filter damage. Ref: Procedure No. 1.
		D	Open Item: There is no documentation to verify that the hose hookup system was tested.
5022	When practicable, the maximum number of systems that may be expected to operate in case of fire shall be in full operation simultaneously in order to check the adequacy and conditions of the water supply.	W	Comply: The maximum number of systems expected to operate is one per water supply. The water spray and sprinkler systems are supplied by different pumps and risers. The charcoal filter spray systems only protect the interior of the unit.
5023	The discharge pressure at the highest, most remote nozzle, shall be at least that for which the system was designed.	D	Open Item: There is no documentation to verify this code section.
5030	Operating Tests		Title
5031	All operating parts of the system shall be fully tested to assure they are in operating condition.	D	Comply: The operating parts of the system were tested during the pre-operational tests. Ref: Procedure No. 1 Section 9.
		D	Open Item: There is no documentation to verify that the hose hookup system was tested.
5032	The operating tests shall include a test of automatic detection equipment.	D	Comply: The preoperational tests included the detection equipment. Ref: Procedure No. 1 Section 9.

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STANDARD FOR WATER SPRAY FIXED SYSTEMS FOR FIRE PROTECTION

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
5040	Acceptance Test Suggestions (See Appendix A-5040.)		Title Information Only

REV	BY	DATE	CHECKED	DATE
0	KMJ	4/21/83	WJH	4/21/83

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 6. PERIODIC TESTING AND MAINTENANCE		Title
6000	General		Title
6001	Water spray systems require competent and effective care and maintenance to assure that they will perform their purpose effectively at the time of fire. Systems shall be serviced and tested periodically by men trained in this work. An inspection contract with a qualified agency for service, test, and operation at regular intervals is recommended and may be required.	D	Comply: All systems are tested and maintained as required per this code section [except for the hose hookup system] and documented as follows. Ref: Procedure No. 1-4.
		D	Open Item: There is no documentation to verify that the hose hookup system has been maintained.
6002	Operating and maintenance instructions and layouts shall be available or can be posted at control equipment and at the plant fire headquarters. Selected plant personnel shall be trained and assigned to the task of operating and maintaining the equipment.	D	Comply: See response to code section 6001.
		D	Open Item: See response to code section 6001.
6003	At weekly, or other frequent regularly scheduled plant inspections, equipment shall be checked visually for obvious defects, such as broken or missing parts, nozzle loading, or other evidence of impaired protection.	D	Comply: See response to code section 6001.
		D	Open Item: See response to code section 6001.
6010	Maintenance		Title
6011	Water Supplies. Proper precautions shall be taken to insure that water supplies are kept turned on and are in full operating condition at all times when hazard or exposure exists.	D	Comply: The requirements of this code section is accomplished by the pressure pegging system. Ref: Technical Data No. 2 Section 3.4.3.
6012	Strainers. Strainers, except individual nozzle strainers (see 6018), shall be	D	Comply: See response to code section 6001.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	thoroughly inspected after each operation or flow test and cleaned if necessary. Routine inspection and cleaning shall be performed annually, and more frequently if necessary, based on experience.		
6013	Piping. All piping shall be examined at regular intervals to determine condition and proper drainage. Frequency of inspections will be dependent upon local conditions and shall be at intervals of not more than one year.	D	Comply: Inspection procedures are provided for the water spray systems. Ref: Procedure No. 2.
		D	Open Item: See response to code section 6001.
6014	Flow tests of open head spray systems shall be made at least every five years or more frequently, as determined from experience.	D	Comply: Air flow tests are performed at least once per 3 years. These air air flow tests verify that the system piping and nozzles are not obstructed. See response to code section 6001. Ref: Procedure No. 3 Section 1.1-4.7.9.2.c.
		D	Open Item: See response to code section 6001.
6015	Control Valves & Devices. Control valves and automatic detection equipment shall be tested at least annually, by qualified personnel.	D	Comply: Control valves and devices are tested every 6 months. See response to code section 6001. Ref: Procedure No. 4 Section 1.4.
		D	Open Item: See response to code section 6001.
6016	Manual tripping devices and valves, including O. S. & Y. gate and post indicator valves, shall be operated at least annually.	D	Comply: Manual tripping devices and valves are tested every 6 months. See response to code section 6001. Ref: Procedure No. 4 Section 1.4.
		D	Open Item: See response to code section 6001.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
6017	Where normally opened valves are closed following system operation or test, suitable procedures shall be instituted to insure that they are reopened and that the system is promptly and properly restored to full normal operating condition. Main drain flow tests shall be made after valves are reopened (see Recommended Practice for the Care and Maintenance of Sprinkler Systems, NFPA No. 13A, 1971 - Flow Tests).	D D	Comply: See response to code section 6001. Open Item: See response to code section 6001.
6018	Spray Nozzles. All spray nozzles shall be inspected for proper positioning, external loading, and corrosion, and cleaned if necessary at intervals of not more than twelve months or more frequently if necessary, based on experience. Local conditions may require such inspection and cleaning more frequently and may require internal inspection. After each operation open spray nozzles equipped with individual screens shall be removed and the spray nozzle and screen cleaned, unless observation under flow conditions indicates this is not necessary.	D D	Comply: The nozzle inspections are performed on an annual basis. Ref: Procedure No. 2. Open Item: See response to code section 6001.
6019	Flushing. Underground lead-in connections to system risers shall be flushed at least annually, in accordance with 5001. This may be accomplished by: (a) A flow test of the system, or (b) Flowing water from a suitable flushing connection of adequate size.	D	Comply: Flow tests are performed every 6 months. See response to code section 6001. Ref: Procedure No. 4.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 7. PLANS, SPECIFICATIONS & HYDRAULIC CALCULATIONS		Title
7000	Plans and Specifications		Title
	Working plans, including elevations, shall be drawn to an indicated scale, show all essential details, and the following data: Date Name of owner and occupant Location, including street address Point of compass Structural features Relative elevations of nozzles, junction points and supply or reference points Full information concerning water supplies, including pumps, underground mains, etc., and flow test results. Make, type, size, location, position, and direction of spray nozzles. Make, type, model, and size of special system valve. Types of alarms to be provided. Number of each size and type of spray nozzles on each system. Lengths of pipe and whether center to center or cutting lengths are shown. Size of all pipe and fittings. Heat responsive equipment, including type, arrangement and location. Hydraulic reference points. Design purpose of system. Make and type of hangers and inserts. All control and check valves, strainers, drain pipes, and test pipes. Small hand hose and hose equipment. The weight or class, lining and size of underground pipe and the depth that the top of the pipe is to be laid below grade. Provisions for flushing underground pipe.	D	Does Not Comply: There are no plant drawings to show the hose hookup system, or the configuration of the nozzles within the charcoal filters. All the required information for the hydrogen cylinder system does not appear on the drawing. Ref: Drawing No. 8.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	Accurate and complete layout of the hazard being protected. When the equipment to be installed is an addition or change, enough of the old system should be indicated on the plans to make all conditions clear. Name and address of contractor.		
7010	Hydraulic Calculations		Title
	General. Hydraulic calculations shall be prepared on forms that include a summary sheet, detailed work sheets, and a graph sheet.	D	Does Not Comply: A graph sheet is not provided in the hydraulic calculation for the hydrogen cylinder tank water spray system.
		D	Open Item: Hydraulic calculations for the water spray systems are not provided.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 8. AUTOMATIC DETECTION EQUIPMENT		Title
8000	General		Title
8001	The arrangement of automatic detection equipment for water spray systems requires careful engineering, and a different arrangement from that required for other types of systems. The provisions of this Chapter are based upon the type of equipment presently available for use with special systems. Other types shall give at least equivalent performance.	W, D	Comply: Automatic detection for the charcoal filters is provided by ACI thermistor wires. Automatic detection for the hydrogen cylinder system is provided by a pilot line. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Sections 9 & 10, No. 14 item 4.
8010	Selection		Title
8011	Care shall be exercised in the selection and adjustment of detection equipment to assure proper operation and to guard against premature operation of the system from normally fluctuating conditions. For example, particular care shall be taken to compensate for normal temperature fluctuations in installations such as transformer protection involving heat exchangers having automatic fans, and installations involving industrial ovens and furnaces. Additionally, protection of machinery involving movement of a hazardous material such as a belt conveyor would require a detection system having a faster response time than normal, and appropriate interlocks to stop drive units, etc.	W, D	Comply: See response to code section 8001.
8020	Protection		Title
8021	Corrosion Protection. Detection equipment installed out of doors in the presence of possible corrosive vapors or atmospheres	W, D	Comply: Pilot lines which serve as the fire detection mechanism for the H_2 cylinder system are covered with

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	shall be protected from corrosion by suitable materials of construction or by suitable protective coatings applied by the equipment manufacturer.		a protective coating. Ref: Walkdown Checklist No. 1-6; Technical Data No. 4.
8022	Protective Canopy. Detection equipment requiring protection from the weather shall be provided with a canopy, hood, or other suitable protection.	W, D	Not Applicable: See response to code section 2021.
8023	Mechanical Damage. Detection equipment shall be located so as to be protected from mechanical damage.	W	Comply: Walkdowns show that detection equipment is not susceptable to damage. Ref: Walkdown Checklist No. 1-6.
8024	Mounting. Detectors shall, in all cases, be supported independently of their attachment to wires or tubing.	W	Comply: The detectors are properly installed by the use of thermistor cable clamps. Ref: Walkdown Checklist No. 1-6.
8030	Location & Spacing of Detectors		Title
8031	Automatic detection equipment shall be so located and adjusted as to operate reliably. The location of detectors shall be based upon data obtained from field experience, tests, engineering surveys, the manufacturer's recommendations, and recognized laboratory listing, insofar as these are applicable. In addition, location shall take into consideration such factors as the nature of the hazard being protected, air velocity, temperature variations, number and height of structural levels, shielding, indoors or outdoors, open or closed structures, and other variable conditions where the exercise of judgment based upon experience with such detection equipment in actual tests and service, is needed. For example, the spacing and location of detectors for belt conveyors	D	Comply: The detection for the charcoal filters is accomplished by thermister wire which was installed in accordance with ANI guidelines, and is therefore acceptable. Ref: Technical Data No. 12 Section 3-5.11. The pilot nozzles providing actuation of the H_2 systems are properly spaced. Ref: Technical Data No. 2 Section 9.2.2.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	must include consideration of the nature of the material being conveyed, the combustibility of the belt, the speed at which the material is conveyed, the rapidity of detection necessary, the necessity of detection devices between upper and lower belts as well as above the conveyor belt, etc.		
8032	Two or More Systems. Where there are two or more systems in one area controlled by separate systems of fire detectors, those on each system shall be spaced at least up to the dividing line between systems, as to a wall or partition or draft stop.	W, D	Comply: Each water spray system is provided with its own detection system controlled independently. See response to code section 8001. Ref: Walkdown Checklist No. 1-6.
8040	Arrangement & Supervision of Systems		Title
8041	Supervision. Central station, remote station, or proprietary supervision of detection equipment is recommended.		Information Only.
8042	Electric Systems. Water spray systems which depend for operation on electric thermostats, relay circuits, or other similar equipment shall be so arranged that such equipment is normally energized, or completely supervised in a manner that will result in positive notifications of an abnormal condition unless failure of the detection system results in the operation of the water spray system.	W, D	Comply: The charcoal filter water spray systems are monitored in the control room and are supervised through the detection control cabinets. The hydrogen cylinder system will operate upon actuation of pilot heads. Ref: Walkdown Checklist No. 1-6; Technical Data No. 2 Sections 9 & 10.2.
8043	Pneumatic and Hydraulic Systems. Pneumatically and hydraulically operated systems shall be supervised in a manner so that failure will result in positive notification of the abnormal condition, unless the failure shall result in operation of the water spray system.	D	Comply: Low air pressure is supervised on the pilot lines for the hydrogen system. This is the only system with penumatic operation. Ref: Technical Data No. 11 Section 3443.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
8050	Response Time		Title
8051	The heat detection system shall be designed to cause actuation of the special system water control valve within 20 seconds under expected fire conditions. Under test conditions when exposed to a standard heat source, the system shall operate within 40 seconds. These are to be considered maximum response times subject to the considerations described in 8011 and 8031.	D	Does Not Comply: The response time of the thermistor wire detectors is not acceptable as indicated by the results of the pre-operational tests. Ref: Procedure No. 1.

CALCULATION/PROBLEM COVER SHEET

Calculation/Problem No: 0120-108-007

Title: NFPA 72D CODE COMPLIANCE VERIFICATION CHECKLIST

Client: AEP **Project:** CODE COMPLIANCE REVIEW

Job No: 0120-108

Design Input/References: SEE SECTION 5.0

Assumptions: SEE SECTION 2.0. ALSO SEE PROJECT INSTRUCTION PI-FP-01, REVISION 1, CONDUCTING AND DOCUMENTING NFPA CODE COMPLIANCE REVIEWS. SEE IMPELL REPORT 09-0120-0123, CODE COMPLIANCE SUMMARY REPORT.

Method: SEE SECTION 3.0. ALSO SEE PROJECT INSTRUCTION PI-FP-01, REVISION 1.

Remarks: PAGES 25 AND 26 IDENTIFY THE SYSTEMS EVALUATED UNDER THE REQUIREMENTS OF THE 1967 EDITION OF THIS CODE. PAGE A1 IDENTIFIES THE SYSTEMS EVALUATED UNDER THE REQUIREMENTS OF THE 1979 EDITION OF THE CODE.

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	EKlemsay	5/16/88

EDS 8068 8/78

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

For the purpose of this report, it is assumed that under most conditions the authority having jurisdiction was the architect/engineer (A/E) for the plant who is American Electric Power Service Corporation (AEPSC) unless otherwise indicated.

The thermistor detection devices installed in the containment cable trays and RCP pumps are not included as part of this review.

3.0 METHODOLOGY

Reference Section 2.1.1 of Impell Project Instruction PI-FP-01, Revision 1.

All maintenance issues noted during the walkdown phase of the project have been identified in the CCVC's, but are not considered deviations due to the limited number.

Justifications for deviations and open items identified in the CCVC's, are detailed in Impell Technical Report No. 09-0120-0123. The basis for the review of the fire protection systems against a specific code edition was determined by reviewing the systems against the code edition in effect during the time of the original system installation. Systems that were installed under modifications that took place after the original installation, would be reviewed under the code edition in effect during the period of the modification installation.

Code sections of subsequent editions that provided typical requirements of the initial code edition reviewed, were verified under the initial code edition requirements. Code sections of subsequent editions that provided significant code requirement changes from the initial code edition, were reviewed under the subsequent code edition.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

5.0 REFERENCES

Ref. No.	Document Number	Title	Revision No./Date		Elevation
		72D Walkdown Verification Checklists			
1	0120-108-007A	Fire Zone 1-1H, 29G 29A-F, 7 thru 11, 1,3,4,5, 6N,6M,6S, 13,15,16, 18,19,21 and a portion of 79 & 85.	0	12/10/87	573' 587' 587' 587'
2	0120-108-007B	Fire Zone 32, 33-33B, 34-34B, 37 thru 39, 40A&B, 41 42A-D, 43, 44N&44S, 45, 46A thru D, 47A&B	0	12/10/87	609' 609' 609' 609' 609' 609' 609' 609'
3	0120-108-007C	Fire Zone 56, 57, 58, and a portion of 44N	0	12/10/87	620'
4	0120-108-007D	Fire Zone 49 thru 54	0	12/10/87	633'
5	0120-108-007E	Fire Zone 69 thru 73	0	12/10/87	650'
		72E Walkdown Verification Checklists			
1	0120-108-008A	Fire Zone 1-1H	0	12/10/87	573'
2	0120-108-008B	Fire Zone 29G	0	12/10/87	573'
3	0120-108-008C	Fire Zone 14 & 79	0	12/10/87	587'
4	0120-108-008D	Fire Zone 3, 4, 5, 6N, 6M, 6S, 64A&B, 65A&B, 61, 62A thru C, 63A thru C	0	12/10/87	587'
5	0120-108-008E	Fire Zone 13,15,16	0	12/10/87	587'
6	0120-108-008F	Fire Zone 17C	0	12/10/87	587'
7	0120-108-008G	Fire Zone 7 thru 11	0	12/10/87	587'

Ref. No.	Document Number	Title	Revision No./Date		Elevation
8	0120-108-008H	Fire Zone 29A thru F	0	12/10/87	587'
9	0120-108-008J	Fire Zone 23 thru 27	0	12/10/87	587'
10	0120-108-008K	Fire Zone 18, 19 & 21	0	12/10/87	587'
11	0120-108-008L	Fire Zone 20 & 85	0	12/10/87	587'
12	0120-108-008M	Fire Zone 37, 43, 44N & 44S	0	12/10/87	609'
13	0120-108-008N	Fire Zone 33 thru 33B	0	12/10/87	609'
14	0120-108-008O	Fire Zone 38	0	12/10/87	609'
15	0120-108-008P	Fire Zone 40A&B, 41 42A thru D	0	12/10/87	609'
16	0120-108-008Q	Fire Zone 34 thru 34B	0	12/10/87	609'
17	0120-108-008R	Fire Zone 45, 46A thru D 47A&B	0	12/10/87	609'
18	0120-108-008S	Fire Zone 39	0	12/10/87	609'
19	0120-108-008T	Fire Zone 56 & 57	0	12/10/87	620'
20	0120-108-008U	Fire Zone 58 & 59	0	12/10/87	620'
21	0120-108-008V	Fire Zone 55	0	12/10/87	620'
22	0120-108-008H	Fire Zone 60	0	12/10/87	620'
23	0120-108-008X	Fire Zone 53 & 145	0	12/10/87	633'
24	0120-108-008Y	Fire Zone 54 & 144	0	12/10/87	633'
25	0120-108-008Z	Fire Zone 52 & 106	0	12/10/87	633'
26	0120-108-008AA	Fire Zone 48 thru 51 & 107	0	12/10/87	633'
27	0120-108-008BB	Fire Zone 32, 69, 70 & 73	0	12/10/87	650'
28	0120-108-008CC	Fire Zone 71 & 72	0	12/10/87	650'

Ref. No.	Document Number	Title	Revision No./Date
	Procedures		
1	12-OHP4030.STP.120	Fire Protection System - Water & CO_2	11 01/30/87
2	1-OHP4030.STP.121LD	Low Demand Fire Pump Oper. Test	1 12/13/85
3	1-OHP4030.STP.121HD	High Demand Fire Pump Oper. Test	1 12/13/85
4	2-OHP4030.STP.121HD	High Demand Fire Pump Oper. Test	1 12/13/85
5	2-OHP4030.STP.121DD	Diesel Fire Pump Oper. Test	0 02/17/85
6	1-OHP4030.STP.121DD	Diesel Fire Pump Oper. Test	0 02/17/85
7	12-THP4030.STP.223	Fire Protection Water System Test	6 09/04/86
8	12-OHP4030.STP.003	Standpipe Oper. Test	0 07/18/85
9	12-THP6030.IMP.144	Man. Oper. Fire Alarm Boxes	2 06/09/81
10	12-THP6030.IMP.142	Fire Det. Inst. & CO_2 Surv.	10 05/09/87
11	12-THP6030.IMP.153	Sys. 3 Fire Det. Surv. Testing	4 04/23/87
12	12-THP6030.IMP.051	Fire Det. High Volt. Prev. Maint.	2 05/18/87
13	12-THP4030.STP.224	Control Room Cable Vault Halon System Surv.	4 01/15/87
14	-	-	- -
15	12-THP6040.PER.105HR	Hose Reel Sta. CO_2 Test	0 04/25/86
16	12-THP4030.STP.225.010	Control Room Cable Vault CO_2 System Test	1 05/14/87

Ref. No.	Document Number	Title	Revision No./Date
17	12-THP4030.STP.225.020	Auxiliary Cable Vault CO_2 System Test	1 05/14/87
18	12-THP4030.STP.225.030	Reactor C.T.Q #1 CO_2 Test	1 06/04/87
19	12-THP4030.STP.225.031	Reactor C.T.Q #2 CO_2 Test	1 06/04/87
20	12-THP4030.STP.225.032	Reactor C.T.Q #3S CO_2 Test	1 06/11/87
21	12-THP4030.STP.225.033	Reactor C.T.Q #3M CO_2 Test	1 06/18/87
22	12-THP4030.STP.225.034	Reactor C.T.Q #3N CO_2 Test	1 06/18/87
23	12-THP4030.STP.225.035	Reactor C.T.Q #4 CO_2 Test	1 06/11/87
24	12-THP4030.STP.225.042	Diesel Generator Oil & Pump & Valve Room CO_2 Test	1 05/29/87
25	12-THP4030.STP.225.050	4KV Swtgr CO_2 Test	1 06/23/87
26	12-THP4030.STP.225.051	Emergency Swtgr. CO_2 Test	1 06/25/87
27	12-THP4030.STP.225.052	CRD Trans. Swtgr Room CO_2 Test	1 06/24/87
28	12-THP4030.STP.225.053	Swtgr. Cable Vault CO_2	1 08/20/87
29	1-THP4030.STP.225.040	Unit 1 AB Diesel Gen. CO_2 Test	1 06/04/87
30	1-THP4030.STP.225.041	Unit 1 CD Diesel Gen. CO_2 Test	1 05/29/87
31	1-OHP4024.102.001-050	Annunciator #2 Resp. Misc. Area Fire System	3 11/06/86
32	2-OHP4024.202.001-050	Annunciator #2 Resp. Misc. Area Fire System	1 11/06/86
33	1-OHP4024.101.001-100	Annunciator #1 Resp. Plant Fire System	2 04/27/82

Ref. No.	Document Number	Title	Revision No./Date
34	2-OHP4024.201.001-100	Annunciator #1 Resp. Plant Fire System	2 12/03/86
35	PMI-2270	Fire Protection	16 07/09/87
36	12-PMP2070.TRN.108	Maint. Skills Testing Prog.	1 04/23/87
37	OHI-2272	Use & Maint. of D.C.C. Fire Prg --Rans	0 06/13/85
38	OHI-4011	Conduct of Oper. (Shift Staffing)	3 06/25/87
39	OHI-4013	Operators: Auth. & Resp.	2 04/23/87
40	12-AHP2060.SEC.052	Fitness for Duty	0 11/06/85
41	OHI-4012	Conduct of Operator (Shift Turnover)	5 01/06/87
42	12-AHP2060.SEC.016	Employee ID	12 08/27/87
43	12-OHP2270.FIRE.011	Fire Watch Activities	2 07/31/86
44	12-PMP2070.TRN.115	Fire Brigade Training	2 05/09/87
45	OHI-2070	Training	5 04/07/86
46	PMI-2070	Training	8 07/26/85
47	12-THP6030.IMP.307	System 3 Fire Det. Surv. Testing	0 04/16/85
48	PMI-2040	Information Management	6 06/26/86
49	PMI-4030	Technical Specifications	13 12/24/87
50	12-THP4030.STP.239	RCP Pump Fire Prot. Test	5 07/09/87
51	12-OHP4022.066.001	Alternate Filter Unit Valve Operator	1 11/06/86
52	1-THP6030IMP.151	Containment Cable Tray Fire Detection	4 04/11/86
53	2-THP6030IMP.251	Containment Cable Tray Fire Detection	5 12/20/85

Ref. No.	Document Number	Title	Revision No./Date
	Technical Data		
1	-	Alison Controls Operation Maintenance Manual	- 01/15/75
2	00900020001	FCI Ltr. Ref. Cook Plant & Job #1882	- 12/06/77
3	PLC Report	D.C. Cook Unit 1 Control Room Fire Det. Test Results	- 10/13/83
4	Ref. 2-6.4, F.I. 78-2	NFPA 72E - '84 Edition Formal Interpretation	- 1984
5	-	NFPA 220 - '85 Edition Page 4 & 5 only	- 1985
6	SD-DCC-FP101	Fire Protection System Water System Description	2 Draft
7	SD-DCC-FP103	Fire Protection System-Misc. System Description	3 08/16/87 Draft
8	-	Specification for Fire Protection System @ D.C. Cook Unit 1 & Unit 2	0 04/02/71
9	DCCFP106QCF	Specification for Low Volt Ion Fire Detection System	0 03/15/87
10	Letter from P. Regenscheid to P. Hycoff	Fire Protection for Char Filter Unit @ Spray Add. Tank Room	- 01/15/87
11	Sht. 1-54	D.C. Cook "Pyralarm" Detection System Ckt. Layout Unit 1 & 2	1 04/09/85
12	-	ANI Recom. for Charcoal Filter	- 09/77

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13	Technical Data "Viking"	Emergency Release Part #01553C	- -
14	Hercoid Pg. 1-5 Data Sheet	Hercoid Pressure & Temperature Controls	- -
15	Page 1 of 1 Potter Electric	Gate Valve Switch Model #OSYS-U	- -
16	Potter Electric Bulletin 518 Page 1 & 2 of 2	Gate Valve Switch Model #OSYS-B	Pg 1 12/83 Pg 2 07/84
17	3129402021 Page 1-3	Telex with Cable Descriptions	- 12/17/87
18	January 1985	Underwriters Laboratories Fire Protection Equipment Directory	- 12/31/84
19	January 1977	Underwriters Laboratories Fire Protection Equipment Directory	- 12/31/76
20	UL864	UL Standard for Safety Control Units for Signaling System	6th 06/06/80
21	P7825	Factory Mutual Approval Guide 1986	Rev 86 01/86
22	RFC#12-2521	Fire Detection Design Packet	- 08/14/85
23	RFC#12-2741	Fire Detection Design Packet	0 02/13/87
24	RFC#12-1843	Fire Detection Design Packet	3 10/23/87
25	RFC#01-2679	Fire Detection Design Packet	0&1 01/31/86
26	RFC#02-2694	Fire Detection Design Packet	0&1 05/02/86

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27	RFC#12-2678	Fire Detection Design Packet	0&1 12/18/87
28	-	-	- -
29	NFPA 13	Installation of Sprinklers	- 1971 1983
30	NFPA 720	Proprietary Protection Signaling System	- 1967 1979
31	NFPA 72E	Automatic Fire Detection	- 1974 1978 1982 1984
32	Data Sheet 3050	Pyrotronics "System 3" CP-30	- 04/82
33	Data Sheet 3165	Pyrotronics "System 3" BH-30	- 12/76
34	Data Sheet 3173	Pyrotronics "System 3" BH-32	- 08/78
35	ROC dated 12/3/87 B. Gerwe from D. Kipley	Ambient Conditions of Plant	- 12/03/87
36	Data Sheet 3325	Pyrotronics "System 3" "EA" Enclosure	- 08/82
37	Data Sheet 6113	Pyrotronics Ion Det. DI-4A	- 04/79
38	Data Sheet S121	AFA-Minerva I.R. Det. S121	- -
39	ROC From D. Kipley (Impell) to D. Bronmier (U.L.)	U.L. Listed Pyrotronics Det. Equipment	- -
40	RFC 12-2231	RCP Pump Fire Detection Supp. Protection Modification Packet	0 03/27/87

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41	ROC dated 1/8/88 L. Taylor from D. Kipley	Pressure Switch Numbering Data	- 01/08/88
42	RFC 12-2149	P-250 Comp. Room Halon System Modification Packet	- -
43	Data Sheet 3168	Pyrotronics "System 3" HC-30	- 12/79
44	-	FCI Detection System System Data Sheet & Man.	App 01/22/75
45	Data Sheet 403-4	Pyrotronics I.R. DFS-10	- 05/73
46	ROC from Joe Black to Delpoletto/Veldhuizen	Pyrotronics FIU & CP-30	- 01/05/88
47	ROC from Joe Black to Depona/Guilfoos	Rochester AN-159	- 01/06/88
48	ROC from J. Black to to E. Taylor	Cable Information	- 01/12/88
49	ROC from J. Black to F. Keymak (M. Kimak; ACI)	ACI Power Supply	- 01/13/88
50	NFPA 70, Section 310	NEC Table 310-16	- 1987
51	Data Sheet 3351	Pyrotronics BH-30	- 03/80
52	0120-108-009	Impell Air Movement Calculation	0 02/24/88
53	Impell Letter 0120-108-019	Meeting Minutes of Jan. 28 & 29, 1988 (Item: Table 3-7.1, Section 4116)	- -
54	UL 346	UL Standard for Safety Waterflow Indicators for Protective Signaling System	2nd 08/19/82
55,	UL 38	UL Standard for Safety Manually actuated signaling Boxes	4th 07/23/82

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56	Catalog #29	Automatic Switch - Co. Pages 3, 9, 50 & 98	- 1973
57	NFPA 90A, Section 4-3	Air Conditioning and Ventilating System	- 1978
58	"Snaplock" Data Sheet	National Acme Company	
59	HVAC Data Input From B. Gerwe to D. Kipley	HVAC Data	- 02/19/88
60	Pyr-A-Larm B-335-8-74	Application Engineering Fundamentals	- 1974
61	Radiation Data From B. Gerwe to D. Kipley	Radiation Level Data	- 03/04/88
62	Fire Protection Report Output #1	D.C. Cook Power Plant, Units 1 and 2	- 12/03/86
63		HVAC Systems Duct Design Page 5.10, Section E.1	- 1981
	Licensing Documents		
1	Letter from S.A. Varga (NRC) to J. Dolan (I & MEC)	Appendix A to BTP APCSB/ 9.5-1 Deviations Pg. 1-10	- 08/27/85
2	Letter from S.A. Varga (NRG) to J. Dolan (I & MEC), Page 1-19	Appendix R to 10CFR 50 Section III G & III O Exemption	- 12/23/83
3	Letter from S.A. Varga (NRG) to J. Dolan (I & MEC), Page 1-19	Appendix R to 10CFR 40 Section III G & III L Exemption	- 11/22/83
4	AEP:NRC:00258 Pg 1-32	Amendments # 31 & 12 Facility Operator License	- 07/31/79
5	-	NRC 53 Questions on Appendix A & FHA 1st & 2nd Sub.	#1 09/30/77 #2 11/22/77
6	I & MEC D.C. Cook Units 1 & 2	Response to Appendix A to BTP/APCSB 9.5-1	0 01/31/77
7	Docket #50-315 & 316 DPR 58 & 74	Fire Hazard Analysis D.C. Cook Units 1 & 2	1 01/30/87
8	Appendix R to 10CFR 50 Part 50	Fire Protection Program for Nuclear Power Facility	- 09/01/82

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1	1-98602-51	Descriptive List of Annunciators Station #2	51	04/16/86
2	12-5266-2	Fire Facilities Plan Below Basement El. 573'	2	08/17/87
3	12-5267-3	Fire Facilities Plan Basement El. 591'-0" & 587'-0"	3	08/17/87
4	12-5268-2	Fire Facilities Plan Mezzanine Floor El. 609'	2	08/17/87
5	12-5268A-2	Fire Facilities Plan Cable Vaults El. 620'-6" & 625'-10"	2	08/17/87
6	12-5269-2	Fire Facilities Plan Main Floor El. 633'-0"	2	08/17/87
7	12-5270-2	Fire Facilities Reactor Building El. 650'-0"	2	08/17/87
8	1-5152B-2	Flow Diagram F.D. Water Unit 1: Turbine Building & Screenhouse	2	08/25/87
9	2-5152C	Flow Diagram F.D. Water Unit 2: Turbine Building & Screenhouse	0	10/06/86
10	12-5152D	Flow Diagram F.P. Water Auxiliary & Cont Buildings Units 1 & 2	0	10/06/86
11	1-98602-51	Descriptive List of Annunciators, Sheet 2	51	04/16/86
12	1-98601-51	Description List of Annunciators, Sheet 1	51	06/19/86
13	12-98992-2	Pyr-A-Larm Systems Service Building Ele. Diagram	2	05/29/79
14	1-92003-35	Emergency Fire Panel "EF" Wiring Diagram	35	02/10/87
15	1-92006-10	Emergency Fire Rear Panel "EFR", Sheet 1	10	06/26/81

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16	1-92007-29	Emergency Fire Rear Panel "EFR", Sheet 2	29 04/01/87
17	1-92161-13	F.P. System Logic Cabinet Hiring Diagram	13 07/16/81
18	1-92160-2	Emergency Fire Rear Panel "EFR", Sheet 4	2 07/18/74
19	1-98611-4	Annunciator Internal Diagrams Unit 1	4 05/14/87
20	1-98612-12	Plant Fire System Annunciator Elevation Diagram Unit 1	12 07/01/86
21	1-98951-3	Scheme of F.P. Turbine & Auxiliary Sheet 1	3 03/09/79
22	1-98952-3	Scheme of F.P. Turbine & Auxiliary Sheet 2	3 12/18/86
23	1-98966-14	F.P. Logic Diagram Unit 1	14 03/16/87
24	2-92003-24	Emergency Fire Panel "EF" Hiring Diagram Unit 2	24 09/18/86
25	2-92006-7	Emergency Fire Panel "EFR" Sheet 1, Unit 2	6 12/30/77
26	2-92007-24	Emergency Fire Rear Panel "EFR" Sheet 2	24 08/04/87
27	2-92008-11	Emergency Fire Rear Panel "EFR" Sheet 3	11 09/17/87
28	2-92160-4	Emergency Fire Rear Panel "EFR" Sheet 4	4 11/07/78
29	2-92161-15	F.P. System Logic Cabinet Unit 2	15 08/04/87
30	2-98612-16	Plant Fire System Annunciator Unit 2	16 08/14/87
31	2-98952-2	Scheme of F.P. Turbine & Auxiliary Sheet 2	2 12/18/86

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32	1-92335-14	Cont. & Auxiliary sub panel "CAS" Sheet 8	14 04/01/87
33	1-92373-1	RCP Fire System Control Cab	1 04/01/87
34	1-95901-4	F.P. Emergency Fire Pump Hiring Diagram	4 11/16/72
35	1-95902-13	Diesel Engine Fire Pump Sheet 1	13 11/26/79
36	2-95926-7	F.D. Charcoal Filter Unit 2	7 08/18/86
37	2-98977-4	F.D. Cont. Detection, Sheet 4	4 08/21/78
38	2-98979-2	F.D. Reactor Cool Pumps Sprinkler System	2 01/09/87
39	12-95914-1	Auxiliary Building Sprinkler System	1 05/01/84
40	A924-1	Alison Control Inc. Sprinkler Control System	0 05/18/72
41	A924-2	Alison Control Inc. Sprinkler Control System	0 05/17/72
42	541012	Sensor Detection	1 07/27/77
43	324022	Interconnection Diagram	A 08/14/72
44	324028	Elementary Diagram	
45	324029	Elemental Diagram	A 09/30/82
46	771026	Schematic Diagram - (4) Sheets	E 11/23/83
47	771478	Schematic & Interconn Diagram - (2) Sheets	D 06/27/79
48	324173	Int. Diagram A700-9 System - (2) Sheets	D 06/27/79
49	191006	F.P. System Solenoid Valve	C 12/27/79
50	883072	F.P. System 19" Rack - (2) Sheets	E 06/26/79
51	771477	Sch. & Interconn Diagram - (4) Sheets	D 06/27/79

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52	1-95906-10	F.P. Transformer H_2O	10 02/13/76
53	1-95909-6	F.P. Charcoal Filter H_2O Spray Systems	6 04/29/87
54	1-95910-6	F.P. Charcoal Filter H_2O Spray Systems Turbine & Auxiliary	6 01/29/87
55	1-95911-6	F.P. Charcoal Filter H_2O Spray Systems Turbine & Auxiliary	6 01/29/87
56	1-95926-9	F.P. Charcoal Filter H_2O Spray Systems Unit 1 Containment	9 09/18/86
57	1-98969-7	F.P. H_2O Systems Sheet 3 Elevation Diagram	7 06/08/87
58	1-98971-8	F.P. H_2O System Sheet 1	8 07/29/83
59	1-98972-9	F.P. H_2O Systems Sheet 2 Elevation Diagram	9 11/05/86
60	1-98977-5	F.P. Containment Detection Sheet 4	5 01/07/85
61	1-98978-8	F.P. H_2O Systems Sheet 4	8 07/01/86
62	1-98979-3	F.P. Reactor Coolant Pumps	3 04/02/87
63	2-95901-1	F.P. Emergency Fire Pump Hiring Diagram	1 06/13/77
64	2-95902-8	Diesel Engine Fire Pump	8 11/26/79
65	2-95906-10	F.P. Transformer H_2O Spray	10 10/21/86
66	2-95909-3	F.P. Charcoal Filter H_2O Spray Auxiliary & Turbine System	3 04/29/87
67	2-95910-4	F.P. Charcoal Filter H_2O Spray Auxiliary & Turbine System	4 04/29/87
68	2-95911-4	F.P. Charcoal Filter H_2O Spray Auxiliary & Turbine System	4 04/29/87

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69	2-95946-6	F.P. System Control Room Cable Vault Halon	6 02/06/86
70	DK-NY-1433	Pipe Layout Computer Room Units 1 & 2	1 03/28/79
71	DL-NY-1433-1	Logic Diagram Comp. Room Units 1 & 2	- -
72	1-95946-6	F.P. Control Room Cable Vault Halon	6 02/06/86
73	12-98996-4	Miscellaneous Halon System	4 09/03/86
74	12-98997-2	Comp. Rooms Halon System	2 09/04/86
75	12-95913-4	Comp. Rooms F.P. Wiring Diagram	4 09/04/86
76	12-95915-1	Comp. Rooms F.P. Wiring Diagram Sheet 2	1 06/08/86
77	1-95936-15	F.P. Turbine & Auxiliary Building CO_2, Sheet 1	15 04/29/86
78	1-95937-18	F.P. Turbine & Auxiliary Building CO_2, Sheet 2	18 04/29/86
79	1-95938-14	F.P. Turbine & Auxiliary Building CO_2, Sheet 3	14 04/29/86
80	1-95939-14	F.P. Turbine & Auxiliary Building CO_2, Sheet 4	14 12/05/87
81	1-95941-15	F.P. Turbine & Auxiliary Building CO_2, Sheet 6	15 04/29/86
82	1-95942-15	F.P. Turbine & Auxiliary Building CO_2, Sheet 7	15 04/29/86
83	1-95943-15	F.P. Turbine & Auxiliary Building CO_2, Sheet 8	15 04/29/86
84	1-95944-16	F.P. Turbine & Auxiliary Building CO_2, Sheet 9	16 12/01/83

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85	1-95945-14	F.P. Turbine & Auxiliary Building CO_2, Sheet 10	14 04/29/86
86	1-98981-20	F.P. CO_2 System, Sheet 1	20 06/15/87
87	1-98983-1	F.P. CO_2 System, Sheet 3	1 07/16/87
88	2-95936-10	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 1	10 04/29/86
89	2-95937-13	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 2	13 04/29/86
90	2-95938-11	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 3	11 04/29/86
91	2-95941-14	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 6	14 06/13/85
92	2-95942-6	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 7	6 04/29/86
93	2-95943-6	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 8	6 04/29/86
94	2-95944-10	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 9	10 04/29/86
95	12-95993-2	F.P. Turbine & Auxiliary CO_2 Hose Reels	2 04/29/86
96	FL-15771	Cardox Fire Extinguisher System Elm. Line, Sheet 17	B 04/21/72
97	FL-15771	Cardox Fire Extinguisher System Elm. Line, Sheet 18	B 04/31/72
98	FL-15771	Cardox Fire Extinguisher System Elect. Control Cab., Sheet 19	A 05/07/71
99	FL-15771	Cardox Fire Extinguisher System Elect. Control Cab., Sheet 20	A 05/07/71
100	FL-15771	Cardox Fire Extinguisher System Alarm System Elm. Line, Sheet 21	A 05/07/71

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101	FL-15771	Cardox Low Pressure Fire Extinguisher System	D 02/15/72
102	12-95929-5	Fire Detection System Screenhouse & ESH	5 10/15/86
103	1-95927-1	F.P. System Main Steam Line Etc.	1 10/16/86
104	1-95928-4	F.P. System Trans. Room Etc.	4 10/15/86
105	1-95981-18	Auxiliary Building Pyr-A-Larm Fire System, Sheet 1	18 03/18/87
106	1-95984-1	Auxiliary Building Pyr-A-Larm Fire System, Sheet 3	1 10/16/86
107	1-95995-3	F.P. System Auxiliary Building Fire Siren	3 09/03/74
108	1-98970-5	F.P. Miscellaneous Elementary Diagram	5 01/23/80
109	1-98990-3	F.P. Pyr-A-Larm System, Sheet 3	3 10/16/86
110	1-98991-12	F.P. Detection System Elementary Diagram	12 08/06/86
111	2-95927-1	F.P. System Main Line Etc.	1 08/11/86
112	2-95928-2	F.P. System Trans. Room Etc.	2 10/16/86
113	2-95981-12	Auxiliary Building Pyr-A-Larm Fire System	12 10/05/87
114	2-95982-1	Auxiliary Building Pyr-A-Larm Fire System, Sheet 2	1 10/16/86
115	2-98990-4	F.P. Pyr-A-Larm System	4 11/18/86
116	2-95995-3	F.P. System Auxiliary Building Fire Siren	3 09/19/75
117	PM-4302	Detection System Screenhouse - Sheet 1	3 03/04/85
118	PM-4302	Detection System Screenhouse - Sheet 2	1 04/30/85

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120	PM-4303	Detection System Main Steam Encl. Etc. - Sheet 2	2 07/25/85
121	PM-4303	Detection System Main Steam Encl. Etc. - Sheet 3	0 05/01/85
122	PM-4303	Detection System Main Steam Encl. Etc. - Sheet 4	2 07/25/85
123	PM-4303	Detection System Main Steam Encl. Etc. - Sheet 5	2 07/25/85
124	PM-4304	Detection System Main Steam Line Area - Sheet 1	5 07/25/85
125	PM-4304	Detection System Main Steam Line Area - Sheet 2	2 07/25/85
126	PM-4304	Detection System Main Steam Line Area - Sheet 3	2 07/25/85
127	PM-4304	Detection System Main Steam Line Area - Sheet 4	2 07/25/85
128	PM-4305	Detection System Auxiliary Feed Pump	5 07/25/85
129	PM-4308	Detection System Tranf. Room	5 07/25/85
130	2-95907-13	Fire Protection XFMR Sprinkler Wiring Diagram	13 10/86
131	1-95907-16	Fire Protection XFMR Sprinkler Wiring Diagram	16 04/01/87
132	1-95906-10	Fire Protection XFMR Sprinkler Wiring Diagram	10 02/86
133	1-95903-7	Diesel Engine Fire Pump Wiring Diagram	7 03/79
134	2-95903-5	Diesel Engine Fire Pump Wiring Diagram	5 03/20/79

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138	2-98971-10	Fire Protection Elementary Diagram, Unit 2, Sheet 1	10 07/08/87
139	1-95940-18	Fire Protection Turbine & Auxiliary CO_2 Wiring Diagram Unit 1, Sheet 5	18 04/24/86
140	1-95939-14	Fire Protection Turbine & Auxiliary CO_2 Wiring Diagram Unit 2, Sheet 4	14 10/14/87
141	2-95940-13	Fire Protection Turbine & Auxiliary CO_2 Wiring Diagram Unit 2, Sheet 5	13 04/24/86
142	2-98981-20	Fire Protection CO_2 Elementary Diagram Unit 2, Sheet 1	20 10/30/87
143	2-98983-1	Fire Protection CO_2 Elementary Diagram Unit 2, Sheet 3	1 06/19/81
144	1-98613-19	Miscellaneous Fire Area System & Vent. Elementary Diagram	19 10/26/87
145	12-5972-2	FHA Plan Below Basement, Units 1 & 2	2 04/03/86
146	12-5973-3	FHA Base T Plan - 587' & 591' Units 1 & 2	3 01/06/87
147	12-5974-2	FHA Mezzanine Floor - 609'	2 09/03/86
148	12-5975-2	FHA Plan 601', 609', & 620'-6" to 625'	2 09/03/86
149	12-5976-3	FHA Turbine Building Main Floor 633'	3 11/25/86

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150	12-5977-2	FHA Reactor Building - 650'	2	09/31/86
151	12-5152P-2	Flow Diagram Water Fire Protection	2	02/25/87
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153	12-5152M-1	Flow Diagram Water Fire Protection	1	07/02/87
154	12-5152L-2	Flow Diagram Water Fire Protection	2	02/25/87
155	12-5152K-1	Flow Diagram Water Fire Protection	1	02/25/87
156	12-5152J-0	Flow Diagram Water Fire Protection	0	10/06/86
157	12-5152H-0	Flow Diagram Water Fire Protection	0	10/06/86
158	12-5152G-1	Flow Diagram Water Fire Protection	1	08/06/87
159	12-5152F-1	Flow Diagram Water Fire Protection	1	01/22/87
160	12-5152E-2	Flow Diagram Water Fire Protection	2	07/07/87
161	12-5152A-1	Flow Diagram Water Fire Protection	1	01/22/87
162	12-5152-1	Flow Diagram Water Fire Protection	1	02/20/87
163	1-2010-58	Conduit & Cable Schedule, Unit 1	58	05/23/86
164	1-94211-19	600VA Auxiliary Bus Wiring Diagram	19	04/08/87
165	1-2011-49	Conduit & Cable Schedule	49	05/18/87
166	1-2012-38	Conduit & Cable Schedule	38	05/21/87
167	1-2098-51	Conduit & Cable Schedule	51	12/16/86
168	1-2111-27	Conduit & Cable Schedule	27	03/31/87
169	1-12000-3	Auxiliary One-Line Index	3	04/10/87
170	1-12001-4	Main Auxiliary One-Line Diagram Bus A & B	4	-
171	1-12002-3	Main Auxiliary One-Line Diagram Bus C & D	3	04/10/87

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172	1-12003-2	250V DC Main One-Line	2	02/26/87
173	1-12050-2	120/208V AC Control Room Inst.	2	09/14/87
174	1-12051-3	120V AC Critical Control Room	3	05/26/87
175	1-12052-6	120/208V AC Control Room Power	6	05/13/87
176	1-12060-2	DC Auxiliary One-Line 250V DC Bus	2	02/26/87
177	1-12061-1	DC Auxiliary One-Line 250V DC Bus	1	02/26/87
178	1-12062-1	DC Auxiliary One-Line 250V DC Bus	1	02/26/87
179	1-12063-3	DC Auxiliary One-Line 250V DC Bus	3	04/10/87
180	1-12065-2	DC Auxiliary One-Line 250V DC Bus	2	06/19/87
181	1-12070-2	DC Auxiliary One-Line 250V DC Bus	2	02/26/87
182	1-12071-2	DC Auxiliary One-Line 250V DC Bus	2	07/15/87
183	1-12072-3	DC Auxiliary One-Line 250V DC Bus	3	04/10/87
184	1-12073-2	DC Auxiliary One-Line 250V DC Bus	2	02/26/87
185	1-93211-17	600V Auxiliary Bus 11C	17	06/20/85
186	1-94230-9	600V Auxiliary Bus 11D	9	07/15/87
187	2-2009-43	Conduit & Cable Schedule	43	01/29/87
188	2-2010-35	Conduit & Cable Schedule	35	08/11/87
189	2-2011-32	Conduit & Cable Schedule	32	09/05/79
190	2-2098-34	Conduit & Cable Schedule	34	
191	2-2111-27	Conduit & Cable Schedule	27	10/08/87
192	2-12000-3	Auxiliary One-Line Index	3	03/26/87
193	2-12001-2	Main Auxiliary One-Line Diagram	2	09/09/87
194	2-12002-1	Main Auxiliary One-Line Diagram	1	09/09/87

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195	2-12003-0	250V DC Main One-Line Diagram	0	10/06/86
196	2-12050-2	120V AC Control Room Inst.	2	-
197	2-12052-4	120/208V AC Control Room Power	4	10/15/87
198	2-12060-0	DC Auxiliary One-Line 250V DC Bus	0	10/06/86
199	2-12061-0	DC Auxiliary One-Line 250V DC Bus	0	10/06/86
200	2-12062-1	DC Auxiliary One-Line 250V DC Bus	1	-
201	2-12063-1	DC Auxiliary One-Line 250V DC Bus	1	04/10/87
202	2-12065-1	DC Auxiliary One-Line 250V DC Bus	1	06/19/87
203	2-12070-0	DC Auxiliary One-Line 250V DC Bus	0	10/06/86
204	2-12071-0	DC Auxiliary One-Line 250V DC Bus	0	10/06/86
205	2-12072-1	DC Auxiliary One-Line 250V DC Bus	1	09/09/87
206	2-12073-1	DC Auxiliary One-Line 250V DC Bus	1	-
207	2-93211-11	600V Auxiliary Bus 21C	11	07/02/85
208	2-94211-7	600V Auxiliary Bux 21A	7	07/07/87
209	2-98991-7	Fire Detection Elementary Diagram	7	-
210	2-98613-17	Misc. Fire Area System & Vent. Elementary Diagram	17	10/30/87
211	1-95982-11	Auxiliary Building Pyralarm Wiring Diagram	11	10/15/87
212	2-98611-1	Annunciator Internal Diagram	1	10/87
213	2-98951-2	Schedule of Fire Protection Turbine & Building, Sheet 1	2	07/09/87
214	2-98970-3	F.P. Misc. Elementary Diagram	3	03/08/78
215	12-5152B-2	Flow Diagram Fire Protection Water	2	08/25/87
216	12-5152D	Flow Diagram Fire Protection Water	0	10/06/86
217	12-5152C	Flow Diagram Fire Protection Water	0	10/06/86
218	1-98963-1	CO_2 Fire Protection Elementary	1	07/16/87
219	2-98963-1	CO_2 Fire Protection Elementary	1	06/19/81

Ref. No.	Document Number	Title		Revision No./Date
220	1-98977-5	CAS ELementary Diagram	5	01/07/85
221	2-98977-4	CAS Elementary Diagram	4	08/21/78
222	1-92335-14	CAS Wiring Diagram	14	04/01/87
223	2-92335-14	CAS Wiring Diagram	14	-
224	12-5713-4	Heat & Vent. Aux. Bldg. Elev. 573'	4	05/17/84
225	12-5714-13	Heat & Vent. Aux. Bldg. Elev. 587'	13	None
226	12-5715-12	Heat & Vent. Aux. Bldg. Elev. 587'	12	05/08/87
227	12-5719A-3	Heat & Vent. Aux. Bldg. Elev. 587'	3	08/29/85
228	12-5718A-0	Heat & Vent. Aux. Bldg. Elev. 587'	0	09/16/81
229	1-5688-10	Heat & Vent. Reactor Cont. Elev. 598' & 612	10	02/01/88
230	2-5688-8	Heat & Vent. Reactor	8	02/01/88
231	1-5724-8	Heat & Vent Aux. Center, North, South & East 587' & 609' Elec. Swgr & Dsl. Gen.	8	09/27/85
232	1-5724-11	Heat & Vent Aux. Bldg. 609'	11	06/07/84
233	2-5724-9	Heat & Vent Aux. Bldg. 609'	9	11/10/82
234	1-5724B-2	Heat & Vent Aux. Bldg. 609'	2	05/11/84
235	2-5724B-2	Heat & Vent Aux. Bldg. 609'	2	05/24/84
236	12-5736-6	Heat & Vent Aux. Bldg. 609'	9	05/01/87
237	12-5736B-2	Heat & Vent Aux. Bldg. 609'	2	02/05/87
238	1-5750-9	Heat & Vent Aux. Bldg. 633'	9	05/01/87
239	2-5750-5	Heat & Vent Aux. Bldg. 633'	5	06/10/87
240	12-5737-8	Heat & Vent Aux. Bldg. 620' & 609'	8	05/13/87
241	12-5718-5	Heat & Vent Aux. Bldg. 609'	5	10/28/83
242	12-5720-7	Heat & Vent Aux. Bldg. 633' & 650'	7	10/07/80

Ref. No.	Document Number	Title	Revision No./Date	
243	1-51486-0	Flow Diagram Aux. Bldg. Elec. Equip. Area. Heat & Vent	0	None
244	1-5148C-0	Flow Diagram Aux. Bldg. Elec. Equip. Area. Heat & Vent	0	None
245	2-5148C-0	Flow Diagram Aux. Bldg. Elec. Equip. Area. Heat & Vent	0	None
246	12-5719-8	Heat & Vent. Aux. Bldg. Elev. 633'	8	08/20/85
247	12-5733-5	Heat & Vent. Aux. Bldg. Elev. 633'	5	02/05/79
248	12-5722-5	Heat & Vent. Aux. Bldg. Exhaust Sys. Plan & Sections	5	08/25/75
249	1-5149-22	HVAC Flow Diagram	22	01/25/88
250	2-5149-25	HVAC Flow Diagram	25	01/25/88
251	12-5265-2	Fire Facilities Plot Plan	2	08/17/87

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PROPRIETARY PROTECTIVE SIGNALING SYSTEMS

Review includes the following systems:	INITIAL SYSTEM INSTALLATION DATE
• Pyrotronics "Pyralarm" detection panels which include:	
a. Unit 1 "EFR" Panel	2/72
b. Unit 2 "EFR" Panel	2/72
c. Unit 1/2 "GRC" Panel	2/72
• Pyrotronics "System 3" detection panels which include:	
a. ESW Pump Cube panels;	
• Fire Zones 29A, 29B and 29E	11/07/83
• Fire Zones 29C, 29D and 29F	01/16/85
• Fire Zone 29G	08/12/83
b. Unit 1 & 2 Transformer RM/Diesel Corridor/AFW Vestible;	
• Fire Zones 17C, 79 and 85	08/12/83
• Fire Zone 14	11/07/83
• Fire Zone 20	01/16/85
c. Unit 1 & 2 Main Steam Line, Main Steam Enclosure;	
• Fire Zones 33 thru 33B	11/07/83
• Fire Zones 34 thru 34B	01/16/85
d. Unit 1 & 2 Computer Rooms, fire zones 71 (Unit 1); 72 (Unit 2)	8/83
• Alison Controls detection panels which include:	

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PROPRIETARY PROTECTIVE SIGNALING SYSTEMS
(Continued)

a. Charcoal filter units: 2/72

- 1 & 2 - HV-CIPX-1
- 1 & 2 - HV-CPR-1
- 12-HV-SATFUF
- 12-HV-AFX-1
- 1 & 2 - HV-ACRF-1
- 1 & 2 - HV-AES-1
- 1 & 2 - HV-AES-2

b. Reactor coolant pumps

- Unit 1 & 2 RCP Pump # 1-4 (panels only) 4/79

c. Unit 1 & 2 Control Room Cable Vault 10/73

d. Unit 1 & 2 Diesel Generator Detection panels (zones 13, 15, 16, 18, 19 & 21) 2/72

e. Unit 1 & 2 Halon panels, fire zones 57 (Unit 1); 58 (Unit 2) 2/72

f. Containment Alarm System Unit 1 and 2 (panels only) 6/71

- Unit 1 & 2 Chemetron CO_2 panels, fire zones 7 thru 11, 13, 15 and 16, 38, 40A thru 42C, 55 thru 57 (Unit 1); 18, 19, 21, 23 thru 27, 39, 45 thru 46C, 47A & B, 58 thru 60 (Unit 2). 2/72

- Automatic sprinkler, fire pump and hose station alarm signaling arrangement for the Auxiliary Building. 2/72

- The plant "EF" annunciator panels in Unit 1 & 2 control rooms. 2/72

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 1. GENERAL ARTICLE 100. DEFINITIONS		Title Title. Entire section for information only, entire section will be deleted.

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D.C. COOK Units 1 and 2

IMPELL CORPORATION

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0	RKW	5/14/88	ADC	5/15/88

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 2. COMMON REQUIREMENTS ARTICLE 200. GENERAL		Title Title
2010.	Scope		
2011.	The provisions of this Chapter apply to all fire-protective signaling systems covered by this standard except as otherwise indicated in other sections.		Title For Information Only.
2012.	The intent and meaning of the terms used in this standard are, unless otherwise defined herein, the same as those of the National Electrical Code.		For Information Only.
2013.	These protective signaling systems consist of electrical circuits and associated instruments and devices having their operation under the control or domination of the owner or others interested in the property to be protected; they shall include owned, leased or rented systems.		For Information Only.
2030.	APPROVAL		Title
2031.	Information at the request of the authority authority having jurisdiction, complete information regarding the system including specifications, wiring diagrams, and floor plans shall be submitted for approval prior to installation of equipment or wiring.	D	
2032.	Equipment. All devices, combinations of devices, and equipment constructed and installed in conformity with this standard shall be approved for the purposes for which they are intended.	W,D	Comply: All Pyrotronics smoke detectors, control panels (System 3). Halon system components, CO_2 system components and Ansul IIc release panel approved for application used. Does Not Comply: The Alison control panels,

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0	DKH	5/14/88	CJC	5/15/88

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0	DRW	9/14/88	ABC	9/15/88

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			majority of sprinkler alarm devices, "EF" panels and Pyralarm control panels have not been approved by a testing laboratory or independant engineer for the application in which they are used. Ref: Technical Data No. 19, 21, 1, 13 thru 16, 32 thru 34, 36 thru 39, and 43 thru 45. Drawing No. 20, 19, 30, 144, 210 and 211; Walkdown Checklist No. (72D)1.
2033.	Acceptance Tests. Upon completion of a system, a satisfactory test of the entire installation shall be made in the presence of a representative of the authority having jurisdiction.	D	Comply: The detection system for zones 53, 54, 71, and 72 were witnessed by AEP during testing being performed. Does Not Comply: The Pyralarm high voltage and Pyrotronics "System 3" detector test reports indicated that the authority having jurisdiction was not present at the time of the tests. Ref: Technical Data No. 2, 25, 26, 27, 3 & 42. Open Item: Data was not available for review of the following systems: a. Alison control detector systems. b. Chemetron CO_2 control systems. c. "EF" annunciator panels.
2034.	Maintenance Agreement. Where required by the authority having jurisdiction, a satisfactory agreement on the maintenance, operation, and efficiency of the system shall be provided. All systems shall be under the supervision of qualified persons satisfactory to the authority having jurisdiction. These persons shall cause proper tests and inspections to be made at prescribed intervals and shall have general charge of all alterations and additions to the systems under their supervision. For sprinkler waterflow alarm tests, an actual water flow, through the use of a test connection, shall be the method	D	Comply: The surveliances are performed per the frequency or the technical specifications by trained personnel. All alterations or modifications within the plant will require the review of the plant fire protection coordinator to verify the impact on fire protection systems. Does Not Comply: The procedures do not confirm that alarm signals are received by the control room during waterflow testing of the hose station or preaction and deluge suppression systems. The springler system valve tampers, low air pressure and fire pump supervisory devices are not verified for receipt of alarm signals in the control room. Ref: Procedures No. 46, 36, 35, 13, 9, 10, 11, 12, 16, thru 30, 15, 1 thru 8, 50, 52 and 53.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	employed for testing the reliability of the sprinkler alarm unit as a whole. For a wet pipe system, the test connection at the extremity of the system shall be used.		
2040.	INSTALLATION AND DESIGN		Title
2041.	General. All systems shall be installed in a workmanlike manner and in accordance with specifications and standards approved by the authority having jurisdiction.	D	Comply: All systems were provided as required by the approved specifications. Ref: Technical Data No. 8 and 9.
2042.	Jarring. Devices shall be so located and mounted that accidental operation will not be caused by vibration or jarring.	W,D	Comply: All equipment was properly installed as required with the exception of the devices noted below. Several detection devices and manual stations were mounted such that they are exposed to potential accidental operation. The valve tamper switch for Valve No. 12-FP-371 on elevation 609' (Zone 96) is improperly mounted and has damaged the switch causing potential non-operation. Ref: Walkdown Checklists No. (72D) 2 & 3; (72E) No. 4, 13 thru 18, 22, 25 & 26.
2043.	Grounding. All systems shall test free of grounds, except parts of circuits or equipment which are intentionally and permanently grounded to provide ground fault detection, emergency ground signalling, or circuit protective grounding. All systems shall be so designed that they do not depend upon the effectiveness of any ground connection for normal operation.	W,D	Comply: The detection systems were tested prior to turnover to AEPSC and the walkdown verified that the systems were operating in a "System Normal" status, except for CO_2 panel 1-PTR-CO_2-RBX for U14KV area. The "CO_2 Normal" lamp was not operating. No other lamps were operating also. Ref: Technical Data No. 2, 3, 25, 26, 27 & 42; Walkdown Checklist No. (72D), 2. Open Item: No data was available for pre-operational testing of the "EF" panels, ACI control panels and CO_2 system controls.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2044.	Pre-Signal Feature. It is recommended that systems in hotels, department stores, hospitals, and similar institutions having sounding devices within the protected premises, be so designed that initial fire signals will sound only in department offices, engine rooms, fire brigade stations and other central locations, with provisions whereby authorized persons may subsequently sound a general alarm.	D	Comply: Pre-signaling feature is provided to alert the control room staff so as to direct emergency operations. Ref: Procedure No. 31 thru 34; Drawing No.: 21, 22, 31, 19, 212, 213, 220 thru 223.
2045.	Use Restrictions. Fire alarm systems shall be used for no other than fire-protective signalling purposes, except that local control functions, necessary to make the premises safer in the event of fire, or to make it possible to hear fire alarm signals, may be automatically performed. The performance of automatic control functions shall not interfere with power for lighting or for operating elevators. This does not preclude the combination of fire protective signalling systems, with other systems provided for protection of life and property.	W,D	Comply: The "EF" panels and all auxilary alarm system control panels are used for no other purpose than fire alarm signaling. Ref: Drawing No. 21, 22, 31 & 213.
2046.	Voltage Variation. A system shall be so designed and installed that it shall be capable of performing its intended function at 85 percent and at 110 percent of the rated voltage.	D	Comply: The detection systems will operate as required by this code section. Ref: Technical Data No. 18, 19, 20 & 1. Open Item: Data available did not confirm if the "EF" panels, ACI panels or CO_2 panels would operate under these conditions.
2047.	Rewinding or Resetting. All apparatus requiring rewinding or resetting to maintain normal operation shall be restored to normal as promptly as possible after each test or alarm, and kept in normal condition for operation.	D	Comply: All CO_2 system, Halon fire suppression and and fire detection signals are verified for reset upon completion of testing. Does Not Comply: The sprinkler hose station, fire suppression and fire pump signals are not verified for reset of alarms during testing of the

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0	DKK	5/14/84	[illegible]	5/15/84

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc.; as required)
			systems. Ref: Procedure Data No. 31 thru 34, 13, 15, 16 thru 30, 10 thru 12, 47, 1 thru 8, 50, 52 and 53.
2048.	Coded Alarm Signal. A coded alarm signal shall consist of not less than three complete rounds of the number transmitted.	W	Not Applicable. Coded signals are not provided at this plant.
	ARTICLE 210. WIRING.		Title
2110.	General		Title
2111.	The provisions of this Article apply to installation wiring for interconnecting system components.		For Information Only.
2112.	Fire-protective signaling circuits, at multiple circuit terminal and junction locations where circuits for other purposes are present, shall be marked for identification or so protected as to avoid interruption of service due to short-circuiting or other conditions of testing and servicing which might affect adversely the connected fire-protective signaling equipment.	W	Not Applicable. The plant fire alarm system is routed through it's own conduit. Ref: Walkdown Checklist No. (72D), 1 thru 5.
2120.	Exposure		Title
2121.	Insulation. The insulation materials of conductors and cables shall be suitable for the normal conditions to which they are exposed in service.	D	Comply: The cable insulating materials provided are adequate for existing conditions. Ref: Drawing No. 163, 165 thru 167; Technical Data No. 17 & 35.
2122:	Wiring cables, and terminal and junction facilities, unless adequately protected, shall be located where they are not exposed	W	Comply: All cables were properly protected within our area of review with the exception of the items listed below.

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	to hazardous or corrosive atmospheres, stored combustible materials, or to other potential hazards which might cause disruption of service.		Does Not Comply: Flexible type conduit for sprinkler alarm devices at risers on elevations 587' (zone 79, 80, 84 & 85), 609' (zones 31, 96), 633' (zone 49), and 650' (zone 69), are not water tight. Also open junction boxes for smoke detectors on elevation 624' in Unit 1 control room cable vault (zone 57). Open junction boxes were noted at elevation 650' computer room halon panel and a damaged flex conduit for the U2 computer room (zone 72) solenoid circuit exposing the circuit wiring. Ref: Walkdown Checklists No. (72D), 1, 2, 4 & 5; (72E), 13, 19 & 28.
	Outside Wiring.		Title
2130.	Circuits.		Title: Only the safety related areas inside the plant are being addressed for this scope of work. The entire section will be deleted.
	Inside Wiring.		Title
2140.	General.		
2141.	All inside wiring shall be in conformity with the requirements of the National Electrical Code (Article 725) for Class 1 Signal Systems except as otherwise permitted in this Article, or other Articles, of this Standard. Flexible cords of the types described in Article 400 of the National Electrical Codes shall not be used.	D	Not Applicable: The requirements of this code section have not been committed to in licensing documents by this plant and are outside the scope of this review. Ref: Licensing Document No. 1.
2150.	Special Cables.		Title
2151.	Special cable approved for the purpose may be used as detailed in Paragraphs 2152, 2153, 2154, 2155, 2156.	D	Reference the applicable sections results.

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2	RKH	3/14/88	DC	3/15/88

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2152.	Low Voltage Applications. Cable for operation at 150 volts or less shall be constructed as follows: a. Conductors shall be of solid copper, not less than No. 14 AWG for single- and two-conductor cables, not less than No. 18 AWG for three- and four-conductor cables, and not less than No. 22 AWG for cables having more than four conductors. b. The individual conductors shall have approved insulation having a nominal thickness of not less than 1/32 inch. c. The cable conductors shall have a solid metallic sheath or a moisture-resistant and flame-retardant jacket providing equivalent protection against mechanical injury to that obtained with nonmetallic sheathed cable described in the National Electrical Code.	D	Not Applicable: All alarm system cables are limited energy applications. Ref: Code Section 2154.
2153.	The special cables may be installed exposed on a ceiling and on a side wall if not less than 7 feet from the floor and if adequately protected against injury. Concealed cable and cable passed through a floor or located on a side wall within 7 feet of the floor shall be installed in conduit or other approved raceway, unless solid metallic sheath is provided. Cable shall be adequately supported and terminated in approved fittings.	W	Comply: All cables are installed in conduit or cable trays with the exception of line type heat detectors. This exposed detector is installed at the ceiling of protected areas or inside charcoal filter units. Ref: Walkdown Checklist No. (72E), 5, 10 & 27.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2154.	Limited Energy Applications. Approved cable meeting the requirements of Paragraphs 2155 and 2156 may be used in circuits having energy limiting characteristics as follows: a. Circuit voltages not to exceed those shown in Column 1 of Table 1. b. Maximum fault currents designed into the circuit not to exceed those shown in Column 2 of Table 1. c. Noninterchangeable overcurrent protection not to exceed that shown in Column 3 of Table 1. d. Energy limitations not to exceed those shown in Column 4 of Table 1.	D	Title Comply: The cables meet the voltage criteria referenced in Table 1 of this Code Section. Ref: Drawing No. 19, 46, 48, 86, 142, 218, 219 & 212, 69 & 72; Procedure No. 10; Technical Data No. 44 & 32 & 1. Open Item: The maximum fault, overcurrent protection, energy limitations and the approval of the cable for the application, could not be verified for compliance due to the lack of data.
2155.	Conductors of cable for use with limited energy circuits shall be: a. Solid copper, bunched-tinned (bonded) stranded copper, or copper alloys of equivalent tensile strength b. Not smaller than 1. 16 gauge single conductor copper 2. 19 gauge multi-conductor copper c. Covered by approved insulation having a 0.012 inch nominal 0.010 inch minimum thickness for both the outside jacket and the conductors. A single conductor cable shall have a jacket not less than 0.035 inch nominal 0.030 inch minimum thickness.	D	Comply: A random sampling of the different types of alarm signaling and initiating device circuit conductors has verified that the cables meet or exceed the requirements of this Code Section. Ref: Drawing No. 163, 165 thru 167 and 187 thru 191; Technical Data No. 17.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	Two or more conductors may be in flat parallel construction with 0.023 inch nominal integral insulation jacket, minimum 0.020 inch and with 0.031 inch minimum web. d. The insulation compound shall have a temperature rating not less than 105°C and the jacket compound shall have a high degree of abrasion resistance.		
2156.	Limited energy cable described in Paragraphs 2154 and 2155 may be installed as follows: a. Exposed on surface of ceiling and walls or "fished" in concealed spaces. Cable shall be adequately supported and terminated in approved fittings and installed in such a way that maximum protection against mechanical injury is afforded by building construction such as baseboards, door frames, ledges, etc. When located within 7 feet of the floor cable shall be securely fastened in an approved manner, such as insulated stapling at intervals of not more than 18 inches. b. As protection against mechanical injury, cable shall be installed in metal raceway when passing through a floor or wall to a height of 7 feet above the floor unless adequate protection can be afforded by building construction such as detailed in Paragraph 2156 or unless solid metallic sheath is provided.	D	Not Applicable. The fire alarm system cables are installed in conduit with the exception of line type thermal detectors. Reference Code Section 2153 & 2161 this edition.

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D	DKL	5/14/88	MDC	5/15/88

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2160.	Line Thermostats.		Title
2161.	Line type thermostats, including insulated copper tubing of pneumatically operated detectors employed for both detection and current-carrying purposes, shall be installed in conformity with Paragraph 2153 and shall provide adequate insulation for the voltage applied to the thermostat. (See Paragraph 2155.)	D	Comply: Reference Code Section 2153 insulation is adequate for maximum voltage of 2 to 24 VDC applied. Ref: Procedure No. 10; Drawing No. 46 & 51; Technical Data No. 1.
	ARTICLE 220. POWER SUPPLY SOURCES		Title
2210.	General.		Title
2211.	The provisions of this Article apply to sources of power supply which shall be used, for the type of system involved subject to acceptance by the authority having jurisdiction.	D	Comply: The NRC has considered the power supply for the alarm system acceptable. Ref: Licensing Document No. 5, Question No. 16C.
2212.	Equipment. The equipment shall be approved for the particular application.	W,D	Comply: Reference Code Section 2032 72D, 1967 Edition Compliance Statement. Does Not Comply: The ACI panels, sprinkler alarm,sprinkler solenoid devices and "EF", EFR & GRC panels are not approved or listed for the application in which they are used. Ref: Technical Data No. 1, 13 thru 16, 19, 21, 32 thru 34, 36 thru 39 & 43 thru 45; Walkdown Checklist No. (72D) 1 thru 5.
2213.	Installation. All power supply equipment (batteries, battery chargers, rectifiers, switching facilities, transformers, etc.) and wiring shall be installed in conformity with the	D	Not Applicable: The requirements of this code section have not been committed to into licensing documents by this plant and are outside the scope of this review. Ref: Licensing Document No. 1

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	requirements of the National Electrical Code for such equipment, except as otherwise indicated in this Article.		
2220.	Light and Power Services.		Title
2221.	General. A reliable electric light or power service may be used as a source of supply for fire-protective signaling systems under the following conditions: a. Two-Wire Supplies. A two-wire supply circuit may be used for either the main operating power supply or the trouble signal power supply of the signaling system. b. Three-Wire Supplies. A three-wire a-c and d-c supply circuit having a continous unfused neutral conductor, or a polyphase a-c supply circuit having a continuous unfused neutral conductor where interruption of one phase does not prevent operation by the other phase may be used with one side or phase for the trouble signal power supply of the signaling system.	D	Comply: The Pyralarm (GRC & EFR) control panels are provided with three-wire supplies. The "EF" panels are provided with (2) two wire supplies, (1) for the main circuitry (1) for the trouble circuitry. Does Not Comply: Two-wire supplies are provided for the main operating power only for the following systems: • ACI control panels A909, A92A, A700-9, 6007 & 7035. • Chemetron CO_2 panels. Ref: Drawing No. 13, 19, 74, 86, 109, 110, 115, 209, 212, 44, 45, 47, 142, 220 & 221.
2222.	Point of Connection. The conductors of the signaling system power supply circuit shall be connected on the line side of the main service of a commercial light or power plant located on the premises. A circuit disconnecting means shall be so installed that it will be accessible only by authorized personnel.	W,D	Comply: The primary power supplies for the alarm system is properly connected to the line side of the off-site power via 345KV, (Unit 1 source), 765KV (Unit 2 source), 69KV emergency power (Unit 1 & 2) are stepped down to 26KV or 34.5 KV, 4.16KV and eventually to 600 VAC buses. Unit 1 & 2 turbine generators are also connected to the respective 26KV buses for each unit to produce on-site power. All

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			power circuits are provided with circuit breakers which are normally not accessible to unauthorized personnel. Ref: Drawing No. 169 thru 184, 195 thru 206, 5 & 6; Walkdown Checklist No (72D), 1 thru 5.
2223.	An overcurrent protective device of suitable current-carrying capacity and capable of interrupting the maximum short-circuit current to which it may be subjected shall be provided in each ungrounded conductor. The overcurrent protective device shall be enclosed in a locked or sealed cabinet located immediately adjacent to the point of connection to the light and power conductors.	W,D	Comply: All fire detection and "EF" panels were properly protected with the exception of the circuit discussed below. Does Not Comply: A review of the power cable size for the ACI A924 panels has indicated that the conductors installed are undersized for the 35A overcurrent device provided in 1 & 2-DAB panel circuit No. 5. The power panels are not sealed or locked, however all areas where the panels are located require security clearance in order to gain access to the area. Ref: Drawing No. 69, 13, 74, 38, 62, 57, 109, 110, 72, 115, 209, 212, 19, 169 thru 184, & 192 thru 206; 220 & 221 Procedure No. 42; Technical Data No. 48 & 50.
2230.	Motor-Generator.		Title
2231.	General. A motor-generator set shall be used only where an operator is on duty at all times. Power for operating the motor-generator shall be available from not less than two independent sources of energy. One source may be a special generator plant driven from some form of prime mover continously available.	D	Comply: Two 3500KW, 4KV (AB, CD, U1 & U2) diesel driven generators are provided for each unit for standby power (4KV buses, T11A through T11D, Unit 1 and T21A through T21D, Unit 2) upon loss of offsite power. Two independent power sources for operating the generators are provided via 250VDC bus (TDAB, TDCD; U1 & U2) or 120VAC alternate source. Operators are continuously on duty. Ref: Procedure No. 38 & 39; Drawing No. 170, 171, 193 & 194.

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2240.	Storage Batteries.		Title
2241.	Location. Storage batteries shall be so located or enclosed that the equipment of the signalling system, including overcurrent protective devices, will not be affected adversely by battery gases.	D	Not Applicable: Batteries are provided for Pyrotronics *System 3 and ACI A700-9 panels only and has been addressed under NFPA 72D, 1979 Edition, Section 2-6.6.
2242.	Charging Source. A reliable source of power supply of not more than 250 volts shall be provided for charging the batteries. Where the record of continuity of the supply source makes it desirable, two separate, independent sources of supply shall be provided.	D	Not Applicable: Reference Code Section 2241, this edition.
2243.	Overcurrent Protection. The battery shall be protected by overcurrent devices having a rating not to exceed 150 percent and not more than 200 percent of the maximum normal operating load applied to the battery.	D	Not Applicable: See Code Section 2242, this edition.
2244.	The method of charging a battery shall provide either integral meters of readily accessible terminal facilities for the connection of portable meters by which the battery voltage and charging current can be determined.	D	Not Applicable: See Code Section 2242, this edition.
2245.	Cycle-Charged Batteries. a) Duplicate Sets. Duplicate sets of batteries shall be employed for cycle charging. b) Capacity. The capacity of the battery in hours shall not be less than two times the recharging time, but in no case less than 24 hours.	D	Not Applicable: See Code Section 2242, this edition.

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	c) Charging. Provision shall be made for transferring each set of batteries to either load or charging circuits in a practical manner without affecting the system performance adversely.		
2246.	Trickle-Charged Batteries.		Title
	Charging Source. A reliable source of power supply of not more than 250 volts shall be provided for charging the batteries. Where the record of continuity of the supply source makes it desirable, two separate, independent sources of supply shall be provided.	D	Not Applicable: Reference results comments of Code Section 2241, this edition.
	a. Venting. Provision shall be made to prevent spraying of the electrolyte of the battery while the battery is being charged at the maximum rate permitted by its charging means.		
	b. Capacity. The battery shall be operating the system for not less than 24 hours with the maximum normal load and with the power supply to the charger disconnected.		
	c. Charging. Adequate facilities shall be provided to maintain the battery fully charged under all conditions of normal operation.		
	d. Rectifiers. A rectifier shall be energized by an insulating transformer having a supply circuit of not more than 250 volts.		

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2250.	Rectifiers, Direct-Connected.		Title
2251.	A rectifier power supply, employed as a direct source of supply for a signalling system, shall be approved for the purpose and of adequate capacity to maintain voltage regulation between 130 percent of rated voltage at no load and 100 percent of rated voltage at maximum rated load.	D	Comply: The power supplies are provided as required. Ref: Technical Data No. 46, 47, 49, 19, 21, 39; Drawing No. 74, 38, 62, 13, 110, 209, 109, 115 & 47, 19, 212, 220 & 221. Open Item: ACI would not release data to confirm compliance for panel A909, A924, 6007 and A700-9.
2260.	Primary Batteries.		Title
2261.	Use. A primary battery (including dry cells) shall not be used as the main operating supply of a signalling system. It may be used: a. As a source of supply for operating trouble signal devices. b. As an emergency auxiliary source of supply for operating a signaling system temporarily in the event of interruption of the main operating supply. Note: The use of a common battery for both conditions (a) and (b) above is acceptable. c. As a source of bias potential where depreciation of the battery results in a trouble signal when the circuit becomes inoperative.	D	Not Applicable: This section refers to dry type cell batteries which are not provided. The standby batteries provided for Pyrotronic "System 3" and ACI A700-9 panels are of the gel-cell type. Ref: Drawing No. 47, 74, 109, & 115; Technical Data No. 51.
2262.	Location. Primary batteries shall be located in a clean, dry place, accessible for servicing and where the ambient air temperature will not be less than 40°F and not more than 100°F.	D	Not Applicable: Reference code Section 2261, this edition.

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2263.	Enclosure. Primary batteries shall be housed in a locked, substantial enclosure or otherwise suitably protected against movement, injury, and moisture. Reliable separation between cells shall be provided to prevent contact between terminals of adjacent cells and between battery terminals and other metal parts which may result in depletion of the battery or other deterioration.	D	Not Applicable: See Code Section 2261, this edition.
2264.	Insulating Containers. Battery cells having containers constructed of other than suitable electrical insulating material shall be located on insulating supports.	D	Not Applicable: See Code Section 2261, this edition.
2265.	Connectors. Battery cells shall be interconnected by suitable connectors.	D	Not Applicable: See Code Section 2261, this edition.
2266.	Inspection and Test. Each primary battery shall be inspected and tested to determine its terminal voltage while supplying the maximum load permitted by its application at least once each month. The battery shall be replaced when this voltage indicates its minimum rated discharge voltage.	D	Not Applicable: See Code Section 2261, this edition.
2267.	Maximum Load. The maximum normal load of a primary battery shall not be more than two amperes per cell.	D	Not Applicable: See Code Section 2261, this edition.
2268.	Capacity. A primary battery shall have sufficient capacity to supply 125 percent of the maximum normal load for not less than one year.	D	Not Applicable: See Code Section 2261, this edition.

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2269.	Replacement of No. 6 Dry Batteries. No. 6 batteries shall be replaced under the following conditions: a) An individual dry battery cell rated 1-1/2 volts shall be replaced when its short-circuit current is less than 10 amperes or when a load of one ohm reduces the potential below one volt. b) A unit assembly of dry battery cells rated 6 volts shall be replaced when a load of four ohms reduces the potential of the unit below four volts.	D	Not Applicable: See Code Section 2261, this edition.
	ARTICLE 230. OVERCURRENT PROTECTION.		Title
2310.	General - Batteries.		Title
2311.	See Paragraphs 2223 and 2243.		For Information Only.
2320.	Conductors.		Title
2321.	Conductors shall be protected in accordance with their rated current-carrying capacities, as given the National Electrical Code.	D	NFPA 70 has not been committed to in licensing documents by this plant and is outside the scope of this review. Ref: Licensing Document No. 1.
2331.	A system control unit shall be protected on the supply side by overcurrent devices having a rating not greater than 150 percent of the rating of the control unit.	W,D	Comply: All Pyrotronics System 3 and Rochester AN-159 power supplies meet these requirements. Does Not Comply: The over current device for "EFR" and "GRC" panels are 5 amp devices. The full load demand is 475 ma. The over current are rated greater than 150% of the power supply. Reference data from code section 2251. Open Item: Data was not released from ACI for our review.
2340.	Transformers.		

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2341.	A transformer shall be protected on either the primary or secondary side by overcurrent devices having a rating not greater than the continuous duty rating of the transformer unless the current is limited to the same value by other approved means.	D	Open Item: Data could not be retrieved from Pyrotronics, Alison Control and Rochester to confirm compliance. Reference data from code section 2251, this edition.
	ARTICLE 240. ELECTRICAL SUPERVISION.		Title
2410.	General.		Title
2411.	Except as otherwise permitted in this standard, a system shall be electrically supervised so that the occurrence of a break or a ground fault condition of its installation-wiring circuits which prevents the required operation of the system, or failure of the main power supply source, will be indicated by a distinctive trouble signal.	D	Comply: All Alison & Pyrotronics fire detection initiating circuits are electrically supervised. All detection and CO_2 system control panel powers failure signals are monitored by the "EF" Panels. The alarm initiating circuits between the "EFR" and "EF" annunciator panel are not electrically supervised. However, NFPA 72D, Section 2-7.1, 1986 edition indicates that electrical supervision of interpanel circuits are not required if located inside substantial metal enclosures. Does Not Comply: The initiating circuits for the "EF" panels do not provide electrical supervision of the alarm initiating devices connected to them. All hose and CO_2 system manual stations are not connected to electrically supervised circuits. Ref: Drawing No.: 13, 36, 59, 72, 69, 74, 19, 212, 20, 30, 144 & 210, 220 & 221; Technical Data No. 1.
2420.	Electrical Supervision. The electrical supervision shall include:		For information only.
2421.	Power supply circuit supervision. All sources of energy, except the following secondary sources: a) One employed for the operation of trouble signal circuits and appliances. b) One employed as an auxiliary means for	D	Comply: All primary power supplied for the ACI pyrotronics and "EF" panels and the secondary standby batteries for Pyro "System 3" and ACI A700-9 panels are monitored for their integrity and annunciate a trouble condition at the "EF" panels. Ref: See code Section 2411 72D, 1967 Edition.

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	maintaining the normal operation of the system following trouble signal indication when the main supply source is interrupted. c) One employed as a means for operating a supplementary circuit for alarm bells, annunciators, time stamps, and similar circuits, the failure of which will not prevent the operation of the system for the required signals. d) The battery leads of a trickle-charged battery. e) The neutral of a three-, four-, or five-wire AC or DC supply source.		
2422.	Signal Initiating Circuits. All circuits for signals initiated by the operation of fire alarm boxes, fire detectors, automatically operated transmitters, or other appliances or devices which initiate or transmit signals either manually or automatically, except: a) A noninterfering shunt circuit, provided that a fault condition of the shunt circuit wiring results only in the loss of the noninterfering feature of operation. b) The circuits of a supplementary signal annunciator, provided that the fault condition of this circuit wiring results only in the loss of annunciation. c) The circuits within initiating devices where wiring terminals of such devices are connected in multiple across electrically supervised circuits.	D	Comply: Reference Code Section 2411 72D, 1967 edition. Does Not Comply: Reference Code Section 2411 72D, 1967 Edition.

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2423.	Supplementary Control Circuit. A supplementary circuit for operating fan motor stops or similar industrial control equipment intended to be actuated at the time of an alarm signal, need not be electrically supervised, provided a fault condition of the circuit in no way affects the normal operation of the signaling system.	D	Comply: These type of circuits are not electrically supervised and will not impact the normal operation of the systems should they fail, due to the isolation of these circuits by normally open contacts of auxiliary relays. Reference ... the results of Code Sections 2411 & 2422 72D, 1967 edition.
2424.	Alarm Signal Sounding Circuits. All circuits for operating alarm sounding devices and appliances except: a) A circuit employed to produce a supplementary local alarm signal to indicate the operation of an automatically operated alarm transmitter or a manual fire alarm box, provided that an open or ground fault of the signal circuit conductor results only in the loss of of the supplementary signal. b) The circuit of an alarm bell installed in the same room with the central supervising station, provided the bell circuit conductors are installed in conduit or equivalently protected against mechanical injury and tampering. c) The circuit of an alarm bell installed in the same room with a system control unit, provided the bell circuit conductors are installed in conduit or equivalently protected against mechanical injury and tampering. d) A trouble signal circuit.	D	Comply: Alarm signaling is performed by the plant fire siren system which is not an integral part of the proprietary alarm system. All other local alarm signaling circuits are supplementary circuits and are not required to be connected to electrically supervised circuits. Ref: Drawing No. 74, 109, 115, 108, 214, 87 & 143.

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2425.	In a Supervising Station. Where personnel responsible for the supervision and operation of the system are on duty continuously, the following features or facilities located in the supervising station need not be electrically supervised. a. The station circuits for alarm bells and registers which are controlled by devices which have their operating circuits electrically supervised. b. Main power supply failure if the condition is otherwise indicated so as to be obvious to the operator on duty.	D	Comply: The "EF" panels audible circuits are provided in accordance with code sections 2424.b, 72D, 1967 Edition, and the "EF" panel power supply are monitored as discussed in code section 2411. Also operators are on duty continuously. Ref: Drawing No. 19 & 212; Procedure No. 38, 39 & 41.
2430.	Trouble Signals.		Title
2431.	Distinctive Trouble Signals. Trouble signals shall be distinctive from both alarm and supervisory signals and shall be indicated by the continuous operation ation of a sounding appliance or where there is supervisory attendance at all times, a suitable coded signal. An audible trouble signal may be common to several supervised circuits.	D	Does Not Comply: The "EF" panel audibles are common to fire alarm, supervisory, trouble and other plant alarm signals. Ref: Drawing No. 74, 19, 212, 13, 46, 109, 110, 115, 47, 209, 136 & 59; Technical Data No. 1.
2432.	Silencing Switch. A switch for silencing the trouble signal sounding appliance shall be permitted only if it transfers the trouble indication to a lamp or other acceptable visible indicator adjacent to the switch. The visual indication shall remain operated until the silencing switch is restored to its normal position unless the audible trouble signal will be obtained when a fault occurs without	D	Does Not Comply: ACI panel A700-9 does not provide an indicating lamp for identifying a silenced condition. Ref: Drawing No. 19, 13, 46, 47, 59, 74, 109, 110, 115, 136, 209, 212 & 50; Technical Data No. 1.

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	restoring the switch to normal, or unless the audible trouble signal is again energized upon correction of the fault.		
2433.	Location of Trouble Signal. Trouble sounding appliances shall be located as required by the authority having jurisdiction.	D	Comply: Devices located per requirements of A/E (AEPSC). Ref: Technical Data No. 8, 25, 26, 27, 40 & 42.
	ARTICLE 250. AUDIBLE SIGNALING APPLIANCES.		Title
2510.	Evacuation Systems.		Title
2511.	Fire alarm systems provided for evacuation of occupants of factories, workshops, institutions and similar premises shall have one or more audible signalling appliances, approved for the purpose, on each floor of the building, so located that their operation will be heard clearly regardless of the maximum noise level obtained from machinery or other equipment under normal conditions of occupancy. Each section of a floor divided by a fire wall may be considered as a separate floor for the purpose of this protection.	D	Not Applicable: The proprietary alarm system does not provide evacuation signaling for the occupants. The plant fire siren system and plant public address are activated manually at the "EF" panels. Ref: Procedure No. 31 thru 34.
2520.	Distinctive Signals		Title
2521.	Audible signal appliances of a fire alarm system shall produce signals which are distinctive from other similar appliances used for other purposes in the same area. Different types of fire-protective audible signaling appliances in the same area are not recommended.	W,D	Comply: Local audible signalling for CO_2 and halon protected areas and zones 29A-G, 14, 17C, 20, 79, 85, 33-33B & 34-34B which are provided with area detection, are distinctive and consistant in type except zone 71 & 72 (halon system). Two different types are provided in zone 71 & 72 for staged signalling prior to discharge. Ref: Drawing No. 74, 109, 115, 87 & 143; Walkdown Checklist No. (72D) 1 thru 5.

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	ARTICLE 260. SIGNAL CAPACITY OF CIRCUITS		Title
2610.	General		Title
2611.	The number of signal transmitting devices connected to any signalling line circuit shall be limited to avoid interference. The total number of code wheels connected to a single circuit shall not exceed two hundred fifty.	W	Not Applicable: A coded signaling system is not provided at this plant. Ref: Walkdown Checklists (72D) 1 thru 5.
2612.	The number of waterflow switches which may be connected to actuate a single transmitter shall not exceed five, and the number of supervisory switches which may be connected to actuate a single transmitter shall not exceed twenty.	D	Not Applicable: All sprinkler supervisory alarm devices are directly connected to "EF" panels independant of waterflow circuits. Ref: Drawing No. 20, 30, 144 & 210.
2630.	Combined Alarm and Supervisory Signal Circuits.		Title
2631.	When both sprinkler supervisory signals and fire or waterflow alarm signals are transmitted over the same signaling line circuit, provision shall be made to either obtain alarm signal precedence or sufficient repetition of the alarm signal to prevent the loss of any alarm signal transmittal devices. The trouble signal of a combined alarm and supervisory signal circuit shall not be used for the supervisory signal feature, except as indicated in Paragraph 3422.	W,D	Comply: All fire detection, CO_2 system, sprinkler systems transmit distinictive alarm, trouble or supervisory signals as required with the exception of the systems listed below. Does Not Comply: The "EF" panels cannot differenciate between local panel fire alarm or trouble conditions from the "EFR", ACI A924 and A700-9 panels. Alarm signals do not take precedence. This condition also exists beween the "EFR" panel and the pyrotronics "System 3" panels monitored by the "EFR". Ref: Drawing No. 20, 30, 144, 210, 209, & 110; Technical Data No. 1.
2640.	Loading Capacity of Alarm Circuits.		Title

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2641.	One signaling line circuit shall serve not more than twenty-five plants.	D	Not Applicable: This system serves only this plant. Ref: Licensing Document No. 7.
2650.	Loading Capacity of Sprinkler Supvisory Signal Circuits.		Title
2651.	One signaling line circuit may serve not more than 25 plants.	D	Not Applicable: This system serves only this plant. Ref: Licensing Document No. 7.
2660.	Loading Capacity of Watch Supervisory Signal Circuits.		Title. Not Applicable: Guard supervision is not provided by this system.

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	CHAPTER 3. TYPES OF SIGNALING SERVICES.		Title
	ARTICLE 300. SCOPE.		Title
3010.	The provisions of this Chapter apply to signaling services which may be provided individually or in combination by different types of systems except as otherwise indicated for each type of system.		For Information Only.
	ARTICLE 310. MANUAL FIRE ALARM SERVICE.		Title
3110.	Fire Alarm Boxes.		Title
3111.	General. Manual fire alarm boxes shall be approved for the particular application and shall be used only for fire protective signaling purposes. Combined fire alarm and watchmen's signalling boxes are acceptable.	D	Comply: All Halon, CO_2 Ansul IIc panels and preaction system manual stations are approved for the application. Does Not Comply: The ACI and hose station manual stations have not been listed or approved for their application. Ref: Technical Data No. 19 & 21.
3112.	Mounting. Each box shall be securely mounted. It is recommended that the bottom of the box be not less than 4-1/2 feet and not more than 6 feet above the floor level.	W	Comply: All pull boxes in the area of our review were properly mounted with the exception of the devices listed below. Does Not Comply: The hose station manual station @ elevation 620' - 6" in zone 44N was not securely mounted. The manual stations at elevations 609' - 0", 620' - 6" and 650' - 0" are mounted below the minimum elevation above the floor. Ref: Walkdown Checklist No. (72D), 1 thru 5.
3113.	Distribution. Manual fire alarm boxes shall be distributed throughout the protected area so that they are unobstructed, readily accessible, and located in the normal path of exit from the area, and as follows: a) One box shall be provided on the first floor and on each succeeding alternate	W	Not Applicable: The alarm system does not provide manual fire alarm service. Manual stations provided activate suppression systems. Ref: Walkdown checklist No. (72D) 1 through 5.

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	floor, except that one box shall be provided for each floor where the maximum fire area is 10,000 square feet or more. b) Additional boxes shall be provided on each floor to obtain a maximum horizontal travel distance of 200 feet to the nearest box.		
3114.	Coded Signal Designations. A coded fire alarm box shall produce not less than three signal impulses for each revolution of the coded signal wheel.	W	Not Applicable: Fire alarm boxes are not coded. Ref: Walkdown Checklist No. (72D) 1 thru 5.
	ARTICLE 320. WATCHMAN'S TOUR SUPERVISORY SERVICE.		Title: Guard service is not provided by this system. The entire section is deleted.
	ARTICLE 330. AUTOMATIC FIRE DETECTION AND ALARM SERVICE.		Title
3310.	General.		Title
3311.	The provisions of this Article apply to systems employed for automatic fire alarm signals.		For Information Only.
3320.	Supplementary Manual Alarm Signal Operation.		Title
3321.	Supplementary means for manually operating an automatic fire alarm system for an alarm signal shall be located where designated by the authority having jurisdiction. (See Paragraph 3421.)	W,D	Comply: The alarm system is provided with a manual means or activating the plant fire siren system at the "EF" panels. Ref: Drawing No. 68, 214; Technical Data No. 8.
3330.	Detecting Equipment.		Title: This section is verified under NFPA 72E. The entire section is deleted.

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	ARTICLE 340. SPRINKLER SYSTEM WATERFLOW ALARM AND SUPERVISORY SIGNAL SERVICE.		Title
3410.	Scope.		Title
3411.	The provisions of this Article apply to sprinkler system signaling attachments for indicating the off-normal condition of sprinkler system components which may affect the performance of the system adversely.		For Information Only.
3420.	General.		Title
3421.	Supplementary Manual Alarm Signal. It is recommended that premises having a sprinkler system equipped to provide a waterflow alarm signal have supplementary means for manually transmitting an alarm signal located in the normal path of exit from the area.	W,D	Comply: Manual stations were provided in the normal path of egress in accordance with A/E requirements. Ref: Drawing No. 2 thru 7; Technical Data No. 8; Walkdown Checklist No. (72D), 1 thru 5.
3422.	A dry pipe sprinkler system, equipped for waterflow alarm signals only, shall provide supplementary supervision of the system air pressure to avoid false alarm signals due to neglect in maintaining air pressure. Connection of the pressure supervisory attachment contacts to obtain trouble signal operation of the transmitter used for waterflow alarm signals is acceptable for this purpose.	D	Not Applicable: Dry pipe sprinkler systems are not provided in safety related areas of this plant. Ref: Drawing No. 2 thru 7.
3423.	Signal Identification. The signals received shall indicate the particular element of the sprinkler property which is abnormal and when it has been restored.	D	Comply: All waterflow signals provide distinctive signaling. Does Not Comply: Low air pressure and valve tamper switches are typically connected to the same initiating circuit for a specific sprinkler system. Ref: Drawing No. 20, 30, 144 & 210.

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3424.	Tampering. A signal attachment and its circuits shall be so designed and installed that they cannot be readily tampered with or removed without causing a signal to be produced.	W,D	Comply: All sprinkler alarm devices were properly on sprinkler piping and not readily accessible. All circuits were installed in conduit. Does Not Comply: The devices are not readily accessible to tampering, however, the devices or initiating circuits could be tampered with, and a trouble signal would not be received by the "EF" panels. Ref: Drawing No. 20, 30, 144 & 210; Walkdown Checklist No. (72D), 1 thru 5.
3430.	Waterflow Alarm Service.		Title
3431.	General. Provision shall be made to indicate the flow of water in a sprinkler system, except movement of water due to waste, surges, or variable pressure, by an alarm signal. The waterflow signaling attachment shall operate to indicate any loss of flow of water occurring at a rate of ten or more gallons per minute.	W,D	Does Not Comply: The charcoal filter unit spray system risers and the hose station supply riser for ZMO-10 & ZMO-20 are not provided with waterflow devices. All other systems are acceptable. Ref: Drawing No. 152, 154, 155, 160, 215 thru 217; Walkdown Checklist No. (72D), 1 thru 5.
3440.	Supervisory Signal Services.		Title
3441.	General. Provision shall be made for supervising the required conditions, which are essential for the proper operation of sprinkler systems, except those related to water mains, tanks, cisterns, reservoirs, and other containers of water controlled by a municipality or a public utility.	D	Comply: Reference Code Sections 3442, 3443 & 3446. Does Not Comply: Reference the results of code sections 3442, 3443 & 3446.
3442.	Gate Valve Position Supervision. A gate valve shall be supervised to obtain two separate and distinctive signals, one indicating movement of the valve to its normal position and the other indicating restoration of the valve to its normal position. The off-normal signal shall be obtained either during the first	W,D	Comply: The sprinkler valve tamper devices do not obstruct the operation of the valves. The devices are wired to the alarm initiating circuits such that the circuit will not restore to "Normal" until the valve tamper has returned to it's normal position. The "EF" panels do provide restoration signals. Does Not Comply: The valve tamper for valve #12-FP-193 (for ZMO-20) was provided but not

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	two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal position. a) Where the signaling attachments of two or more valves utilize a common circuit, a restoration signal shall be obtained only when all of the valves of the group are in their normal positions. b) An attachment for supervising the position of a gate valve shall not interfere with the operation of the valve nor obstruct the view of its indicator nor prevent access to its stuffing box.		connected to the alarm system. The tamper switches for the sprinkler isolation valves for the charcoal filter units were not connected to the ACI panels. Open Item: The verification of actual receipt of alarms by the movement of the valve handles could not be confirmed due to plant operation. Ref: Drawing No. 20, 30, 144, 210 & 57; Licensing Document No. 5.
3443.	Pressure Supervision. Pressure sources shall be supervised to obtain two separate and distinctive signals, one indicating that the required pressure has been decreased or increased and the other indicating restoration of the pressure to its normal value. a) A pressure supervisory signal attachment for a pressure tank shall indicate both high and low pressure conditions. A signal shall be obtained when the pressure is increased or decreased ten pounds from the required pressure valve. b) A pressure supervisory signal attachment for a dry pipe sprinkler system shall indicate both high and low pressure conditions. A signal shall be obtained when the required pressure is	W,D	Comply: Air pressure devices were properly provided for system risers at elevations 587' & 609'. Does Not Comply: Air pressure supervisory devices are not provided for concrete mixing building (fire zone 31) pre-action sprinkler system piping. The "EF" panels do not provide restoration signaling. Ref: Drawing No. 152 & 154; Technical Data No. 7; Walkdown Checklist No. (72D), 1 thru 5. Not Applicable: The equipment referenced in Code Sections 3443a, 3443c & d. are not provided in the area of our review.

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	increased or decreased in accordance with the requirements of the authority having jurisdiction. c) A steam pressure supervisory attachment shall indicate a low pressure condition. A signal shall be obtained when the normal pressure is reduced to a value which is not less than 110 percent of the minimum operating pressure of the steam-operated equipment supplied. d) An attachment for supervising the pressure of other sources than those specified above shall be capable of being applied and operated as required by the authority having jurisdiction.		
3444.	Water Level Supervision. Water storage containers shall be supervised to obtain two separate and distinctive signals, one indicating that the required water level has been lowered or increased and the other indicating restoration to the normal level. a) A pressure tank supervisory attachment shall indicate both high and low level conditions. A signal shall be obtained when the water level is lowered or raised three inches from the required level. b) A supervisory attachment for other than pressure tanks shall indicate a low level condition. A signal shall be obtained when the water level is lowered 12 inches from the required level.	D	Not Applicable: Water is obtained from Lake Michigan. No water storage containers are installed. Ref: Drawing No. 251

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3445.	Temperature Supervision. Water storage containers shall be supervised to obtain two separate and distinctive signals, one indicating that the temperature of the water has been lowered to 40°F and the other indicating restoration to the proper temperature.	D	Not Applicable: No storage containers are installed. Ref: Drawing No. 251
3446.	Pump Supervision. Automatic fire pumps, auxiliary booster and special service pumps shall be supervised as prescribed by the authority having jurisdiction. Where supervision is applied to the electric power supplying the pump, connection of the supervisory device shall be made on the line side of the motor starter so that open fuses or open circuit breakers in the supply line to the pump will be detected at once.	D	Comply: Fire pumps are monitored by the "EF" panels as dictated by A/E (AEPSC). Ref: Drawing No. 20, 30, 144, 210, 5 & 135.
	ARTICLE 350. AUTOMATIC SMOKE ALARM SERVICE.		Title
3510.	General		Title
3511.	The authority having jurisdiction shall be consulted in all cases before installation of equipment.	D	Comply: A/E (AEPSC) is authority having jurisdiction and provided design criteria for construction. Ref: Technical Data No. 8, 22 thru 27, 40 & 42.
3521.	Abnormal smoke density shall result in transmission of a distinctive smoke alarm signal to the central supervising station. The signal transmitted shall designate the building protected. The floor, section, or subdivision of the building at which the signal originated shall be indicated also, either by the signal to the central supervising station or by approved visual means	W,D	Comply: Distinctive smoke alarm signals are provided at the "EFR" and "GRC" panels indicating what floor, section or subsection of the building the signal originated. Duplicate annunciation of these panels is provided at the "EF" panels. Ref: Drawing No. 21 & 213 & 13.

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	in or at the building when the condition of occupancy and application of smoke detection are such that this feature is essential for adequate protection.		
3522.	Smoke alarm service may include provision for connection of a supplementary circuit for actuation of equipment controlling blowers, fans, shutters, etc. at the time of a smoke alarm signal.	D	Comply: Automatic HVAC unit and fire damper controls are provided for CO_2 and halon 1301 systems as required by A/E (AEPSC) manual means for HVAC shutdown is provided for control room HVAC units. Ref: Drawing No. 22, 31 & 74; Procedure No. 33 & 34 (Drop # .029 & .041).
3530.	Location of Detectors.		Title: Requirements verfied under NFPA 72E Code Review. Entire section is deleted.
3540.	Maintenance Servicing.		Title
3541.	All equipment requiring servicing shall be readily accessible and shall provide practical means for cleaning parts which accumulate dust, replacement of illuminating lamps, etc.	W	Comply: All alarm equipment is readily accessible for maintance in the areas reviewed with exception of the devices discussed below. Does Not Comply: Several detectors on elevations 587' (zone 5, 6N, 6M, & 6S) and 609' (zone 44N & 44S) are not readily accessible due to conduit congestion. Detectors in zones 7, 27, 32 & 69 are located at high ceilings and are difficult to access for testing. Ref: Walkdown Checklist No. (72E), 1 thru 28.
3542.	Suitable and practical facilities shall be provided to permit periodic testing for sensitivity.	W,D	Comply: The manufacturers sensitivity equipment is is used for testing or smoke detectors. Does Not Comply: Detector No. 3-29 in zone 44S is obstructed by sprinkler piping and will prevent the adequate testing of this device. Ref: Walkdown Checklist No. (72E), 1 thru 28; Procedure No. 12 & 47.

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3543.	The equipment shall be inspected monthly and maintained in proper operating condition.	D	Comply: Monthly inspections are performed for the CO_2 and sprinkler suppression systems, water hose reel system, and fire pumps. Does Not Comply: The fire detection, halon or CO_2 system controls are not inspected on a monthly basis. Ref: Procedure No. 35.
3550.	Circuit Arrangement		Title
3551.	A smoke detecting combination of a Class A Proprietary System shall be capable of operating for a smoke alarm signal during a single break or a single ground fault condition of the circuit wiring conductors a) between the central supervising station and the smoke alarm signal transmitter. b) between the smoke alarm signal transmitter and the smoke detector control unit, except as indicated in Paragraph 3552.	D	Not Applicable: The intent of the alarm system is to be a "Class B" system. Reference code section 2411 and 2422 72D, 1967 edition.
3552.	The requirement of Paragraph 3551 does not apply to the circuits between the smoke detector control unit if both of these units are locatd in a common enclosure, or in adjacent enclosures not more than three feet apart and having the circuits between the enclosures run in conduit.	D	Not Applicable: Reference code section 3551 this edition.
3553.	The motor of a blower provided as a part of a smoke detector shall be electrically supervised to indicate stalling or burnout.		Not Applicable: This equiment is not provided in the smoke detectors installed at this plant. Ref: Drawing No. 109, 110, 115, 74 & 209.
3554.	The requirements of Article 240 for electrical supervision of circuits applies to all wiring employed to interconnect separate units of a smoke detecting system and its power supply circuit wiring at the installation. In addition, the smoke	D	Comply: The smoke and fire detection initiating circuits of the "EFR", "GRC", Pyrotronics "System 3", ACI 6007, A700-9, A909, & A924 panels are electrically supervised as required. Ref: Drawing No. 74, 109, 110, 115, 209, 59, 136, 57, 62, 38, 220 & 221.

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	detecting system shall provide electrical supervision of all filaments of photo-electric cell illuminating lamps and the filaments and heaters of all electronic tubes, if their failure prevents normal operation for a smoke alarm signal.		
3555.	The failure of electrically-supervised circuits and parts shall be indicated by a trouble signal which is distinctive from a smoke alarm signal.	D	Comply: The ACI A700-9, Pyrotronics "System 3" and Pyralarm panels are provided with distinctive trouble audibles and lights. ACI 6007, A909 and A924 panels are provided with distinctive visual indicators. Ref: Drawing No. 74; 38, 62, 57, 59, 109, 110, 209, 220 & 221.

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	CHAPTER 4. PROPRIETARY SYSTEMS.		Title
4010.	Scope.		Title
4011.	The provisions of this article shall apply to a system supervised by competent and experience personnel in a central supervising station at the property protected. The system is to include equipment and other facilities required to permit the operators to test and operate the system and, upon receipt of signal, to take such action as shall be required under the rules established for their guidance by the authority having jurisdiction. The system shall be maintained and tested by owner personnel or an organization satisfactory to the authority having jurisdiction. These systems are designated "Class A" and "Class B", except as indicated in Paragraphs 4012, below. Class A system provides emergency operation for fire alarm, waterflow alarm, and guard's tour signals during a single break or a single ground fault of the signaling line circuit. A Class B system does not include this emergency operating feature.	D	Comply: Reference the results of Code Sections 2034, 4072, 4111, 4112, 4116 and 4117, this edition for operator staff qualifications, maintenance and actions taken upon receipt of signals. Does Not Comply: The intent of the system is to provide a "Class B" (two wire) system, however, the "EF" panels alarm initiating circuits do not meet this requirement. Reference the results of code sections 2411, 2422 and 3551, 72D, 1967 edition.
4012.	The emergency operation required for Class A systems in Paragraph 4011 shall not apply to circuits providing only manual fire alarm service when all of the following requirements are met: a) Each circuit serves only one manual fire alarm station or box. b) Not less than two manual fire alarm boxes are installed on the system.	D	Not Applicable: Reference code section 4011 this edition.

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	c) Manual fire alarm stations are so located that there is not more than 400 feet of travel distance between stations. d) Automatic visual or audible indication is provided at each station or box to indicate that the box is inoperative.		
4020.	Supervisory Station Structure		Title
4021.	It is recommended that the supervising station shall be located in a fire-resistive, detached building or in a suitably cut-off room, and, in any event, shall not be near or exposed to the hazardous parts of the premises protected.	W,D	Comply: The control room is enclosed in a three hour rated enclosure. Ref: Licensing Document No.: Section II.F.2.; Walkdown Checklist No. 4.
4030.	Fire Department Signals.		Title
4031.	General. The central supervisory station shall have reliable means for transmitting fire alarms to the fire department over wires electrically supervised and under the control of the plant owner or occupant. a. Where permissible and deemed necessary the means shall consist of a direct electrically-supervised line to the fire department, with suitable code-sending device and register, or a municipal fire alarm box, either of ordinary or auxiliary type, within fifty feet of the central supervising station. b. It is recommended that there be a telephone line from the central supervising station to the fire department, such line to available at all times and independent of the plant telephone switchboard.	D	Does Not Comply: Offsite fire department(s) are normally not required since a trained fire brigade is on site (24) hrs per day. All communication to the offsite fire department is performed by the Secondary Alarm Station personnel via telephone. Ref: Procedure No. 35.

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4040.	Signal Recording.		Title
4041.	The proprietary system shall be arranged to receive and record all signals received at its central supervisory station and to transmit to the fire department, indication of the building or group of buildings from which an alarm has been received.	W,D	Does Not Comply: The alarm system does not provide signal recording devices or retransmit signals received to the offsite fire department. Ref: Procedure No. 31 thru 35; Drawing No. 21 & 213; Walkdown Checklist No. 4.
4042.	Recording Devices. Recording devices shall be designed and arranged to provide a permanent record. The time of receipt of all recorded signals shall be marked adjacent to the signal preferably by automatic means.	W,D	Does Not Comply: Reference Code Section 4041, this edition.
4050.	Tests.		Title
4051.	Circuits. Facilities shall be provided at the central supervising station on all circuits extending from the central supervisory station and on all legal current sources at the central supervisory station for making the following daily tests: a. Current strength on each circuit. b. Voltage across terminals of each circuit at the inside terminals of protective devices. c. Voltage between ground and each side of each circuit.	D	Does Not Comply: Daily tests are not performed. Ref: Procedure No. 35.
4052.	Devices. Except as otherwise permitted by the authority having jurisdiction and as otherwise indicated in Paragraph 3335 complete and satisfactory tests of all coded and non-coded signaling devices shall be made quarterly.	D	Comply: Satisfactory tests are performed as discussed in code section 2034, except as discussed below. Does Not Comply: Tests are not performed to verify the operability of sprinkler and hose station system waterflow and supervisory alarm initiating devices and circuits. The ACI A700-9 panels or the hose

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			station manual stations are not verified for operability by testing. The frequency of testing is performed in accordance with the NRC requirements and the utility commitments. Reference Code Section 2034 72D, 1967 Edition; Licensing Document No. 6 Section II.E.1.
4053.	Records. A complete record shall be kept of the tests and operations of each system. The record shall be available for examination and, where required, reported to the authority having jurisdiction.	D	Comply: Fire alarm signals received at the control room are documented and all surveillances performed are documented and distributed for review. Does Not Comply: Records are not provided for sprinkler system supervisory or proprietary alarm system trouble conditions. Ref: Procedure No. 31 thru 35.
4060.	Durability		Title
4061.	General. The devices and circuits shall be designed and installed so as to meet successfully the most severe conditions liable to be met in practice. No change or alteration shall be made without approval by the authority having jurisdiction.	W,D	Comply: Systems were provided as designed by the architect/engineer (AEPSC). Does Not Comply: The sprinkler alarm device circuits are not installed in water tight flex conduit at the risers and U2 computer room (zone 72) solenoid circuit cable is exposed to mechanical damage. Ref: Technical Data No. 22 thru 27, 40 & 42; Walkdown Checklists No. (72D), 1, 2, 4 & 5. Also Reference Code Section 2122 72D, 1967 Edition.
4070.	Operating Personnel		Title
4071.	General. Watchman and other employees not required to operate the system shall not be admitted to the central supervising station where signals are recorded.	D	Comply: Only personnel with the proper access are admitted to the control rooms. Ref: Procedure No. 42.
4072.	Number of Operators. A sufficient number of reserve operators shall be kept in training so that at least two competent operators are constantly on duty and in addition, maintain a service so arranged	D	Comply: A minimum of (3) competent operators shall be in the control room at all times. Ref: Procedure No. 38, 39, 41 & 45.

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	that any building protected can be reached by a runner within 15 minutes. Runner service shall be so maintained that two operators will always be in attendance except, in an extreme case, one operator may be used as a runner. All runners shall be of a mature age.		
4073.	Modification. The authority having justification may modify or reduce the number of operators where alarms are automatically transmitted to the fire department and the number and kind of installations indicates satisfactory supervision can be maintained over the system. Operation and supervision shall be the primary function of the operators and no other interest or activities shall take precedence over the protective service.	D	Not Applicable: Automatic transmission of signals to fire department has not been provided. Ref: Procedure No. 35.
4080.	Emergency Operation of Circuits-Class A System.		Title
4081.	Signaling Line Circuits. Except as provided in Paragraph 4012, each signaling line circuit and the devices connected to it shall be capable of operating for their intended signaling services during a single break or a single ground fault condition of any signaling circuit conductor. Note: It is intended that this emergency signaling feature of operation will be obtained by either automatic or manual adjustments of the signaling circuit when the fault condition is indicated by a trouble signal.	D	Not Applicable: The intent of the Proprietary Alarm System is to be a "Class B" system as discussed in code section 4011 72D, 1967 edition.

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NFPA 72D-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

JOB NO 0120-108
CALC NO 0120-108-007

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 72D-1967
PROPRIETARY PROTECTIVE SIGNALING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4082.	Transmitter Actuating Circuits. An automatic transmitter employed for waterflow alarm signals shall be capable of operating for an alarm signal during a single break or a single ground fault condition of any of its initiating device circuit conductors, except as indicated in Paragraph 4083. Note: It is intended that this emergency signaling feature or operation will be obtained by automatic adjustments of the transmitter when the fault is indicated.	D	Not Applicable: Reference code section 4081 72D, 1967 edition.
4083.	Exceptions. The requirements of Paragraph 4082 may be waived by the authority having jurisdiction where a separate automatic transmitter is employed for each actuating device, if the conductors are installed in conduit, and the actuating device and automatic transmitter are adjacent to each other (within twenty feet).	D	Not applicable: Reference code section 4081 72D, 1967 edition.
4090.	Circuits.		Title
4091.	General. Circuits shall be so arranged that a single break or a single ground shall not cause a false alarm signal. A break or a ground which prevents the normal functioning of any circuit shall be automatically indicated at the central supervisory station by a trouble signal which will compel the attention of attendants. The trouble signal shall be distinguishable from other signals, except where such other signals denote an abnormal condition of supervised parts of a fire-extinguishing system.	D	Comply: The Alison Control Inc., Pyralarm and Pyrotronics panels provide electrically supervised alarm initiating circuits as required. Does Not Comply: The "EF" panel, hose and CO_2 system manual station alarm initiations circuits do not indicate a trouble condition upon a fault in the circuit. The remote signalling of the Pytrotronics "System 3" panels for trouble conditions to the "EFR" panels, and the ACI panels to be EF panels are not distinguishable from "EFR" circuit faults.. Reference the data from Code Section 2411 72D, 1967 Edition.

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4100.	Signals and Reports.		Title
4101.	General. Arrangements shall be made to furnish such reports of signals that may be received and in such form as may be required by the authority having jurisdiction. Daily reports may be required.	D	Comply: Fire reports are generated as required. Does Not Comply: Receipt of supervisory or trouble signals at the "EF" panels is not documented by the operators for corrective action. Ref: Procedure No. 31 thru 35.
4102.	Automatic Fire Detection Signals. Provision shall be made to designate, by the signal transmitted, the building in which a signal originates. The floor, section, or other subdivision of the building shall be indicated by either the signal transmitted to the supervising station or by approved visual means in or at the building protected, except that the authority having jurisdiction may waive this detailed indication where the area, height, or special conditions of occupancy make it unessential.	D	Comply: Reference code section 3521 72D, 1967 edition.
4103.	Sprinkler System Supervisory Signals. See paragraph 3423.		For Information Only.
4104.	Combined Water Flow and Manual Fire Alarm Signals. When signals from manual fire alarm boxes and waterflow alarm signaling devices within a building are transmitted over the same signaling circuit, there shall be no interference with the fire box signals when both types of signaling devices are operated at the same time. Provision of the shunt non-interfering method of operation is acceptable for this performance.	D	Not Applicable: Waterflow and manual stations are not connected to the same circuit. Ref: Drawing No. 20, 30, 144 & 210.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4110.	Disposition of Signals.		Title
4111.	Upon receipt of trouble signals or other signals referring to matters of purely equipment maintenance of the signaling system, the station operator shall immediately send a runner to investigate and, if possible, see that the trouble is remedied at once. Written notice shall be given the authority having jurisdiction and the property owner in all cases where service of the signaling system is interrupted and is not immediately corrected.	D	Comply: The procedures require the operators to take corrective action upon receipt of trouble signals. Does Not Comply: Operators actions indicate the requirement for corrective action or investigation. The procedures however, do not indicate the requirement for documenting trouble conditions. Ref: Procedure No. 31 thru 34.
4112.	Upon receipt of signals showing flow of water in the system, the central supervisory station shall notify the fire department and such other parties as the authority having jurisdiction may require. They shall also dispatch a runner to the location indicated. They shall also notify the property owner by telephone or by the quickest method available. In addition to which written notice should be given to the property owner. In all cases where notification is required to parties with whom private lines of communcation have not been provided, the quickest available means of communcation shall be used.	D	Comply: The notification of the appropriate on site and off site personnel, fire brigades, fire departments and the preparation of post fire reports are properly performed by the control room operators as required. Ref: Procedure No. 31 thru 35.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4113.	If at any time a combination signal is received which from its nature is indicative of water flow on the premises equipped, such combination signal shall be treated by the central supervising station as a fire alarm, provided that the authority having jurisdiction may waive the notification of the fire department for sprinkler flow alarms during working hours unless accompanied by other signals indicating a probable fire. Definite instruction as to the handling of alarms shall be posted for the guidance of operators.	D	Comply: The procedures direct the operators to verify alarm conditions prior to the verification of trouble conditions for combined "Fire/Trbl" signals from the ACI A700-9 and A924 panels. "EFR", "GRC". Ref: Procedure No. 31 thru 34.
4114.	All alarms initiated by manual or automatic fire alarm devices are to be treated as fire alarms and be transmitted to the city fire alarm office and patrol, or such other place as required by the authority having jurisdiction.	D	Comply: Reference code sections 4102, 4112 and 4113, this edition.
4115.	Upon failure of the watchman to transmit his regular signal within the period of grace provided, the operator shall dispatch a runner and shall also endeavor to get in touch with the watchman or someone else by telephone or by calling back over the system circuit. A suitable record shall be made, and the owner shall be notified in writing. Failure of a watchman to follow a definite route when such is required shall be considered a delinquency which shall be reported in writing to the owner and to the authority having jurisdiction.		Not Applicable: Guard service is not provided by the plant fire alarm system.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4116.	Sprinkler system supervisory and other supervisory alarms shall be immediately communicated to a designated person at the plant protected, and shall be investigated by a runner unless supervised conditions are restored to normal. The authority having jurisdiction and the owner shall be notified of the signal and time of occurrence and restoration of service. Notice shall be given the fire department when sprinkler systems are wholly or partially out of service.	D	Comply: Notification to the control room unit supervisor, who is the designated person, of impairment is provided. Ref: Procedure No. 31 thru 34; Technical Data No. 53.
4117.	A man shall be available within two-hour travel who is competent to inspect, maintain and repair the system.	D	Comply: Competent personnel are on staff at the plant continuously. Ref: Procedure No. 36.
4120.	Power Supply Sources.		Title
4121.	Two alternate main power supply sources shall be provided within the supervisory central station. The secondary source shall be independent of other sources and a high degree of reliability. The secondary source shall be arranged as follows: a. It shall not operate through or be dependent upon the same motor-generator, convertor, or other device having moving parts which supplies the primary or normal supply, except that no additional source of power is required when a storage battery floating on a rectifier or generator is capable of carrying the load without the battery. The same regulation shall be provided as required in Paragraph 2251.	D	Comply: One offsite power source for each unit is connected to the 345KV (Unit 1), 765KV (Unit 2) and 69KV (Units 1 & 2 Emergency) transformers which steps down to 26KV 01234-5 buses which are in turn stepped down to 4.16KV buses. The 4.16KV buses (1A, 1B to T11A, T11B; 2A, 2B to T21A, T21B; 1C, 1D to T11C, T11D; 2C, 2D to T21C, T21D) are stepped down to 600V and then to 120V which then powers the "EFR" & "GRC" panels (CRP-1, Circuits 1 & 3, Units 1 & 2 and CRP-2 Circuits 15 & 20 respectively). The "EF" panels (AFC-1, Circuits 20 & 21, Units 1 & 2) are powered from 250V DC rectified power (Unit 1 & 2 AB batteries) which is derived from the 600V AC buses (11A & B and 21A & B).

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	b. It shall be of such capacity and reliability as to assure system operation, in case of interruption of the normal supply, for a period of 24 hours, and shall have, in addition, at the conclusion of this 24 hour period, a residual capacity sufficient to operate the system through at least one complete cycle of alarm initiation, transmission, and registration.		
	c. It shall automatically supply the circuit or circuits upon loss of the normal source within 30 seconds; this automatic feature may be omitted if suitable provisions are made for manually transferring to the secondary source within 30 seconds.		Th 250V DC power also provides a supplemental power source from standby batteries which are monitored and charged by battery charger units. The trouble signal power is supplied from the secondary power supply for the "EFR" and "GRC" panels (CRP-1, Circuit 1, Unit 1 & 2 "EFR" & Circuit 15, Unit 1 "GRC"). The trouble signal power for the "EF" panels are provided from CRP-2, Circuit 16, Unit 1 & 2. Secondary power is provided by two diesel generators per Unit (1AB & 1CD and 2AB & 2CD) which are directly connected to 4.16KV buses T11A, T11B, T21A & T21B.
	d. The secondary source may be used for trouble signal power supply.		Open Item: Data was not available to confirm the automatic transfer of power from primary to secondary within 30 seconds. Also since other equipment outside the scope of this review, are powered from the same secondary sources as the alarm system, the capacity of the secondary source could not be confirmed.

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APPENDIX A
NFPA 72D - 1979 EDITION
PROPRIETARY PROTECTIVE SIGNALING SYSTEMS

Review includes the following systems:	INITIAL SYSTEM INSTALLATION DATE
• Pyrotronics "System 3" local panels which include:	
a. ESW Pump Cubicle panel;	
• Fire Zones 29A, 29B and 29E	11/07/83
• Fire Zones 29C, 29D and 29F	01/16/85
• Fire Zone 29G	08/12/83
b. Unit 1 Transformer RM/Diesel Corridor/AFW Vestibule;	
• Fire Zones 17C and 79	08/12/83
• Fire Zone 14	11/07/83
c. Unit 1 Main Steam Line, Main Steam Valve Enclosure & NESW Valve Areas; fire zones 33 thru 33B.	11/07/83
d. Unit 2 Main Steam Line, Main Steam Valve Enclosure & NESW Valve Areas; fire zones 34 thru 34B.	01/16/85
e. Unit 2 Diesel Corridor/Transformer Room;	
• Fire Zone 20	01/16/85
• Fire Zone 85	08/12/83
f. Units 1 & 2 Computer Room detection/halon panel; fire zones 71 & 72.	8/83
• Alison Controls, Inc. panel A700-9 (Unit 1 & Unit 2) for Reactor Coolant Pump detection.	4/79

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 1 FUNDAMENTALS		Title
1-1	SCOPE.		Title
1.1.1	This standard deals with the installation, maintenance, testing and use of a proprietary protective signaling system which serves contiguous or noncontiguous properties under one ownership from a central supervising station at the protected property, where trained, compentent personnel are in constant attendance. It covers the minimum requirements for operating personnel, the central supervising station, power supplies, signal initiation, signal notification, and automatic permanent visual recording of signals.		For Information Only.
1.2	DEFINITIONS. Unless expressly stated elsewhere, the following terms will, for the purpose of this standard, have the meanings indicated below.		Entire section deleted: For information only.
1-3.2	The central supervising station shall be restricted to those persons directly concerned with the implementation and direction of emergency action initiation and procedure.	D	Not Applicable: Verified under Code Section 4071, 1967 Edition.
1-3.3	A sufficient number of reserve operators shall be kept in training so that one competent operator is constantly on duty. When the means for transmitting alarms to the fire department is not automatic, at least two operators, one of whom may be a runner, shall be on duty at all times. When the runner is not in attendance at the central supervising station, the runner shall establish two-way communications with the station at intervals not exceeding 15 minutes.	D	Not Applicable: Verified under Code Section 4072, 1967 Edition.

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1-3.4	The primary duties of the operator(s) shall be to monitor signals, operate the system and take such action as shall be required by the authority having jurisdiction. The operator(s) shall not be assigned any additional duties that would take precedence over the primary duties.	D	Not Applicable: The requirements for the operating personnel are verified under Code Section 4070, 1967 Edition.
1-4	SYSTEM OPERATION.		Title
1-4.1	Indication of a fire shall be promptly retransmitted to the municipal fire communications center or other locations acceptable to the authority having jurisdiction, indicating the building or group of buildings from which the alarm has been received.		Not Applicable: Verified under Code Section 4031, 1967 Edition.
*1-4.2	The means of retransmission shall be acceptable to the authority having jurisdiction and shall be in accordance with Standard for Auxiliary Protective Signaling System, NFPA 72B, Standard for Remote Station Protective Signaling Systems, NFPA 72C, or Standard for Public Fire Service Communications, NFPA 1221. EXCEPTION: SECONDARY (STANDBY) POWER SUPPLY CAPACITY SHALL BE AS REQUIRED IN 2-6.2.3.	D	Not Applicable: Plant has fire brigade on site 24 hours per day. External fire fighting forces are normally not called to the plant. Ref: Procedure No. 35.
*1-4.3	Retransmission by coded signals shall be confirmed by two-way voice communication indicating nature of the alarm. (See 1-4.1)	W	Not Applicable: Coded signaling of alarm signals is not provided at this plant. Ref: Walkdown checklists (72D) 1 thru 5.
1-4.4	When trouble conditions exist, it shall be the duty of the operator(s) to initiate action immediately to notify the personnel responsible for servicing the system, the owner of the system or designated representative, and the authority having jurisdiction.		Editorial changes: Requirements are addressed under code section 4111, 1967 edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 2 GENERAL REQUIREMENTS		Title
*2-1	PURPOSE. This chaper applies to general requirements for proprietary protective signaling systems. These systems provide an automatic, permanent visual record by date and time of alarm and abnormal conditions, except as specifically exempted in Section 2-7, Monitoring Integrity of Installation Conductors, and recognize the interconnection of other systems to make the premises safer in the event of fire or other emergencies indicative of hazards to life or property.	D	Not Applicable: Verified under Code Section 4042 72D, 1967 Edition.
2-2	APPROVAL AND ACCEPTANCE.		Title
2-2.1	The authority having jurisdiction shall be notified prior to installation or alteration of equipment or wiring. At its request, complete information regarding the system or system alterations, including specifications, wiring diagrams, and floor plans, shall be submitted for approval.	D	Comply: The authority having jurisdiction is is the A/E (AEPSC). The A/E designed and reviewed all modifications. Ref: Technical Data No. 25, 26, 27, 40 & 42.
2-2.2	EQUIPMENT. All devices, combinations of devices, appliances and equipment installed in conformity with this standard shall be listed for the protective signaling purpose for which they are used.		Editorial changes: No significant change from Code Section 2032 72D, 1967 Edition. No verification required.
2-2.2.1	VOLTAGE, TEMPERATURE AND HUMIDITY VARIATION. Equipment shall be so designed that it shall be capable of performing its intended function under the following conditions:	D	Comply: Pyrotronics "System 3" has been tested in accordance with UL Test Standard #864 and approved to meet this criteria. Ref: Technical Data No. 18 & 20.
	(a) At 85 percent and at 110 percent of the nameplate primary (main) and secondary (standby) input voltage(s).		Open Item: ACI panel A700-9 has not been tested to confirm operability under these conditions.

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	(b) At ambient temperatures of 32° ± 4°F (0° ± 2°C) and 120° ± 4°F (49° ± 2°C) for a minimum duration at each extreme of three hours. (c) At a relative humidity of 85 ± 5 percent and an ambient temperature of 90° ± 4°F (32° ± 2°C) for a duration of at least 24 hours.		
2-2.3	ACCEPTANCE TESTS. Upon completion of an installation or alterations, satisfactory tests of the entire system shall be made in the presence of a representative of the authority having jurisdiction. All functions of the system shall be tested, including operation of the system in various alarm and trouble modes for which it is designed (e.g., open circuit, grounded circuit, power outage, etc.).	D	Comply: Systems were functionally tested prior to acceptance. Does Not Comply: Systems were functionally tested prior to acceptance, however, not in the presence of the authority having jurisdiction (AEPSC). Ref: Technical Data No. 25, 26, 27, 40 & 42. Open Item: Data was not available to confirm compliance of ACI A700-9 panels or computer room "System 3" panels.
2-3	MAINTENANCE.		Title
2-3.1	MAINTENANCE AND TESTING. All system shall be under the supervision of qualified persons. These persons shall cause proper tests and inspections to be made at prescribed intervals. The authority having jurisdiction shall be consulted on all alterations and additions to the system under its supervision.		Editorial changes: No significant changes from Code Section 2034 72D, 1967 Edition. No verification required.
2-3.1.1	The owner shall provide for proper maintenance of the system. A maintenance agreement with specialists acceptable to the authority having jurisdiction may be used in lieu of developing staff specialists.	D	Comply: Administrative controls are in place to maintain and test the signaling system. Ref: Procedure No. 35.
2-4	DRILLS AND PERIODIC TESTS.		Title
2-4.1	All operator controls at the central supervising station(s) designated by the authority having jurisdiction shall be tested at each change of shift.	D	Not Applicable: Verified under Code Section 4051 72D, 1967 Edition.

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2-4.2	Drills shall be conducted at intervals and in a manner agreed upon by the authority having jurisdiction.	D	Comply: Administrative controls are in place to perform fire drills in accordance with Appendix R to 10CFR Part 50 Section III.I.3. Ref: Procedure No. 46, 35.; Licensing Document No. 8.
2-4.3	Complete and satisfactory tests shall be made of all devices, and test results shall be made available to the authority having jurisdiction in accordance with the following: (a) Monthly for all automatic fire detection systems including circuit interfaces) or other systems and devices not covered by (b), (c) or (d) below. (b) Every two months or more frequently, subject to th authority having jurisdiction, for all circuit interfaces and water flow actuated devices. For sprinkler water flow alarm tests an actual water flow, through the use of a test connection, shall be the method employed for testing the reliability of the sprinkler alarm unit as a whole. (c) Semiannually for gate valve supervisory switches, manual fire alarm boxes, combination night guard and fire alarm boxes, tank water level devices, building and tank water temperature supervisory devices, and other sprinkler system supervisory devices. (d) Inspection and tests of automatic fire detection devices shall be in accordance with the Standard on Automatic Fire Detectors, NFPA 72E.	D	Not Applicable: Verified under Code Sections 2034, 3540 and 4050 72D, 1967 Edition.
2-4.4	A flow through the alarm test bypass connection shall be used for testing the water flow alarm of a dry-pipe, preaction or deluge sprinkler system. For a wet-pipe sprinkler system, the test connection at the extremity of the system shall be used.		Editorial changes. Changes provided clarity for Code Section 2034 72D, 1967 Edition. No verification required.

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2-4.5	If an engine-driven generator dedicated to the protective signaling system is used as a required power source, it shall be operated weekly under load by disconnecting the normal supply to the system for a minimum of one-half hour in a continuous period.	D	Not Applicable: The diesel generator will be addressed under the requirements indicated in the 1967 Edition.
2-4.6	RESTORATION. All apparatus shall be restored to normal as promptly as possible after each test or alarm and kept in normal condition for operation. This shall include rewinding, resetting or replacement as necessary.		Editorial changes: Verified under Code Section 2047,1967 Edition.
2-4.7	A complete record of the tests and operations of each system shall be kept for at least one year. The record shall be available for examination and, when required, reported to the authority having jurisdiction.		Editorial changes: No significant changes from Code Section 4053, 1967 Edition.
2-5	INSTALLATION (All SYSTEMS).		Title
2-5.1	All systems shall be installed in a workmanlike manner and in accordance with applicable standards and with specifications approved by the authority having jurisdiction.		Editorial changes: No significant changes from Code Section 2041, 1967 Edition. No verification required.
2-5.2	Devices shall be located and installed so that accidental operation will not be caused by vibration or jarring.		Editorial changes: No significant changes from Code Section 2042, 1967 Edition. No verification required.
2-5.3	GROUNDING. All systems shall test free of grounds. EXCEPTION: PARTS OF THE CIRCUIT OR EQUIPMENT WHICH ARE INTENTIONALLY AND PERMANENTLY GROUNDED TO PROVIDE GROUND FAULT DETECTION, NOISE SUPPRESSION, EMERGENCY GROUND SIGNALING AND CIRCUIT PROTECTIVE GROUNDING.		Editorial changes: No significant changes Code Section 2043, 1967 Edition. No verification required.

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2-6	POWER SUPPLY SOURCES.		Title
2-6.1	PURPOSE. The provisions of this section apply to sources of power supply which shall be used, for the type of system involved, subject to acceptance by the authority having jurisdiction.		Editorial changes: No significant changes from Code Section 2211, 1967 Edition. No verification required.
2-6.2	POWER SUPPLY. Centeral Supervising Station.		Title
2-6.2.2	The primary (main) power supply shall have a high degree of reliability, adequate capacity or the intended service, and shall consist of one of the following: (a) Light and power service arranged in accordance with 2-6.4. (b) Engine-driven generator or equivalent arranged in accordance with 2-6.5.	D	Not Applicable: Verified under Code Section 2220 and 2230, 1967 Edition.
2-6.2.3	SECONDARY (STANDBY) POWER SUPPLY CAPACITY AND SOURCES. The secondary (standby) supply shall be provided to supply the energy to the system under the maximum normal load for 24 hours and then be capable of receiving one fire alarm signal persisting for five minutes in the event of total failure or low voltage (less than 85 percent of the nameplate voltages) of the primary (main) power supply. The secondary (standby) power supply shall automatically transfer to operate in the system within 30 seconds of the loss of the primary (main) power supply. The secondary (standby) power supply shall consist of the following: (a) A storage battery with a 24-hour capacity arranged in accordance with 2-6.6.	D	Not Applicable: Verified under Code Section 4121, 1967 Edition.

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	(b) An engine-driven generator arranged in accordance with 2-6.5 and storage batteries with a 4-hour capacity arranged in accordance with 2-6.6. (c) Multiple automatic-starting engine-driven generators, arranged in accordance with 2-6.5. capable of supplying the energy required by 2-6.2.3 with the largest generator out of service. EXCEPTION: WHEN ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION, SECONDARY (STANDBY) POWER SHALL NOT BE REQUIRED TO OPERATE EVACUATION ALARM-INDICATING APPLIANCES OR OTHER SUPPLEMENTARY FUNCTIONS NOT ESSENTIAL TO THE RECEIPT OF SIGNALS AT THE CENTRAL SUPERVISING STATION.		
2-6.2.4	A separate power supply, independent of the primary (main) power supply, shall be provided for the operation of trouble signals when the primary (main) power supply fails. EXCEPTION: THE SECONDARY (STANDBY) POWER SUPPLY OF 2-6.2.3(a) or (b) MAY BE USED FOR THIS PURPOSE.	D	Not Applicable: Verified under Code Section 4121 72D, 1967 Edition.
2-6.3	POWER SUPPLY FOR REMOTELY LOCATED CONTROL EQUIPMENT. Additional power supplies, when provided for control units, circuit interfaces, or other equipment essential to system operation, located remote from the central supervising station, shall consist of a primary (main) and secondary (standby) which shall meet the same requirements as for the central supervising station power supplies (See 2-6.1 through 2-6.2.3)	D	Comply: A dedicated, reliable primary power supply is provided and a secondary 24 hr. standby battery power supply within each control panel, is provided for each "System 3" and ACI A700-9 alarm system. Ref: Drawing No. 47, 109, 115, 74, 175 & 197.

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2-6.4	LIGHT AND POWER SERVICE.		Title
2-6.4.1	A light and power service employed to operate the system under normal conditions shall have a high degree of reliability and capacity for the intended service.	D	Not Applicable: Verified under Code Section 2221 72D, 1967 Edition.
2-6.4.2	Connections to the light and power service shall be on a dedicated branch circuit. The circuit and connections shall be mechanically protected. The circuit disconnecting means shall be accessible only to authorized personnel and shall be clearly marked FIRE ALARM CIRCUIT CONTROL.	W,D	Comply: All primary power supplies for the "System 3" and A700-9 panels are dedicated and the breakers properly labelled. The power panels reviewed were not locked or sealed, however, shift supervisor approval was required prior to opening the power panel doors. Ref: Drawing No. 74, 38, 62, 109, 115, 175 & 197. Walkdown Checklist No. (72D), 1 thru 5.
2-6.5	ENGINE-DRIVEN GENERATOR.		Title
2-6.5.1	An engine-driven generator shall be used only where a person specifically trained in its operation is on duty at all times. EXCEPTION: WHEN ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION AND WHEN THE REQUIREMENT OF 2-6.2.3(b) or (c) IS MET, A PERSON SPECIFICALLY TRAINED IN THE OPERATION OF A GENERATOR DEDICATED TO THE PROTECTIVE SIGNALING SYSTEM SHALL NOT BE REQUIRED TO BE ON DUTY AT ALL TIMES.	D	Not Applicable: Verified under Code Section 2231 72D, 1967 Edition.
2-6.5.3	When gasoline is used as the main fuel, it shall be stored for six month of testing plus 24 hours of operation at full load. EXCEPTION NO. 1: IF A RELIABLE SOURCE OF SUPPLY IS AVAILABLE AT ANY TIME ON TWO-HOUR NOTICE, SUFFICIENT FUEL SHALL BE IN STORAGE FOR 12.HOURS OF OPERATION AT FULL LOAD.	D	Not Applicable: Diesel type fuel generators are used at this plant. Ref: Licensing Document No 7.

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	EXCEPTION NO. 2: FUEL SYSTEMS USING NATURAL OR MANUFACTURED GAS SUPPLIED THROUGH RELIABLE UTILITY MAINS SHALL NOT BE REQUIRED TO HAVE FUEL STORAGE TANKS UNLESS LOCATED IN AN EARTHQUAKE-PRONE AREA.		
2-6.5.5	A separate storage battery and separate automatic charger shall be provided for starting the engine-driven generator and shall not be used for any other purpose.	D	Not Applicable: The diesel generator requirements are addressed under the 1967 Edition.
2-6.6	STORAGE BATTERIES.		Title
2-6.6.1	Adequate facilities shall be provided to automatically maintain the battery fully charged udner all conditions of normal operation. After the fully charged battery is subjected to a single discharge cycle as specified in 2-6.2.3, the charging current shall be such that the battery capacity after 48 hours complies with the requirements of 2-6.2.3. Upon attaining a fully charged condition, the trickle charge rate shall not be excessive so as to result in battery damage.	D	Comply: The batteries and charges provided for the "System 3" and A700-9 panels operate as required by this code section. Ref: Technical Data No. 20, 39, 33, 34, 43 & 1; Drawing No. 47.
2-6.6.2	Storage batteries shall be so located or enclosed that the equipment of the signaling system, including overcurrent protective devices, will not be affected adversely by battery gases. Installation of the batteries shall conform to the requirements of Article 480, National Electrical Code, NFPA 70.	D	Comply: The batteries are enclosed within the control panels and are properly vented. Ref: Technical Data No. 36; Drawing No. 50.
2-6.6.3	The method of charging a battery shall provide either integral meters or readily accessible terminal facilities for the connection of portable meters by which the battery voltage and charging current can be determined.	W,D	Comply: The battery charging modules are provided with accessible terminals. Ref: Technical Data No. 33, 34 & 43; Walkdown Checklist No. (72D), 1 thru 5; Drawing No. 47.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2-7	MONITORING INTEGRITY OF INSTALLATION CONDUCTORS.		Title
2-7.1	All means of interconnecting equipment, devices and appliances shall be monitored for the integrity of the interconnecting conductors or equivalent so that the occurrence of a single open or a single ground trouble condition in the installation conductors shall be automatically signaled to and recorded in the central supervising station within 200 seconds. EXCEPTION NO. 1: STYLES OF INITIATING DEVICE CIRCUITS AND SIGNALING LINE CIRCUITS TABULATED ON TABLE 3.9-1 AND 3-10.1 WHICH DO NOT HAVE AN "X" UNDER "TROUBLE." EXCEPTION NO. 2: SHORTS BETWEEN CONDUCTORS, EXCEPT AS REQUIRED BY TABLES 3-9.1 AND 3-10.1, ARE NOT CONTEMPLATED BY THIS STANDARD. EXCEPTION NO. 3: INTERCONNECTION TO POWER FOR A TROUBLE SIGNAL. EXCEPTION NO. 4: INTERCONNECTION TO SECONDARY (STANDBY) POWER SUPPLY. EXCEPTION NO. 5: INTERCONNECTION TO SUPPLEMENTARY EQUIPMENT DEVICES, INCLUDING VISUAL ANNUNCIATORS, AND INTERCONNECTING MEANS, PROVIDED THAT THEIR ABNORMAL CONDITION SHALL NOT AFFECT NORMAL OPERATION OF THE PROTECTIVE SIGNALING SYSTEM. EXCEPTION NO. 6: THE NEUTRAL OF A THREE-WIRE AC SOURCE.	D	Comply: The "System 3" and ACI A700-9 panels electrically supervise initiating and indicating circuits for a single open or ground condition and transmit all trouble conditions to the control room automatically. The recording of signals and response time is verified under 72D-1967 edition. Ref: Drawing No. 102, 103, 104, 111, 112, 74, 110, 209, 144, 210, 47 & 50. Technical Data No. 32.

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	EXCEPTION NO. 7: A NONINTERFERING SHUNT CIRCUIT, PROVIDED THAT A FAULT CONDITION ON THE SHUNT CIRCUIT WIRING RESULTS ONLY IN THE LOSS OF NONINTERFERING FEATURE OF OPERATION. EXCEPTION NO. 8: THE CIRCUIT OF AN ALARM-INDICATING APPLIANCE INSTALLED IN THE SAME ROOM WITH THE CENTRAL SUPERVISING STATION, PROVIDED THAT THE INDICATING APPLIANCE CIRCUIT CONDUCTORS ARE INSTALLED IN CONDUIT OR EQUIVALENT PROTECTED AGAINST MECHANICAL INJURY. EXCEPTION NO. 9: INTERCONNECTION TO REGISTERS AND PRINTERS. EXCEPTION NO. 10: A TROUBLE SIGNAL CIRCUIT. EXCEPTION NO. 11: INTERCONNECTON BETWEEN EQUIPMENT WITHIN A COMMON ENCLOSURE SUBJECT TO THE AUTHORITY HAVING JURISDICTION. EXCEPTION NO. 12: INTERCONNECTION BETWEEN ENCLOSURES CONTAINING CONTROL EQUIPMENT LOCATED WITHIN 20 FT (6M) WHEN THE CONDUCTORS ARE INSTALLED IN CONDUIT OR EQUIVALENTLY PROTECTED AGAINST MECHANICAL INJURY. EXCEPTION NO. 13. A SINGLE GROUND THAT DOES NOT PREVENT THE NORMAL OPERATION OF THE SYSTEM.		
2-7.2	CONNECTIONS OF INSTALLATION-WIRING. Connections of installation-wiring to alarm-initiating devices and alarm-indicating appliances shall be monitored for integrity.	D	Not Applicable: Verified under Code Section 2422 and 2424, 1967 Edition.

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2-7.3	Interconnecting means shall be arranged so that a single break or single ground fault will not cause and alarm signal.		Editorial changes: Verifies under Code Section 4091 72D, 1967 Edition.
2-8	POWER SUPPLY MONITORING.		Title
2-8.1	All primary (main) power supplies shall be monitored for integrity to the point of connection at the equipment.	D	Comply: "System 3" and ACI A700-9 panels monitor the primary power supply and will annunciate a loss of that power supply at the panel and in the respective control room. Ref: Drawing No. 50, 48, 74, 144, 209, 210, 110, 109 & 115; Technical Data No. 32.
	EXCEPTION: PRIMARY (MAIN) POWER FOR SUPPLEMENTARY EQUIPMENT.		
2-8.2	All primary (main) power supplies shall be monitored for integrity to the point of connections of battery chargers.	D	Comply: The primary power supply is this same source for the system as it is for the battery charger. Ref: Code Section 2-8.1 72D, 1979 Edition.
	CHAPTER 3 SIGNAL INITIATION, TRANSMISSION AND PROCESSING		Title
3-1	PURPOSE. The provisons of this chapter describe the required performance of signal initiation, transmission and processing means and the optional services that may be selected for a proprietary protective signaling system.		For Information Only.
3-2	GENERAL. For automatic fire detectors and alarm service and water flow alarm service, a means shall be provided to manually initiate a fire alarm signal located where requied by the authority having jurisdiction.	D	Not Applicable: Verified under Code Sections 3320 and 3421 72D, 1967 Edition.
3-3	MANUAL FIRE ALARM SERVICE.		Title
3-3.1	FIRE ALARM BOXES.		Title

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3-3.1.2	Each box shall be securely mounted. The bottom of the box shall be not less than 3-1/2 ft (1.1 m) and not more than 5 ft (1.4 m) above the floor level.	W	Does Not Comply: The Pyrotronics Halon stations are installed 5.5' above finished floor. Ref: Walkdown Checklists No. (72D), 5.
3-3.1.4	A coded alarm signal shall meet the requirements of 4-4.2.		Editorial changes: No verification required. Plant is not provided with a coded system.
3-4	GUARD'S TOUR SUPERVISORY SERVICE.		Title. No verification required for entire section, plant is not provided with guard's tour service.
3-5	AUTOMATIC FIRE DETECTION AND ALARM SERVICE.		Title
3-5.1	GENERAL.		Title
3-5.1.1	Automatic fire detectors shall be located, maintained, and tested in accordance with the Standard on Automatic Fire Detectors, NFPA 72E.		Verified under NFPA 72E.
3-5.1.2	Automatic fire detectors which have integral trouble contacts shall be wired on the initiating device circuit so that a trouble condition on one detector will not impair the alarm operation from other initiating devices.	D	Not Applicable: Integral trouble contacts are not provided as part of the detectors installed Ref: Technical Data No. 37 & 38; Drawing No. 74, 48, 109 & 115.
3-6	SPRINKLER SYSTEM WATER FLOW ALARM AND SUPERVISORY SIGNAL SERVICE.		Title
3-6.2	GENERAL.		Title
3-6.2.1	A dry-pipe sprinkler system equipped for water flow alarm signals shall provide supplementary supervision of the system air pressure to avoid false alarm signals due to neglect in maintaining air pressure.		Editorial changes: Verified under Code Section 3422, 1967 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
3-6.2.2	Signals transmitted shall indicate distinctively the particular function (such as valve position, pressure, etc.) of the automatic sprinkler system which is abnormal and its restoration to a normal condition.		Editorial changes. Verified under Code Section 3423 72D, 1967 Edition.
3-6.2.3	A signal attachment and its circuits shall be so designed and installed that they cannot be readily tampered with or removed without causing a signal to be produced. This specifically includes junction boxes on the outside of the buildings.		Editorial changes. Verified under Code Section 3424 72D, 1967 Edition.
*3-6.3	WATER FLOW ALARM SERVICE. Provisions shall be made to indicate the flow of water in the sprinkler system by an alarm signal. The water flow signaling attachment shall operate to indicate an alarm in accordance with the Standard for the Installation of Sprinkler Systems, NFPA 13. EXCEPTION: MOVEMENT OF WATER DUE TO WASTE, SURGES OR VARIABLE PRESSURE NEED NOT BE INDICATED.		Editorial changes. Verified under Code Section 3431 72D, 1967 Edition.
3-6.4.1	Provision shall be made for supervising the required conditions which are essential for the proper operation of sprinkler systems.		Editorial changes: Addressed under Code Section 3441 72D, 1967 Edition.
3-6.4.2	A control valve shall be supervised to obtain two separate and distinctive signals, one indicating movement of the valve from is normal position and the other indicating restoration of the valve to its normal position. The off-normal signal shall be obtained either during the first two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal positions.	W,D	Comply: The RCP pump valve tamper device will not obstruct the normal operation of the valve and will not restrore to "normal" until the valve is restored to it's normal position. Does Not Comply: The valve devices are wired in series in the initiating circuit, therefore, preventing distinctive signaling between a circuit fault and an alarm for the ACI A700-9 panels. Ref: Drawing No. 48; Walkdown Checklists No. (72D), 4; Technical Data No. 40 & 15.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	(a) Where the initiating device of two or more valves a common circuit, a restoration signal shall be obtained only when all of the valves of the group are in their normal positions.		
	(b) An initiating device for supervising the position of a gate valve shall not inerfere with the operation of the valve, nor obstruct the view of its indicator, nor prevent access to its stuffing box.		
	(c) The off-normal signal shall not be restored at any valve position except normal.		
3-6.4.6	Fire pumps shall be supervised in accordance with the requirements of the Standard for the Installation of Centrifugal Fire Pumps, NFPA 20, and the authority having jurisdiction. When both sprinkler supervisory signals and pump running signals are transmitted over the same signaling circuit, provision shall be made to obtain pump running signal preference unless the circuit is so arranged that no signals shall be lost.		Editorial changes: Verified under Code Section 3446, 1967 Edition.
3-7	PRIVATE RADIO SIGNALING.		Title. This type of signaling equipment is not provided at this plant. Entire section is deleted.
3-9	PERFORMANCE OF INITIATING DEVICE CIRCUITS.		Title
3-9.1	The purpose of Table 3-9.1 is to identify the style of initiating device circuits based on their ability to indicate alarm and trouble at the central supervising station during specified abnormal conditions.		For Information Only.
*3-9.2	Use of Table 3-9 is explained in Appendix A. (See Section 3-10.)		For Information Only.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
3-9.3	Initiating devices listed in Table 3-9.1, Section E, shall not be combined on the same initiating device circuit. (See 3-6.2.2.) EXCEPTION NO. 1: WHEN IMPLEMENTING SECTION 3-1, MANUAL MEANS AND AUTOMATIC MEANS MAY BE COMBINED IN THE SAME INITIATING DEVICE CIRCUIT. EXCEPTION NO. 2: WHERE ONLY ONE FIRE ALARM BOX IS REQUIRED, IT MAY BE CONNECTED TO THE WATER FLOW INITIATING DEVICE CIRCUIT.	D	Comply: The panels monitor fire detection, suppression or halon alarm devices only and these devices are not intermixed on circuits. Ref: Drawing No. 50, 74, 109 & 115.
3-9.4	The loading of initiating device circuits shall not exceed those listed in Table 3-9.1. EXCEPTION: WHERE OCCUPANCY CONDITIONS PERMIT, THE AUTHORITY HAVING JURISDICTION MAY ALLOW CONNECTION OF A SINGLE INERMEDIATE FIRE ALARM OR FIRE SUPERVISORY CONTROL UNIT TO A PROPRIETARY PROTECTIVE SIGNALING SYSTEM INITIATING DEVICE CIRCUIT.	D	Comply: The alarm devices connected to the initiating circuits of the "System 3" and ACI A700-9 panels do not exceed the requirements of Table 3-9.1. Ref: Drawing No. 74, 62, 38, 109 & 115.
3-10	PERFORMANCE OF SIGNALING LINE CIRCUITS.		Title
3-10.1	The purpose of Table 3-10 is to identify signaling line circuits based on their ability to indicate alarm and trouble at the central supervising station during specified abnormal conditions.	D	Not Applicable: Signaling line circuit arrangement will be verified under Code Sections 2422 and 4011 72D, 1967 Edition.
*3-10.2	Use of Table 3-10.1 is explained in Appendix A. (See 3-9.1)		For Information Only

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	CHAPTER 4 SIGNAL NOTIFICATION		Title
4-1	PURPOSE. This chapter applies to signal notification requirements in a central supervising station and, if provided, signal notification for evacuation of occupants or signals directing aid to the location of an emergency.		For Information Only
4-2	GENERAL.		Title
4-2.1	The suitability and location of indicating appliances for alarm, supervisory, and trouble signals shall be determined by the authority having jurisdiction.	D	Comply: The placement of the indicating devices have been designated by the A/E (AEPSC). Ref: Technical Data No. 25, 26, 27, 40 & 42.
4-2.2	Provision shall be made to designate the building in which a signal originates. The floor, section, or other subdivision of the building shall be designated at the central supervising station or at the building protected, except that the authority having jurisdiction may waive this detailed designation where the area, hiehgt, or special conditions of occupancy make it unessential. The indication of location shall utilize indicating appliances acceptable to the authority hving jurisdiction.	D	Not Applicable: Verified under Code Section 4102 72D, 1967 Edition.
4-2.3	This standard does not require the use of audible alarm signals other than one at the central supervising station. If it is desired to operate audible alarm-indicating appliances for the purpose of evacuation or directing aid to the locatin of an emergency, the alarm-indicating circuits and their controls shall comply with the applicable provisions of the Standard for Local Protective Signaling Systems, NFPA 72A, in addition to the provisions of this standard.	D	Not Applicable: Verified under Code Section 2511 72D, 1967 Edition.

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4-3	TROUBLE SIGNALS.		Title
4-3.1	In the central supervising station and other location(s) determined by the authority having jurisdiction, trouble shall be indicated by distinctive audible signals.		Editorial changes: Verified under Code Section 2431 72D, 1967 Edition.
4-3.2	SILENCING SWITCH. A switch for silencing the audible trouble signal shall be permitted only if it transfers the trouble indication to a lamp or other acceptable visual indicator adjacent to the switch. The visual indication shall persist until the trouble has been corrected. The audible trouble signal shall sound if the switch is in its "silence" position and no trouble exists.		Editorial changes: Verified under Code Section 2432 72D, 1967 Edition.
4-3.3	At a central supervising station an audible trouble signal shall be permitted to be silenced provided the act of silencing it following the receipt of one trouble signal shall not prevent it from operating immediately upon receipt of a subsequent trouble signal.	D	Not Applicable: The modifications performed during this period were the addition of local panels. The central supervising panel is verified under 1967 Edition.
4-4	DISTINCTIVE SIGNALS.		Title
4-4.1	Audible signal appliances of a fire alarm system shall produce signals which are distinctive from other similar appliances used for other purposes in the same area. The distinction among signals shall be as follows: (a) Fire alarm signals shall be distinctive in sound from other signals, and this sound shall not be used for any other purpose.	D	Comply: Different types of indicating devices are provided for distinctive fire alarm signaling and trouble signaling at the panels or area protected. Ref: Technical Data No. 32; Drawing No. 47, 74, 109 & 115.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	(b) Supervisory signals shall be distinctive in sound from other signals, and this sound shall not be used for any other purpose. EXCEPTION: IT MAY BE EMPLOYED TO INDICATE A TROUBLE CONDITION. (c) Fire alarm, supervisory, and trouble signals shall take precedence over all other signals. EXCEPTION: WHERE SUITABLE MEANS IS PROVIDED IN THE CENTRAL SUPERVISING STATION TO READILY IDENTIFY THE TYPE OF SIGNAL RECEIVED, A COMMON AUDIBLE INDICATING APPLIANCE MAY BE USED FOR ALARM, SUPERVISORY, AND TROUBLE INDICATION.		
4-5	SYSTEM OPERATION.	D	Not Applicable: The system operation requirements are addressed under Code Sections 4030, and 4040, 1967 Edition.
4-5.3	SYSTEM RESPONSE TIME.	D	Not Applicable: The response requirements are addressed under Article 260, 1967 Edition, by limiting the number of devices on signaling line circuits.
4-6	TRANSMISSION FAULT.	D	Not Applicable: This section's requirements are addressed under Code Section 4080, 1967 Edition.
4-7	SIGNAL REPORTS AND DISPOSITION	D	Not Applicable: This section's requirements are addressed under Code Sections 4100 and 4110, 1967 Edition.

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CALCULATION/PROBLEM COVER SHEET

Calculation/Problem No: 0120-108-008

Title: NFPA 72E CODE COMPLIANCE VERIFICATION CHECKLIST

Client: AEP **Project:** CODE COMPLIANCE REVIEW

Job No: 0120-108

Design Input/References: SEE SECTION 2.0

Assumptions: SEE SECTION 2.0. ALSO SEE PROJECT INSTRUCTION PI-FP-01, REVISION 1, CONDUCTING AND DOCUMENTING NFPA CODE COMPLIANCE REVIEWS. SEE IMPELL REPORT 09-0120-0123, CODE COMPLIANCE SUMMARY REPORT;

Method: SEE SECTION 3.0, ALSO SEE PROJECT INSTRUCTION PI-FP-01, REVISON 1.

Remarks: PAGES 25 AND 26 IDENTIFY THE ZONES/AREAS EVALUATED UNDER THE REQUIREMENTS OF THE 1974 EDITION OF THIS CODE. PAGE A1 IDENTIFIES THE ZONES/AREAS EVALUATED UNDER THE 1978 EDITION. PAGE B1 IDENTIFIES THE ZONES/AREAS EVALUATED UNDER THE 1982 EDITION. PAGE C1 IDENTIFIES THE ZONES/AREAS EVALUATED UNDER THE 1984 EDITION

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	E Klemsay	5/16/88

EDS 8004 STS

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

It is assumed that the detection arrangements for the space above the control room ceilings are as depicted in the walkdown data sheet sketch so as to confirm compliance.

It is assumed that the detection arrangement for the charcoal filter units are typical with exception of change in the number of charcoal filter beds.

It is assumed that the detectors identified in item 3.8.1c are installed and are verified for operability as indicated in the Surveillance Procedures.

3.0 METHODOLOGY

Reference Section 2.1.1 of Impell Project Instruction PI-FP-01, Revision 1.

All maintenance issues noted during the walkdown phase of the project have been identified in the CCVC's, but are not considered deviations due to the limited number.

Justifications for deviations and open items identified in the CCVC's, are detailed in Impell Technical Report No. 09-0120-0123.

The basis for the review of the fire protection systems against a specific code edition was determined by reviewing the systems against the code edition in effect during the time of the original system installation. Systems that were installed under modifications that took place after the original installation, would be reviewed under the code edition in effect during the period of the modification installation.

Code sections of subsequent editions that provided typical requirements of the initial code edition reviewed, were verified under the initial code edition requirements. Code sections of subsequent editions that provided significant code requirement changes from the initial code edition, were reviewed under the subsequent code edition.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

5.0 REFERENCES

Ref. No.	Document Number	Title	Revision No./Date		Elevation
		72D Walkdown Verification Checklists			
1	0120-108-007A	Fire Zone 1-1H, 29G 29A-F, 7 thru 11, 1,3,4,5, 6N,6M,6S, 13,15,16, 18,19,21 and a portion of 79 & 85.	0	12/10/87	573' 587' 587' 587'
2	0120-108-007B	Fire Zone 32, 33-33B, 34-34B, 37 thru 39, 40A&B, 41 42A-D, 43, 44N&44S, 45, 46A thru D, 47A&B	0	12/10/87	609' 609' 609' 609' 609' 609' 609' 609'
3	0120-108-007C	Fire Zone 56, 57, 58, and a portion of 44N	0	12/10/87	620'
4	0120-108-007D	Fire Zone 49 thru 54	0	12/10/87	633'
5	0120-108-007E	Fire Zone 69 thru 73	0	12/10/87	650'
		72E Walkdown Verification Checklists			
1	0120-108-008A	Fire Zone 1-1H	0	12/10/87	573'
2	0120-108-008B	Fire Zone 29G	0	12/10/87	573'
3	0120-108-008C	Fire Zone 14 & 79	0	12/10/87	587'
4	0120-108-008D	Fire Zone 3, 4, 5, 6N, 6M, 6S, 64A&B, 65A&B, 61, 62A thru C, 63A thru C	0	12/10/87	587'
5	0120-108-008E	Fire Zone 13,15,16	0	12/10/87	587'
6	0120-108-008F	Fire Zone 17C	0	12/10/87	587'
7	0120-108-008G	Fire Zone 7 thru 11	0	12/10/87	587'

Ref. No.	Document Number	Title	Revision No./Date		Elevation
8	0120-108-008H	Fire Zone 29A thru F	0	12/10/87	587'
9	0120-108-008J	Fire Zone 23 thru 27	0	12/10/87	587'
10	0120-108-008K	Fire Zone 18, 19 & 21	0	12/10/87	587'
11	0120-108-008L	Fire Zone 20 & 85	0	12/10/87	587'
12	0120-108-008M	Fire Zone 37, 43, 44N & 44S	0	12/10/87	609'
13	0120-108-008N	Fire Zone 33 thru 33B	0	12/10/87	609'
14	0120-108-008O	Fire Zone 38	0	12/10/87	609'
15	0120-108-008P	Fire Zone 40A&B, 41 42A thru D	0	12/10/87	609'
16	0120-108-008Q	Fire Zone 34 thru 34B	0	12/10/87	609'
17	0120-108-008R	Fire Zone 45, 46A thru D 47A&B	0	12/10/87	609'
18	0120-108-008S	Fire Zone 39	0	12/10/87	609'
19	0120-108-008T	Fire Zone 56 & 57	0	12/10/87	620'
20	0120-108-008U	Fire Zone 58 & 59	0	12/10/87	620'
21	0120-108-008V	Fire Zone 55	0	12/10/87	620'
22	0120-108-008W	Fire Zone 60	0	12/10/87	620'
23	0120-108-008X	Fire Zone 53 & 145	0	12/10/87	633'
24	0120-108-008Y	Fire Zone 54 & 144	0	12/10/87	633'
25	0120-108-008Z	Fire Zone 52 & 106	0	12/10/87	633'
26	0120-108-008AA	Fire Zone 48 thru 51 & 107	0	12/10/87	633'
27	0120-108-008BB	Fire Zone 32, 69, 70 & 73	0	12/10/87	650'
28	0120-108-008CC	Fire Zone 71 & 72	0	12/10/87	650'

Ref. No.	Document Number	Title	Revision No./Date
	Procedures		
1	12-OHP4030.STP.120	Fire Protection System - Water & CO_2	11 01/30/87
2	1-OHP4030.STP.121LD	Low Demand Fire Pump Oper. Test	1 12/13/85
3	1-OHP4030.STP.121HD	High Demand Fire Pump Oper. Test	1 12/13/85
4	2-OHP4030.STP.121HD	High Demand Fire Pump Oper. Test	1 12/13/85
5	2-OHP4030.STP.121DD	Diesel Fire Pump Oper. Test	0 02/17/85
6	1-OHP4030.STP.121DD	Diesel Fire Pump Oper. Test	0 02/17/85
7	12-THP4030.STP.223	Fire Protection Water System Test	6 09/04/86
8	12-OHP4030.STP.003	Standpipe Oper. Test	0 07/18/85
9	12-THP6030.IMP.144	Man. Oper. Fire Alarm Boxes	2 06/09/81
10	12-THP6030.IMP.142	Fire Det. Inst. & CO_2 Surv.	10 05/09/87
11	12-THP6030.IMP.153	Sys. 3 Fire Det. Surv. Testing	4 04/23/87
12	12-THP6030.IMP.051	Fire Det. High Volt. Prev. Maint.	2 05/18/87
13	12-THP4030.STP.224	Control Room Cable Vault Halon System Surv.	4 01/15/87
14	-	-	- -
15	12-THP6040.PER.105HR	Hose Reel Sta. CO_2 Test	0 04/25/86
16	12-THP4030.STP.225.010	Control Room Cable Vault CO_2 System Test	1 05/14/87

Ref. No.	Document Number	Title	Revision No./Date
17	12-THP4030.STP.225.020	Auxiliary Cable Vault CO_2 System Test	1 05/14/87
18	12-THP4030.STP.225.030	Reactor C.T.Q #1 CO_2 Test	1 06/04/87
19	12-THP4030.STP.225.031	Reactor C.T.Q #2 CO_2 Test	1 06/04/87
20	12-THP4030.STP.225.032	Reactor C.T.Q #3S CO_2 Test	1 06/11/87
21	12-THP4030.STP.225.033	Reactor C.T.Q #3M CO_2 Test	1 06/18/87
22	12-THP4030.STP.225.034	Reactor C.T.Q #3N CO_2 Test	1 06/18/87
23	12-THP4030.STP.225.035	Reactor C.T.Q #4 CO_2 Test	1 06/11/87
24	12-THP4030.STP.225.042	Diesel Generator Oil & Pump & Valve Room CO_2 Test	1 05/29/87
25	12-THP4030.STP.225.050	4KV Swtgr CO_2 Test	1 06/23/87
26	12-THP4030.STP.225.051	Emergency Swtgr. CO_2 Test	1 06/25/87
27	12-THP4030.STP.225.052	CRD Trans. Swtgr Room CO_2 Test	1 06/24/87
28	12-THP4030.STP.225.053	Swtgr. Cable Vault CO_2	1 08/20/87
29	1-THP4030.STP.225.040	Unit 1 AB Diesel Gen. CO_2 Test	1 06/04/87
30	1-THP4030.STP.225.041	Unit 1 CD Diesel Gen. CO_2 Test	1 05/29/87
31	1-OHP4024.102.001-050	Annunciator #2 Resp. Misc. Area Fire System	3 11/06/86
32	2-OHP4024.202.001-050	Annunciator #2 Resp. Misc. Area Fire System	1 11/06/86
33	1-OHP4024.101.001-100	Annunciator #1 Resp. Plant Fire System	2 04/27/82

Ref. No.	Document Number	Title	Revision No./Date	
34	2-OHP4024.201.001-100	Annunciator #1 Resp. Plant Fire System	2	12/03/86
35	PHI-2270	Fire Protection	16	07/09/87
36	12-PHP2070.TRN.108	Maint. Skills Testing Prog.	1	04/23/87
37	OHI-2272	Use & Maint. of D.C.C.. Fire Prg - Rans	0	06/13/85
38	OHI-4011	Conduct of Oper. (Shift Staffing)	3	06/25/87
39	OHI-4013	Operators: Auth. & Resp.	2	04/23/87
40	12-AHP2060.SEC.052	Fitness for Duty	0	11/06/85
41	OHI-4012	Conduct of Operator (Shift Turnover)	5	01/06/87
42	12-AHP2060.SEC.016	Employee ID	12	08/27/87
43	12-QHP2270.FIRE.011	Fire Watch Activities	2	07/31/86
44	12-PHP2070.TRN.115	Fire Brigade Training	2	05/09/87
45	OHI-2070	Training	5	04/07/86
46	PHI-2070	Training	8	07/26/85
47	12-THP6030.IHP.307	System 3 Fire Det. Surv. Testing	0	04/16/85
48	PHI-2040	Information Management	6	06/26/86
49	PHI-4030	Technical Specifications	13	12/24/87
50	12-THP4030.STP.239	RCP Pump Fire Prot. Test	5	07/09/87
51	12-OHP4022.066.001	Alternate Filter Unit Valve Operator	1	11/06/86
52	1-THP6030IHP.151	Containment Cable Tray Fire Detection	4	04/11/86
53	2-THP6030IHP.251	Containment Cable Tray Fire Detection	5	12/20/85

Ref. No.	Document Number	Title	Revision No./Date
	Technical Data		
1	-	Alison Controls Operation Maintenance Manual	- 01/15/75
2	00900020001	FCI Ltr. Ref. Cook Plant & Job #1882	- 12/06/77
3	PLC Report	D.C. Cook Unit 1 Control Room Fire Det. Test Results	- 10/13/83
4	Ref. 2-6.4, F.I. 78-2	NFPA 72E - '84 Edition Formal Interpretation	- 1984
5	-	NFPA 220 - '85 Edition Page 4 & 5 only	- 1985
6	SD-DCC-FP101	Fire Protection System Water System Description	2 Draft
7	SD-DCC-FP103	Fire Protection System-Misc. System Description	3 08/16/87 Draft
8	-	Specification for Fire Protection System @ D.C. Cook Unit 1 & Unit 2	0 04/02/71
9	DCCFP106QCF	Specification for Low Volt Ion Fire Detection System	0 03/15/87
10	Letter from P. Regenscheid to P. Hycoff	Fire Protection for Char Filter Unit @ Spray Add. Tank Room	- 01/15/87
11	Sht. 1-54	D.C. Cook "Pyralarm" Detection System Ckt. Layout Unit 1 & 2	1 04/09/85
12	-	ANI Recom. for Charcoal Filter	- 09/77

Ref. No.	Document Number	Title	Revision No./Date
13	Technical Data "Viking"	Emergency Release Part #01553C	- -
14	Hercoid Pg. 1-5 Data Sheet	Hercoid Pressure & Temperature Controls	- -
15	Page 1 of 1 Potter Electric	Gate Valve Switch Model #OSYS-U	- -
16	Potter Electric Bulletin 518 Page 1 & 2 of 2	Gate Valve Switch Model #OSYS-8	Pg 1 12/83 Pg 2 07/84
17	3129402021 Page 1-3	Telex with Cable Descriptions	- 12/17/87
18	January 1985	Underwriters Laboratories Fire Protection Equipment Directory	- 12/31/84
19	January 1977	Underwriters Laboratories Fire Protection Equipment Directory	- 12/31/76
20	UL864	UL Standard for Safety Control Units for Signaling System	6th 06/06/80
21	P7825	Factory Mutual Approval Guide 1986	Rev 86 01/86
22	RFC#12-2521	Fire Detection Design Packet	- 08/14/85
23	RFC#12-2741	Fire Detection Design Packet	0 02/13/87
24	RFC#12-1843	Fire Detection Design Packet	3 10/23/87
25	RFC#01-2679	Fire Detection Design Packet	0&1 01/31/86
26	RFC#02-2694	Fire Detection Design Packet	0&1 05/02/86

Ref. No.	Document Number	Title	Revision No./Date	
27	RFC#12-2678	Fire Detection Design Packet	0&1	12/18/87
28	-	-	-	-
29	NFPA 13	Installation of Sprinklers	-	1971 1983
30	NFPA 72D	Proprietary Protection Signaling System	-	1967 1979
31	NFPA 72E	Automatic Fire Detection	-	1974 1978 1982 1984
32	Data Sheet 3050	Pyrotronics "System 3" CP-30	-	04/82
33	Data Sheet 3165	Pyrotronics "System 3" BM-30	-	12/76
34	Data Sheet 3173	Pyrotronics "System 3" BM-32	-	08/78
35	ROC dated 12/3/87 B. Gerwe from D. Kipley	Ambient Conditions of Plant	-	12/03/87
36	Data Sheet 3325	Pyrotronics "System 3" "EA" Enclosure	-	08/82
37	Data Sheet 6113	Pyrotronics Ion Det. DI-4A	-	04/79
38	Data Sheet S121	AFA-Minerva I.R. Det. S121	-	-
39	ROC From D. Kipley (Impell) to D. Bronmier (U.L.)	U.L. Listed Pyrotronics Det. Equipment	-	-
40	RFC 12-2231	RCP Pump Fire Detection Supp. Protection Modification Packet	0	03/27/87

Ref. No.	Document Number	Title	Revision No./Date
41	ROC dated 1/8/88 L. Taylor from D. Kipley	Pressure Switch Numbering Data	- 01/08/88
42	RFC 12-2149	P-250 Comp. Room Halon System Modification Packet	- -
43	Data Sheet 3168	Pyrotronics "System 3" HC-30	- 12/79
44	-	FCI Detection System System Data Sheet & Man.	App 01/22/75
45	Data Sheet 403-4	Pyrotronics I.R. DFS-10	- 05/73
46	ROC from Joe Black to Delpoletto/Veldhuizen	Pyrotronics FIU & CP-30	- 01/05/88
47	ROC from Joe Black to Depona/Guilfoos	Rochester AN-159	- 01/06/88
48	ROC from J. Black to to E. Taylor	Cable Information	- 01/12/88
49	ROC from J. Black to F. Keymak (M. Kimak; ACI)	ACI Power Supply	- 01/13/88
50	NFPA 70, Section 310	NEC Table 310-16	- 1987
51	Data Sheet 3351	Pyrotronics BM-30	- 03/80
52	0120-108-009	Impell Air Movement Calculation	0 02/24/88
53	Impell Letter 0120-108-019	Meeting Minutes of Jan. 28 & 29, 1988 (Item: Table 3-7.1, Section 4116)	- -
54	UL 346	UL Standard for Safety Waterflow Indicators for Protective Signaling System	2nd 08/19/82
55	UL 38	UL Standard for Safety Manually actuated signaling Boxes	4th 07/23/82

Ref. No.	Document Number	Title	Revision No./Date
56	Catalog #29	Automatic Switch - Co. Pages 3, 9, 50 & 98	- 1973
57	NFPA 90A, Section 4-3	Air Conditioning and Ventilating System	- 1978
58	"Snaplock" Data Sheet	National Acme Company	
59	HVAC Data Input From B. Gerwe to D. Kipley	HVAC Data	- 02/19/88
60	Pyr-A-Larm B-335-8-74	Application Engineering Fundamentals	- 1974
61	Radiation Data From B. Gerwe to D. Kipley	Radiation Level Data	- 03/04/88
62	Fire Protection Report Output #1	D.C. Cook Power Plant, Units 1 and 2	- 12/03/86
63		HVAC Systems Duct Design Page 5.10, Section E.1	- 1981
	Licensing Documents		
1	Letter from S.A. Varga (NRC) to J. Dolan (I & MEC)	Appendix A to BTP APCSB/ 9.5-1 Deviations Pg. 1-10	- 08/27/85
2	Letter from S.A. Varga (NRG) to J. Dolan (I & MEC), Page 1-19	Appendix R to 10CFR 50 Section III G & III O Exemption	- 12/23/83
3	Letter from S.A. Varga (NRG) to J. Dolan (I & MEC), Page 1-19	Appendix R to 10CFR 40 Section III G & III L Exemption	- 11/22/83
4	AEP:NRC:00258 Pg 1-32	Amendments # 31 & 12 Facility Operator License	- 07/31/79
5	-	NRC 53 Questions on Appendix A & FHA 1st & 2nd Sub.	#1 09/30/77 #2 11/22/77
6	I & MEC D.C. Cook Units 1 & 2	Response to Appendix A to BTP/APCSB 9.5-1	0 01/31/77
7	Docket #50-315 & 316 DPR 58 & 74	Fire Hazard Analysis D.C. Cook Units 1 & 2	1 01/30/87
8	Appendix R to 10CFR 50 Part 50	Fire Protection Program for Nuclear Power Facility	- 09/01/82

Ref. No.	Document Number	Title	Revision No./Date	
	Drawings			
1	1-98602-51	Descriptive List of Annunciators Station #2	51	04/16/86
2	12-5266-2	Fire Facilities Plan Below Basement El. 573'	2	08/17/87
3	12-5267-3	Fire Facilities Plan Basement El. 591'-0" & 587'-0"	3	08/17/87
4	12-5268-2	Fire Facilities Plan Mezzanine Floor El. 609'	2	08/17/87
5	12-5268A-2	Fire Facilities Plan Cable Vaults El. 620'-6" & 625'-10"	2	08/17/87
6	12-5269-2	Fire Facilities Plan Main Floor El. 633'-0"	2	08/17/87
7	12-5270-2	Fire Facilities Reactor Building El. 650'-0"	2	08/17/87
8	1-5152B-2	Flow Diagram F.D. Water Unit 1: Turbine Building & Screenhouse	2	08/25/87
9	2-5152C	Flow Diagram F.D. Water Unit 2: Turbine Building & Screenhouse	0	10/06/86
10	12-5152D	Flow Diagram F.P. Water Auxiliary & Cont Buildings Units 1 & 2	0	10/06/86
11	1-98602-51	Descriptive List of Annunciators, Sheet 2	51	04/16/86
12	1-98601-51	Description List of Annunciators, Sheet 1	51	06/19/86
13	12-98992-2	Pyr-A-Larm Systems Service Building Ele. Diagram	2	05/29/79
14	1-92003-35	Emergency Fire Panel "EF" Wiring Diagram	35	02/10/87
15	1-92006-10	Emergency Fire Rear Panel "EFR", Sheet 1	10	06/26/81

Ref. No.	Document Number	Title	Revision No./Date
16	1-92007-29	Emergency Fire Rear Panel "EFR", Sheet 2	29 04/01/87
17	1-92161-13	F.P. System Logic Cabinet Wiring Diagram	13 07/16/81
18	1-92160-2	Emergency Fire Rear Panel "EFR", Sheet 4	2 07/18/74
19	1-98611-4	Annunciator Internal Diagrams Unit 1	4 05/14/87
20	1-98612-12	Plant Fire System Annunciator Elevation Diagram Unit 1	12 07/01/86
21	1-98951-3	Scheme of F.P. Turbine & Auxiliary Sheet 1	3 03/09/79
22	1-98952-3	Scheme of F.P. Turbine & Auxiliary Sheet 2	3 12/18/86
23	1-98966-14	F.P. Logic Diagram Unit 1	14 03/16/87
24	2-92003-24	Emergency Fire Panel "EF" Wiring Diagram Unit 2	24 09/18/86
25	2-92006-7	Emergency Fire Panel "EFR" Sheet 1, Unit 2	6 12/30/77
26	2-92007-24	Emergency Fire Rear Panel "EFR" Sheet 2	24 08/04/87
27	2-92008-11	Emergency Fire Rear Panel "EFR" Sheet 3	11 09/17/87
28	2-92160-4	Emergency Fire Rear Panel "EFR" Sheet 4	4 11/07/78
29	2-92161-15	F.P. System Logic Cabinet Unit 2	15 08/04/87
30	2-98612-16	Plant Fire System Annunciator Unit 2	16 08/14/87
31	2-98952-2	Scheme of F.P. Turbine & Auxiliary Sheet 2	2 12/18/86

Ref. No.	Document Number	Title	Revision No./Date
32	1-92335-14	Cont. & Auxiliary sub panel "CAS" Sheet 8	14 04/01/87
33	1-92373-1	RCP Fire System Control Cab	1 04/01/87
34	1-95901-4	F.P. Emergency Fire Pump Hiring Diagram	4 11/16/72
35	1-95902-13	Diesel Engine Fire Pump Sheet 1	13 11/26/79
36	2-95926-7	F.D. Charcoal Filter Unit 2	7 08/18/86
37	2-98977-4	F.D. Cont. Detection, Sheet 4	4 08/21/78
38	2-98979-2	F.D. Reactor Cool Pumps Sprinkler System	2 01/09/87
39	12-95914-1	Auxiliary Building Sprinkler System	1 05/01/84
40	A924-1	Alison Control Inc. Sprinkler Control System	0 05/18/72
41	A924-2	Alison Control Inc. Sprinkler Control System	0 05/17/72
42	541012	Sensor Detection	1 07/27/77
43	324022	Interconnection Diagram	A 08/14/72
44	324028	Elementary Diagram	
45	324029	Elemental Diagram	A 09/30/82
46	771026	Schematic Diagram - (4) Sheets	E 11/23/83
47	771478	Schematic & Interconn Diagram - (2) Sheets	D 06/27/79
48	324173	Int. Diagram A700-9 System - (2) Sheets	D 06/27/79
49	191006	F.P. System Solenoid Valve	C 12/27/79
50	883072	F.P. System 19" Rack - (2) Sheets	E 06/26/79
51	771477	Sch. & Interconn Diagram - (4) Sheets	D 06/27/79

Ref. No.	Document Number	Title	Revision No./Date	
52	1-95906-10	F.P. Transformer H_2O	10	02/13/76
53	1-95909-6	F.P. Charcoal Filter H_2O Spray Systems	6	04/29/87
54	1-95910-6	F.P. Charcoal Filter H_2O Spray Systems Turbine & Auxiliary	6	01/29/87
55	1-95911-6	F.P. Charcoal Filter H_2O Spray Systems Turbine & Auxiliary	6	01/29/87
56	1-95926-9	F.P. Charcoal Filter H_2O Spray Systems Unit 1 Containment	9	09/18/86
57	1-98969-7	F.P. H_2O Systems Sheet 3 Elevation Diagram	7	06/08/87
58	1-98971-8	F.P. H_2O System Sheet 1	8	07/29/83
59	1-98972-9	F.P. H_2O Systems Sheet 2 Elevation Diagram	9	11/05/86
60	1-98977-5	F.P. Containment Detection Sheet 4	5	01/07/85
61	1-98978-8	F.P. H_2O Systems Sheet 4	8	07/01/86
62	1-98979-3	F.P. Reactor Coolant Pumps	3	04/02/87
63	2-95901-1	F.P. Emergency Fire Pump Wiring Diagram	1	06/13/77
64	2-95902-8	Diesel Engine Fire Pump	8	11/26/79
65	2-95906-10	F.P. Transformer H_2O Spray	10	10/21/86
66	2-95909-3	F.P. Charcoal Filter H_2O Spray Auxiliary & Turbine System	3	04/29/87
67	2-95910-4	F.P. Charcoal Filter H_2O Spray Auxiliary & Turbine System	4	04/29/87
68	2-95911-4	F.P. Charcoal Filter H_2O Spray Auxiliary & Turbine System	4	04/29/87

Ref. No.	Document Number	Title	Revision No./Date	
.69	2-95946-6	F.P. System Control Room Cable Vault Halon	6	02/06/86
70	DK-NY-1433	Pipe Layout Computer Room Units 1 & 2	1	03/28/79
71	DL-NY-1433-1	Logic Diagram Comp. Room Units 1 & 2	-	-
72	1-95946-6	F.P. Control Room Cable Vault Halon	6	02/06/86
73	12-98996-4	Miscellaneous Halon System	4	09/03/86
74	12-98997-2	Comp. Rooms Halon System	2	09/04/86
75	12-95913-4	Comp. Rooms F.P. Wiring Diagram	4	09/04/86
76	12-95915-1	Comp. Rooms F.P. Wiring Diagram Sheet 2	1	06/08/86
77	1-95936-15	F.P. Turbine & Auxiliary Building CO_2, Sheet 1	15	04/29/86
78	1-95937-18	F.P. Turbine & Auxiliary Building CO_2, Sheet 2	18	04/29/86
79	1-95938-14	F.P. Turbine & Auxiliary Building CO_2, Sheet 3	14	04/29/86
80	1-95939-14	F.P. Turbine & Auxiliary Building CO_2, Sheet 4	14	12/05/87
81	1-95941-15	F.P. Turbine & Auxiliary Building CO_2, Sheet 6	15	04/29/86
82	1-95942-15	F.P. Turbine & Auxiliary Building CO_2, Sheet 7	15	04/29/86
83	1-95943-15	F.P. Turbine & Auxiliary Building CO_2, Sheet 8	15	04/29/86
84	1-95944-16	F.P. Turbine & Auxiliary Building CO_2, Sheet 9	16	12/01/83

Ref. No.	Document Number	Title	Revision No./Date
85	1-95945-14	F.P. Turbine & Auxiliary Building CO_2, Sheet 10	14 04/29/86
86	1-98981-20	F.P. CO_2 System, Sheet 1	20 06/15/87
87	1-98983-1	F.P. CO_2 System, Sheet 3	1 07/16/87
88	2-95936-10	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 1	10 04/29/86
89	2-95937-13	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 2	13 04/29/86
90	2-95938-11	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 3	11 04/29/86
91	2-95941-14	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 6	14 06/13/85
92	2-95942-6	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 7	6 04/29/86
93	2-95943-6	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 8	6 04/29/86
94	2-95944-10	F.P. Turbine & Auxiliary CO_2 Fire System, Sheet 9	10 04/29/86
95	12-95993-2	F.P. Turbine & Auxiliary CO_2 Hose Reels	2 04/29/86
96	FL-15771	Cardox Fire Extinguisher System Elm. Line, Sheet 17	B 04/21/72
97	FL-15771	Cardox Fire Extinguisher System Elm. Line, Sheet 18	B 04/31/72
98	FL-15771	Cardox Fire Extinguisher System Elect. Control Cab., Sheet 19	A 05/07/71
99	FL-15771	Cardox Fire Extinguisher System Elect. Control Cab., Sheet 20	A 05/07/71
100	FL-15771	Cardox Fire Extinguisher System Alarm System Elm. Line, Sheet 21	A 05/07/71

Ref. No.	Document Number	Title	Revision No./Date
101	FL-15771	Cardox Low Pressure Fire Extinguisher System	D 02/15/72
102	12-95929-5	Fire Detection System Screenhouse & ESH	5 10/15/86
103	1-95927-1	F.P. System Main Steam Line Etc.	1 10/16/86
104	1-95928-4	F.P. System Trans. Room Etc.	4 10/15/86
105	1-95981-18	Auxiliary Building Pyr-A-Larm Fire System, Sheet 1	18 03/18/87
106	1-95984-1	Auxiliary Building Pyr-A-Larm Fire System, Sheet 3	1 10/16/86
107	1-95995-3	F.P. System Auxiliary Building Fire Siren	3 09/03/74
108	1-98970-5	F.P. Miscellaneous Elementary Diagram	5 01/23/80
109	1-98990-3	F.P. Pyr-A-Larm System, Sheet 3	3 10/16/86
110	1-98991-12	F.P. Detection System Elementary Diagram	12 08/06/86
111	2-95927-1	F.P. System Main Line Etc.	1 08/11/86
112	2-95928-2	F.P. System Trans. Room Etc.	2 10/16/86
113	2-95981-12	Auxiliary Building Pyr-A-Larm Fire System	12 10/05/87
114	2-95982-1	Auxiliary Building Pyr-A-Larm Fire System, Sheet 2	1 10/16/86
115	2-98990-4	F.P. Pyr-A-Larm System	4 11/18/86
116	2-95995-3	F.P. System Auxiliary Building Fire Siren	3 09/19/75
117	PM-4302	Detection System Screenhouse - Sheet 1	3 03/04/85
118	PM-4302	Detection System Screenhouse - Sheet 2	1 04/30/85

Ref. No.	Document Number	Title	Revision No./Date	
119	PM-4303	Detection System Main Steam Encl. Etc. - Sheet 1	5	07/27/85
120	PM-4303	Detection System Main Steam Encl. Etc. - Sheet 2	2	07/25/85
121	PM-4303	Detection System Main Steam Encl. Etc. - Sheet 3	0	05/01/85
122	PM-4303	Detection System Main Steam Encl. Etc. - Sheet 4	2	07/25/85
123	PM-4303	Detection System Main Steam Encl. Etc. - Sheet 5	2	07/25/85
124	PM-4304	Detection System Main Steam Line Area - Sheet 1	5	07/25/85
125	PM-4304	Detection System Main Steam Line Area - Sheet 2	2	07/25/85
126	PM-4304	Detection System Main Steam Line Area - Sheet 3	2	07/25/85
127	PM-4304	Detection System Main Steam Line Area - Sheet 4	2	07/25/85
128	PM-4305	Detection System Auxiliary Feed Pump	5	07/25/85
129	PM-4308	Detection System Tranf. Room	5	07/25/85
130	2-95907-13	Fire Protection XFMR Sprinkler Wiring Diagram	13	10/86
131	1-95907-16	Fire Protection XFMR Sprinkler Wiring Diagram	16	04/01/87
132	1-95906-10	Fire Protection XFMR Sprinkler Wiring Diagram	10	02/86
133	1-95903-7	Diesel Engine Fire Pump Wiring Diagram	7	03/79
134	2-95903-5	Diesel Engine Fire Pump Wiring Diagram	5	03/20/79

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135	12-95908-15	Auxiliary Building Sprinkler Wiring Diagram	15 -
136	2-98972-9	Fire Protection Elementary Diagram, Unit 2, Sheet 2	9 10/24/86
137	2-98978-7	Fire Protection Elementary Diagram, Unit 2, Sheet 4	7 01/26/85
138	2-98971-10	Fire Protection Elementary Diagram, Unit 2, Sheet 1	10 07/08/87
139	1-95940-18	Fire Protection Turbine & Auxiliary CO_2 Wiring Diagram Unit 1, Sheet 5	18 04/24/86
140	1-95939-14	Fire Protection Turbine & Auxiliary CO_2 Wiring Diagram Unit 2, Sheet 4	14 10/14/87
141	2-95940-13	Fire Protection Turbine & Auxiliary CO_2 Wiring Diagram Unit 2, Sheet 5	13 04/24/86
142	2-98981-20	Fire Protection CO_2 Elementary Diagram Unit 2, Sheet 1	20 10/30/87
143	2-98983-1	Fire Protection CO_2 Elementary Diagram Unit 2, Sheet 3	1 06/19/81
144	1-98613-19	Miscellaneous Fire Area System & Vent. Elementary Diagram	19 10/26/87
145	12-5972-2	FHA Plan Below Basement, Units 1 & 2	2 04/03/86
146	12-5973-3	FHA Base T Plan - 587' & 591' Units 1 & 2	3 01/06/87
147	12-5974-2	FHA Mezzanine Floor - 609'	2 09/03/86
148	12-5975-2	FHA Plan 601', 609', & 620'-6" to 625'	2 09/03/86
149	12-5976-3	FHA Turbine Building Main Floor 633'	3 11/25/86

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150	12-5977-2	FHA Reactor Building - 650'	2	09/31/86
151	12-5152P-2	Flow Diagram Water Fire Protection	2	02/25/87
152	12-5152N-2	Flow Diagram Water Fire Protection	2	07/01/87
153	12-5152M-1	Flow Diagram Water Fire Protection	1	07/02/87
154	12-5152L-2	Flow Diagram Water Fire Protection	2	02/25/87
155	12-5152K-1	Flow Diagram Water Fire Protection	1	02/25/87
156	12-5152J-0	Flow Diagram Water Fire Protection	0	10/06/86
157	12-5152H-0	Flow Diagram Water Fire Protection	0	10/06/86
158	12-5152G-1	Flow Diagram Water Fire Protection	1	08/06/87
159	12-5152F-1	Flow Diagram Water Fire Protection	1	01/22/87
160	12-5152E-2	Flow Diagram Water Fire Protection	2.	07/07/87
161	12-5152A-1	Flow Diagram Water Fire Protection	1	01/22/87
162	12-5152-1	Flow Diagram Water Fire Protection	1	02/20/87
163	1-2010-58	Conduit & Cable Schedule, Unit 1	58	05/23/86
164	1-94211-19	600VA Auxiliary Bus Wiring Diagram	19	04/08/87
165	1-2011-49	Conduit & Cable Schedule	49	05/18/87
166	1-2012-38	Conduit & Cable Schedule	38	05/21/87
167	1-2098-51	Conduit & Cable Schedule	51	12/16/86
168	1-2111-27	Conduit & Cable Schedule	27	03/31/87
169	1-12000-3	Auxiliary One-Line Index	3	04/10/87
170	1-12001-4	Main Auxiliary One-Line Diagram Bus A & B	4	-
171	1-12002-3	Main Auxiliary One-Line Diagram Bus C & D	3	04/10/87

Ref. No.	Document Number	Title	Revision No./Date	
172	1-12003-2	250V DC Main One-Line	2	02/26/87
173	1-12050-2	120/208V AC Control Room Inst.	2	09/14/87
174	1-12051-3	120V AC Critical Control Room	3	05/26/87
175	1-12052-6	120/208V AC Control Room Power	6	05/13/87
176	1-12060-2	DC Auxiliary One-Line 250V DC Bus	2	02/26/87
177	1-12061-1	DC Auxiliary One-Line 250V DC Bus	1	02/26/87
178	1-12062-1	DC Auxiliary One-Line 250V DC Bus	1	02/26/87
179	1-12063-3	DC Auxiliary One-Line 250V DC Bus	3	04/10/87
180	1-12065-2	DC Auxiliary One-Line 250V DC Bus	2	06/19/87
181	1-12070-2	DC Auxiliary One-Line 250V DC Bus	2	02/26/87
182	1-12071-2	DC Auxiliary One-Line 250V DC Bus	2	07/15/87
183	1-12072-3	DC Auxiliary One-Line 250V DC Bus	3	04/10/87
184	1-12073-2	DC Auxiliary One-Line 250V DC Bus	2	02/26/87
185	1-93211-17	600V Auxiliary Bus 11C	17	06/20/85
186	1-94230-9	600V Auxiliary Bus 11D	9	07/15/87
187	2-2009-43	Conduit & Cable Schedule	43	01/29/87
188	2-2010-35	Conduit & Cable Schedule	35	08/11/87
189	2-2011-32	Conduit & Cable Schedule	32	09/05/79
190	2-2098-34	Conduit & Cable Schedule	34	
191	2-2111-27	Conduit & Cable Schedule	27	10/08/87
192	2-12000-3	Auxiliary One-Line Index	3	03/26/87
193	2-12001-2	Main Auxiliary One-Line Diagram	2	09/09/87
194	2-12002-1	Main Auxiliary One-Line Diagram	1	09/09/87

Ref. No.	Document Number	Title	Revision No./Date	
195	2-12003-0	250V DC Main One-Line Diagram	0	10/06/86
196	2-12050-2	120V AC Control Room Inst.	2	-
197	2-12052-4	120/208V AC Control Room Power	4	10/15/87
198	2-12060-0	DC Auxiliary One-Line 250V DC Bus	0	10/06/86
199	2-12061-0	DC Auxiliary One-Line 250V DC Bus	0	10/06/86
200	2-12062-1	DC Auxiliary One-Line 250V DC Bus	1	-
201	2-12063-1	DC Auxiliary One-Line 250V DC Bus	1	04/10/87
202	2-12065-1	DC Auxiliary One-Line 250V DC Bus	1	06/19/87
203	2-12070-0	DC Auxiliary One-Line 250V DC Bus	0	10/06/86
204	2-12071-0	DC Auxiliary One-Line 250V DC Bus	0	10/06/86
205	2-12072-1	DC Auxiliary One-Line 250V DC Bus	1	09/09/87
206	2-12073-1	DC Auxiliary One-Line 250V DC Bus	1	-
207	2-93211-11	600V Auxiliary Bus 21C	11	07/02/85
208	2-94211-7	600V Auxiliary Bux 21A	7	07/07/87
209	2-98991-7	Fire Detection Elementary Diagram	7	-
210	2-98613-17	Misc. Fire Area System & Vent. Elementary Diagram	17	10/30/87
211	1-95982-11	Auxiliary Building Pyralarm Wiring Diagram	11	10/15/87
212	2-98611-1	Annunciator Internal Diagram	1	10/87
213	2-98951-2	Schedule of Fire Protection Turbine & Building, Sheet 1	2	07/09/87
214	2-98970-3	F.P. Misc. Elementary Diagram	3	03/08/78
215	12-5152B-2	Flow Diagram Fire Protection Water	2	08/25/87
216	12-5152D	Flow Diagram Fire Protection Water	0	10/06/86
217	12-5152C	Flow Diagram Fire Protection Water	0	10/06/86
218	1-98963-1	CO_2 Fire Protection Elementary	1	07/16/87
219	2-98963-1	CO_2 Fire Protection Elementary	1	06/19/81

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220	1-98977-5	CAS ELementary Diagram	5	01/07/85
221	2-98977-4	CAS Elementary Diagram	4	08/21/78
222	1-92335-14	CAS Hiring Diagram	14	04/01/87
223	2-92335-14	CAS Hiring Diagram	14	-
224	12-5713-4	Heat & Vent. Aux. Bldg. Elev. 573'	4	05/17/84
225	12-5714-13	Heat & Vent. Aux. Bldg. Elev. 587'	13	None
226	12-5715-12	Heat & Vent. Aux. Bldg. Elev. 587'	12	05/08/87
227	12-5719A-3	Heat & Vent. Aux. Bldg. Elev. 587'	3	08/29/85
228	12-5718A-0	Heat & Vent. Aux. Bldg. Elev. 587'	0	09/16/81
229	1-5688-10	Heat & Vent. Reactor Cont. Elev. 598' & 612	10	02/01/88
230	2-5688-8	Heat & Vent. Reactor	8	02/01/88
231	1-5724-8	Heat & Vent Aux. Center, North, South & East 587' & 609' Elec. Swgr & Dsl. Gen.	8	09/27/85
232	1-5724-11	Heat & Vent Aux. Bldg. 609'	11	06/07/84
233	2-5724-9	Heat & Vent Aux. Bldg. 609'	9	11/10/82

Ref. No.	Document Number	Title	Revision No./Date	
234	1-5724B-2	Heat & Vent Aux. Bldg. 609'	2	05/11/84
235	2-5724B-2	Heat & Vent Aux. Bldg. 609'	2	05/24/84
236	12-5736-6	Heat & Vent Aux. Bldg. 609'	9	05/01/87
237	12-5736B-2	Heat & Vent Aux. Bldg. 609'	2	02/05/87
238	1-5750-9	Heat & Vent Aux. Bldg. 633'	9	05/01/87
239	2-5750-5	Heat & Vent Aux. Bldg. 633'	5	06/10/87
240	12-5737-8	Heat & Vent Aux. Bldg. 620' & 609'	8	05/13/87
241	12-5718-5	Heat & Vent Aux. Bldg. 609'	5	10/28/83
242	12-5720-7	Heat & Vent Aux. Bldg. 633' & 650'	7	10/07/80
243	1-51486-0	Flow Diagram Aux. Bldg. Elec. Equip. Area. Heat & Vent	0	None
244	1-5148C-0	Flow Diagram Aux. Bldg. Elec. Equip. Area. Heat & Vent	0	None
245	2-5148C-0	Flow Diagram Aux. Bldg. Elec. Equip. Area. Heat & Vent	0	None
246	12-5719-8	Heat & Vent. Aux. Bldg. Elev. 633'	8	08/20/85
247	12-5733-5	Heat & Vent. Aux. Bldg. Elev. 633'	5	02/05/79
248	12-5722-5	Heat & Vent. Aux. Bldg. Exhaust Sys. Plan & Sections	5	08/25/75
249	1-5149-22	HVAC Flow Diagram	22	01/25/88
250	2-5149-25	HVAC Flow Diagram	25	01/25/88
251	12-5265-2	Fire Facilities Plot Plan	2	08/17/87

NFPA 72E - 1974 EDITION
AUTOMATIC FIRE DETECTORS

This review includes the following fire zones:

FIRE ZONE	FIRE AREA	ELEVATION	SYSTEM ORIGINAL INSTALLATION DATE
1-1H	A	573'	2/72
13	K	578'	2/72
15	M	578'	2/72
16	N	578'	2/72
7	F	578'	2/72 THRU 1977
8	G	578'	2/72 THRU 1977
9 & 10	H	578'	2/72 THRU 1977
11	I	578'	2/72 THRU 1977
23	AA	578'	2/72 THRU 1977
24 & 25	BB	578'	2/72 THRU 1977
26	CC	578'	2/72 THRU 1977
27	DD	578'	2/72 THRU 1977
18	V	578'	2/72
19	W	578'	2/72
21	Y	578'	2/72
56	TT	625'	2/72
57	UU	625'	2/72
58	VV	625'	2/72

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AUTOMATIC FIRE DETECTORS
(Continued)

FIRE ZONE	FIRE AREA	ELEVATION	SYSTEM ORIGINAL INSTALLATION DATE
59	WW	625'	2/72
48	C	633'	2/72
51 & 107	C	633'	2/72
32 & 69	C	650'	2/72
	C	633'	2/72

Charcoal filter unit detection in fire zones 49, 50.

In addition, portions of the fire zones addressed under Appendix A, B, & C, will be review under this edition.

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 72E-1974
AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 1 INTRODUCTION		Title
1-1	PURPOSE		Title
1-1.1	The purpose of this standard is to provide basic minimum requirements for performed of automatic fire detectors to insure timely warning for the purpose of life safety and property protection.		For Information Only
1-1.2	This standard is intended for use by persons knowledgeable for Fire Protection.		For Information Only
1-2	SCOPE		Title
1-2.1	This standard covers minimum performance, location, mounting, testing, and maintenance requirements of automatic fire detectors for protection of the occupant, building, space, structure, area, or object to be protected in accordance with the stated purpose.		For Information Only
1-2.2	This standard is intended to be used with other NFPA standards that deal specifically with fire alarm, extinguishment or control. Automatic fire detectors add to fire protection by initiating emergency action but only when used in conjunction with other equipment.		For Information Only
1-2.3	The interconnection of detectors, the control configurations, the power supply or the output systems responding to automatic fire detector actuation are detailed in NFPA Standards Nos. 71, 72A, 72C, 72D, 74 an others.		For Information Only

REV | BY | DATE | CHECKED | DATE
Q | DRW | 9/14/88 | JPC | 9/15/88

IMPELL CORPORATION

NFPA 72E-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

JOB NO 0120-108
CALC NO 0120-108-008

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 72E-1974
AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
1-2.5	Nothing in this standard is intended to prevent the use of new methods or devices providing sufficient technical data are submitted to the authority having jurisdiction to demonstrate that the new method or device is equivalent in quality, effectiveness, durability and safety to that prescribed by this standard.		For Information Only
	CHAPTER 2 GENERAL		Title
2-1	CLASSIFICATION OF FIRE DETECTORS		Title
2-1.1	For the purpose of this standard, automatic fire detectors are classified as listed below:		For Information Only
2-1.1.1	Heat Detector. A device which detects abnormally high temperature or rate-of-temperature rise.		For Information Only
2-1.1.2	Smoke Detector. A device which detects the visible or invisible particles of combustion.		For Information Only
2-1.1.3	Flame Detector. A device which detects the infrared, or ultraviolet, or visible produced by a fire.		For Information Only
2-1.1.4	Other Fire Detectors. A device which detects a phenomenon other than heat, smoke or flame, produced by a fire.		For Information Only
2-2	DEFINITIONS		Title This section for information only. Entire section deleted.
2-2.1	General		Title

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IMPELL CORPORATION

NFPA 72E-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

JOB NO 0120-108
CALC NO 0120-108-008

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 72E-1974
AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2-2.2	Types of Detectors.		Title
2-2.2.1	Line-Type Detector. A device in which detection is continuous along a path. Typical examples are rate-of-rise pneumatic tubing detectors, projected beam smoke detectors, and heat senstive cable.		For Information Only
2-2.2.2	Spot-Type Detector. A device whose detecting element is concentrated at a particular location. Typical examples are bimetallic detectors, fusible alloy detectors, certain pneumatic rate-of-rise detectors, certain smoke detectors and thermoelectric detectors		For Information Only
2-2.3	Operating Modes.		Title
2-2.3.1	Non-restorable Detector. A device whose sensing element is designed to be destroyed by the process of detecting a fire.		For Information Only
2-2.3.2	Restorable Detector. A device whose sensing element is not ordinarily destroyed by the process of detecting a fire. Restoration may be manual or automatic.		For Information Only
2-2.3.3	Self-Restoring Detector. A restorable detector whose sensing element is designed to be returned to normal automatically.		For Information Only
2-3	SHAPES OF CEILINGS		Title
2-3.1	The shapes of ceilings are classified as follows:		For Information Only
2-3.1.1	Level Ceilings. Those that are actually level or have a slope of 1-1/2 inches or less per foot.		For Information Only

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IMPELL CORPORATION

NFPA 72E-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

JOB NO 0120-108
CALC NO 0120-108-008

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 72E-1974
AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2-3.1.2	Sloping Ceilings. Those having a slope of more than 1-1/2 inches per foot. Sloping ceilings are further classified as follows: (a) Sloping-Peaked Type. Those in which the ceiling slopes in two directions from the highest point. Curved or domed ceilings may be considered peaked with the slope figured as the slope of the chord from highest to lowest point. (b) Sloping Shed Type. Those in which the high point is at one side with the slope extending toward the opposite side.		For Information Only
2-4	CEILING SURFACES		Title
2-4.1	Ceiling surfaces referred to in connection with the locations of fire detectors are:		For Information Only
2-4.1.1	Beam Construction. Ceilings having beam projecting below the ceiling surface more than four inches and spaced more than three feet center to center.		For Information Only
2-4.1.2	Girders. Girders support beams or joists, and run at right angles to the beams or joists. When girders are within four inches of the ceiling, they are factor in determining the number of detectors and are to be considered as beams. When the top of the girder is more than 4 inches from the ceiling, it is not a factor in detector location.		For Information Only
2-4.1.3	Open Joist Construction. Any construction in which solid joists project below the ceiling surface a distance of more than four inches and are spaced at intervals of three feet or less, center to center.		For Information Only

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IMPELL CORPORATION

NFPA 72E-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

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AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2-4.1.4	Smooth Ceiling. A surface uninterrupted by continuous projections, such as solid joists, beams, or ducts, extending more than four inches below the ceiling surface.		For Information Only
2-5	COMMON REQUIREMENTS		Title
2-5.1	APPROVAL		Title
2-5.1.1	All fire detection devices shall be listed or approved for the purpose for which they are intended, and shall be installed in conformity with this standard.	W,D	Comply: All the detection devices are either UL listed or FM approved. Ref: Technical Data No. 19 & 21
2-5.1.2	When required by the authority having jurisdiction, complete information regarding the fire detectors, including specifications and floor plans showing the location of the detectors shall be submitted for approval prior to installation of the detectors.	D	Comply: AEPSC is the A/E and designed, reviewed and approved the installation. Ref: Technical Data No. 8, 9, 22 thru 27, 40 & 42.
2-5.1.3	Before requesting final approval of the installation by the authority having jurisdiction, the installng contractor shall furnish a written statement to the effect that the detectors have been installed in accordance with approved plans and tested in accordance with the manufacturer's specifications.	D	Comply: The detectors were tested prior to turn over to AEPSC. Ref: Technical Data No. 2, 22 thru 27, 40 & 42.
2-5.2	ACCEPTANCE TEST		Title
2-5.2.1	Upon completion of the installation, a satisfactory test of the fire detectors shall be made in the presence of a representative of the authority having jurisdiction.	D	Comply: None Does Not Comply: The final tests were not performed in the presence of the A/E (AEPSC). Ref: Technical Data No. 2, 22 thru 27, 40 & 42.

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IMPELL CORPORATION

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JOB NO 0120-108
CALC NO 0120-108-008

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 72E-1974
AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2-6	INSTALLATION		Title
2-6.1	Where subject to mechanical damage, detectors shall be protected.	W	Comply: All the detectors reviewed where installed such that the potential for mechanical damage was negligible with the exception of areas noted. Does Not Comply: Several detectors on elevations 587', 609', 625' and 633' were installed in locations such that the devices are exposed to mechanical damage. Ref: Walkdown Checklists No (72E), 4, 13, 14, 15, 16, 17, 18, 22, 25 & 26.
2-6.2	Detectors shall be supported, in all cases, independently of their attachment to the circuit conductors.	W	Comply: All detectors were properly installed in the conduit system. Ref: Walkdown Checklists No. (72E) , 1.thru 28.
2-6.3	Detectors shall not be recessed in any way into the mounting surface unless they have been tested and listed for such recessed mounting.	W	Not Applicable: All devices in the areas reviewed are surface mounted. Ref: Walkdown Checklists No. (72E), 1 thru 28.
2-6.4	In the case of solid joist construction, detectors shall be mounted at the bottom of the joists.	W	Comply: Detectors installed in zones 33 and 34 at elevation 631' were properly installed at the bottom of 12" deep beam, 18" on center. This construction did not exist in other areas of our review. Ref: Walkdown Checklist No. (72E), 13 & 16.
2-6.5	Detectors shall be installed in all areas where required by appropriate NFPA Standard or the authority having jurisdiction. Where total coverage is required this shall include all rooms, halls, storage areas, basements, attics, lofts, spaces above suspended ceilings,	W,D	Comply: Reference Code Section 2-6.5 72E, 1978 Edition Does Not Comply: Reference Code Section 2-6.5 72E, 1978 Edition.

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	and other sub-divisions and accessible spaces, and inside all closets, elevator shafts, enclosed stairways, dumbwaiter shafts and chutes. Inaccessible areas which contain combustible material shall be made accessible and protected by detector(s). EXCEPTION No. 1: DETECTORS MAY BE OMITTED FROM COMBUSTIBLE BLIND SPACES WHEN ANY OF THE FOLLOWING CONDITIONS PREVAIL: a) When the ceiling is attached directly to the underside of the supporting beams of a combustible roof or floor deck. b) When the concealed space is entirely filled with a noncombustible insulation. In solid joisted construction the insulation need fill only the space from the ceiling to the bottom edge of the joist of the roof or floor deck. c) When there are small concealed spaces in question does not exceed 50 square feet in area. d) In spaces formed by sets of facing studs or solid joists in walls, floors or ceilings where the distance between the facing studs or solid joists is less than 6 inches.		
*2-6.6	Detectors shall also be required underneath open loading docks or platforms and their covers, and for accessible under-floor spaces of buildings without basements.	W	Comply: 1" x 4" open grated platforms were provided in several zones and detection was not installed under them. Exception No. 2 of Code Section 2-6.5, 72E, 1978 Edition can be applied to this application since the platform configuration meets or exceeds the

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	EXCEPTION: BY PERMISSION OF THE AUTHORITY HAVING JURISDICTION, DETECTORS MAY BE OMITTED WHEN ALL OF THE FOLLOWING CONDITIONS PREVAIL: a) The space is not accessible for storage purposes or entrance of unauthorized persons and is protected against accumulation of windborne debris. b) The space contains no equipment such as stream pipes, electric wiring, shafting, or conveyors. c) The floor over the space is tight. d) No flammable liquids are processed, handled or stored on the floor above.		requirements discussed. These platforms are in compliance. The zones where this applies are as follows: Zone No. — Elevation 5 — 587' 15 — 587' 16 — 587' 18 — 587' 19 — 587' 29A-F — 587' 79 (Ramp Corridor) — 587' 85 (Ramp Corridor) — 587' 33 & 33A — 609' 34 & 34A — 609' 38 — 609' 39 — 609' 44N — 609' 69 — 650' Ref: Walkdown Checklist No. (72E), 4, 5, 10, 8, 3, 11, 13, 16, 14, 18, 12 & 27.
2-6.7	Where codes, standards, laws, or authorities having jurisdiction require the protection of selected areas only, the specified areas shall be protected in accordance with this standard.	W,D	Comply: Reference Code Section 2-6.5 72E, 1978 Edition Does Not Comply: Reference Code Section 2-6.5 72E, 1978 Edition.

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3.1	GENERAL		Title
3-1.1	The purpose and scope of this chapter is to provide standards for location and spacing of heat detectors.		For Information Only
3-1.2	Heat detectors shall be installed in all areas where required either by the appropriate NFPA Standard or the authority having jurisdiction.	W,D	Comply: Heat detectors have been provided in the appropriate areas. Ref: Walkdown Checklists No. (72E), 5, 10, 25, & 26; Licensing Document No. 8.
3-2	OPERATING PRINCIPLES		This section for information only. Entire section deleted.
3-3	TEMPERATURE CLASSIFICATION		Title
3-3.1	Heat detectors of the fixed-temperature or rate-compensated spot-pattern type shall be classified as to the temperature of operation and marked with the appropriate color code.	W,D	Comply: Heat detectors in zones 106 and 107 are marked with white tip which indicates 190°F device. The line-type heat detectors have adjustible sensitivity. Ref: Walkdown Checklist No. (72E), 25 & 26; Technical Data No. 1 & 44.
3-3.1.2	Where the overall color of a detector is the same as the color code marking required for that detector, either one of the following arrangements, applied in a contrasting color and visible after installation, shall be employed: a) A ring on the surface of the detector. b) The temperature rating in numerals at least 3/8 inch (9.5 mm) high.	W,D	Not Applicable: The detectors are properly marked. Reference Code Section 3-3.1 72E, 1974 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
3-4	LOCATION		Title
3-4.1	Spot-type heat detectors shall be located upon the ceiling not less than 6 inches from the side wall between 6 inches and 12 inches from the ceiling.	W	Comply: The heat detectors in zones 106 and 107 are installed at the bottom of 6" beams but are within 12" of the ceiling. Ref: Walkdown Checklists No. (72E), 25 & 26.
3-4.2	Line-type heat detectors shall be located upon the ceiling or on the side walls not more than 20 inches from the ceiling.	W	Comply: All line-type heat detectors are installed within 3" of the ceilings in zones 13, 15, 16, 18, 19 and 21. Ref: Walkdown Checklists No. (72E), 5 & 10.
3-4.3	High Temperature Areas. Detectors having fixed temperature or rate compensated elements shall be selected in accordance with paragraph 3-3.1 for the maximum ceiling temperature that can be expected.	W,D	Comply: The heat detectors are properly provided for the maximum temperature of 135°F in zones 13, 15, 16, 18, 19 & 21, or 104°F in zones 106 and 107 and the charcoal filter units Ref: Technical Data No. 1, 12, 44, 35, 31, 52, 53 (1974 Edition, Table 3.3.1.1). Open Item: Data was not available to confirm compliance of charcoal filter unit thermistor applications.
3-5	SPACING		Title
*3-5.1	Smooth Ceiling Spacing. One of the following rules shall apply: a) The distance between detectors shall not exceed their listed spacing and there shall be detectors within a distance of one half the listed spacing, measured at a right angle, from all walls or partitions extending to within 18 inches of the ceiling; or:	W,D	Comply: The detectors in zones 13, 15, 16, 18, 19 and 21 are properly spaced as required. Ref: Walkdown Checklists No. (72E), 5 & 10; Technical Data No. 21; Drawing No. 3.

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	b) All points on the ceiling shall have a detector within a distance equal to 0.7 times the listed spacing. This will be useful in calculating locations in corridors or irregular areas.		
*3-5.1.1	IRREGULAR AREAS. For irregular shaped areas the spacing between detectors may be greater than the listed spacing, provided the maximum spacing from a detector to the furthest point of a side wall or corner within its zone of protection is not greater than 0.7 times the listed spacing (0.7S).	W,D	Comply: This type construction did not occur within the areas where heat detectors were installed within our review with the exception of the charcoal filter units. The application of the line-type detectors at each filter bed will provide adequate detection as required by ANI criteria. Ref: Walkdown Checklist No. (72E), 5, 10, 25, 26, & 27; Technical Data No. 10 & 12.
*3-5.2	OPEN JOIST CONSTRUCTION. The spacing of spot-type heat detectors installed on a joisted ceiling shall not exceed 50 percent of their listed spacing when measured at right angles to the solid joists.	W	Not Applicable: The plant does not use this type of construction within the areas of our review. Ref: Walkdown Checklist No. (72E), 1 thru 28.
3-5.3	BEAM CONSTRUCTION. It shall be treated as a smooth ceiling if the beams project no more than 4 inches below the ceiling. If the beams project more than 4 inches below the ceiling, detectors shall be located at no more than two-thirds the spacing schedule in the direction at right angles to the direction of beam travel. If the beam projects more than 18 inches below the ceiling, each bay formed by the beams shall be treated as a separate area.	W,D	Not Applicable: All zones where heat detection is applied, has smooth ceiling construction with the exception of the zones listed. Does Not Comply: The fixed temperature portion of heat detectors in zones 106 and 107 do not comply with the two-thirds spacing reduction requirements. Ref: Walkdown Checklist No. (72E), 25 & 26; Technical Data No. 44; Drawing No. 6.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
3-5.4	SLOPED CEILINGS		Title
*3-5.4.1	PEAKED. A row of detectors shall first be spaced and located at or within three feet of the peak of the ceiling. The number and spacing of additional detectors, if any, shall be based on the horizontal projection of the ceiling in accordance with the type of ceiling construction.	W	Not Applicable: The plant does not use this type of construction within the areas of our review. Ref: Walkdown Checklist No. (72E), 1 thru 28
*3-5.4.2	SHED. The shed shall have a row of detectors located on th ceiling within three feet of the ceiling, spaced in accordance with the type of construction. Remaining detectors, if any, are then located in the remaining area on the basis of the horizontal projection of the ceiling.	W	Not Applicable: The plant does not use this type of construction within the area of our review. Ref: Walkdown Checklist No. (72E), 1 thru 28.
4-1	GENERAL		Title
4-1.1	The purpose and scope of this chapter is to provide standards for location and spacing of smoke detectors.		For Information Only
*4-1.2	Smoke detectors shall be installed in all areas where required either by the apropriate NFPA Standard, or by the authority having jurisdiction.	W,D	Comply: Reference Code Section 2-6.5 72E, 1987 Edition. Does Not Comply: Reference Code Section 2-6.5 72E, 1978 Edition.
4-2	OPERATING PRINCIPLES		This section for information only. Entire section deleted.
4-3	LOCATION		Title
4-3.1	Spot-type smoke detectors shall be located on the ceiling not less than 6 inches from a sidewall, or if on the sidewall, between 6 to 12 inches from the ceiling.	W	Comply: Reference Code Section 4-3.2, 72E, 1987 and 1982 Editions. Does Not Comply: Reference Code Section 4-3.2 72E, 1978 and 1982 Editions.

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4-3.2	Line-type smoke detectors shall be located on the ceiling or on the sidewalls not more than 20 inches from the ceiling. Exception: See paragraph 4-4.5.	W	Not Applicable: Line-type (beam) detectors are not provided in the areas reviewed. Ref: Walkdown Checklists No. (72E) 1 thru 28
4-4	SPACING		Title
4-4.1	General. Spacing of smoke detectors shall result from an evaluation based upon engineering judgement supplemented, if feasible, by field tests. Ceiling shape and surfaces, ceiling height, configuration of contents, burning characteristics of the stored combustible, and ventilation are some of the parameters that shall be considered.	W,D	Comply: All fire zones reviewed, were acceptable for the room, combustible loading, ventilation configurations and radiation levels present with the exception of the zones listed below. Does Not Comply: High ceilings in zones 7, 27, 32, 33, 34 and 69 have not been properly provided with smoke detection. Area protection by infrared detectors in zones 33A and 34A is adequate in lieu of ceiling mounted smoke detectors as discussed inRFC #02-2694 and 01-2679. Device placement near supply air diffusers are deficient in zone 43. Conduit and cable tray congestion in zones 5, 6N, 6M and 6S should consider the replacement of smoke detectors under the congestion due to the potential for the stratification of smoke. Ref: Technical Data No. 25, 26, 60 & 61; Walkdown Checklist No. (72E), 7, 9, 13, & 27; Licensing Document No. 7.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-4.2	Smooth Ceilings. On smooth ceilings, with no forced air flow, spacing of 30 feet may be used as a guide. In all cases, the manufacturer's recommendations shall be followed. Other spacing may be used depending on ceiling height, different conditions for response requirements.	W,D	Comply: The spacing of smoke detectors in all fire zones reviewed with the exception of the zones listed below. Does Not Comply: The control room operators area (zone 53 & 54), the vestibule area (zone 53) and the toilet (zone 54) are not provided with detection at the suspended ceiling. The fire zones listed are not properly provided with fire detectors for the air movement present. Fire Zone — Elevation 1 — 573' 6N,6M & 6S — 587' 8 & 10 — 596' 37 — 625' 40A & 40B — 609' 42A - 42C — 609' 43 — 609' 46A - 46C — 609' 47A & 47C — 609' 55 & 60 — 625' 26 — 596' Ref: Walkdown Checklist No. (72E), 23 & 24; Technical Data No. 52.
4-4.3	Joisted Ceilings. Ceiling obstructions 8 inches or less in depth shall be considered equivalent to a smooth ceiling in view of the "spill over" effect of smoke.	W	Comply: Reference Code Section 2-6.4 72E, 1974 Edition.
*4-4.4	Slope Ceilings (Peaked or Shed-Type). A row of detectors shall first be spaced and located within 3 feet of the peak measured horizontally. (Fig. A-4-4.4 of Appnedix.) The number and spacing of additional detectors, if any, shall be based on the horizontal projection of the ceiling.		Not Applicable. This type of construction is not provided at this plant. Ref: Walkdown Checklist No. 1 thru 28.
4-4.5	High Ceilings.		Title

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4-4.5.1	Stratification occurs when the temperature of the smoke particles as generated, usually from a smoldering or small fire, reach the temperature of the surrounding air. Since it has lost the thermal lift, the smoke stops rising and stratifies. The temperature of the air near a ceiling is usually a few degrees higher than the air near the floor. Sufficient heat (thermal lift) is therefore required to overcome this heat barrier in order to carry the smoke particles to the detector. This condition is probably true in warehouses with metal roofs. During the day the air under the roof may be heated by the sum and a thermal (heat) barrier forms which would prevent the warm smoke from reaching the ceiling. The smoke will then stratify at a level below this thermal barrier. Generally, at night, this condition will not exist.		For Information Only
*4-4.5.2	For proper protection for buildings with high ceilings, detectors shall be installed alternately at two levels; one half at ceiling level, and the other half at least three feet below the ceiling.	W,D	Not Applicable: High ceilings were not present in the fire zones present with the the zones list below. Does Not Comply: Detectors are not properly provided in zones 7, 27, 32, 33, 34 and 69 which have high ceilings. Ref: Walkdown Checklist No. (72E), 7, 9, 13, 16 & 27; Technical Data No. 25 & 26
4-4.6	Beam Construction. Beams 8 inches or less in depth can be considered equivalent to a smooth ceiling in view of the "spill over" effect of smoke. In beam construction over 8 inches in depth, movement of heated air and smoke may be slowed by the pocket or bay formed by the beams. In this case, spacing shall be reduced. If the beams exceed 18 inches in	W	Comply: Reference Code Section 4-3.7 72E, 1978 Edition. Does Not Comply: Reference Code Section 4-3.7 72E, 1978 Edition.

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	depth and are more than 8 feet on centers, each bay shall be treated as a separate area requiring at least one detector.		
4-4.7	Beam Type Detectors.	W	This section is not applicable and has been deleted because there are no beam type detectors used in this plant. Ref: Walkdown Checklist No. 1 thru 28.
4-5	SPECIAL CONSIDERATIONS		Title
4-5.1	The selection and installation of smoke detectors shall take into consideration both the design characteristics of the detector and the areas into which the detectors will be installed so as to prevent false operation or nonoperation after installation. Some of the considerations are as follows:	W,D	Does Not Comply: Reference Code Section 4-4.1 72E, 1974 Edition.
4-5.1.1	Smoke detectors having a fixed temperature element as part of the unit shall be selected in accordance with paragraph 3-3.1 for the maximum ceiling temperature that can be expected in service.	W	Not Applicable: These elements have not been provided on the detectors installed. Ref: Walkdown Checklist No. (72E), 1 thru 28
4-5.1.2	The installation shall take into consideration the maximum ambient smoke density resulting from manufacturing processes or other sources.	W	Comply: Where this potential existed, (Zones 15, 16, 18 & 19) heat detection was installed. Ref: Walkdown Checklist No. (72E), 5 & 10.
4-5.1.3	Since the projected beam-type unit will operate when the light-path to the receiver is interrupted or obscured, the light-path shall be kept clear of opaque obstacles at all times.	W	This section not applicable because this plant does not use this type of detector. Ref: Walkdown Checklist No. (72E), 1 thru 28.

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4-5.1.4	High Rack Storage. In these areas it shall be necessary to consider installing detectors at several levles in the racks to insure quicker response to smoldering fires.	W	This section not applicable because this plant contains no High Rack Storage in. safety related areas. Ref: Walkdown Checklist No. (72E), 1 thru 28
4-5.1.5	Air Conditioned Facilities. In air conditioned facilities and others, where forced ventilation or open windows are present, detectors shall not be mounted near fresh air inlets. Detectors located shall favor air flow toward air outlet openings. The manufacturer shall be consulted before installation of detectors.	W	Comply: Reference Code Section 4-4.1 72E, 1978 Edition. Does Not Comply: Reference Code Section 4-4.1 72E, 1978 Edition.
4-6	SPECIAL USES		Title
4-6.1	Air Duct Detectors. For Air Duct Detectors, refer to Chapter 8, Section 8-1.		For Information Only
4-6.2	Door Release Service. Refer to Chapter 8, Section 8-2.		For Information Only
4-6.3	Automatic Data Processing Facilties. Refer to Chapter 8, Section 8-3.		For Information Only

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	CHAPTER 5 FLAME DETECTORS		Title
5-1	GENERAL		Title
5-1.1	Flame detectors shall be installed in all areas where they are required either by the appropriate NFPA Standard, or by the authority having jurisdiction.	W,D	Comply: Typically infrared detectors are provided to perform a secondary function in addition to ionization detectors. Where the infrared devices perform the primary purpose of detection (zones 33 & 33A and 34 & 34A), they provide detection in all zones. Ref: Walkdown Checklists No. (72E), 7, 9, 13, 14, 15, 16, 17, 18, 21, & 22; Licensing Document No. 8
5-2	OPERATING PRINCIPLES		This section is for information only and has been deleted.
5-3	FIRE CHARACTERISTICS		Title
5-3.1	Flame detectors are sensitive to glowing embers, coals, or actual flames, which radiate to the detectors energy of sufficient intensity and spectral quality to initiate action.		For Information Only
5-3.2	The detector(s) shall respond to the radiation from the area of fire that is to be detected. This usually involves expert application engineering. The time in which a fire must be detected and the area or intensity thereof may have to be related to the capabilities of associated extinguishing media and equipment.	W,D	Comply: Reference Code Section 5-4.1 72E, 1974 Edition. Does Not Comply: Reference code section 5-4.1 72E, 1974 edition.

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5-4.1	Except as otherwise permitted herein; flame detectors shall not be spaced beyond their listed or approved maximums. Closer spacing shall be utilized where the structural and other characteristics of the protected hazard would otherwise impair the effectiveness of the detection.	W,D	Comply: Fire zones reviewed which included flame detection, detector spacing was found to be acceptable with the exception of the devices listed below. Does Not Comply: The field of vision for several infrared detectors were obstructed by conduit/cable tray systems, structure and equipment. In several cases the arrangement of the detector was not appropriate. The deficiencies include:

Zone No.	Device No.	Deficiency
7	17-1	Obstruction by cable trays.
7	17-2	Misalignment for the combustibles present.
7	17-3	Obstructed by conduit.
8	18-5	Misalignment and obstructed.
8	18-1	Obstructed.
10	14-2	Obstructed.
10	14-1	Obstructed.
11	13-3	Obstructed.
25	19-3	Obstructed.
26	22-4	Misaligned and obstructed.
26	22-5	Misaligned and obstructed.

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			27	21-3	Misaligned and obstructed.
			27	21-2	Misaligned for combustibles present.
			27	21-3	Obstructed by cable tray.
			33	3-23 & 3-24	The alignment of the detectors for the platform @ elev. 646'-9" is not adequate for coverage. Detector is obstructed by platform.
			34	3-23 & 3-24	Typical of zone 33.
			38	16-3 & 16-4	Obstructed by cable tray. Misalignment due to low ceiling for 16-3.
			39	20-3 & 20-4	Typical of zone 38 except replace 16-3 with 20-3.
			41	21-3, 21-4 & 21-5	Det. 21-3 obstructed by MCC equipment. Detector 21-4 & 21-5 misaligned and obstructed.
			42A	22-1	Misaligned.
			42C	22-3 & 22-4	Misaligned and obstructed.

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JOB NO 0120-108
CALC NO 0120-108-008

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)		
			45	25-3, 25-4 & 25-5	Det. 25-3 obstructed by HCC equipment. Detector 25-4 & 25-5 misaligned and obstructed.
			55	23-3 & 23-4	Obstructed by structure; do not provide proper area coverage.
			60	27-1, 27-2, 27-3 & 27-4	Det. 27-3 obstructed by structure. Detector 27-1, 27-2 and 27-4 misaligned, obstructed and do not provide adequate area coverage.
5-4.2	Flame detectors shall be so designed and installed that their field of vision will be sufffficient to assure detection of a specified area of fire.	W	The type of combustibles are typically provide within the Zone is Class A (cable insulation) some Class B combustibles are present in zones 33 and 34. Ref: Walkdown Checklist No. 7, 9, 13 thru 18, 21 & 22; Licensing Document No. 7.		
			Comply: the installation of flame detection in the fire zones reviewed, was proper for the combustibles presently with the exception of the zones listed below: Does Not Comply: Reference Code Section 5-4.1, 72E, 1974 Edition. In addition, large portions of the floor area is not adequately covered due to the following conditions:		

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			Zone No. — Deficiency 7 — Misalignment of devices and high ceilings. 27 — Typical of zone 7. 33 — Improper placement of devices to provide adequate coverage of platforms at 646'-9". 34 — Typical of zone 33. 55 — Misalignment of devices and obstructions. 60 — Typical of zone 55.
5-4.3	Where conveyance of materials on chutes or belts, or in ducts or tubes, or otherwise, to or past a detector is involved, spacing considerations will not govern, but strategic placement of detectors is required to assure adequate detection.	W,D	Not Applicable: This type of process is not provided in the area of our review. Ref: Walkdown Checklist No. (72E), 1 thru 28; Licensing Document No. 7.
5-5.1	Since flame detectors are essentially line-of-sight devices, special care shall be taken in applying them to assure that their ability to respond to the required area of fire in the zone which is to be protected will not be unduly compromised by the presence of intervening structural members or other opaque objects or materials.	W	Comply: Reference Code Section 5-4.1 72E, 1974 Edition. Does Not Comply: Reference Code Section 5-4.1 72E, 1974 Edition.

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5-5.2	The overall situation shall be reviewed frequently to assure that changes in structural or usage conditions could interfere with fire detection capabilities are remedied promptly.	D	Does Not Comply: The alignment, obstructions or change in combustible loading are not verified for impact on flame detectors. Ref: Procedure No. 10 & 11.
5-6	OTHER CONSIDERATIONS		Title
5-6.1	Flame detectors shall have such spectral and optical response capabilities that they will initiate action from the specific spectral emission which occurs when the particular fuel(s) of the protected hazard is a fire.	D	Comply: The combustibles present, primarily Class A (cable insulation), will produce heated gases and open flame (infrared light spectrum) required to activate the flame detectors. Ref: Technical Data No. 25, 26 & 44; Licensing Document No. 7.
5-6.2	Detectors shall be designed, protected, or serviced so that interference with reception of radiation will not occur so as to prevent operation.	W,D	Comply: The detector placement or control configuration (isolation switches) will prevent inadvertent operation. Ref: Procedure No. 35; Walkdown Checklist No. (72E), 7, 9, 13 thru 18, 21 & 22.
5-6.3	Where necessary, detectors shall be shielded or otherwise arranged to prevent action from unwanted radiant energy.	W,D	Not Applicable: Permanent unwanted radiant energy sources are not present in the areas of our review. Appropriate actions are taken to prevent inadvertent operation of the systems by transient energy sources (welding, etc.). Ref: Procedure No. 35; Walkdown Checklist No. (72E), 7, 9, 13 thru 18, 21 & 22.
	CHAPTER 6 OTHER FIRE DETECTORS		This section has been deleted because this plant does not contain detectors which operate on different principles than those described in Chapters 3, 4, and 5. Ref: Walkdown Checklist No. (72E), 1 thru 28.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 7 MAINTENENACE AND TESTING		Title
7-1	GENERAL		Title
7-1.1	Each automatic detector shall be continuously maintained in reliable operating condition at all times, and such periodic inspections and tests shall be made as are necessary to assure proper maintenance as specified.	W,D	Comply: The detection device surveillance frequencies are performed in accordance with the Tech. Specs. and PMI-2270 as indicated in response to Appendix A to BTP/APCSB 9-5.1. Several detectors however were noted as requiring maintenance. These devices are as follows:

Zone No.	Device No.	Maintenance Item
57	18-25 & 18-26	Missing locking shell.
58	12-37	Missing locking shell.
55	24-5	Dirty lense on infrared detector.
60	28-5	Dirty lense on infrared detector.
43	23-3, 23-14 & 23-17	Detector No. 23-3 & 23-17 have dirty outer chamber grills. Detector 23-17 is missing locking shell.
44N	3-29,	Device can not be removed for servicing due to sprinkler piping.
40B	12-2	Missing locking shell.

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			42A 14-1 Dirty chamber grill.
			29A-D 2-6 & 3-6 Dirty detector housing.
			26 22-4 Dirty lense on infrared detector.
			Ref: Walkdown Checklist No. (72E), 1 thru 28; Procedure No. 10, 11, 12, 47, 35, 50, 52 & 53. Licensing Document No. 6.
7-1.2	Detectors shall be under the supervision of a responsible person who shall cause proper tests to be made at specified intervals and have general charge of all alterations and additions.	D	Comply: The plant fire protection coordinator is responsible for all fire protection issues and shall advise the plant manager on all matters relating to the fire protection program. The respective department personnel performing the testing will be properly trained. Ref: Procedure No. 35.
7-1.3	In any tests, all persons who would automatically receive an alarm shall be notified, so that an unnecessary response shall not take place.	D	Comply: The control room is notified prior to the start of any testing. Ref: Procedure No. 10, 11, 12, 47, 50, 52, & 53.
7-1.4	After installation, a visual inspection of all detectors shall be made to be sure that they are properly located.	D	Comply: All detectors were verified for placement and operation. Ref: Technical Data No. 2, 22 thru 27, 40 & 42.
7-1.5	After installation, each detector shall be checked to insure that it is properly connected and powered in accordance with the manufacturer's recommendations.	D	Comply: Reference Code Section 7-1.4 above.
7-2	INITIAL INSTALLATION TESTS		Title
7-2.1	HEAT DETECTORS		Title

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
7-2.1.1	A restorable spot-type detector shall be tested with a heat source, such as a hair dryer or shielded heat lamp, until it responds. After each heat test, the detector shall reset.	D	Comply: The spot-type heat detectors are all tested with heat and are verified for reset. Ref: Procedures No. 10 & 12.
7-2.1.2	A pneumatic tube line-type detector shall be tested either with a heat source (if a test chamber is in the circuit) or tested pneumatically with a pressure pump. The manufacturer's instruactions shall be followed.	W	Not Applicable: Because this plant does not use this type of detector. Ref: Walkdown Checklist No. (72E), 1 thru 28.
7-2.1.3	Line or spot-type detectors of the non-restorable type shall not be heat tested.	D	Comply: The line-type devices are restorable. The spot-type are combination restorable/non restorable. The restorable portion is tested with heat and the non-restorable portion is tested by destructive testing. Ref: Technical Data No. 1 & 44; Procedure No. 10 & 12.
7-2.1.4	Detectors with a replaceable fusible alloy element shall be tested by: a) removing the fusible element to determine that the detector contacts operate properly, and then b) reinstalling the fusible element.	D	Not Applicable: This type element is not employed in the area of review. Ref: Walkdown Checklist No. (72E), 1 thru 28; Technical Data No. 1 & 44.
7-2-2	SMOKE DETECTORS		Title
7-2.2.1	To assure that each smoke detector is operative, it shall be tested, in place, in accordance with the manufacturer's instructions.	D	Comply: Each detector is tested with a test gas to simulate an alarm condition. Ref: Procedure No. 10, 11 & 12.

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7-2.2.2	Instruments for checking the sensitivity of some detectors are available from the manufacturer. When using these, the manufacturer's recommended test instructions shall be followed.	D	Comply: Detector sensitivity is verified for each detector with the manufacturers meters. Ref: Procedure No. 10 & 47.
7-2.3	FLAME DETECTORS AND OTHER FIRE OUTPUT DETECTORS		Title
7-2.3.1	Flame detectors and other fire output detectors shall be tested for operation in accordance with instructions supplied by the manufacturer.	D	Comply: The detectors are tested with a simulated heat source as recommended. Ref: Technical Data No. 25, 26 & 45; Procedure No. 10, 11 & 12.
7-3	PERIODIC TESTS		Title
7-3.1	Detectors shall be tested as described in the following paragraphs. The method of test shall be as outlined in Section 7-2.		For Information Only
7-3.1.1	For nonrestorable spot-type detectors, after the fifteenth year, at least two detectors out of every hundered, or fraction thereof, shall be removed every five years and sent to a nationally recognized testing laboratory for tests. The detectors that have been removed shall be replaced with new detectors. If a failure occurs on any of the detectors removed, additional detectors shall be removed and tested as a further check on the installation until there is proven to exist either a general problem involving faulty detectors or a localized problem involving only one or two defective detectors.	D	Comply: Two heat detectors out of (14) are verified for the operability of the non-restorable portion of the detectors on an annual basis. Ref: Procedure No. 12.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
7-3.1.2	For restorable spot-type heat detectors, at least one detector on each signal initiating circuit shall be tested semi-annually and different detectors shall be selected for each test.	D	Comply: All spot-type detectors in zones 106 & 107 and line-type detectors in zones 13, 15, 16, 18, 19, 21 and charcoal filter units are tested as required. Does Not Comply: All spot-type detectors are rate-or-rise/fixed temp. devices and are tested semi-annually with the exception of the RCP pump and containment cable tray line type heat detectors. Ref: Procedure No. 10, 12, and 56.
7-3.1.3	Pneumatic line-type detectors shall be tested for leaks and proper operation semiannually.		Not applicable: Because this plant does not use this type of detector. Ref: Walkdown Checklist No. (72E), 1 thru 28.
7-3.1.4	Line-type fixed-temperature detectors shall have their loop resistance measured and recorded in the control cabinet at least semiannually.	D	Comply: The thermistor detectors for zones 13, 15, 16, 18, 19, 21, charcoal filter units, and the containment cable trays are tested as required. Does Not Comply: The thermistor detectors for their operability by loop resistance testing as required. Ref: Procedure No. 10 & 50.
7-3.1.5	Smoke detectors shall be tested semiannually in accordance with the manufacturer's instructions.	D	Comply: The smoke detectors are tested as required. Ref: Procedure No. 10, 11, 12 & 47.
7-3.1.6	Flame detectors and other fire output detectors shall be tested at least semiannually as prescribed by the manufacturer and more often if found to be necessary for the applications in question.	D	Comply: Flame detectors are tested as required. Ref: Procedure No. 10 & 11.

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7-3.2	A permanent record showing all details of the test including the name of the inspector, type, number, location, and the results of detectors tested on a specific date shall be kept on the premises for at least five years.	D	Comply: Surveillance reports properly document the test results as required. The records are retained in accordance with the regulatory requirements. Ref: Procedure No. 10 thru 12, 47 & 48.
7-4	CLEANING AND MAINTENANCE		Title
7-4.1	Ionization and photoelectric smoke detectors may require periodic cleaning to remove dust or dirt which has accumulated. The frequency of cleaning will depend on the local ambient conditions. For each detector, the cleaning, checking, operation, and sensitivity adjustment shall be attempted only after consulting the manufacturer's instructions.	D	Comply: Smoke detectors are cleaned on an annual basis or as required. Ref: Procedure No. 10 thru 12 & 47.
7-5	TESTS FOLLOWING AN ALARM		Title
7-5.1	Detectors shall be restored to service as promptly as possible after each test or alarm, and shall be kept in normal conditon for operation. Devices requiring resetting or replacement shall be reset or replaced as promptly as possible after each test or alarm.	D	Comply: All detectors are tested and restored to normal as required. Ref: Procedure No. 10, 11, 12, 35, & 47.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 8 SPECIAL APPLICATIONS		Title
8-1	DUCT DETECTORS		Title
8-1.1	GENERAL		Title
8-1.1.1	The function of air duct smoke detectors is to detect smoke for the primary purpose of controlling blowers and dampers of air conditioning and ventilating systems in an attempt to prevent possible panic and damage from distribution of smoke and gaseous products.	D	Does Not Comply: The air duct detectors for the control room HVAC and filter units do not perform automatic fan shutdown as required. Ref: Drawing No. 110 & 209.
8-1.1.2	An air duct smoke detector installation shall not be used as a substitute for open area protection because: a) Smoke may not be drawn from open areas when air conditioning systems or ventilating systems are shut down. b) Dilution by smoke-laden air from other parts of the building, or dilution by fresh air intakes, may allow high densities of smoke in a single room with no appreciable smoke in the duct at the detector location.	W	Comply: Air duct smoke detectors are provided in addition to ceiling mounted detectors in the control room. Ref: Walkdown Checklists No. (72E), 23, 24 and 27.
8-1.1.3	Detectors shall be within the duct, or protruding into the duct, or mounted in a housing with sampling tubes protruding into or traversing the duct.	W	Comply: Air duct detectors are mounted directly to the duct with sampling tubes protruding into the duct. Ref: Walkdown Checklists No. (72E), 27.

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8-1.1.4	Air duct smoke detectors, including housing and sampling tubes where used, shall be listed or approved for the range of air velocities which may exist in service.	W,D	Comply: The Pyrotronics DIA-10 air duct detectors are approved for the application. Ref: Technical Data No. 19, 62 and 63; Walkdown Checklist No. 27. Drawing No. 249 and 250.
8-1.1.5	Air duct smoke detectors shall be suitable for the maximum temperature which may exist in service.	W,D	Comply: The maximum temperature in the control room HVAC and charcoal filter units is 104°F. The detectors are approved by F.M. to operate in maximum temperatures of 125°F. Ref: Technical Data No. 21 and 59.
8-1.2	APPLICATION OF DUCT DETECTORS		
8-1.2.1	Air duct smoke detectors shall be provided as requied by the Standard on Air Conditioning and Ventilation Systems, NFPA No. 90A.	W,D	Does Not Comply: Air duct detectors are provided for the control room HVAC units only. HVAC units provided in zones 44N & 52, are not furnished with air duct detectors Ref: Walkdown Checklist No. (72E), 12, 25 & 27; Technical Data No. 12 and 57; Licensing Document No. 1.
8-1.2.2	Air duct smoke detectors used only to control blowers and dampers and not connected to a fire protective signaling system shall be listed or approved as suitable for releasing device service.	W,D	Not Applicable: The only air duct detectors provided, are directly connected to the "EFR" panels in the control room. Ref: Walkdown Checklists No. (72E), 27; Drawing No. 110, 209, 113 & 211.
8-1.2.3	Air duct smoke detectors connected in the signal actuating circuit of a fire protective signaling system shall be listed or approved for this application.	W,D	Comply: Reference Code Section 8-1.1.4 72E, 1974 Edition.

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8-1.3	TESTING AND MAINTENANCE OF DUCT DETECTORS		Title
8-1.3.1	Due to the quantity of smoke that may be required, an in-service test of an air duct smoke detector installation is not practical. Reference shall be made to Chapter 7 for the "Initial" and "Periodic" tests which may be conducted.		For Information Only
8-1.3.2	Cleaning frequency of air duct smoke detectors will depend on local ambient conditions. Following placement in service, installations shall be inspected as necessary to establish a cleaning schedule. Refer to Section 7-4 for further details on cleaning.	D	Comply: Air duct detectors are tested under the same requirements for smoke detectors. Ref: Procedure No. 10 & 12.
8-2	SMOKE DETECTORS FOR DOOR RELEASE SERVICE		Title
8-2.1	Where smoke detectors are used for individual door release service they shall be applied as specified in this section.		For Information Only
8-2.2	Smoke detectors for individual door release service shall not be considered to replace, but may supplement, detectors employed for open area protection. When used to supplement detectors employed for open area protection refer to applicable standards.	W,D	Not Applicable: Door release for the control room door (zone 53 & 54) and computer rooms (zones 71 & 72) are provided by open area detectors only. Typical for all of Code Section 8-2. Ref: Drawing No. 74 110 & 209; Walkdown Checklist No. (72E), 1 thru 28.
8-2.3	Smoke detectors may be of the photoelectric or ionization type or other approved type.	W,D	Not Applicable: Reference Code Section 8-2.2, 72E, 1974 Edition. Typical for Code Sections 8-2.4 thru 8-2.5, this edition.

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8-2.4	NUMBER OF DETECTORS REQUIRED		Title
8-2.4.1	Where doors are to be closed in response to smoke flowing in either direction the following rules apply:		For Information Only
8-2.4.1.1	Where the depth of wall section above the door is 24 inches or less, one ceiling mounted detector shall be required on one side of the doorway only.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-2.4.1.2	Where the depth of wall section above the door is greater than 24 inches, two ceiling mounted detectors shall be required, one on each side of the doorway.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-2.4.1.3	Where the depth of wall section above the door is 60 inches (1.5 m) or greater, additional detectors may be required as indicated by an engineering evaluation.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-2.4.1.4	Where a detector is specifically listed for door frame mounting, or where a listed combination or integral-detector-door closer assembly is used, only one detector is required when installed in the manner recommended by the manufacturer.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-2.4.2	Where door release is intended to prevent smoke transmission from on space to another in one direction only, one detector located in the space to which smoke is to be confined shall suffice regardless of the depth of wall section above the door. Alternatively, a smoke detector conforming with 8-2.4.1.4 shall be used.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.

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8-2.4.3	Where there are multiple doorways, additional ceiling mounted detectors shall be required as follows:		For Information Only
8-2.4.3.1	Where the separation between doorways exceeds 24 inches, each doorway must be treated separately.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-2.4.3.2	Each group of three doorway openings must be treated separately.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-2.4.3.3	Each group of doorway openings which exceeds 20 feet in width measured at its overall extremes must be treated separately.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-2.4.4	Where there are multiple doorways and listed door frame mounted detectors or where listed combination or integral-detector-door closer assemblies are used, ther shall be one detector for each single or double doorway.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-2.4.4.1	A double doorway is a single opening that has no intervening wall space or door trim separating the two doors.		For Information Only
8-2.5	LOCATION		Title
8-2.5.1	Where ceiling mounted smoke detectors are to be installed on a smooth ceiling for a single or double doorway, they shall be located as follows: a) On the centerline of the doorway and b) No more than 5 feet (1.5 m) measured perpendicularly on the ceiling from the wall section above the door and c) No closer than shown on Figures A-8-2.4.1.1 B, C & E.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.

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8-2.5.1	Where ceiling mounted detectors are to be installed in conditions other than those outlined in Paragraph 8-2.5.1, engineering judgment is required.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-2.5.2	Where ceiling mounted detectors are to be installed in conditions other than those outlind in Paragraph 8-2.5.1, engineering judgment is required.	W,D	Not Applicable: See Code Section 8-2.2 72E, 1974 Edition.
8-3	AUTOMATIC DATA PROCESSING FACILITIES		Title
8-3.1	GENERAL. The purpose and scope of this section is to provide location and spacing for smoke detectors in automatic data processng facilities.		For Information Only
8-3.2	SELECTION OF DETECTOR. The detector selected for this application shall be capable of responding to the particular products that will be produced by the burning of materials in the area protected.	W,D	Comply: Ionization detectors are provided in the computer rooms (zone 71 & 72). Combustibles are Class A. The detector selection is adequate. Ref: Walkdown Checklist No (72E), 28; Licensing Document No. 7.
8-3.3	RESPONSE TIME. Detector response time shall be determined by the authority having jurisdiction.	D	Comply: The placement of high voltage ionization detectors are provided in accordance with the A/E (AEPSC). Ref: Technical Data No. 8.
8-3.4	LOCATION. Spot-type smoke detectors shall be located on the ceiling, in spaces above the ceiling used as air return plenums and under raised floor spaces.	W	Comply: Plenum ceilings are not provided in the computer rooms (zone 71 & 72), however, raised floors are. Ionization detectors are provided in these floors. Ref: Walkdown Checklists No. (72E), 28.
8-3.5	SPACING		Title

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AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
8-3.5.1	Detector spacing depends upon the volume of air circulated within the room, which can be designated as "minutes per air change" or "air changes per hour." Except where otherwise accepted by the authority having jurisdiction, spacing shall be in accordance with Figs. A-8-3.5.1 A & B.	W,D	Comply: Smoke detection for zones 71 & 72 has been properly provided for the air movement present. Ref: Technical Data No. 42.
8-3.5.2	Detectors shall not be located near air supply diffusers.	W	Comply: The detectors in the computer rooms (zones 71 & 72) are properly spaced away from the diffusers as required. Ref: Walkdown Checklist No. 28.

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APPENDIX A
NFPA 72E - 1978 EDITION
AUTOMATIC FIRE DETECTORS

This review includes the following fire zones:

FIRE ZONE	FIRE AREA	ELEVATION	SYSTEM ORIGINAL INSTALLATION DATE	MODIFICATION NUMBER	MODIFICATION DATE
3	C	587'	2/72	RFC-12-2230	3/79
4	D	587'	2/72	RFC-12-2230	3/79
5, 6N, 6S, 6M, 64A & B, 65A & B, 61	E	587'	2/72	RFC-12-2230	3/79
62A-C	YY	587'	2/72	RFC-12-2230	3/79
63A-C	ZZ	587'	2/72	RFC-12-2230	3/79
70 & 73	BBB	650'	3/79	RFC-12-2230	3/79
49 & 50	C	633'	3/79	RFC-12-2230	3/79
144	UU	625'	3/79	RFC-12-2230	3/79
145	VV	625'	3/79	RFC-12-2230	3/79

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PROPRIETARY PROTECTIVE SIGNALING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2-6.4	In the case of solid joist construction, detectors shall be mounted at the bottom of the joists. In the case of beam construction where the beams are 12 inches (300 mm) or more in depth and 8 feet (8.5 m) or more on centers, the detector shall be mounted on the ceiling between the beams.	W	Comply: Reference Code Section 2-6.4 72E, 1974 Edition.
2-6.5	Detectors shall be installed in all areas where required by appropriate NFPA Standard or the authority having jurisdiction. Where total coverage is required this shall include all rooms, halls, storage areas, basements, attics, lofts, spaces above suspended ceilings, and other sub-divisions and accessible spaces, and inside all closets, elevator shafts, enclosed stairways, dumbwaiter shafts and chutes. Inaccessible areas which contain combustible material shall be made accessible and protected by detector(s). EXCEPTION No. 1: DETECTORS MAY BE OMITTED FROM COMBUSTIBLE BLIND SPACES WHEN ANY OF THE FOLLOWING CONDITIONS PREVAIL: a) When the ceiling is attached directly to the underside of the supporting beams of a combustible roof or floor deck. b) When the concealed space is entirely filled with a noncombustible insulation. In solid-joisted construction the insulation need fill only the space from the ceiling to the bottom edge of the joist of the roof or floor deck.	W,D	Comply: All fire zones reviewed were properly provided with detection with the exception of the fire zones listed below. Does Not Comply: The portions of a fire zone which had detectors installed were reviewed for compliance with this code section. Zones which did not have total coverage within the zone where detectors are provided, are identified as follows: Zone No. / Elevation / Deficiency 1 / 573' / Air Movement & Det. 1-1 for Beam Construction 3 / 587' / Throughout Zone 4 / 587' / Deep Bay @ West End 5 / 587' / Det. 2-25 & 2-3, Beam Construction 6N / 587' / Air Movement, 6M / 587' / inadequate 6S / 587' / Det. spacing 7 / 587' / I.R. Det. obstr. Beam Const. @ center of zone 8 / 587' / I.R. Det. obstructions & air movement 10 / 587' / I.R. Det. obstructions & air movement 11 / 587' / I.R. Det. obstructions 23 / 587' / I.R. Det. obstructions & air movement

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c) When there are small concealed spaces over rooms provided any space in question does not exceed 50' sq. ft. (4.6 m²) in area.

d) In spaces formed by sets of facing studs or solid joists in walls, floors or ceilings where the distance between the facing studs or solid joists is less than 6 in. (150 mm).

EXCEPTION NO. 2: DETECTORS MAY BE OMITTED FROM BELOW OPEN GRID CEILINGS WHEN ALL OF THE FOLLOWING CONDITIONS PREVAIL:

a) The openings of the grid are 1/4 in. (6.5 mm) or larger in the least dimension.

b) The thickness of the material does not exceed the least dimension.

c) The openings constitute at least 70 percent of the area of the ceiling material.

Zone No.	Elevation	Deficiency
24	587'	I.R. Det. obstructions & air movement
25	587'	I.R. Det. obstructions & air movement
26	587'	Typical of zone 11
27	587'	Typical of zone 11
33	612'	Det. not installed @ ceiling
34	612'	Det. not installed @ ceiling
37	609'	Air movement
38	609'	Typical of zone 11
39	609'	Typical of zone 11
44N	609'	Det. 3-4, beam constr.
44S	609'	Det. 3-27 & 3-28 @ bottom of beam
40A	609'	Air movement & beam construction
40B	609'	Air movement & beam construction
32	609'	High ceilings & beam construction
42A-C	609'	Air movement
43	609'	Air movement
47A&B	609'	Air movement & beam construction
46A-C	609'	Air movement
41 & 45	609'	Det. 13-9(41) & 8-9 & 8-7 (45) do not cover entire area. I.R. obstructions
56	620'	Det. 18-10 & 10-12 within 4" of deep beam
48	625'	Deep bay const. @ east end of room

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
			Zone No. 49 & 50 — Elevation 633' — Deficiency: Deep beam const. @ east end and for 8" beam construction throughout each zone
			Zone No. 51 — Elevation 633' — Deficiency: Deep beam construction @ northeast & southeast end of zone
			Zone No. 52 — Elevation 633' — Deficiency: Det. not spaced for deep & 8" beam construction @ north & south end of zone
			Zone No. 55 — Elevation 620' — Typical of zone 10
			Zone No. 60 — Elevation 620' — Typical of zone 10
			Zone No. 69 — Elevation 650' — Typical of zone 32
*3-5.2	OPEN JOIST CONSTRUCTION. The spacing of heat detectors, when measured at right angles to the solid joists, shall not exceed 50 percent of the smooth ceiling spacing allowable under paragraphs 3-5.1 and 3-5.1.1. (See Figure A-3-5.2 of Appendix A.)		Editorial changes. Clarification for requirements. Verified under Code Section 3-5.2 72E, 1974 Edition.
3-5.3	BEAM CONSTRUCTION. It shall be treated more than 4 inches (100 mm) below the ceiling. If the beams project more than 4 inches (100 mm) below the ceiling, the spacing of spot-type heat detectors at right angles to the direction of beam travel shall be not more than two-thirds the smooth ceiling spacing allowable under paragraphs 3-5.1 and 3-5.1.1. If the beams project more than 18 inches (450 mm) below the ceiling, and are more than 8 feet (2.5 m) on centers each bay formed by the beams shall be treated as a separate area.	W,D	Comply: Reference Code Section 3-5.3 72E, 1974 Edition. Does Not Comply: Reference Code Section 3-5.3 72E, 1974 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-3	LOCATION AND SPACING.		Title.
*4-3.1	GENERAL. The location and spacing of smoke detectors shall result from an evaluation based on engineering judgment supplemented by the guidelines detailed in this Standard. Ceiling shape and surfaces, ceiling height, configuration of contents, burning characteristics of combustible material present, and ventilation are some of the conditions that shall be considered.		Editorial changes. Verified under Code Section 4-4.1 72E, 1974 Edition.
4-3.1.1	Where the intent is to protect from a specific hazard, the detector(s) may be installed closer to the hazard in a position where the detector will readily intercept the smoke.	W	Not Applicable: Detectors have not been provided to perform this protection for the applicable areas. Detectors however, should be provided in portions of zones 5, 6N, 6M, 6S where substantial conduit and cable tray congestion exist. Ref: Walkdown Checklist No. (72E), 4.
*4-3.1.2	STRATIFICATION. The possible effect of smoke stratification levels below the ceiling shall also be considered.		Verified under Code Section 4-4.5.2 72E, 1974 Edition.
4-3.2	Spot-type smoke detectors shall be located on the ceiling not less than 4 inches (100 mm) from a side wall to the near edge, or if on a sidewall, between 4 and 12 inches (100 and 300 mm) down from the ceiling to the top of the detector. (See Figure A-3-4.1 of Appendix A.) EXCEPTION: SEE PARAGRAPH 4-3.1.2.	W	Comply: All fire zones where smoke detectors were installed within this review, were properly located as required with this exception of the fire zones listed below. Does Not Comply: Detectors in zones 57, 49, 32 and 69 are installed at the bottom of deep beams or greater than 12" from the ceiling. Ref: Walkdown Checklist No. (72E), 19, 26 & 27.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-3.3	Line-type smoke detectors shall be located with their projected beams parallel to the ceiling, and not more than 20 inches (0.5 m) below the ceiling. EXCEPTION NO. 1: SEE PARAGRAPH 4-3.1.2 EXCEPTION NO. 2: BEAMS MAY BE INSTALLED VERITICALLY, OR AT ANY ANGLE NEEDED TO AFFORD PROTECTION OF THE HAZARD INVOLVED. (EXAMPLE: VERTICAL BEAMS THROUGH THE OPEN OR SHAFT AREA OF A STAIR WELL WHERE THERE IS A CLEAR VERTICAL SPACE INSIDE HANDRAILS.)	W	Not Applicable: Projected beam type detectors are not installed at this plant. Ref: Walkdown Checklist No. (72E), 1 thru 28.
4-3.3.1	The beam length shall not exceed the maximum permitted by the equipment listing.	W	Not Applicable. See Code Section 4-3.3, this edition.
4-3.3.1.1	Where mirrors are used with projected beams, the total listed length of the beams shall be progressively reduced by 33 1/3 percent for each mirror used. (See Figure A-4-3.3.1.1 of Appendix A.)	W	Not Applicable. See Code Section 4-3.3, this edition.
4-3.3.1.2	Beams shall be adjustable for total light cut-off values ranging from five percent on up to at least 40 percent. Settings of 1/2 percent per floor (0.3 m), or less (more sensitive) shall be used wherever conditions permit. Not more than 60 feet (18 m) of beam length shall be considered, in determining percent cut-off per foot. While the cut-off is not linear since each increment of beam length affects the next increment, linear calculations may be used for purposes of this Standard.	W	Not Applicable. See Code Section 4-3.3, this edition..

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4-3.4	Each sampling port of a sampling-type smoke detector shall be treated as a spot-type detector for the purpose of location and spacing.	W	Not Applicable: Sampling-type smoke detectors are not provided with the exception of air which are addressed under Chapter 8, 72E, 1974 Edition. Ref: Walkdown Checklist No. (72E) 1 thru 28.
4-3.5	SMOOTH CEILINGS SPACING		Title
4-3.5.1	SPOT-TYPE DETECTORS. On smooth ceilings, spacing of 30 feet (9 m) may be used as a guide. In all cases, the manufacturer's recommendations shall be followed. Other spacing may be used depending on ceiling height, different conditions or response requirements.		Editorial changes. Addressed under Section 4-4.2 72E, 1974 Edition
*4-3.5.2	LINE-TYPE DETECTORS. For location and spacing of line-type detectors, the manufacturer's installation instructions shall be followed. (See Figure A-4-3.5.2 of Appendix A.)	W	Not Applicable: Line-type (beam) smoke detectors are not provided in the areas of our review. Ref: Walkdown Checklist No. (72E) 1 thru 28.
*4-3.6	OPEN JOIST CONSTRUCTION		Title
4-3.6.1	Ceiling construction where joists are 8 inches (200 mm) or less in depth shall be considered equivalent to a smooth ceiling.	W	Not Applicable: This type construction is not provided in the areas of our review. Ref: Walkdown Checklist No. (72E), 1 thru 28.
4-3.6.2	If joists exceed 8 inches (200 mm) in depth, the spacing of spot-type detectors in the direction perpendicular to the joists shall be reduced. If the projected light beams of line-type detectors run perpendicular to the joists, no spacing reduction is necessary; however, if the projected light beams are parallel to the joists, the spacing between light beams shall be reduced.		Reference Code Section 4-3.6.1 above.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-3.7	BEAM CONSTRUCTION		Title
4-3.7.1	Ceiling construction where beams are 8 inches (200 mm) or less in depth shall be considered equivalent to a smooth ceiling.	W	Comply: Detectors were properly provided in the zones 57, 58 & 48 where this construction occurred. Ref: Walkdown Checklist No. (72E), 19 20 & 26.
4-3.7.2	If beams are over 8 inches (200 mm) in depth, the spacing of spot-type detectors in the direction perpendicular to the beams shall be reduced. The spacing of line-type detectors run perpendicularly to the beams need not be reduced; however, if the line-type detectors are run parallel to the beams the spacing shall be reduced.	W	Comply: Fire zones with smoke detection where this type of beam construction occurred within our review, was found to be acceptable with the exception of the zones listed below. Does Not Comply: Detectors do not properly provide adequate coverage as required in zones 5, 6N, 6S, 52, 50, 49. Ref: Walkdown Checklists No. (72E) 4, 25 & 26.
4-3.7.3	If the beams exceed 18 inches (450 mm) in depth and are more than 8 feet (2.5 m) on centers, each bay shall be treated as a separate area requiring at least one spot-type or line-type detector.	W	Comply: Fire zones with smoke detection where this type of beam construction occurred within our review, was found to be acceptable with the exception of the zones listed below. Does Not Comply: Detectors are not properly provided in each bay as required in zones 32, 69, 49, 50, 51, 48, 3, 27, 7, and 1. Ref: Walkdown Checklists No. (72E) 4, 7, 1, 9, 26, & 27.
4-3.8	SLOPED CEILINGS	W	Not Applicable: This type of construction is not provided at plant. Ref: Walkdown Checklist No. (72E), 1 thru 28.
4-3.9	SUSPENDED CEILINGS. (See 2-6.5.)		Title
4-3.10	PARTITIONS. Where partitions extend upward to within 18 inches (450 mm) of the ceiling, they will not influence the spacing. Where the partition extends to within less than 18 inches (450 mm) of the ceiling, the effect of smoke travel shall be considered in reduction of spacing.	W,D	Not Applicable: Where partitions were provided, fire zone 5, 42C, 44N, 46C, they were not installed within 18" of the ceiling and would not impact the flow of smoke. Ref: Walkdown Checklist No. (72E) 1 thru 28.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-4	HEATING, VENTILATING AND AIR CONDITIONING (HVAC).		Title
4-4.1	In rooms, buildings, etc. where forced ventilation is present, detectors shall not be located where air from supply diffusers could dilute smoke before it reaches the detector. Detectors shall be located to favor the air flow toward return openings. This may require additional detectors, since placing detectors only near return air openings may leave the balance of the area with inadequate protection when the air handling system is shut down. The detector manufacturer shall be consulted before installation of detectors.	W	Comply: All fire zones where smoke detectors were installed within our review, were properly located away from diffusers, with the exception of zone 43 listed below. Does Not Comply: Several detectors in zone 43 were installed within 2' of a supply air diffuser. Ref: Walkdown Checklist No. (72E), 12.
4-4.2	In above-ceiling plenum areas which are designed as common returns for HVAC systems, the air circulating through them is usually at a higher velocity than would be prevalent in the room below. For this reason, detector spacing shall be reduced. (See paragraph 4-3.5.1)	W	Not Applicable: Plenum ceilings were not provided in the area of our review. Ref: Walkdown Checklists No. (72E), 1 thru 28.
4-4.2.1	Detectors placed in the plenum area shall not be used as a substitute for open area protection because: a) Smoke may not be drawn into the plenum area when the ventilating system is shut down. b) The detector will be less responsive to a fire condition in room below due to dilution by clean air before the smoke reaches a detector.	W	Not Applicable: Reference Code Section 4-4.2 72E, 1978 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-5	SPECIAL CONSIDERATIONS		Title
4-5.1	GENERAL. The selection and installation of smoke detectors shall take into consideration both the design characteristics of the detector and the areas into which the detectors will be installed so as to prevent false operation or nonoperation after installation. Some of the considerations are as follows:		Verified under Code Section 4-5.1 72E, 1974 Edition.
4-5.1.1	Line-type detectors and mirrors shall be firmly mounted on stable surfaces, so as to prevent false or erratic operation due to movement. The beam shall be so designed that small angular movements of the light source or receiver do not prevent operation due to smoke and do not cause false alarms. Ordinarily, movement of ± 1/4 degree shall be tolerated (1/2 degree circular included angle).	W	Not Applicable: See Code Section 4-3.3 72E, 1978 Edition.
4-5.1.2	Since the projected beam-type unit will not operate for alarm (but will give a trouble signal) when the light-path to the receiver is interrupted or obscured, the light-path shall be kept clear of opaque obstacles at all times.	W	Not Applicable: See Code Section 4-3.3 72E, 1978 Edition.
4-5.1.3	Smoke detectors having a fixed temperature element as part of the unit shall be selected in accordance with 3-3.1 for the maximum ceiling temperature that can be expected in service.	W	Not Applicable: Fixed temperature elements are not provided as part of smoke detectors. Ref: Walkdown Checklist No. (72E), 1 thru 28.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-5.1.4	Smoke detectors shall not be installed in areas where the normal ambient temperature is likely to exceed 100°F (38°C) or fall below 32°F (0°C), unless they have been specifically listed by a recognized testing laboratory for installation at higher or lower temperatures.	W,D	Comply: Although the temperature in most areas exceeds 100°F (maximum 110°F), Factory Mutual has approved the Pyrotronics smoke detectors for temperatures of 125°F to 32°F. Ref: Technical Data No. 21, 35, 59.
4-5.1.5	The installation shall take into consideration any normal sources, such as manufacturing processes, which may produce smoke, so as to avoid possible false alarms.	W,D	Comply: Heat detection has been provided in areas where smoke or vapors may be produced. Areas with high radiation concerns, have been verified for proper smoke detector operation in the environment or smoke detection devices have not been installed. Ref: Technical Data No. 23, 25, 26, 27 & 61; Walkdown Checklists No. (72E), 1 thru 28.
*4-5.1.6	HIGH RACK STORAGE. (See Figures A-4-5.1.6(a) and A-4-5.1.6(b) of Appendix A.) Detection systems are often installed in addition to suppres- sion systems. Where smoke detectors are installed for early warning in high rack storage areas it shall be necessary to consider installing detectors at several levels in the racks to insure quicker response to smoke. Where detectors are installed to actuate a suppression system, see STANDARD FOR RACK STORAGE OF MATERIALS, NFPA 231C.	W	Not Applicable: This storage arrangement is not installed at this plant in safety related areas. Addressed under Code Section 4-5.1.4 72E, 1974 Edition. Ref: Walkdown Checklist No. (72E), 1 thru 28.

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	CHAPTER 8 MAINTENANCE & TESTING		Entire section typical of Chapter 7 72E, 1974 Edition with exception of numbering.
9-2	SMOKE DETECTORS FOR DOOR RELEASE SERVICE		Title
9-2.2	Smoke detectors listed or approved exclusively for door release service shall not be used for open area protection. (SEE PARAGRAPH 1-2.3.) A smoke detector used concurrently for door release service and open area protection shall be acceptable if listed or approved for open area protection and installed in accordance with Chapter 4 of this Standard.	W	Not Applicable: Reference Code Section 8-2, 72E, 1974 Edition.
9-2.4.1.4	Where a detector is specifically listed for door frame mounting, or where a listed combination or integral-detector-door closer assembly is used, only one detector is required when installed in the manner recommended by the manufacturer.		Editorial changes. Verified under Code Section 8-2.4.1.4 72E, 1974 Edition.
9-3	AUTOMATIC DATA PROCESSING FACILITIES		Title
9-3.2	SELECTION OF DETECTOR. The detector selected for this application shall be capable of responding to the particular products that will be produced by the burning of materials in the area protected. It may be necessary to intermingle smoke detectors of various operating principles to achieve an early response to the variety of combustible materials.	W,D	Comply: Reference Code Section 8-3 72E, 1974 Edition.

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0	DRW	7/14/82	MDE	8/5/82

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APPENDIX B
NFPA 72E - 1982 EDITION
AUTOMATIC FIRE DETECTORS

This review will include the following fire zones:

FIRE ZONE	FIRE AREA	ELEVATION	SYSTEM ORIGINAL INSTALLATION DATE	MODIFICATION NUMBER	MODIFICATION DATE
29G	EE	573'	8/83	RFC 12-2678	8/83
14	L	587'	8/83	RFC 01-2679	8/83
79 (Ramp Corridor only)	B	587'	8/83	RFC 12-2678	8/83
17C	Q	587'	8/83	RFC 12-2678	8/83
29A-F	EE	587'	8/83	RFC 01-2679 & RFC 02-2694	8/83
20	X	587'	8/83	RFC 02-2694	8/83
85 (Ramp Corridor only)	B	587'	8/83	RFC 12-2678	8/83
37, 43, 44N, & 44S	HH	609'	2/72	RFC 1595 & RFC 12-2678	8/83
33-33B	FF	609'	8/83	RFC 01-2679	8/83
34-34B	GG	609'	8/83	RFC 02-2694	8/83
46A-D	OO	609'	10/82	RFC 1843	10/82
47A & B	PP	609'	10/82	RFC 1843	10/82
53	Q	633'	3/79	RFC 2521	3/82
54	RR	633'	3/79	RFC 2521	3/82
71 & 72	BBB	650'	8/82	RFC 12-2149	8/82

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2-4.1.1	BEAM CONSTRUCTION. Ceilings having solid structural or solid nonstructural members projecting down from ceiling surface more than 4 in. (100 mm) and spaced more than 3 ft (0.9 m) center to center.		Editorial changes: For information only.
2-4.1.3	SOLID JOIST CONSTRUCTION. Ceilings having solid structural or solid nonstructural members projecting down from the ceiling surface a distance of more than 4 in. (100 mm) and spaced at intervals 3 ft (0.9 m) or less, center to center.		Editorial changes: For information only.
2-4.1.4	SMOOTH CEILING. A surface uninterrupted by continuous projections, such as solid joists, beams, or ducts, extending more than 4 in. (100 mm) below the ceiling surface. NOTE: Open truss constructions are not considered to impede the flow of fire products unless the upper member in continuous contact with the ceiling projects below the ceiling more than 4 inc. (100 mm).		Editorial changes: For information only.
2-5.2	ACCEPTANCE TEST. Upon completion of the installation, a satisfactory test of the fire detectors in accordance with Chapter 8 of this standard shall be made in the presence of a representative of the authority having jurisdiction.	D	Does Not Comply: The tests were not performed in the presence of the A/E (AEPSC). Ref: Technical Data No. 25, 26, 27, 40 & 42.

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0	RWL	7/14/88	LSC	7/15/88

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 3 - HEAT SENSING FIRE DETECTORS		Title
3-4	Location		Title
3-4.1	Spot-type heat detectors shall be located upon the ceiling not less than 4 in. (100 mm) from the side wall or on the side walls between 4 in. (100 mm) and 12 in. (300 mm) from the ceiling. EXCEPTION NO. 1: IN THE CASE OF SOLID JOIST CONSTRUCTION, DETECTORS SHALL BE MOUNTED AT THE BOTTOM OF THE JOISTS. EXCEPTION NO. 2: IN THE CASE OF BEAM CONSTRUCTION WHERE BEAMS ARE LESS THAN 12 IN. (300 mm) IN DEPTH AND LESS THAN 8 FT. (2.4 m) ON CENTER, DETECTORS MAY BE INSTALLED ON THE BOTTOM OF BEAMS.	W	Comply: Heat detectors in zone 106 are mounted at the bottom of 6" beam which is less than 8' on center. Ref: Walkdown Checklist No. (72E), 25.
3-5.1.2	HIGH CEILINGS. On ceilings 10 ft. (3 m) to 30 ft. (9.1 m) high, heat detector spacing shall be reduced in accordance with Table 3-5.1.2.	W	Not Applicable: Heat detector in zone 106 is mounted on a ceiling that is approximately 8' above the finished floor. Ref: Walkdown Checklist No. (72E), 25.

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TABLE 3-5.1.2

Ceiling Height (ft) Above	Up to	Percent of Listed Spacing
0	10	100
10	12	91
12	14	84
14	16	77
16	18	71
18	20	64
20	22	58
22	24	52
24	26	46
26	28	40
28	30	34

EXCEPTION: TABLE 3-5.1.2 DOES NOT APPLY TO THE FOLLOWING DETECTORS WHICH RELY ON THE INTEGRATION EFFECT:

a) Line-type electrical conductivity detectors.
b) Pneumatic rate-of-rise tubing.
c) Series connected thermoelectric effect detectors.

In these cases, the manufacturer's recommendations shall be followed for appropriate alarm point and spacing.

3-5.2 SOLID JOIST CONSTRUCTION. The spacing of heat detectors, when measured at right angles to the solid joists, shall not exceed 50 percent of the smooth ceiling spacing allowable under 3-5.1 and 3-5.1.1.

Editorial changes: Addressed under Section 3-5.2, 1974 Edition.

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0	DMC	9/14/88	MC	9/15/88

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 4 - SMOKE DETECTORS		Title
4-3	Location		Title
4-3.1	GENERAL. The location and spacing of smoke detectors shall result form an evaluation based on engineering judgment supplemented by the guidelines detailed in this standard. Ceiling shape and surfaces, ceiling height, configuration of contents, burning characteristics of combustible material present, and ventilation are some of the conditions that shall be considered.		Editorial changes: Verified under code section 4-4.1, 1974 Edition. Detector #23-10 in zone 43 is provided under equipment congestion to provide detection.
4-3.1.1	Where the intent is to protect from a specific hazard, the detector(s) may be installed closer to the hazard in a position where the detector will readily intercept the smoke.	W	Comply: Smoke detectors are placed at alternate platform levels in zones 33 and 34 at elevation 609' to provide specific hazard detection. Ref: Walkdown Checklists No. (72E), 13 & 16.
4-3.1.2	STRATIFICATION. The possible effect of smoke stratification at levels below the ceiling shall also be considered.		For information only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-3.2	Spot-type smoke detectors shall be located on the ceiling not less than 4 in. (100 mm) from a sidewall to the near edge, or if on a sidewall between 4 in. and 12 in. (100 mm and 300 mm) down from the ceiling to the top of the detector. EXCEPTION NO. 1: SEE 4-3.1.2. EXCEPTION NO. 2: IN THE CASE OF SOLID JOIST CONSTRUCTION, DETECTORS SHALL BE MOUNTED AT THE BOTTOM OF THE JOISTS. EXCEPTION NO. 3: IN THE CASE OF BEAM CONSTRUCTION WHERE BEAMS ARE LESS THAN 12 IN. (300 mm) IN DEPTH AND LESS THAN 8 FT. (2.4 m) ON CENTER, DETECTORS MAY BE INSTALLED ON THE BOTTOM OF BEAMS.	W	Comply: All fire zones within this review were properly provided with smoke detectors with the exception of the fire zones listed below. Does Not Comply: • Several smoke detectors at the control room (zone 53 & 54) suspended ceilings are not installed within 12" of the ceiling. • Detector No. 23-10 in zone 43 is installed under equipment congestion approx. 2.5' below the ceiling. • Detector No. 2-6 and 3-6 are installed approx. 10' down from the ceiling in a doorway leading to zone 29A-D. • Detector No. 4-26 in zone 52 is installed within 4" to an 18" deep beam at the ceiling. • Detectors are not installed at the ceiling of zones 33 and 34. • Detector No. 18-10 & 18-12 in zone 57 are located within 4" to a deep beam. Ref: Walkdown Checklists No. (72E), 8, 13, 16, 12, 22, 23 and 24.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-3.5.1	SPOT-TYPE DETECTORS. On smooth ceilings, spacing of 30 ft. (9.1 m) may be used as a guide. In all cases, the manufacturer's recommendatins shall be followed. Other spacing may be used depending on ceiling height, different conditions or response requirements.		Editorial changes: Addressed under Section 4-4.1 72E, 1974 Edition
4-4.2	In above-ceiling areas which are designed as common returns for HVAC systems, the air circulating through them is usually at a higher velocity than would be prevalent in the room below. For this reason, detector spacing shall be reduced. (See 4-3.5.1.)	W	Not Applicable: Suspended ceiling areas in zones 53, 54 and 43 are not plenums. Plenum ceilings were not provided in our area of review. Ref: Walkdown Checklist No. (72E), .12, 23 &
4-4.2.1	Detectors placed in the areas used to handle environmental air shall not be used as a substitute for open area protection because: a) Smoke may not be drawn into the area when the ventilating system is shut down. b) The detector will be less responsive to a fire condition in room of fire origin due to dilution by clean air.	W	Comply: Air duct detectors for the control room HVAC units are provided in addition to ceiling mounted detectors in the control room. Ref: Walkdown Checklists No. (72E), 23, 24 and 27.
4-5.1.1	Projected beam-type detectors and mirrors shall be firmly mounted on stable surfaces so as to prevent false or erratic operation due to movement. The beam shall be so designed that small angular movements of the light spurce or receiver do not prevent operation due to smoke and do not casue false alarms. Ordinarily, movement of 1/4 degree shall be tolerated (1.2 degree circular included angle).		Not applicable: This equipment is not installed at this plant.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 5 - FLAME SCANNING FIRE DETECTORS		Title
5-6.4	When used in outdoor applications, detectors shall be shielded in a fashion to prevent diminishing sensitivity by rain, snow, etc., and yet allow a clear field of vision of the hazard area.		Not applicable: All devices installed in safety related areas reviewed for this project, are provided inside the plant.
	CHAPTER 8 - MAINTENANCE AND TESTING		Title
8-1	GENERAL		Title
8-1.1	Each automatic detector shall be maintained in reliable operating condition. Periodic inspections and tests shall be made to assure proper maintenance as specified herein.		For information only
8-1.1.1	Maintenance and testing shall be in accordance with this standard supplemented by the manufacturer's instructions and those of the authority having jurisdiction.	D	Does Not Comply: Reference Code Sections 8-2.1.2, 1982 Edition.
8-1.6	Any method or device used for testing in a hazardous atmosphere or process shall be suitable for use within the hazardous atmosphere or process.	D	Not Applicable: Hazardous atmospheres or processes do not exist in the areas reviewed. Ref: Licensing Document No. 7.
8-1.7	A permanent record of all test results shall be kept on the premises for at least five years for review by the authority having jurisdiction.		Editorial change: Addressed under Code Section 7-3.2, 1974 Edition

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
8-2	INITIAL INSTALLATION TESTS.		Title
8-2.1	HEAT DETECTORS.		Title
8-2.1.1	A restorable heat detector shall be tested with a heat source, such as a hair dryer or shielded heat lamp, until it responds. After each heat test, the detector shall reset. Precaution shall be taken to avoid damage to the nonrestorable fixed temperature element of a combination rate-of-rise/fixed temperature detector. EXCEPTION: A PNEUMATIC TUB LINE-TYPE DETECTOR SHALL BE TESTED EITHER WITH A HEAT SOURCE (IF A TEST CHAMBER IS IN THE CIRCUIT) OR TESTED PNEUMATICALLY WITH A PRESSURE PUMP. THE MANUFACTURER'S INSTRUCTIONS SHALL BE FOLLOWED.		Editorial change: Addressed under Sections 7-2.1.1 and 7-2.1.2, 1974 Edition
8-2.1.2	Line- or spot-type nonrestorable fixed temperature heat detectors shall not be heat tested, but shall be tested mechanically or electrically for fire alarm function. Line-type detectors shall have their loop resistance measured to see if it is within acceptable limits for the equipment being used. The loop resistance shall be recorded for future reference. The record shall be maintained on the premises. Other tests shall be performed as required by the manufactureres.	D	Comply: Reference Code Section 7-3.1.4, 72E, 1974 Edition. Does Not Comply: Reference Code Section 7-3.1.4 72E, 1974 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
8-2.2	SMOKE DETECTORS.		Title
8-2.2.2	Detector sensitivity shall be determined using either: (a) A calibrated test method, or (b) The manufacturer's calibrated sensitivity test instrument, or (c) Other calibrated sensitivity test method acceptable to the authority having jurisdiction. Detectors found to be outside the approved range of sensivity shall be replaced. EXCEPTION: If the detector is listed as field adjustable, it may be either adjusted to bring it within an approved range or replaced.	D	Comply: All ionization detectors are calibrated with the manufacturer's test meters. All detectors which do not operate properly are replaced. Ref: Procedure No. 12 and 47.
8-2.3	FLAME DETECTORS, FIRE-GAS DETECTORS AND OTHER FIRE DETECTORS. Flame detectors, fire-gas detectors and other fire detectors shall be tested for operation in accordance with instructions supplied by the manufacturer or other test methods acceptable to the authority having jurisdiction.		Editorial changes: Addressed under Code Section 7-2.3.1, 1974 Edition
8-3	PERIODIC TESTS.		Title
8-3.1*	Detectors shall be tested as described in the following paragraphs. The method of test shall be as outlined in Section 8.2. The authority having jurisdiction may accept testing at a greater or lesser frequency.		Editorial changes: Addressed under Code Section 7-3.1, 1974 Edition

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
8-3.2	HEAT DETECTORS.		Title
8-3.2.2	For restorable heat detectors (except pneumatic line-type), one or more detectors on each signal-initiating circuit shall be tested at lease semi-annually and different detectors shall be selected for each test. Within five years, each detector shall have been tested.	D	Comply: All line type heat detectors are tested as required with the exception of the systems listed below. Does Not Comply: The thermistor heat detectors for the RCP pumps and the containment cable trays are not tested semi-annually. Ref: Procedure No. 10, 12, 50, 52 and 53.
8-3.2.4	Nonrestorable line-type fixed temperature detectors shall be tested for alarm function at lease semiannually. The loop resistance shall be measured, recorded and compared with that previously recorded. Any change in loop resistance shall be investigated.	D	Comply: Reference Code Section 8-2.1.2 72E, 1982 Edition. Does Not Comply: Reference Code Section 8-2.1.2 72E, 1982 Edition.
8-3.3	SMOKE DETECTORS. All smoke detectors shall be tested at least semiannually.		Editorial changes: Verified under Code Section 7-3.1.5 72E, 1974 Edition.
8-3.4	FLAME DETECTORS, FIRE-GAS DETECTORS AND OTHER FIRE DETECTORS. All flame detectors, fire-gas detectors and other fire detectors shall be tested at least semiannually as prescribed by the manufacturer and more often if found to be necessary for the application.	D	Comply: All infrared detectors are tested semi-annually as required. Ref: Procedure No. 10 & 11.
8-4	Cleaning and Maintenance. Detectors require periodic cleaning to remove dust or dirt which has accumulated. The frequency of cleaning will depend upon the type of detector, the cleaning, checking, operation, and sensitivity adjustment shall be attempted only after consulting the manufacturer's instructions.		Editorial change: Addressed under Code Section 7-4.1 72E, 1974 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
8-5	Tests Following an Alarm. All detectors shall be restored to service as promptly as possible after each test or alarm, and shall be kept in normal condition for operation. Detectors requiring resetting or replacement shall be reset or replaced as promptly as possible after each test or alarm All detectors exposed to a fire shall be tested.	D	Comply: All detectors are tested and restored to normal as required. Ref: Procedure No. 10, 11, 12, 35 & 47.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 9 - SPECIAL APPLICATIONS		Title
9-1.2	APPLICATION OF DUCT DETECTORS		Title
9-1.2.2	Air duct smoke detectors used only to initiate control of air movement and not connected to a fire protective signaling system shall be listed or approved as suitable for releasing device service.		Editorial change: Addressed under Code Section 8-1.2.2 72E, 1974 Edition
9-2	DETECTORS FOR SMOKE DAMPER RELEASE SERVICE.		Title
9-2.1	Where control of smoke dampers is not initiated by a fire alarm which includes automatic smoke detection devices in the area served by the related ducts, the control shall be initiated by either of the following methods:		For information only
9-2.1.1*	Preferably by open area-type smoke detectors listed or approved for releasing service located for protection of the area(s) served by the related ducts.	D	Not Applicable: Smoke damper release service is not provided. Ref: Licensing Document No. 6.
9-2.1.2	By listed or approved duct-type smoke detectors located in the related ducts.	D	Not Applicable: Reference Code Section 9-2.1.1 above.
9-3	HIGH AIR MOVEMENT AREAS.		Title
9-3.1	GENERAL. The purpose and scope of this section is to provide location and spacing from smoke detectors in high air movement areas.		For information only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
9-3.2	ACCEPTANCE CRITERIA. Detector response shall be determined by the authority having jurisdiction who may utilize the detector manufacturer's recommendations.	D	Comply: The acceptance criteria for the detectors are in accordance with the A/E (AEPSC). Ref: Technical Data No. 22 thru 27, 40 & 42.
9-3.3	LOCATION. Smoke detectors shall not be located near air supply registers.	W	Comply: All fire zones reviewed which were provided with smoke detectors were acceptable with the exception of zone 43 below. Does Not Comply: Several smoke detectors were installed within 2' of supply air diffusers in zone 43. Ref: Walkdown Checklist No. (72E), 12.
9-3.4*	SPACING. Smoke detector spacing depends upon the movement of air within the room (including both supplied and recirculated air) which can be designated as minutes per air change or air changes per hour. Except where otherwise accepted by the authority having jurisdiction, spacing shall be in accordance with Figures A-9.3.4 (a) and (b).	W,D	Comply: Calculations have been performed to confirm proper placement in accordance with this code section for zones 14, 17C, 20, 29A-G, 33-33B, 34-34B, 44N, 44S, 79 and 85. Functional burn tests were performed to confirm proper placement in zones 53 and 54. Ref: Technical Data No. 22 thru 27, 40, 42 & 3; Walkdown Checklist No. (72E), 1 thru 28. Does Not Comply: Impell Calculation No. 0120-108-009, Rev. 0, confirmed deficient detector spacing for the air movement present. The deficient zones include 40B, 42A, 46A, 55 & 60. Zones 38, 39, 41 & 45 were verified as being acceptable.
9-4	SMOKE DETECTORS FOR DOOR RELEASE SERVICE.		Title
9-4.1	Smoke door release not initiated by a fire alarm system which includes smoke detectors protecting the areas on both sides of the door affected shall be accomplished by smoke detectors applied as specified in this section.		Editorial change: Addressed under Code Section 8-2.1 72E, 1974 Edition

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9-4.2	Smoke detectors listed or approved exclusively for door release service shall not be used for open area protection. (See 1-2.3.)	D	Not Applicable: Door release for the control rooms (zone 53 & 54) and computer rooms (zone 71 & 72) are provided by the room smoke detectors. Ref: Drawing No. 74, 110 & 209.

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APPENDIX C
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AUTOMATIC FIRE DETECTORS

This review will include the following fire zones:

FIRE ZONE	FIRE AREA	ELEVATION	SYSTEM ORIGINAL INSTALLATION DATE	MODIFICATION NUMBER	MODIFICATION DATE
38	II	609'	2/72	RFC 1843	7/84
40A & B	KK	609'	2/72	RFC 1843	7/84
41	LL	609'	2/72	RFC 1843	7/86
42A-D	MM	609'	2/72	RFC 1843	7/84
4S	NN	609'	2/72	RFC 1843	7/86
39	JJ	609'	2/72	RFC 1843	7/84
55	SS	625'	2/72	RFC 1843	7/84
60	XX	625'	2/72	RFC 1843	7/84
52 & 106	C	633'	3/72	RFC 1843	7/86

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 3 HEAT SENSING FIRE DETECTORS		Title
3-5.4.3	For a roof slope of less than 30 degrees, all detectors will be spaced utilizing the height a the peak. For a roof slope of greater than 30 degrees, the average slope height will be used for all detectors other than those located in the peak.	W	Not Applicable: Slope ceilings do not exist at this plant. Ref: Walkdown Checklists No. 1 thru 28.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 4 SMOKE DETECTORS		Title
4-3.1.1	Where the intent is to protect against a specific hazard, the detector(s) may be installed closer to the hazard in a position where the detector will readily intercept the smoke.		Editorial changes: Verified under code section 4-3.1.1 72E, 1982 edition.
4-3.5.1.1	Where a specific spacing is selected by the authority having jurisdiction, by engineering judgment, by Appendix C or by other method, for smooth ceilings, all points on a ceiling shall have a detector within 0.7 times this spacing. This will be useful in calculating locations in corridors or irregular areas.	W	Comply: All zones reviewed were acceptable with the exception of those discussed below. Does Not Comply: The placement of smoke detectors in zones 52, 55, 60, 40A & B, 47A & B, 41 & 45 do not adequately cover large portions of the zone. Ref: Walkdown Checklists No. (72E), 15, 17 21, 22 & 25.
4-3.7.2	If beams are over 8 inches (200 mm) in depth, the spacing of spot-type detectors in the direction perpendicular to the beams shall be reduced. The spacing of projected beam-type detectors run perpendicularly to the beams need not be reduced; however, if the projected beam-type detectors are run parallel to the beams the spacing shall be reduced.		Editorial changes: Addressed under Code Section 4-4.6 72E, 1974 Edition.
4-3.7.3	If the beams exceed 18 inches (460 mm) in depth and are more than 8 feet (2.5 m) on centers, each bay shall be treated as a separate area requiring at least one spot-type or projected beam-type detector.		Editorial Changes: Addressed under Code Section 4-4.6 72E, 1974 Edition.
4-5.2	High Air Movement Areas.		Editorial Changes: Verified under Code Section 8-3 72E, 1974 Edition.

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IMPELL CORPORATION

NFPA 72E-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

JOB NO 0120-108
CALC NO 0120-108-008

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 72E-1984
AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 8 MAINTENANCE AND TESTING.		Title
8-2.2.2	Detector sensitivity shall be determined using either: a) A calibrated test method, or b) The manufacturer's calibrated sensitivity test instrument, or c) Other calibrated sensitivity test method acceptable to the authority having jurisdiction. Exception: If the detector is listed as field adjustable, it may be either adjusted to bring it within an approved range or replaced. NOTE: The detector sensitivity cannot be tested or measured using any spray device that administers an unmeasured concentration of aerosol into the detector.	D	Comply: Reference Code Section 8-2.2.2 72E, 1982 Edition.
8-3.3	Smoke Detectors.		Title
8-3.3.1	All smoke detectors shall be tested at least semiannually. (See 8.2.2.) Except where a different frequency is required or permitted by the authority having jurisdiction, the sensitivity test cited in 8-2.2.2 shall be performed within one year after installation and every alternate year thereafter.		Verified under Code Sections 7-2.2, 7-3.1.5, 7-4.1 and 8-1.3, 1974 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
8-3.3.2	Air duct detector testing and maintenance shall consist of: a) A visual inspection of the detector installation, including seals, looking for any mistreatment or modification of the device or installation and its intended operation. b) Using the manufacturer's recommendations, verify that the device will measure/detect smoke in the air stream (i.e., measuring pressure drop for devices using sampling tubes is acceptable). c) Using the manufacturer's recommended proecedures, determine that the sensitivity of the detection devices is correct. d) Using smoke or a substitute, or a calibrated test method, perform a full-functional test of the detector, put the detector into alarm, and determine that proper operation occurs. This can be done by directly injecting the smoke or a substitute into the detection chamber or sampling means.		Verified under Code Sections 7-2.2, 7-4.1 and 8-1.3, 1974 Edition.

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BY DBL
DATE 5/14/88
CHECKED JDC
DATE 5/16/88

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CODE COMPLIANCE VERIFICATION CHECKLIST
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AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 9 SMOKE DETECTORS FOR CONTROL OF SMOKE SPREAD		Title
9-1	General		Title
9-1.1	Note: See NFPA 101, Life Safety Code, for definition of smoke compartment and NFPA 90A, Air Conditioning and Ventilating Systems, for definition of duct systems.		For Information Only
9-1.2	This chapter covers installation and use of all types of smoke detectors to prevent smoke spread by initiating control of fans, dampers, doors, and other equipment. Detectors for this use may be classified as: a) area detectors which are installed in the related smoke compartments. b) detectors which are installed in the air duct systems.		For Information Only
9-1.3	Detectors which are installed in the air duct system, per 9-1.2(b), shall not be used as a substitute for open area protection because: a) smoke may not be drawn from open areas when air conditioning systems or ventilating systems are shut down.		Editorial Changes: Verified under Code Section 8-1.1.2, 1974 Edition.

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	b) dilution of smoke-laden air by clean air from other parts of the building, or dilution by outside air intakes, may allow high densities of smoke in a single room with no appreciable smoke in the air duct at the detector location.		
9-1.4	Smoke detectors in the related smoke compartment for open area protection are the preferred means to initiate control of smoke spread.		For Information Only.
9-2	Purposes.		Title
9-2.1	The purposes to which smoke detectors may be applied in order to initiate control of smoke spread are:		Verified under Code Sections 8-1.1.1 and 8-2, 1974 Edition.
	a) prevention of the recirculation of dangerous quantities of smoke within a building.		
	b) selective operation of equipment to exhaust smoke from a building.		
	c) selective operation of equipment to pressurize smoke compartments.		
	d) operation of doors to close the openings in smoke compartments.		

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
9-2.2	To prevent the recirculation of dangerous quantities of smoke, a detector approved for air duct use shall be installed on the supply side of air handling systems in accordance with NFPA 90A, Air Conditioning and Ventilating Systems, and 9-3.2.1.		Verified under Code Section 8-1.2.1, 1974 Edition.
9-2.3	To selectively initiate the operation of equipment to control smoke spread, the requirements of 9-3.2.2 shall apply.		Verified under Code Sections 8-1.1.1 and 8-2, 1974 Edition.
9-2.4	To initiate the operation of smoke doors, the requirements of Section 9-5 shall apply.		For Information Only.
9-3	Application.		Title
9-3.1	Area Detectors Within Smoke Compartments. Area smoke detectors which are located within a smoke compartment for open area coverage may also be used to initiate control of smoke spread by operating doors, dampers and other equipment when appropriate in the overall firesafety plan.		Verified under Code Section 8-2, 1974 Edition.
9-3.2	Smoke Detectors in the Air Duct System.		Title
9-3.2.1	Supply Air System. Where the detection of smoke in the supply air system is required by other NFPA standards, the following alternative methods may be employed:		Verified under Code Sections 8-1.1.4 and 8-1.2.1, 1974 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	a) detector(s) listed for the air velocity present and located in the supply air duct downstream of both the fan and the filters, or		
	b) total smoke detector coverage within the smoke compartments served by the supply air stream.		
9-3.2.2	Return Air System. Where the detection of smoke in the return air system is required by other NFPA standards, any one or more of the following methods may be employed:		Verified under Code Sections 8-1.1.4 and 8-1.2.1, 1974 Edition.
	a) Preferably by complete area smoke detection, or		
	b)* Detector(s) listed for the air velocity present and located at every return air opening within the smoke compartment, or where the air leaves each smoke compartment. [See Figures A-9.3.2,2(b) 1 and 2.]		
	Exception: Additional smoke detectors are not required to be installed in ducts where the air duct system passes through other smoke compartments not served by the duct.		
9-4	Location and Installation of Detectors in Air Duct Systems.		Title
9-4.1	Detectors shall be listed for the purpose.		Verified under Code Sections 8-1.1.4, 8-1.1.5, 8-1.2.2 & 8-1.2.3, 1974 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
9-4.2	Air duct detectors shall be securely installed in such a way as to obtain a representative sample of the air stream. This may be done by any of the following: a) Rigidly mounted within the duct. b) Rigidly mounted to the wall of the duct with the sensing element protruding into the duct. c) Outside the duct with rigidly mounted sampling tubes protruding into the duct. d) With projected light beam through the duct.		Verified under Code Section 8-1.1.3 72E, 1974 Edition.
9-4.3	Detectors shall be readily accessible for cleaning and shall be mounted in accordance with the manufacturer's recommendations. If necessary, access doors or panels shall be provided.		Verified under Code Section 7-4.1 and 8-1.3.2 72E, 1974 Edition.
9-4.4	The location of all detectors in air duct systems shall be permanently and clearly identified and recorded.	W,D	Comply: The air duct detectors for the control rooms (zone 70 & 73) are identified and recorded as required. Ref: Walkdown Checklists No. (72E), 27; Procedure No. 10 & 12.
9-4.5	Detectors mounted outside of a duct employing sampling tubes for transporting smoke from inside the duct to the detector shall be arranged to permit verification of air flow from the duct to the detector.	W,D	Not Applicable: Duct detectors installed in zone 70 and 73 are in accordance with the requirements of NFPA 72E, 1974 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
9-4.6	Detectors shall be suitable for proper operation over the complete range of air velocities, temperature, and humidity expected at the detector when the air handling system is operating.		Verified under Code Sections 8-1.1.4 & 8-1.1.5 1974 Edition.
9-4.7	All penetrations of a return air duct in the vicinity of detectors installed on or in an air duct shall be sealed to prevent entrance of outside air and possible dilution or redirection of smoke within the duct.	W,D	Not Applicable: Duct detectors installed to the requirements of NFPA 72E, 1974 Edition.
9-4.8	Location of detectors mounted in or on return air ducts shall be at least six duct widths downstream from any duct openings, deflection plates, sharp bends or branch connections. Exception No. 1: Where detectors are installed in accordance with 9-3.2.2(b), 9-4.8 does not apply. Exception No. 2: Where is it physically impossible to locate the detector according to 9.4-8, it shall be permissible to position the detector closer than the required six duct widths but as far as possible from the opening, bend or deflection plate so that smoke can still adequately be detected in the air stream.	W,D	Not Applicable: Reference 9-4.7, this Edition.

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CALCULATION/PROBLEM COVER SHEET

Calculation/Problem No: 0120-108-001

Title: NFPA 10 CODE COMPLIANCE VERIFICATION CHECKLIST

Client: AEP **Project:** CODE COMPLIANCE REVIEW

Job No: 0120-108

Design Input/References:

SEE SECTION 5.0

Assumptions: SEE SECTION 2.0. ALSO SEE PROJECT INSTRUCTION PI-FP-0.1, REVISION 1, CONDUCTING AND DOCUMENTING NFPA CODE COMPLIANCE REVIEWS. SEE IMPELL REPORT 09-0120-0123, CODE COMPLIANCE SUMMARY REPORT.

Method: SEE SECTION 3.0. ALSO SEE PROJECT INSTRUCTION PI-FP-01, REVISION 1.

Remarks: SEE PAGE 5 FOR AREAS EVALUATED UNDER THE REQUIREMENTS OF THIS CODE

REV. NO.	REVISION	APPROVED	DATE
0	INITIAL ISSUE	EKlemsey	5/16/88

EDS 0008 8/78

1.0 PURPOSE

The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

Activities performed by the fire extinguisher service company are performed in accordance with the appropriate sections of the code.

3.0 METHODOLOGY

Reference Section 2.1.1 of Impell Project Instruction PI-FP-01, Revision 1.

All maintenance issues noted during the walkdown phase of the project have been identified in the CCVC's, but are not considered deviations due to the limited number.

The evaluation of the portable fire extinguisher system was reviewed under the 1984 edition of the code. Although the system was installed under different edition years from 1970 to 1984, the difference in the edition requirements were minimal and the 1984 edition year was deemed to be more applicable to the system installed.

Justifications for deviations and open items identified in the CCVC's are detailed in Impell Technical Report No. 09-0120-0123.

4.0 RESULTS

Reference the code compliance verification checklist.

5.0 REFERENCES

Ref. No.	Document Number	Title	Revision No./Date	
		Walkdown Verification Checklists		
1	0120-108-001A	Deficiency Matrix	0	12-10-87
2	0120-108-001B	Walkdown Verification Checklist	0	12-10-87
3	0120-108-001C	Walkdown Verification Checklist	0	12-10-87

Ref. No.	References Document Number	Title	Revision No./Date	
4	0120-108-001D	Walkdown Verification Checklist	0	12-10-87
5	0120-108-001E	Walkdown Verification Checklist	0	12-10-87
6	0120-108-001F	Walkdown Verification Checklist	0	12-10-87
7	0120-108-001G	Walkdown Verification Checklist	0	12-10-87
		Procedures		
1	12QHP2270 Fire.001	Portable Fire Extinguisher Inspections	9	09/21/87
2	PMI-2270	Fire Protection	16	07/09/87
		Technical Data		
1	January 1985	Underwriter's Laboratories Fire Protection Equipment Directory	-	12/31/84
2	ROC dated from A. Hall to Don Elston, Ansul Co.	New Fire Extinguishers	-	01/11/88
3	NFPA 22, 1984 Edition Fig. 10-1.4	Water Tanks Isothermal Lines-Lowest One-Day Mean Temperatures	-	07/05/84
4	FP-STD-101	Approved List of Fire Protection Equipment	0	01/15/82
5	UL 711	UL Standard of Safety	-	3rd Ed.10/22/79
6	UL 154	UL Standard of Safety	6th Ed.03/08/84	
7	UL 299	UL Standard of Safety	6th Ed.10/77	
8	Form No. F-76176-4	Ansul Dry Chemical Extinguisher Data Sheet	-	1978
9	Page 47	Fire End E - Series CO^2 Fire Extinguisher Data Catalog	-	-

Ref. No.	References Document Number	Title	Revision No./Date
10	ROC dated 12/03/87 B. Gerwe from D. Kipley	Ambient Plant Conditions	- 12/03/87
11	ROC dated 04/25/88 P. Jaques from D. Kipley	Extinguisher Service Agreement	- 04/25/88
		Licensing Documents	
1	Docket #50-315 & 316 DPR 58 & 74	Fire Hazards Analysis D.C. Cook Units 1 & 2	1 01/30/87
		Drawings	
1	12-5266-2	Fire Facilities Plan Below Basement - El. 573'	2 08/17/87
2	12-5267-3	Fire Facilities Plan Basement El. 591'-0" & 587'-0"	3 08/17/87
3	12-5268-2	Fire Facilities Plan Mezzanine Floor El. 609'	2 08/17/87
4	12-5268A-2	Fire Facilities Plan Cable Vaults El. 620'-6" & 625-10"	2 08/17/87
5	12-5269-2	Fire Facilities Plan Main Floor El. 633'-0"	2 08/17/87
6	12-5270-2	Fire Facilities Reactor Building El. 650'-0"	2 08/17/87

NFPA 10 - 1984 EDITION

PORTABLE FIRE EXTINGUISHERS

This Review includes the following areas:

- The Auxiliary Building Including Everything East of Column Line H
- The Auxiliary Feedpump Rooms in the Turbine Building
- The ESW Pump Rooms in the Screen House
- The Unit 1 and Unit 2 Control Rooms

CODE COMPLIANCE VERIFICATION CHECKLIST
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PORTABLE FIRE EXTINGUISHERS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 1 - INTRODUCTION		Title
1-1	Scope. The provisions of this standard apply to the selection, installation, inspection maintenance and testing of portable extinguishing equipment. The requirements given herein are MINIMUM. Portable extinguishers are intended as a first line of defense to cope with fires of limited size. They are needed even though the property is equipped with automatic sprinklers standpipe and hose, or other fixed protection equipment (see 3-1.1, 3-1.4, 3-2.1, and 3-2.3). They do not apply to permanently installed systems for fire extinguishment, even though portions of such systems may be portable (such as hose and nozzles attached to a fixed supply of extinguishing agent).		For Information Only.
1-2	Purpose. This standard is prepared for the use and guidance of persons charged with selecting purchasing, installing, approving, listing, designing, and maintaining portable fire extinguishing equipment. The fire protection requirements of this standard are general in nature and are not intended to abrogate the specific requirements of other NFPA standards for specific occupancies Nothing in this standard shall be construed as a restriction on new technologies or alternative arrangements, provided that the level of protection as herein described is not lowered and is acceptable to the authority having jurisdiction.		For Information Only.

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IMPELL CORPORATION

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D.C. COOK Units 1 and 2

JOB NO 0120-108
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PORTABLE FIRE EXTINGUISHERS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
1-3	Definitions.		For Information Only.
104	Classification, Ratings and Performance of Fire Extinguishers.		Title
1-4.1	Portable fire extinguishers are classified for use on certain classes of fires and rated for relative extinguishing effectiveness at a temperature of plus 70°F (21.1°C) by testing laboratories. This is based upon the preceding classification of fires and the fire-extinguishment potentials as determined by fire tests.		For Information Only.
1-4.2	The classification and rating system described in this standard is that of Underwriters Laboratories Inc., and Underwriters' Laboratories of Canada and is based on extinguishing preplanned fires of determined size and description as follows: CLASS A RATING - wood and excelsior. CLASS B RATING - Two-in. (5.1-cm) depth n-heptane fires in square pans. CLASS C RATING - No fire test. Agent must be nonconductor of electricity. CLASS D RATING - Special tests on specific combustible metal fires.		For Information Only.
1-4.3	Portable fire extinguishers used to comply with this standard shall be listed and labeled and meet or exceed the requirements of one of the fire test standards and one of the appropriate performance standards shown below: (a) Fire Test Standards: ANSI/UL 711, CAN4-S508-M83	D	Complies. Except for five (5) CO_2 extinguishers, portable extinguishers used at D.C. Cook are U.L. listed. To be "listed", extinguishers must meet the appropriate fire test requirements and performance standards identified in this section. Ref: Technical Data No. 5, 6 and 7.

NFPA 10-CODE COMPLIANCE VERIFICATION CHECKLIST
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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	(b) Performance Standards: 1. CO_2 Types: ANSI/UL 154, CAN4-S503,-M83 2. Dry Chemical Types: ANSI/UL 299, ULC-S504 3. Water Types: ANSI/UL 626, CAN4-S507, -M83 4. Halon Types: ANSI/UL 1093, ULC-S512 5. Foam Types: ANSI/UL 8		
*1-4.4	The identification of the listing and labeling organization, the fire test, and performance standard which the extinguisher meets or exceed shall be clearly marked on each extinguisher. EXCEPTION: EXTINGUISHERS MANUFACTURED PRIOR TO JANUARY 1, 1986.	W	Complies. Most extinguishers were manufactured before 1/1/86 and, as such, do not identify the performance standard met. Newer extinguishers do comply but do not have date of manufacture. Five CO_2 extinguishers were identified which do not have the listing organization displayed. These extinguishers are located in fire zones: 1, 17, 19, 33, 47B, and 126. Ref: Walkdown Checklist No. 1 thru 7.
1-5	CLASSIFICATION OF HAZARDS.		Title
1-5.1	LIGHT (LOW) HAZARD. Locations where the total amount of Class A combustible materials, including furnishings, decorations and contents, is of minor quantity. These may include buildings or rooms occupied as offices, classrooms, churches, assembly halls, etc. This classification anticipates that the majority of contents items are either noncombustible or so arranged that a fire is not likely to spread rapidly. Small amounts of Class B flammable used for duplicating machines, art departments, etc., are included provided that they are kept in closed containers and safety stored.		For information only. Most fire zones, of those surveyed are light hazard. Nine (9) zones are ordinary hazard and four (4) are high hazard per the FHA.

REV 2 | BY DSC | DATE 5/14/88 | CHECKED GWT | DATE 5/15/88

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
1-5.2	ORDINARY (MODERATE) HAZARD. Locations where the total amount of Class A combustibles and Class B flammables are present in greater amounts than expected under Light (Low) Hazard occupancies. These occupancies could consist of offices, class-rooms, mercantile shops and allied storage, light manufacturing, research operations, autom showrooms, parking garages, workshop or support service areas of Light (Low) Hazard occupancies and warehouses containing Class I or Class II commodities as defined by NFPA 231, Standard for Indoor General Storage.		For information only. Fire zones 7, 10, 27, 49, 57, 58, 71, 72 and 75 are Ordinary Hazard per the FHA.
1-5.3	EXTRA (HIGH) HAZARD. Locations where the total amount of Class A combustibles and Class B flammables are present, in storage, production use and/or finished product over and above those expected and classed as ordinary (moderate) hazards. These occupancies could consist of woodworking, vehicle repair, aircraft and boat servicing, individual product display showrooms, product convention center displays, storage and manufacturing processes such as painting, dipping, coating, including flammable liquid handling. Also included is warehousing of, or in-process storage of other than Class I and Class II commodities.		For information only. Fire zones 15, 16, 18 and 19 are High Hazard per the FHA.
1-6	GENERAL REQUIREMENTS.		Title
1-6.1	The classification of extinguishers shall consist of a LETTER which indicates the class of fire on which an extinguisher has been found to be effective, preceded	W	Complies. Except for five (5) CO_2 extinguishers which do have a rating displayed on the extinguisher. Ref: Walkdown Checklist 1 thru 7.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	by a rating NUMERAL (Class A and B only) which indicates the relative extinguishing effectiveness. EXCEPTION: EXTINGUISHERS CLASSIFIED FOR USE ON CLASS C OR D HAZARDS SHALL NOT BE REQUIRED TO HAVE A NUMERAL PRECEDING THE CLASSIFICATION LETTER.		
1-6.2	Portable extinguishers shall be maintained in a fully charged and operable condition, and kept in their designated places at all times when they are not being used.	W,D	Comply: Majority of the extinguisher units are located and maintained as required except as indicated below. Does Not Comply: All extinguishers are maintained fully charged and operable, however several units are not kept in their designated locations as shown on the Fire Facilities Drawings. Ref: Drawing No. 1 thru 6, Walkdown Checklist No. 1 thru 7.
1-6.3	Extinguishers shall be conspicuously located where they will be readily accessible and immediately available in the event of fire. Preferably they shall be located along normal paths of travel, including exits from an area.	W	Comply: Extinguishers are placed in conspicuous locations generally along aisle-ways normally traveled. Ref: Walkdown Checklist No. 1 thru 7.
1-6.4	Cabinets housing extinguishers shall not be locked. EXCEPTION: WHERE EXTINGUISHERS ARE SUBJECT TO MALICIOUS USE, LOCKED CABINETS MAY BE USED PROVIDED THEY INCLUDE MEANS OF EMER-GENCY ACCESS.	W	Not Applicable: Cabinets are not provided for the extinguishers in the areas surveyed. Ref: Walkdown Checklist No. 1 thru 7.

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1-6.5	Extinguishers shall not be obstructed or obscured from view. EXCEPTION: IN LARGE ROOMS, AND IN CERTAIN LOCATIONS WHERE VISUAL OBSTRUCTION CANNOT BE COMPLETELY AVOIDED, MEANS SHALL BE PROVIDED TO INDICATE THE LOCATION.	W	Comply: Extinguishers are placed along main aisleways. They are readily noticeable. Ref: Walkdown Checklist No. 1 thru 7.
1-6.6	Extinguishers shall be installed on the hangers or in the brackets supplied, mounted in cabinets, or set on shelves unless the extinguishers are of the wheeled type.	W	Comply: Except for three extinguishers which were found mounted incorrectly in Zones 33A, 38 and 43. Ref: Walkdown Checklist No 1 thru 7.
1-6.7	Extinguishers installed under conditions where they are subject to dislodgement shall be installed in brackets specifically designed to cope with this problem.	W	Comply: Except for an extinguisher which is improperly mounted in Zone 61. Ref: Walkdown Checklist No. 1 thru 7.
1-6.8	Extinguishers installed under conditions where they are subject to physical damage. shall be protected from impact.	W	Comply: Extinguishers are not installed such that they are subject to physical damage. Ref: Walkdown Checklist No. 1 thru 7.
1-6.9	Extinguishers having a gross weight not exceeding 40 lb (18.14 kg) shall be installed so that the top of the extinguisher is not more than 5 ft (1.53 m) above the floor. Extinguishers having a gross weight greater than 40 lb (18.14 kg) (except wheeled types) shall be so installed that the top of the extinguisher is not more than 3-1/2 ft (1.07 m) above the floor. In no case shall the clearance between the bottom of the extinguisher and the floor be less than 4 in. (102 mm).	W	Comply: Extinguishers are mounted such that the bottom of the unit is greater than 4 in. above the floor and the top of the unit is less than 42 in. above the floor. Ref: Walkdown Checklist No. 1 thru 7.

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1-6.10	Operating instruction shall be located on front of the extinguisher. Other labels and markings shall not be placed on the front. EXCEPTION: IN ADDITION TO MANUFACTURER'S LABELS, OTHER LABELS THAT SPECIFICALLY RELATE TO OPERATION, CLASSIFICATION OR WARNING INFORMATION SHALL BE PERMITTED ON THE FRONT.	W	Comply: All extinguishers have operating instructions located on the front of the extinguisher. Ref: Walkdown Checklist No. 1 thru 7.
1-6.11	Extinguishers mounted in cabinets or wall recesses or set on shelves shall be placed in a manner such that the extinguisher operating instructions face outward. The location of such extinguishers shall be marked conspicuously (see 1-6.5).		Not Applicable: Extinguishers are not mounted in cabinets, in wall recesses or on shelves in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.
*1-6.12	Where extinguishers are installed in sealed cabinets which are exposed to elevated temperatures, cabinets shall be provided with screened openings and drains.	W	Not Applicable: Extinguishers are not mounted in cabinets, in wall recesses or on shelves in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.
*1-6.13	Water type (water, foam, AFFF, wetting agent, and soda-acid) extinguishers shall not be installed in areas where temperatures are outside the range of 40°F to 120°F (4°C to 49°C). All other types shall not be installed in areas where temperatures are outside the range of -40°F to 120°F (-40°C to 49°C). EXCEPTION NO. 1: WHEN EXTINGUISHERS ARE INSTALLED IN LOCATIONS SUBJECT TO TEMPERATURES OUTSIDE THESE RANGES, THEY SHALL BE OF A TYPE APPROVED AND LISTED FOR THE TEMPERATURE TO WHICH THEY ARE EXPOSED, OR THEY MUST BE PLACED IN AN ENCLOSURE CAPABLE OF MAINTAINING THE STIPULATED RANGE OF TEMPERATURES.	W	Comply: Water type extinguishers are not provided in the areas surveyed. Two CO_2 extinguishers are provided outside on the roof. Lowest one day mean temperature for this area is -15°F. Ref: NFPA 22, 1984, Fig. 10-1.4; Ref: Walkdown Checklist No. 1 thru 7.

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	EXCEPTION NO. 2: EXTINGUISHERS CONTAINING PLAIN WATER ONLY CAN BE PROTECTED TO TEMPERATURES AS LOW AS -40°F (-40°C) BY THE ADDITION OF AN ANTIFREEZE STIPULATED ON THE EXTINGUISHER NAMEPLATE. CALCIUM CHLORIDE SOLUTIONS SHALL NOT BE USED IN STAINLESS STEEL EXTINGUISHERS. EXCEPTION NO. 3: SOME EXTINGUISHERS THAT USE NITROGEN AS AN EXPELLANT GAS RATHER THAN CARBON DIOXIDE ARE APPROVED OR LISTED FOR TEMPERATURES AS LOW AS -65°F (-54°C).		
1-6.14	An extinguisher instruction manual shall be provided to the owner or his agent giving condensed instructions and cautions necessary to the installation, operation, inspection and maintenance. The manual may be specified to the extinguisher involved or it may cover many types. The manual shall refer to this standard as a source of detailed instruction.	D	Comply: An instruction sheet detailing this information is placed inside each carton with a new extinguisher by the factory. Ref: Technical Data No. 2.
1-7	UNITS. Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI). One unit (liter), outside of but recognized by SI, is commonly used in international fire protection. The units are listed in Table 1-7 with conversion factors.		For Information Only.
1-7.1	If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.		For Information Only.

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1-7.2	The conversion procedure for the SI units has been to multiply the quantity by the conversion factor and then round the result to the appropriate number of significant digits.		For Information Only.

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	CHAPTER 2 - SELECTION OF EXTINGUISHERS		Title
*2-1	GENERAL REQUIREMENTS. The selection of extinguishers for a given situation shall be determined by the character of the fires anticipated, the construction and occupancy of the individual property, the vehicle or hazard to be protected, ambient-temperature conditions, and other factors. (See Table A-2-1, Appendix A.) The number, size, placement, and limitations of use of extinguishers required shall be determined by using Chapter 3.		For Information Only.
*2-2.1.1	Extinguishers for protecting Class A hazards shall be selected from the following: water, antifreeze, soda-acid, foam, aqueous film forming foam (AFFF), wetting agent, loaded stream, multipurpose dry chemical, and bromochlorodifluoromethane (Halon 1211).		For Information Only.
2-2.1.2	Extinguishers for protection of Class B hazards shall be selected from the following: bromotrifluoromethane (Halon 1301), bromochlorodifluoromethane (Halon 1211), carbon dioxide, dry chemical types, foam, and aqueous film forming foam (AFFF).		For Information Only.
*2-2.1.3	Extinguishers for protection of Class C hazards shall be selected from the following: bromochlorodifluoromethane (Halon 1211), carbon dioxide, dry chemical types.[1]		For Information Only.

[1]Carbon dioxide extinguishers equipped with metal horns are not considered safe for use on fires in energized electrical equipment and, therefore, are not classified for use on Class C hazards.

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2-2.1.4	Extinguishers and extinguishing agents for the protection of Class D hazards shall be of types approved for use on the specific combustible metal hazard.	W	Not Applicable: Combustible metals, Class D hazards, are not present in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.
2-3	APPLICATION FOR SPECIFIC HAZARDS.		Title
2-3.1	CLASS B FIRE EXTINGUISHERS FOR PRESSURIZED FLAMMABLE LIQUIDS AND PRESSURED GAS FIRES. Fires of this nature are considered to be a special hazard. Class B fire extinguishers containing agents other than dry chemical are relatively ineffective on this type of hazard due to stream and agent characteristics. Selection of extinguishers for this type of hazard shall be made on the basis of recommendations by manufacturers of this specialized equipment. The system used to rate extinguishers on Class B fires (flammable liquids in depth) is not applicable to these types of hazards. It has been determined that special nozzle design and rates of agent application are required to cope with such hazards. Caution: It is undesirable to attempt to extinguish this type of fire unless there is reasonable assurance that the source of fuel can be promptly shut off.	W	Not Applicable: There are no pressurized flammable liquids or gas systems in the areas surveyed. Lube oil systems do not qualify as this type of hazard. Ref: Walkdown Checklist No. 2 thru 7.
2-3.2	FIRE EXTINGUISHER SIZE AND PLACEMENT FOR COOKING GREASE FIRES. Extinguishers provided for the protection of cooking grease fires shall be only of the sodium bicarbonate or potassium bicarbonate dry chemical type. Installation shall be in accordance with able 3-3.1 for Extra (High) Hazard.	W	Not Applicable: This type of hazard was not present in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.

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2-3.3	THREE-DIMENSIONAL CLASS B FIRES. A three-dimensional Class B fire involves Class B materials in motion such as pouring, running, or dripping flammable liquids and generally includes vertical as well as one or more horizontal surfaces. Fires of this nature are considered to be a special hazard. Selection of extinguishers for this type of hazard shall be made on the basis of recommendations by manufacturers of this specialized equipment. The system used to rate extinguishers on Class B fires (flammable liquids in depth) is not directly applicable to this type of hazard. NOTE: The installation of fixed systems should be considered when applicable.	W	Not Applicable: There are no situations in the areas surveyed where flammable liquids are in motion such as pouring, running or dripping. Ref: Walkdown Checklist No. 2 thru 7.
2-3.4	WATER SOLUBLE FLAMMABLE LIQUID FIRES. Foam and AFFF type fire extinguishers shall not be used for the protection of water soluble flammable liquids, such as alcohol, acetone, esters, ketones, etc., unless specifically referenced on the extinguisher nameplate.	W	Not Applicable: Water soluble flammable liquids are not used in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.
2-3.5	ELECTRONIC EQUIPMENT FIRES. Extinguishers for the protection of delicate electronic equipment shall be selected from the following: bromotrifluoromethane (Halon 1301), bromotrifluoromethane (Halon 1211) and carbon dioxide.	W	Comply: Two computer rooms are located at elevation 650'. CO_2 extinguishers are provided. Ref: Walkdown Checklist No. 2 thru 7.

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	CHAPTER 3 - DISTRIBUTION OF EXTINGUISHERS.		Title
3-1	GENERAL REQUIREMENTS.		Title
*3-1.1	The minimum number of fire extinguishers needed to protect a property shall be determined as outlined in Chapter 3. Frequently, additional extinguishers may be installed to provide more suitable protection. Extinguishers having ratings less than specified in Tables 3-2.1 and 3-3.1 may be installed provided they are not used in fulfilling the minimum protective requirements of this chapter.		For Information Only.
3-1.2	Fire extinguishers shall be provided for the protection of both the building structure, extinguishers provided for hazards within if combustible, and the occupancy hazards contained therein.	W	Comply: Extinghishers are properly provided except as discussed below. Does Not Comply: Insufficient fire building. Several areas containing Class A combustibles are not provided with extinguishers suitable for Class A hazards. Building construction is non-combustible. Ref: Walkdown Checklist No. 1 thru 7.
3-1.2.1	Required building protection shall be provided by fire extinguishers suitable for Class A fires.	W,D	Not Applicable: Building is not combustible. Ref: Walkdown Checklist No. 2 thru 7; Licensing Document No. 1.
3-1.2.2	Occupancy hazard protection shall be provided by fire extinguishers suitable for such Class A, B, C, or D fire potentials as may be present.	W	Comply: Extinguishers are properly provided except as discussed below. Does Not Comply: Several areas containing Class A combustibles are not provided with extinguishers suitable for Class A hazards. Ref: Walkdown Checklist No. 1 thru 7.

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3-1.2.3	Extinguishers provided for building protection may be considered also for the protection of occupancies having a Class A fire potential.	W,D	Not Applicable: Building is not combustible. Ref: Walkdown Checklist No. 2 thru 7; Licensing Document No. 1.
3-1.2.4	Combustible buildings having an occupancy hazard subject to Class B and/or Class C fires shall have a standard complement of Class A fire extinguishers for building protection, plus additional Class B and/or Class C extinguishers. Where fire extinguishers have more than one letter classification (such as 2-A:20-B:C), they may be considered to satisfy the requirements of each letter class.	W,D	Not Applicable: Building is not combustible. Ref: Walkdown Checklist No. 2 thru 7; Licensing Document No. 1.
3-1.3	Rooms or areas shall be classified generally as light (low) hazard, ordinary (moderate) hazards, or extra (high) hazard, Limited areas of greater or lesser hazard shall be protected as required.	D	Comply: The FHA gives criteria for determining the classification of fire zones. Ref: Licensing Document No. 1.
3-1.4	The type, size, number, and placement for special storage occupancies is covered by NFPA 231, Indoor General Storage, NFPA 231C, Rack Storage of Materials, and NFPA 231D, Storage of Rubber Tires.	W	Not Applicable: Storages as described by these codes are not present in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.
3-2	FIRE EXTINGUISHER SIZE AND PLACEMENT FOR CLASS A HAZARDS.		Title
3-2.1	Minimal sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of Table 3-2.1 except a modified by 3-2.3. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table 3-2.1, except as modified by 3-2.3.	W,D	Comply: All fire zones reviewed were properly provided with extinguishers except as listed below. Does Not Comply: Several fire zones exceed maximum travel distances. The zones that do not comply are; 4, 5, 63C, 62B, 62C, 6N, 6S, 64B, 44N and 37. Ref: Walkdown Checklist No. 1 thru 7; Drawing No. 1 thru 6.

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3-2.1.1	Certain smaller extinguishers which are charged with multipurpose dry chemical or Halon 1211 are rated on Class B and Class C fires, but have insufficient effectiveness to earn the minimum 1-A rating even though they have value in extinguishing smaller Class A fires. They shall not be used to meet the requirements of 3-21.	W	Not Applicable: There are no multi-purpose dry chemical extinguishers having a rating less than 4-A, in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.
3-2.2	Up to one-half of the complement of extinguishers as specified in Table 3-2.1 may be replaced by uniformly spaced 1-1/2 in. (3.81 cm) hose stations for use by the occupants of the building. When hose stations are so provided they shall conform to NFPA 14, Installation of Standpipe and Hose Systems. The location of hose stations and the placement of fire extinguishers shall be in such a manner that the hose stations do not replace more than every other extinguisher.	W	Not Applicable: 1-1/2" hose stations which are provided throughout the plant are designated "For Use By Trained Personnel Only", not for use by building occupants. Ref: Walkdown Checklist No. 2 thru 7.
3-2.3	Where the floor area of a building is less than that specified in Table 3-2.1, at least one extinguisher of the minimum size recommended shall be provided.	W,D	Not Applicable: Extinghishers are provided per Section 3-2.1, this edition. Ref: Code Section 3-2.1.
3-2.4	The protection requirements may be fulfilled with extinguishers of higher rating provided the travel distance to such larger extinguishers shall not exceed 75 ft (22.6 m).	W,D	Comply: Many of the extinguishers in use have ratings higher than minimum required. Ref: Technical Data No. 8; Walkdown Checklist No. 1 thru 7; Drawing No. 1 thru 6.
3-2.5	For Class A extinguishers rated under the rating classification system used prior to 1955, their equivalency shall be in accordance with Table 3-2.5.		For Information Only.

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3-3	FIRE EXTINGUISHER SIZE AND PLACEMENT FOR CLASS B FIRES OTHER THAN FOR FIRES IN FLAMMABLE LIQUIDS OF APPRECIABLE DEPTH.		Title
3-3.1	Minimal sizes of fire extinguishers for the listed grades of hazard shall be provided on the basis of Table 3-3.1. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in the table used. EXCEPTION: EXTINGUISHERS OF LESSER RATING, DESIRED FOR SMALL SPECIFIC HAZARDS WITHIN THE GENERAL HAZARD AREA, MAY BE USED, BUT SHALL NOT BE CONSIDERED AS FULFILLING ANY PART OF THE REQUIREMENTS OF TABLE 3-3.1.	W,D	Comply: See Code Section 3-2.1, this section. Does Not Comply: Many areas exceed travel distances. Ref: Code Section 3-2.1, this edition.
3-3.2	Two or more extinguishers of lower rating shall not be used to fulfill the protection requirements of Table 3-3.1. EXCEPTION NO. 1: UP TO THREE FOAM EXTINGUISHERS OF AT LEAST 2-1/2 GAL (9.46 L) CAPACITY MAY BE USED TO FULFILL LIGHT (LOW) HAZARD REQUIREMENTS.	W,D	Not Applicable: Lower rated extinguishers than required are not provided in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7; Technical Data No. 8 and 9.
3-3.3	The protection requirements may be fulflled with extinguishers of higher ratings provided the travel distance to such larger extinguishers shall not exceed 50 ft (15.25 m).	W,D	Comply: See Code Section 3-2.1, this edition. Does Not Comply: Travel distances exceeded. Ref: Code Section 3-2.1, this edition.
3-3.4	For Class B extinguishers rated under the rating classification system used prior to 1955, their equivalency shall be in accordance with Table 3-4.5.		For Information Only.

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3-4	FIRE EXTINGUISHER SIZE AND PLACEMENT FOR CLASS B FIRES IN FLAMMABLE LIQUIDS OF APPRECIABLE DEPTH.[1]		Title
*3-4.1	Portable fire extinguishers shall not be installed as the sole protection for flammable liquid hazards of appreciable depth [greater than 1/4 in. (0.9 m^2). [1]For dip tanks containing flammable or combustible liquids exceeding 150 gal (568 L) liquid capacity or having a liquid surface exceeding 4 sq ft (0.38 m^2), see NFPA 34, Dip Tanks, for requirements of automatic extinguishing facilities. EXCEPTION: WHERE PERSONNEL WHO ARE TRAINED IN EXTINGUISHING FIRES IN THE PROTECTED HAZARDS, OR A COUNTERPART, ARE AVAILABLE ON THE PREMISES, THE MAXIMUM SURFACE AREA SHALL NOT EXCEED 20 SQ FT (1.86 m^2)	W	Not Applicable: There are no appreciable depth flammable liquid hazards in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.
3-4.2	For flammable liquid hazards of appreciable depth such as in dip or quench tanks, a Class B fire extinguisher shall be provided on the basis of at least two numerical units of Class B extinguishing potential per sq ft (0.0929 m^2) of flammable liquid surface of the largest tank hazard within the area. EXCEPTION NO. 1: WHERE APPROVED AUTOMATIC FIRE PROTECTION DEVICES OR SYSTEMS HAVE BEEN INSTALLED FOR A FLAMMABLE LIQUID HAZARD, ADDITIONAL PORTABLE CLASS B FIRE EXTINGUISHERS MAY BE WAIVED. WHERE SO WAIVED, CLASS B EXTINGUISHERS SHALL BE PROVIDED AS COVERED IN 3-3.1 TO PROTECT AREAS IN THE VICINITY OF SUCH PROTECTED HAZARDS.	W	Not Applicable: See response to 3-4.1.

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	EXCEPTION NO. 2: FOAM OR AFFF TYPE EXTINGUISHERS MAY BE PROVIDED ON THE BASIS OF 1B OF PROTECTION PER SQ FT OF HAZARD.		
3-4.3	Two or more extinguishers of lower ratings shall not be used in lieu of the extinguisher required for the largest tank. EXCEPTION: UP TO THREE FOAM OR AFFF EXTINGUISHERS OF 2-1/2 GAL (9.46 L) CAPACITY MAY BE USED TO FULFILL THESE REQUIREMENTS.	W	Not Applicable: See response to 3-4.1.
3-4.4	Travel distances for portable extinguishers shall not exceed 50 ft (15.25 m).	W	Not Applicable: See response to 3-4.1.
3-4.4.1	Scattered or widely separated hazards shall be individually protected. An extinguished in the proximity of a hazard shall be carefully located so as to be accessible in the presence of a fire without undue danger to the operator.	W	Not Applicable: See response to 3-4.1.
3-4.5	For Class B extinguishers rated under the rating classification system used prior to 1955, their equivalency shall be in accordance with Table 3-4.5.		For Information Only.
3-5	Fire Extinguisher Size and Placement for Class C Hazards. \Extinguishers with Class C ratings shall be required where energized electrical equipment may be encountered which would require a nonconducting extinguishing medium. This will include fire either directly involving or surrounding electrical equipment. Since the fire itself is a Class A or Class B hazard, the extinguishers are sized and located on the basis of the anticipated Class A or B hazard.	D	Comply: All extinguishers provided in the areas surveyed have non-conducting extinguishing agents. Ref: Technical Data No. 8 and 9.

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	NOTE: Electrical equipment should be de-energized as soon as possible to prevent reignition.		
3-5.1	For extinguishers classified under the system used prior to 1955, the pre-1955 classifications of "C-2," "C-1," and "C" shall be equivalent to the current "C" designation. EXCEPTION NO. 1: CARBON DIOXIDE EXTINGUISHERS WITH METALLIC HORNS SHALL NOT CARRY ANY "C" CLASSIFICATION. EXCEPTION NO. 2: VAPORIZING LIQUID EXTINGUISHERS (CARBONTETRANCHLORIDE OR CHLOROBROMOMETHAN BASE) ARE NOT RECOGNIZED IN THIS STANDARD.		For Information Only.
3-6	SIZE AND PLACEMENT FOR CLASS D HAZARDS.		Title
3-6.1	Extinguishers or extinguishing agents with Class D ratings shall be provided for fires involving combustible metals.	W	Not Applicable: Class D hazards do not exist in the area surveyed. Ref: Walkdown Checklist No. 2 thru 7.
3-6.2	Extinguishing equipment shall be located not more than 75 ft (22.7 m) from the Class D hazard.	W	Not Applicable: See response to 3-6.1.
3-6.3	Size determination shall be on the basis of the specific combustible metal, its physical particle size, area to be covered and recommendations by the extinguisher manufacturer on data from control test conducted.	W	Not Applicable: See response to 3-6.1.

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	CHAPTER 4 - INSPECTION, MAINTENANCE, AND RECHARGING Title		
4-1	GENERAL.		Title
4-1.1	This chapter is concerned with the rules governing inspection, maintenance, and recharging of extinguishers. These factors are of prime importance in ensuring operation at the time of a fire.		For Information Only.
4-1.2	The procedure for inspection and maintenance of fire extinguishes varies considerably. Minimal knowledge is necessary to perform a monthly "quick check" or inspection in order to follow the inspection procedure as outlined in Section 4-3. A trained person who has undergone the instructions necessary to reliably perform maintenance and has the manufacturer's service manual shall service the fire extinguishers not more than one year apart, as outlined in Section 4.4.	D	Comply: Fire extinguishers are inspected monthly and maintained semi-annually per Procedure 12QHP 2270 Fire.001, Rev. 9, which references Procedure PMI 2270, Rev. 16. PMI 2270 requires tests and surveillances to be conducted by trained individuals utilizing approved procedures. Ref: Procedure No. 1 and 2.
4-1.3	The owner or occupant of a property in which extinguishers are located shall be responsible for such inspection, maintenance, and recharging.	D	Comply: Inspections are performed by the plant Safety & Assessment Dept. Maintenance is performed by servicing contractor. Ref: Procedure No. 1
*4-1.4	Maintenance, servicing and recharging shall be performed by trained persons having available the appropriate servicing manual(s), the proper types of tools, recharge materials, lubricants, and manufacturer's recommended replacement parts.	D	Comply: Persons performing surveillances and tests must pass a test, developed by Twin City Fire Extinguisher Company, on the requirements for performing the tests and surveillances. Ref: Procedure No. 1 and 2.

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4-2	Definitions		For Information Only. Entire section deleted.
4-3	Inspection.		Title
4-3.1	Frequency. Extinguishers shall be inspected monthly, or at more frequent intervals when circumstances required.	D	Comply: Surveillances are performed per the requirements of the Tech. Specs. Ref.: Procedure No. 2.
4-3.2	Procedure. Periodic inspection of extinguishers shall include a check of at least the following items: (a) Located in designated place. (b) No obstruction to access or visibility. (c) Operating instructions on nameplate legible and facing outward. (d) Seals and tamper indicators not broken or missing. (e) Determine fullness by weighing or "hefting." (f) Examine for obvious physical damage corrosion, leakage, or clogged nozzle. (g) Pressure gage reading or indicator in the operable range or position.	W,D	Comply: The surveillance procedure properly verifies the operability of the units and overall area obstructions. Does Not Comply: Procedure 12QHP 2270 Fire.001, Rev. 9. Reference the fire facility drawings for placement of extinguishers. These drawings do not accurately depict actual placement of extinguishers. Also the surveillance checklist does not specifically identify individual extinguishers as to their location. Ref: Walkdown Checklist No. 1 thru 7; Drawing No. 1 thru 6; Procedure No. 1.
4-3.3	Corrective Action. When an inspection of any extinguisher reveals a deficiency in any of the conditions listed in (a) and (b) of 4-3.2, immediate corrective action shall be taken.	D	Comply: Procedure 12QHP 2270 Fire.001, Rev. 9, replaces deficient units with operable ones. Ref: Procedure No. 1.
4-3.3.1	Rechargeable Extinguishers. When an inspection of any rechargeable extinguisher reveals a deficiency in any of the conditions listed in (c), (d), (e), (f), and (g) of 4-3.2, it shall be subjected to applicable maintenance procedures.	D	Comply: Procedure 12QHP 2270 Fire.001, Rev. 9, requires fire extinguisher servicing contractor to be brought in to service unacceptable fire extinguishers. Ref: Procedure No. 1.

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4-3.3.2	Nonrechargeable. When an inspection of any nonrefillable disposable extinguisher reveals a deficiency in any of the conditions listed in (c), (e), (f), and (g) of 4-3.2, it shall be discharged and removed from service.	D	Not Applicable: There are no non-rechargable extinguishers provided in the surveyed areas. Ref: Technical Data No. 8 and 9.
4-3.4	RECORDKEEPING		Title
4-3.4.1	Personnel making inspection shall keep records for those extinguishers that are found to require corrective actions.	D	Comply: Records are kept of all extinguishers inspected, including those requiring servicing. Ref: Procedure No. 1.
4-3.4.2	At least monthly, the date the inspection was performed and the initials of the person performing the inspection shall be recorded.	W	Does Not Comply: During monthly and semi-annual inspections the tags are punched attesting to the completion of the inspection by the Safety and Assessment Dept. The tags are not initialed by the inspector.
*4-4	MAINTENANCE		Title
4-4.1	FREQUENCY. Extinguishers shall be subjected to maintenance not more than one year apart or when specifically indicated by an inspection. Maintenance procedures shall be performed in accordance with 4-4.2.		Comply: Procedure 12QHP 2270 Fire.001 performs maintenance on semi-annual basis. Ref: Procedure No. 1.
4-4.1.1	Stored pressure types containing a loaded stream agent shall be disassembled on an annual basis and subjected to a complete maintenance. Prior to disassembly the extinguisher shall be fully discharged to check the operation of the discharge valve and pressure gage.	W	Not Applicable: There are no stored pressure loaded stream units provided in the areas surveyed. Ref: Walkdown Checklist No 2 thru 7.

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4-4.1.2*	A conductivity test shall be conducted on all carbon dioxide hose assemblies. Hose assemblies found to be nonconductive shall be replaced.	W,D	Comply: Procedure 12QHP 2270 Fire.001, Rev. 9, requires hose conductivity test to be performed during semi-annual inspection. Ref: Procedure No. 1; Walkdown Checklist No. 1 thru 7.
4-4.1.3.	Every six years, stored pressure extinguishers that require a 12-year hydrostatic test shall be emptied and subjected to the applicable maintenance procedures. When the applicable maintenance procedures are performed during periodic recharging or hydrostatic testing, the six-year requirements shall begin from that date. EXCEPTION NO. 1: EXTINGUISHERS HAVING NON-REFILLABLE DISPOSABLE CONTAINERS ARE EXEMPT.	W	Not Applicable: The only stored pressure units provided in the areas surveyed are CO_2 units which require hydrostatic testing every 5 years. Ref: Walkdown Checklist No. 2 thru 7.
4-4.1.4.	Extinguishers out of service for maintenance or recharge shall be replaced by spare extinguishers of the same type and at least equal rating.	D	Comply: Procedure 12QHP 2270 Fire.001, Rev. 9, requires replacement of any deficient extinguisher found. Ref: Procedure No. 1.
4-4.2*	PROCEDURES. Maintenance procedures shall include a thorough examination of the three basic elements of an extinguisher: (a) mechanical parts, (b) extinguishing agent, and (c) expelling means. EXCEPTION NO. 1: IT IS NOT NECESSARY DURING THE ANNUAL MAINTENANCE TO INTERNALLY EXAMINE CO_2 OR STORED PRESSURE EXTINGUISHERS EQUIPPED WITH PRESSURE INDICATORS OR GAGES EXCEPT FOR THOSE TYPES SPECIFIED IN 4-4.1.1. HOWEVER, SUCH EXTINGUISHERS SHALL BE THOROUGHLY EXAMINED EXTERNALLY IN ACCORDANCE WITH THE APPLICABLE ITEMS OF 4-4.2(a).	D	Comply: Procedure 12QHP 2270 Fire.001, checks these elements during the semi-annual inspection. Ref: Procedure No. 1.

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	EXCEPTION NO. 2: FACTORY SEALED ("DISPOSABLE TYPE") EXTINGUISHERS SHALL BE INSPECTED AND MAINTAINED ONLY IN ACCORDANCE WITH THE NAMEPLATE INSTRUCTIONS.		
*4-4.3	RECORDKEEPING. Each extinguisher shall have a tag or label securely attached that indicates the month and year the maintenance was performed and shall identify the person performing the service.[1] The same record tag or label shall indicate if recharging was also performed.	W	Does Not Comply: Tags are provided on each extinguisher. The tags are punched, not initialled, by the person performing the maintenance.
4-4.3.1	For the six-year requirement of 4-4.1.3, this information shall be included on the maintenance tag or label. This information shall be transferred to each subsequent maintenance tag or label.	W	Not Applicable: There are no extinguishers, in the areas surveyed, that require six year maintenance. See response to 4-4.1.3. Ref: Walkdown Checklist No. 2 thru 7.
4-4.3.2	Labels indicating inspection, maintenance hydrostatic retests, and six-year maintenance shall not be placed on the front of the extinguisher.	W	Comply: Tags are either hung around the extinguisher neck or affixed to the back side of the extinguisher. Ref: Walkdown Checklist No. 1 thru 7.
4-5	RECHARGING.		Title
4-5.1	GENERAL. All rechargeable type extinguishers shall be recharged after use or as indicated by an inspection or when performing maintenance. When performing the recharging, the recommendations of the manufacturers shall be followed. For recharge chemicals, see 4-5.3.1.	D	Comply: Procedure 12QHP 2270 Fire.001 requires arrangements to be made with an outside contractor to service extinguishers. Ref: Procedure No. 1.
4-5.2	FREQUENCY.		Title
4-5.2.1	SODA-ACID, FOAM, AND PUMP-TANK. Every 12 months, soda-acid, foam, pump-tank water, and pump tank calcium chloride base antifreeze types of extinguishers shall be recharged with new chemicals or water, as applicable.	W	Not Applicable: These types of extinguishers are not provided in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.

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4-5.2.2	WETTING AGENT. The agent in stored pressure wetting agent (wet chemical) extinguishers shall be replaced annually. NOTE: Only the agent specified on the nameplate shall be used for recharging. The use of water or other agents is prohibited.	W	Not Applicable: These type of extinguishers are not provided in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.
4-5.2.3	AFFF. The agent, liquid or solid charge type, in AFFF (aqueous film forming foam) extinguishers shall be replaced at least once every five years.	W	Not Applicable: These type of extinguishers are not provided in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7.
4-5.3	PROCEDURES.		Title - ENTIRE SECTION IS NOT APPLICABLE.
*4-5.3.1	RECHARGE CHEMICALS. Only those materials specified on the nameplate, or materials proven to have equal chemical composition and physical characteristics, shall be used. Test shall be conducted to assure equal performance.	D	All recharging and maintenance of extinguishers is performed by an outside contractor who specializes in fire extinguisher maintenance and service. This contractor is required to maintain and test the extinguishers properly and provide a state Certificate of Conformance in accordance with the service agreement and the quality suppliers list. Ref: Procedure No. 1; Technical Data No. 11.
*4-5.3.2	MIXING OF AGENTS. Multipurpose dry chemicals shall not be mixed with alkaline based dry chemicals.	D	Not Applicable: See Code Section No. 4-5.3, this edition.
4-5.3.3	TOPPING OFF. The remaining agent in a partially discharged dry chemical extinguisher shall be thoroughly checked for the proper type, contamination and condition. Dry chemical found to be of the wrong type, or contaminated, shall be removed.	D	Not Applicable: See Code Section No. 4-5.3, this edition.

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4-5.3.4	DRY POWDER. Pails or drums containing dry powder agents for scoop or shovel application for use on metal fires shall be kept full and covered at all times. The dry powder shall be replaced if found damp. (See A-4-5.3.1)	W	Not Applicable: Dry powder is not used in the plant. Ref: Walkdown Checklist No. 2 thru 7.
*4-5.3.5	Replacement pressure gages shall have the proper indicated charging (service) pressure, be marked for use with the agent in the extinguisher and be compatible with the extinguisher valve body material. The gage used to set the regulated source of pressure shall be calibrated at least annually.	D	Not Applicable: See Code Section 4-5.3, this edition.
4-5.3.6	PRECAUTIONARY PRESSURIZATION MEASURES. A rechargable stored pressure type extinguisher shall be pressurized only to the charging pressure specified on the extinguisher nameplate. A regulated source of pressure, set no higher than 25 psi (172 kPa) above the operating (service) pressure, shall be used to pressurize fire extinguishers. NOTE: An unregulated source of pressure, such as a nitrogen cylinder without a pressure regulator, should never be used because the extinguisher could be over-pressurized and possibly rupture.	D	Not Applicable: See Code Section 4-5.3, this edition.
*4-5.3.7	PRESSURIZING GAS. Only standard industrial grade nitrogen with a dew point of -70°F (-57°C) or lower shall be used to pressurize stored pressure dry chemical and Halon type fire extinguishers. Compresses air through moisture traps shall not be used for pressurizing even though so stated in the instructions on older extinguishers.	D	Not Applicable: See Code Section 4-5.3, this edition.

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4-5.3.8	CONVERSION OF EXTINGUISHER TYPES. No extinguisher shall be converted from one type to another, nor shall any extinguisher be converted to use a different type of extinguisher agent.	D	Not Applicable: See Code Section 4-5.3, this edition.
*4-5.3.9	REMOVAL OF MOISTURE. For all non-water types of extinguishers any moisture shall be removed before recharging.	D	Not Applicable: See Code Section 4-5.3, this edition.
*4-5.3.10	CARBON DIOXIDE RECHARGING. The vapor phase of carbon dioxide shall not be less than 99.5 percent carbon dioxide. The water content of the liquid phase shall not be more than 0.01 percent by weight [-30°F (-34.3°C) dew point]. Oil content of the carbon dioxide shall not exceed 10 ppm by weight.	D	Not Applicable: See Code Section 4-5.3, this edition.
*4-5.3.11	LEAK TEST. After recharging, a leak test shall be performed on stored pressure and self-expelling types.	D this edition.	Not Applicable: See Code Section 4-5.3,
4-5.3.12	RECHARGING WATER TYPES. When recharging stored pressure extinguishers, overfilling will result in improper discharge. The proper amount of liquid agent shall be determined by using one of the following: (a) exact measurement in gallons, or by weight (b) use of an antioverfill tube when provided, or (c) use of a fill mark on extinguisher shell, if provided.		Not Applicable: See Code Section 4-5.3, this edition.

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	CHAPTER 5 - HYDROSTATIC TESTING		Title
5-1	GENERAL.		Title
5-1.1	Hydrostatic testing shall be performed by persons trained in pressure testing procedures and safeguards, and having available suitable testing equipment, facilities and appropriate servicing manual(s).	D	Comply: All hydrostatic testing is conducted by an outside contractor who specializes in fire extinguisher servicing and testing. The contractor is required to provide a "Certificate of Conformance" for work performed. Ref: Procedure No. 1; Technical Data No. 11.
5-1.2	If, at any time, an extinguisher shows evidence of corrosion or mechanical injury, it shall be hydrostatically tested, subject to the provisions of 5-1.3 and 5-1.4. EXCEPTION NO. 1: PUMP TANKS DO NOT REQUIRE A HYDROSTATIC TEST. EXCEPTION NO. 2: EXTINGUISHERS HAVING NONREFILLABLE DISPOSABLE CONTAINERS SHALL BE DISCHARGED AND DISCARDED.	D	Comply: Procedure for inspecting fire extinguishers directs personnel performing the inspections to make arrangements with the outside contractor to perform service on any extinguishers found deficient. Ref: Procedure No. 1.
5-1.3	EXAMINATION OF CYLINDER CONDITION. When an extinguisher cylinder or shell has one or more conditions listed in this subdivision, it shall not be hydrostatically tested but shall be destroyed by the owner or at his direction: (a) When there exists repairs by soldering, welding, brazing, or use of patching compounds. NOTE: For welding or brazing on mild steel shells, consult the manufacturer of the extinguisher.	W,D	Comply: Outside fire extinguisher contractor would destroy these extinguishers. Ref: Procedure No. 1; Technical Data No. 11.

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	(b) When the cylinder or shell threads are damaged. (c) When there exists corrosion that has caused pitting, including under removable nameplate band assemblies. (d) When the extinguisher has been burned in a fire. (e) When a calciumchloride type of extinguishing agent was used in a stainless steel extinguisher. (f) When the shell is of copper or brass construction joined y soft solder or rivets.		
*5-1.4	ALUMINUM SHELL/CYLINER. Extinguishers having aluminum cylinders or shells suspected of being exposed to temperatures in excess of 350°F (177°C) shall be removed from service and subjected to a hydrostatic test.	D	Not Applicable: Extinguishers in the areas reviewed will not be exposed to temperatures exceeding 350°F. Ref: Technical Data No. 10.
5-2	FREQUENCY. At intervals not exceeding those specified in Table 5-2, extinguishers shall be hydrostatically tested. EXCEPTION NO. 1: NONREFILLABLE FACTORY-SEALED DISPOSABLE CONTAINERS DO NOT REQUIRE HYDROSTATIC TESTING. EXCEPTION NO. 2: EXTINGUISHERS UTILIZING A CYLINDER THAT HAS DOT OR CTC MARKINGS SHALL BE HYDROSTATICALLY TESTED, OR REPLACED, ACCORDING TO THE REQUIREMENTS OF DOT OR CTC. EXCEPTION NO. 3: FOR EXTINGUISHERS NOT COVERED IN EXCEPTIONS NO. 1 AND 2 THE FIRST RETEST MAY BE CONDUCTED WITHIN 12 MONTHS OF THE SPECIFIED TEST INTERVALS.	W,D	Comply: All extinguishers surveyed were found to be in compliance with the hydrostatic test frequencies specified in Table 5-2, except for new extinguishers which do not have the date of manufacture displayed in order to determine when hydrostatic testing is due. Ref: Walkdown Checklist No. 1 thru 7.

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5-2.1	COMPRESSES GAS CYLINDERS AND CARTRIDGES. Nitrogen cylinders or cartridges used for inert gas storage used as an expellant for wheeled extinguishers shall be hydrostatically tested every five years. EXCEPTION: CYLINDER (EXCEPT THOSE CHARGED WITH CARBON DIOXIDE) COMPLYING WITH PART 173.34 (e) 15, TITLE 49, CODE OF FEDERAL REGULATIONS, MAY BE HYDROSTATICALLY TESTED EVERY 10 YEARS.	W	Comply: Nitrogen cylinders on the wheeled extinguishers surveyed had been hydrostatically tested within the past 5 years. Ref: Walkdown Checklist No. 2 thru 7.
5-2.2	HOSE ASSEMBLIES. A hydrostatic test shall be performed on extinguisher hose assemblies which are equipped with a shutoff nozzle at the end of the hose. The test interval shall be the same as specified for the extinguisher on which the hose is installed.	D	Comply: All outside contractor which specializes in fire extinguisher maintenance and testing performs all hydrostatic testing as required. In addition, all work performed by this contractor is required to provide a state Certificate of Conformance in accordance with the service agreement and the quality suppliers list. Ref: Procedure No. 1; Technical Data No. 11.
5-3	TEST PRESSURES.		Title
5-3.1	COMPRESSED GAS CYLINDERS.		Title
5-3.1.1	Carbon dioxide extinguishers shall be tested at 5/3 the service pressure as stamped into the cylinder. EXCEPTION: CARBON DIOXIDE EXTINGUISHERS HAVING CYLINDER SPECIFICATION ICC3 SHALL BE TESTED AT 3,000 PSI (20 685 kPa).	D	Comply: See response to Section 5-2.2.
5-3.1.2	Nitrogen cylinders and carbon dioxide cylinders used with wheeled extinguishers shall be tested at 5/3 the service pressure as stamped into the cylinder.	D	See response to Section 5-2.2.

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5-3.2	STORED PRESSURE TYPES. All stored pressure and bromochlorodifluoromethane (Halon 1211) types of extinguishers shall be hydrostatically tested at the factory test pressure not to exceed two times the service pressure.	W,D	Not Applicable: These type extinguishers are not provided in the areas surveyed. Ref: Walkdown Checklist No. 2 thru 7; Drawing No. 1 thru 6.
5-3.3	SELF-GENERATING AND CARTRIDGE-OPERATED TYPES.		Title
5-3.3.1	Self-generating types (soda acid and foam) of stainless steel construction and cartridge operated water type extinguishers of stainless steel construction shall be hydrostatically tested at 350 psi (2413 kPa). (For those of aluminum shell construction, See 5-1.4.)	W	Not Applicable: These types of extinguishers are not provided in the plant in the areas reviewed. Ref: Walkdown Checklist No. 2 thru 7.
5-3.3.2	Cartridge or cylinder-operated dry chemical and dry powder types of extinguishers shall be hydrostatically tested at their original factory test pressure as shown on the nameplate or shell.	D	Comply: See response to Section 5-2.2.
5-3.4	TEST PRESSURES FOR HOSE ASSEMBLIES.		Title
5-3.4.1	Carbon dioxide hose assemblies requiring a hydrostatic pressure test shall be tested at 1,250 psi (8619 kPa).	D	Comply: See response to Section 5-2.2.
5-3.4.2	Dry chemical and dry powder hose assemblies requiring a hydrostatic pressure test shall be tested at 300 psi (2068 kPa) or at service pressure, whichever is the higher.	D	Comply: See response to Section 5-2.2.
5-4	TEST EQUIPMENT AND PROCEDURES.		Title
5-4.1	GENERAL.		Title
5-4.1.1	Air or gas pressure shall not be used for pressure testing. The failure of an extinguisher shell may be violent and dangerous.	D	Comply: See response to Section 5-2.2.

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5-4.1.2	When extinguisher shells, cylinders, or cartridges fail a hydrostatic pressure test, they shall be destroyed by the owner or at his direction.	D	Comply: See response to Section 5-2.2.
5-4.2	TEST EQUIPMENT FOR COMPRESSED GAS TYPES.		Title
5-4.2.1	The equipment for testing cylinders and cartridges shall be of the water jacket type that meets the specifications of the pamphlet Methods for Hydrostatic Testing of Compressed Gas Cylinders (Pamphlet C-1), published by the Compressed Gas Association.	D	Comply: See response to Section 5-1.1.
5-4.2.2	Hose assemblies of carbon dioxide extinguishers that require a hydrostatic test shall be tested within a protective cage device.	D	Comply: See response to Section 5-1.1.
5-4.3	TEST EQUIPMENT FOR NONCOMPESSED GAS TYPES.		Title
5-4.3.1	The equipment for testing noncompressed gas types consists of the following: (a) A hydrostatic test pump, hand or power operated, to be capable of producing not less than 150 percent of the test pressure. It is to include appropriate check valves and fittings. (b) A flexible connection for attachment to the test pump. It shall be provided with necessary fittings to test through the extinguisher nozzle, test bonnet, or hose outlet, as is applicable. (c) A protective age or barrier for personnel protection, designed to provide visual observation of the extinguisher under test.	W	Comply: See response to Section 5-1.1.

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IMPELL CORPORATION

NFPA 10-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

JOB NO 0120-108
CALC NO 0120-108-001

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 10-1984
PORTABLE FIRE EXTINGUISHERS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
5-4.3.2	Drying equipment is required to dry all non-water types of extinguishers that have passed the hydrostatic test.	D	Comply: See response to Section 5-1.1.
5-5	TESTING PROCEDURES.		Title
5-5.1	COMPRESSED GAS TYPES.		Title
5-5.1.1	In addition to the visual examinations required prior to test as stated in 5-1.3, an internal examination shall be made prior to the hydrostatic test. The Procedures for this internal examination shall be in accordance with the requirements of the Standard for Visual Inspection of Compressed Gas Cylinders (CGA C-6) and Standard for Visual Inspection of High Pressure Aluminum Compressed Gas Cylinders (CGA C-6), published by the Compressed Gas Association.	D	Comply: See response to Section 5-1.1.
5-5.1.2	The hydrostatic testing of compressed gas cylinders and cartridges shall be in accordance with the procedures specified in the pamphlet Methods for Hydrostatic Testing of Compressed Gas Cylinders (Pamphlet C-1), published by the Compressed Gas Association.	D	Comply: See response to Section 5-1.1.
5-5.2	TESTING PROCEDURES FOR NONCOMPRESSED GAS TYPES. The testing procedures for noncompressed gas cylinders and shells and hose assemblies are detailed in Appendix A of this standard.	D	Comply: See response to Section 5-1.1.
5-5.3	TESTING PROCEDURES FOR HOSE ASSEMBLIES. The testing procedures for hose assemblies requiring a hydrostatic test are detailed in Appendix A.	D	Comply: See response to Section 5-1.1.
5-5.4	RECORDING OF TESTS.		Title

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IMPELL CORPORATION

NFPA 10-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

JOB NO 0120-108
CALC NO 0120-108-001

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 10-1984
PORTABLE FIRE EXTINGUISHERS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
5-5.4.1	COMPRESSED GAS TYPES. For compressed gas cylinders and cartridges passing a hydrostatic test, the month and year shall be stamped into the cylinder in accordance with the requirements set forth by DOT or the Canadian Transport Commission. NOTE: It is important that the recording (stamping) be placed only on the shoulder, top head, neck, or footing (when so provided) of the cylinder.	D	Comply: See response to Section 5-1.1.
5-5.4.2	NONCOMPESSED GAS TYPES. Extinguisher shells of the non-compressed gas types that pass a hydrostatic test shall have the test information recorded on a suitable metallic label or equally durable material. The label shall be affixed by a heatless process to the shell. These labels shall be self-destructive when removal from an extinguisher shell is attempted. The label shall include the following information. (a) Month and year the test was performed, indicated by a perforation, such as by a hand punch. (b) Test pressure used. (c) Name or initials of person performing the test, or name of agency performing the test.	W	Comply: All non-compressed gas type extinguishers, which have been hydrostatically tested, do have self-sticking labels, with the required information, affixed the extinguisher shell, except for approximately 30 extinguishers which did not have the tag punched, denoting the test pressure used and 3 extinguishers which were missing tags. Ref: Walkdown Checklist No. 1 thru 7.
5-5.4.3	Hose assemblies passing a hydrostatic test do not require recording.		For Information Only.

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NFPA 10-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

JOB NO 0120-108
CALC NO 0120-108-001

CALCULATION/DESIGN COVER SHEET

Calculation/Design No 0120-108-002

Title: NFPA 12 CODE COMPLIANCE VERIFICATION CHECKLIST

Client: AEP Project: CODE COMPLIANCE REVIEW

Job No: 0120-108-1375

Design Input/References: SEE SECTION 5.0.

Assumptions: SEE PROJECT INSTRUCTION PI-FP-01, REVISION 1, CONDUCTING AND DOCUMENTING NFPA CODE COMPLIANCE REVIEWS. SEE IMPELL REPORT 09-0120-0123 CODE COMPLIANCE SUMMARY REPORT. SEE SECTION 2.0.

Method: SEE PI-FP-01, REVISION 1
SEE SECTION 3.0.

Remarks: SEE PAGE 8 FOR AREAS/ZONES EVALUATED UNDER THE REQUIREMENTS OF THIS CODE.

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	David E. Vigil	5/14/82

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

For the purpose of this report, it is assumed that under most conditions the authority having jurisdiction was the architect/engineer (A/E) for the plant who is American Electric Power Service Corporation (AEPSC) unless other wise incicated.

3.0 METHODOLOGY

3.1 Reference Section 2.1.1 of Impell Project Instruction PI-FP-01, Revision 1.

3.2 An item identified in the Code Compliance Verification Checklist which "Does Not Comply" or is shown as an "Open Item" is further discussed in the Code Compliance Summary Report, Impell Report Number 09-0120-0123.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

5.0 REFERENCES

References

Ref No.	Document Number	Title	Rev. No.	Date
		Walkdown Verification Checklists		
1	0120-108-002A	Impell Calculation, NFPA 12 - Code Compliance Walkdown Verification Checklist	0	01/26/88
		Procedures		
1	PMI-2270	Fire Protection	16	07/09/87
2	12-PMP-2070-TRN-108	Maintenance Skills Training Program	1	04/23/87
3.	12-PMP-2070-TRN-115	Fire Brigade Training Program	2	05/09/87
4	PO-050-506-CO_2	Initial Start-Up Test Results	—	04/30/74
5	12-THP4030 STP.225.010	Control Room Cable Vault CO_2 Fire Suppression Test	1	05/29/87
6	12-THP4030 STP.225.020	Auxiliary Cable Vault CO_2 Fire Suppression Test	1	08/07/87
7	12-THP4030 STP.225.030	Reactor Cable Tunnel Quad 1 CO_2 Fire Suppression Test	1	08/07/87
8	12-THP4030 STP.225.031	Reactor Cable Tunnel Quad 2 CO_2 Fire Suppression Test	1	07/19/87
9	12-THP4030 STP.225.032	Reactor Cable Tunnel Quad 3S CO_2 Fire Suppression Test	1	09/11/87
10	12-THP4030 STP.225.033	Reactor Cable Tunnel Quad 3N CO_2 Fire Suppression Test	1	07/02/87
11	12-THP4030 STP.225.034	Reactor Cable Tunnel Quad 3N CO_2 Fire Suppression Test	1	09/11/87
12	12-THP4030 STP.225.035	Reactor Cable Tunnel Quad 4 CO_2 Fire Suppression Test	1	06/26/87
13	12-THP4030 STP.225.040	Unit 1 AB Diesels CO_2 Fire Suppression Test	1	06/12/87

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
14	12-THP4030 STP.225.041	Unit 1 CD Diesels CO_2 Fire Suppression Test	1	06/05/87
15	12-THP4030 STP.225.042	DG Oil Pump & Valve Rooms CO_2 Fire Suppression Test	1	06/05/87
16	12-THP4030 STP.225.050	4KV Switchgear Room CO_2 Fire Suppression Test	1	06/23/87
17	12-THP4030 STP.225.051	Emerg. Safety Switchgear Room CO_2 Fire Suppression Test	1	05/25/87
18	12-THP4030 STP.225.052	CRD Trans. Swgr. Room CO_2 Fire Suppression Test	1	07/02/87
19	12-THP4030 STP.225.053	Switchgear Cable Vault CO_2 Fire Suppression Test	1	09/04/87
20	12-THP6040 PER.105HR	Hose Reel Stations CO_2 Fire Suppression Test	0	04/25/86
21	12-THP6030 1MP.142	Fire Detection Instrumentation and Cardox System Surveillance Testing (6 month)	10	05/09/87
		Technical Data		
1	0120-108-007	Impell Calculation, NFPA 72D Code Compliance Verification Checklist	0	05/16/88
2	0120-108-008	Impell Calculation, NFPA 72E Code Compliance Verification Checklist	0	05/16/88
3	SD-DCC-FP102	Low Pressure Carbon Dioxide Fire Fighting Systems	2	Draft
4	SD-DCC-FP103	Fire Protection Systems - Miscellaneous	3	Draft
5		Cardox Fire Extinguishing Equipment - Manual		

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
6	Specification DCC PM1040CS	Material Specification	4	11/09/72
7		Cardox Carbon Dioxide Calculations - Cardox Corporation		10/08/71 02/16/71
8	ROC from D. Kipley to B. Gerwe	Ambient Conditions of Plant		12/03/87
9		Original Fire Protection Specification	0	04/02/71
10	90871-040-7X	Purchase Order for Carbon Dioxide Replenishment		12/08/87
11	0120-108-002	Impell Calculation, NFPA 12 - Code Compliance Verification Checklist	0	04/18/88
		Licensing Documents		
1	DRP No. 74	Donald C. Cook, FHA, Docket No. 50-316	1	01/30/87
		Drawings		
1	FL-15771	Cardox Corporation Drawings FL-15771		
1A	SHEET 1	CO_2 Tank Room	F	06/28/74
1B	SHEET 2	Auxiliary Building CO_2 Piping	E	02/10/72
1C	SHEET 3	Auxiliary Building CO_2 Piping	C	02/15/72
1D	SHEET 4	Electric Switchgear Area	G	09/28/72
1E	SHEET 5	Diesel Generator Rooms	E	09/28/72
1F	SHEET 5	Diesel Generator Rooms	F	06/28/74
1G	SHEET 6	Diesel Generator Rooms	E	06/28/76
1H	SHEET 7	Electric Switchgear Area	F	09/28/72

References
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Ref No.	Document Number	Title	Rev. No.	Date
1I	SHEET 8	Reactor Cable Tunnels	C	11/10/71
1J	SHEET 9	Lube Oil Rooms, Turbine Oil Tank Rooms	D	11/10/71
1K	SHEET 10	Switchgear Cable Vault	E	02/11/72
1L	SHEET 11	Switchgear and Control Room Cable Vaults	E	09/28/72
1M	SHEET 12	Details (Bleeder Valve, Booster Pilot Valve, Hosereel, Controls Arrangement)	D	02/15/72
1N	SHEET 13	Control Room Area	D	02/15/72
1O	SHEET 14	Service Building and Record Storage	B	07/12/71
1P	SHEET 15	Service Building Second Floor	D	11/10/71
1Q	SHEET 16	Computer Rooms	B	11/10/71
1R	SHEET 16	Computer Rooms	C	09/16/82
1S	SHEET 17	7.5 Ton Storage Unit	B	04/21/72
1T	SHEET 18	17 Ton Storage Unit	B	04/21/72
1U	SHEET 19	Electrical Control Cabinet with Hired Panel	A	05/07/71
1V	SHEET 20	Control Cabinet and Panel Drilling	A	05/07/71
1W	SHEET 21	Alarm System Elementary Line	—	03/25/71
2		Flow Diagrams, Fire Protection - CO_2		
2A	OP-12-5153-0	17 Ton System Key Plan	0	10/02/87
2B	OP-12-5153A-0	Cardox Valve Details and Hose Reel Header Schematic Unit 1 & 2	0	10/02/87
2C	OP-12-5153B-0	Cardox Valve Details Unit 1 & 2	0	10/02/87

References
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Ref No.	Document Number	Title	Rev. No.	Date
2D	OP-12-5153C-0	Reactor Cable Tunnel	0	10/02/87
2E	OP-12-5153D-0	Reactor Cable Tunnel	0	10/02/87
2F	OP-12-5153E-0	Lower 4KV Areas Unit 1	0	10/02/87
2G	OP-12-5153F-0	Upper 4KV (Switchgear Cable Vault) Unit 1	0	10/02/87
2H	OP-12-5153G-0	Lower 4KV Areas Unit 2	0	10/02/87
2I	OP-12-5153H-0	Upper 4KV (Switchgear Cable Vault) Unit 2	0	10/02/87
2J	OP-12-5153J-0	Computer Room, I&M Security & 7 & One Half Ton CO_2 Tank System Unit 1 & 2	0	10/02/87
2K	OP-12-5153K-0	Emergency Diesel and Fuel Oil Transfer Pump Rm. Unit 1 & 2	0	10/02/87
2L	OP-12-5153L-0	Control Room and Auxiliary Cable Vaults Unit 1 & 2	0	10/02/87

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IMPELL CORPORATION

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CALC NO 0120-108-002

This analysis evaluates the automatic carbon dioxide fire suppression systems installed in the following fire area/zones to the requirements of NFPA 12. The 1968 edition of NFPA 12 was the edition under which the systems were installed and evaluated.

Fire Area	Fire Zone	Unit	Description
F	7	1	Quadrant 1 Cable Tunnel
G	8	1	Quadrant 4 Cable Tunnel
H	9	1	Quadrant 3N Cable Tunnel
H	10	1	Quadrant 3H Cable Tunnel
I	11	1	Quadrant 3S Cable Tunnel
K	13	1	Diesel Oil Pump Room
M	15	1	1 CD Diesel Generator Room
M	16	1	1 AB Diesel Generator Room
V	18	2	2 CD Diesel Generator Room
M	19	2	2 AB Diesel Generator Room
Y	21	2	Diesel Oil Pump Room
AA	23	2	Quadrant 3N Cable Tunnel
BB	24	2	Quadrant 3H Cable Tunnel
BB	25	2	Quadrant 3S Cable Tunnel
CC	26	2	Quadrant 4 Cable Tunnel
DD	27	2	Quadrant 1 Cable Tunnel
II	38	1	Quadrant 2 Penetration Cable Tunnel
JJ	39	1	Quadrant 2 Penetration Cable Tunnel
KK	40A	1	4kv AB Switchgear Room
KK	40B	1	4kv CD Switchgear Room
LL	41	1	Eng. Safety Syst. & MCC Room
MM	42A	1	EPS Transformer Room
MM	42B	1	EPS Control Rod Drive Room
MM	42C	1	EPS Motor Control Room
NN	45	2	Eng. Safety Syst. & MCC Room
OO	46A	2	EPS Transformer Room
OO	46B	2	EPS Control Rod Drive Room
OO	46C	2	EPS Motor Control Room
PP	47A	2	4kv AB Switchgear Room
PP	47B	2	4kv CD Switchgear Room
SS	55	1	Switchgear Room Cable Vault
TT	56	1	Auxiliary Cable Vault
UU	57	1	Control Room Cable Vault
VV	58	2	Control Room Cable Vault
WW	59	2	Auxiliary Cable Vault
XX	60	2	Switchgear Room Cable Vault
BBB	71	1	Unit 1 Computer Room
BBB	72	2	Unit 2 Computer Room

Chapter 4 of this code applies to hand hose line systems. Twenty one hand hose lines are installed in the area/zones evaluated to the requirements of this code. The reels are located as follows:

Fire Area	Fire Zone	Description	HR No.
A	1	North wall of East/West corridor	12-ZCH-1
E	5	On wall beside Waste Evap. Condensate Tanks	12-ZCH-2
E	5	On wall across from the freight elevator	12-ZCH-3
E	6N	On North wall by MCC	12-ZCH-7
E	6S	On East wall by MCC's	12-ZCH-4
B	79	On North wall of corridor between DG's	12-ZCH-6
B	85	On South wall of corridor between DG's	12-ZCH-5
C	32	Behind elevator across from roll-up door	12-ZCH-21
HH	44N	On North wall of corridor across from stair	12-ZCH-8
HH	44N	On East wall by ramp	12-ZCH-12
HH	44S	On East wall by ramp	12-ZCH-9
LL	41	On East wall by MCC's	12-ZCH-18
NN	45	On East wall by MCC's	12-ZCH-15
B	90	On East wall - outside 4kv	12-ZCH-11
B	96	On East wall - outside 4kv	12-ZCH-10
C	52	On East wall by ltg. cabinet	12-ZCH-19
C	51	On West wall by elevator	12-ZCH-13
C	52	On East wall by MCC	12-ZCH-14
B	129	Outside door of U1CR	12-ZCH-17
B	130	Outside door of U2CR	12-ZCH-16
C	69	On wall by stairs	12-ZCH-20

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NFPA 12 - Code Compliance Verification Checklist

D.C. Cook Units 1 & 2

JOB NO U12O-108

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CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 12-1968
STANDARD ON CARBON DIOXIDE EXTINGUISHING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	INTRODUCTION		Title
	1. Purpose. This Standard is prepared for the use and guidance of those charged with the purchasing, designing, installing, testing, inspecting, approving, listing, operating or maintaining carbon dioxide fire extinguishing systems, in order that such equipment will function as intended throughout its life.		Information Only
	2. This Standard contains minimum requirements for carbon dioxide fire extinguishing systems. It includes only the necessary essentials to make the Standard workable in the hands of those skilled in this field. Portable carbon dioxide equipment is covered in Standard for the Installation of Portable Fire Extinguishers NFPA No. 10, and in Recommended Good Practice for the Maintenance and Use of Portable Fire Extinguishers, NFPA No. 10A. Other associated NFPA standards involving the use of carbon dioxide include the following: No. 69 Inerting for Fire and Explosion Prevention No. 302 Motor Craft No. 306 Control of Gas Hazards on Vessels to be Repaired. No. 403 Aircraft Rescue and Fire Fighting Services at Airports and Heliports. No. 409 Aircraft Hangars Only those skilled in the field are competent to design and install this equipment. It may be necessary for many of those charged with the purchasing, inspecting, testing; approving, operating and maintaining this equipment to consult with an		Information Only

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 12-1968
STANDARD ON CARBON DIOXIDE EXTINGUISHING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	experienced and competent fire protection engineer in order to effectively discharge their respective duties.		
	3. Arrangement. This Standard is arranged as follows: Introduction Chapter 1 - General Information and Requirements Chapter 2 - Total Flooding Systems Chapter 3 - Local Application Systems Chapter 4 - Hand Hose Line Systems Chapter 5 - Standpipe Systems and Mobile Supply Appendix A - Explanatory Appendix B - Examples of Hazard Protection Chapters 1 through 5 constitute the body of the Standard and contain the rules and regulations necessary for properly designing, installing, inspecting, testing, approving, operating and maintaining carbon dioxide fire extinguishing systems. The Appendixes contain educational and informative material that will aid in understanding and applying this Standard.		Information Only
	4. Definitions.		Information Only: This entire section has been omitted.

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NFPA 12 - Code Compliance Verification Checklist
D.C. Cook Units 1 & 2

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CALC NO 0120-108-002

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NFPA 12 - Code Compliance Verification Checklist D.C. Cook Units 1 & 2

JOB NO U120-108

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CODE COMPLIANCE VERIFICATION CHECKLIST
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STANDARD ON CARBON DIOXIDE EXTINGUISHING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 1. GENERAL INFORMATION AND REQUIREMENTS		Title
11	General Information		Title
111	Scope. Chapter 1 contains general information and the design and installation requirements for all features that are generally common to all carbon dioxide systems.		Information Only
112	Carbon Dioxide. Carbon dioxide is a colorless, odorless, electrically nonconductive inert gas that is a suitable medium for extinguishing fires.		Information Only
1121	Carbon dioxide extinguishes fire by reducing the concentrations of oxygen and/or the gaseous phase of the fuel in the air to the point where combustion stops.		Information Only
113	Use and Limitations. Carbon dioxide fire extinguishing systems are useful within the limits of this Standard in extinguishing fires in specific hazards or equipment and in occupancies where an inert electrically nonconductive medium is essential or desirable, where cleanup of other media presents a problem, or where they are more economical to install than systems using other media.		Information Only
1131	All areas or parts of a hazard to which or from which a fire may spread shall be simultaneously protected.	W,D	Comply: The hazards which are provided with CO_2 protection for total flooding are separated by fire area or zone boundaries. The area/zones evaluated were all substantially separated from adjacent area/zones by walls, doors, dampers, etc. In all cases, except fire zones 11 and 23, the protection is provided throughout the area/zone.

CODE COMPLIANCE VERIFICATION CHECKLIST
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STANDARD ON CARBON DIOXIDE EXTINGUISHING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
			Fire barriers separate the protected parts from the nonprotected parts of zones 11 and 23. Ref: Walkdown Checklist No. 1; Licensing Document No. 1.
1132	Some of the more important types of hazards and equipment that carbon dioxide systems may satisfactorily protect include: 1. Gaseous and liquid flammable materials. 2. Electrical hazards such as transformers, oil switches and circuit breakers, and rotating equipment. 3. Engines utilizing gasoline and other flammable fuels. 4. Ordinary combustibles such as paper, wood and textiles. 5. Hazardous solids.		Information Only
1133	Carbon dioxide should not be used to extinguish fires involving the following materials: 1. Chemicals containing their own oxygen supply such as cellulose nitrate. 2. Reactive metals such as sodium, potassium, magnesium, titanium, and zirconium. 3. Metal hydrides.	W	Not Applicable: No carbon dioxide systems protecting these materials were observed in safety related areas during the walkdowns. Ref: Walkdown Checklist No. 1.
114	Types of Systems. There are four types of systems recognized in this Standard: Total Flooding Systems. Local Application Systems. Hand Hose Line Systems. Standpipe Systems and Mobile Supply		Information Only

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IMPELL CORPORATION

NFPA 12 - Code Compliance Verification Checklist
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CODE COMPLIANCE VERIFICATION CHECKLIST
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STANDARD ON CARBON DIOXIDE EXTINGUISHING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1141	A Total Flooding System consists of a fixed supply of carbon dioxide normally connected to fixed piping with nozzles arranged to discharge carbon dioxide into an enclosed space or enclosure about the hazard.		Information Only
1142	A Local Application System consists of a fixed supply of carbon dioxide normally connected to fixed piping with nozzles arranged to discharge carbon dioxide directly on the burning material.		Information Only
1143	A Hand Hose Line System consists of a fixed supply of carbon dioxide supplying hose lines.		Information Only
1144	A Standpipe System and Mobile Supply consists of a mobile supply of carbon dioxide capable of being quickly moved to position and connected to a system of fixed piping supplying fixed nozzles and/or hose lines that may be used for either total flooding or local application.		Information Only
115	Carbon Dioxide System. A carbon dioxide system may be used to protect one or more hazards or groups of hazards by means of directional valves (with the permission of the authority having jurisdiction). Where two or more hazards may be simultaneously involved in fire by reason of their proximity, each hazard shall be protected with an individual system with the combination arranged to operate simultaneously or be protected with a single system that shall be sized and arranged to discharge on all potentially involved hazards simultaneously.	W,D	Comply: The zones evaluated meet the requirements of this code section by isolating the suppression zones via actuators on doors, dampers, etc. In some cases, single systems protect two or more adjacent rooms and discharge in all the protected rooms simultaneously. Ref: Walkdown Checklist No. 1; Technical Data No. 1.

NFPA 12 - Code Compliance Verification Checklist
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IMPELL CORPORATION

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CODE COMPLIANCE VERIFICATION CHECKLIST
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STANDARD ON CARBON DIOXIDE EXTINGUISHING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
116	Package Systems (Kits). Package systems consist of system components designed to be installed according to pretested limitations as approved or listed by a nationally recognized testing laboratory.		Information Only
1161	Package Systems may incorporate special nozzles, flow rates, methods of application, nozzle placement, and quantities of carbon dioxide which may differ from those detailed elsewhere in this Standard since they are designed for very specific hazards. All other requirements of the Standard apply.	W	Not Applicable: Package systems protecting safety related areas were not observed during walkdowns. Ref: Walkdown Checklist No. 1.
1162	Package systems shall be installed to protect hazards within the limitations which have been established by the testing laboratories where listed.	W	Not Applicable: Package systems protecting safety related areas were not observed during walkdowns. Ref: Walkdown Checklist No. 1.

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STANDARD ON CARBON DIOXIDE EXTINGUISHING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
12	Personnel Safety		Title
121	Hazards to Personnel. The discharge of large amounts of carbon dioxide to extinguish fire may create hazards to personnel such as oxygen deficiency and reduced visibility.		Information Only
1211	The dilution of the oxygen in the air, by the carbon dioxide concentrations that will extinguish fire, may create atmospheres that will not sustain life. Such atmospheres will be produced in spaces protected by total flooding and may be produced by any large volume discharges drifting and settling in adjacent low places such as cellars and pits. Persons rendered unconscious in these atmospheres can usually be revived without any permanent ill effects when promptly removed from such atmospheres.		Information Only
1212	Large volume discharges of carbon dioxide may seriously interfere with visibility during and immediately after the discharge period.		Information Only
122	Safety Requirements. In any proposed use of carbon dioxide where there is a possibility that men may be trapped in, or enter into atmospheres made hazardous by a carbon dioxide discharge, suitable safeguards shall be provided to insure prompt evacuation of and to prevent entry into such atmospheres and also to provide means for prompt rescue of any trapped personnel. Such safety items as personnel training, warning signs, discharge alarms, pre-discharge alarms and breathing apparatus shall be considered.	W,D	Comply: Administrative procedures are in place for all of the evaluated area/zones which mandate that the CO_2 system is isolated by security prior to entry. Personnel must log into the fire area/zone, and a fire watch is posted. Predischarge alarms, warning signs, etc., are provided for all evaluated area/zones. SCBA's are also readily available for use. Ref: Walkdown Checklist No. 1; Procedure No. 1, Sections 2.0 and 3.0.
		W	Open Item: Locations of the pilot control cabinets for the area/zones are such that, except for zones 55, 56, 57, 58, 59, 60, 7, 27, 38 and 39,

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			leakage of CO_2 from the protected areas via doors, etc., may drop the O_2 concentration near the pilot control cabinet below personnel safety limits prior to the completion of the system discharge. Ref: Walkdown Checklist No. 1.
		W	Does Not Comply: The electro-pneumatic cabinets and associated manual control levers for the 4 main header valves and zones 55, 56, 57, 58, 59 and 60 are located on the wall beside the CO_2 tank. The copper tubing used to vent excess pressure from each of these devices has been disconnected from the vent line, allowing excess CO_2 to vent into the room. Ref: Walkdown Checklist No. 1.
123	Electrical Clearances. All system components shall be so located as to maintain standard electrical clearances from live parts. See Appendix A-123 for a table of clearances.	W	Comply: "Live parts" refers to uninsulated, unenclosed, live electrical components. These conditions were not identified in the hazards evaluated. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
13	Specifications, Plans and Approvals		Title
131	Purchasing Specifications. Specifications for carbon dioxide fire extinguishing systems shall be drawn up with care under supervision of a competent engineer and with the advice of the authority having jurisdiction. To insure a satisfactory system, the following items should be included in the specifications.	D	Comply: Specifications and RFC's were drawn up under competent engineers and went through a review and approval process. Ref: Technical Data No. 6 & 9.
1311	The specifications should designate the authority having jurisdiction and indicate whether plans are required.	D	Comply: The specification contains these requirements. Ref: Technical Data No. 9 Section 1:04.
1312	The specifications should state that the installation shall conform to this Standard and meet the approval of the authority having jurisdiction.	D	Comply: The specification contains these requirements. Ref: Technical Data No. 9 Section 1:04.
1313	The specifications should include the specific tests that may be required to meet the approval of the authority having jurisdiction.	D	Comply: The specification contains these requirements. Ref: Technical Data No. 9 Section 1:03.
1314	These specifications should require the provision of equipment listed for the use intended.	D	Comply: The specification contains this requirement. Ref: Technical Data No. 9 Section 1:04.
132	Plans. Where plans are required, their preparations shall be entrusted to none but fully experienced and responsible persons.	D	Comply: Plan drawings were prepared by the vendor whose business is system design and installation. Ref: Drawing No. 1A-1W.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1321	These plans shall be drawn to an indicated scale or be suitably dimensioned and shall be made so they can be easily reproduced.	D	Comply: The plans provided were dimensioned and drawn to scale. Ref: Drawing No. 1A-1W.
1322	These plans shall contain sufficient detail to enable the authority having jurisdiction to evaluate the hazard or hazards and to evaluate the effectiveness of the system. The detail on the hazards shall include the materials involved in the hazards, the location of the hazards, the enclosure or limits and isolation of the hazards, and the exposures to the hazard.	D	Does Not Comply: This information was not provided on system drawings. Ref: Drawing No. 1A-1W.
1323	The detail on the system shall include information and calculations on the amount of CO_2; the location and flow rate of each nozzle including equivalent orifice area; the location, size and equivalent lengths of pipe, fittings and hose; and the location and size of the CO_2 storage facility. Information shall be submitted pertaining to the location and function of the detection devices, operating devices, auxiliary equipment, and electrical circuitry, if used. Sufficient information shall be indicated to identify properly the apparatus and devices used. Any special features should be adequately explained.	D	Comply: The vendor calculations provided the detail outlined in this code requirement. Additional plant drawings, schematics, and test procedures contain sufficient information. Ref: Procedure No. 4-19; Technical Data No. 7; Drawing No. 1A-1W.
133	Approval of Plans. Plans and calculations shall be submitted to the authority having jurisdiction for approval before work starts.	D	Open Item: No documentation was provided to verify this requirement.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1331	When field conditions necessitate any material change from approved plans the change must be approved.	D	Open Item: No documentation was provided to verify this requirement.
1332	When such material changes from approved plans are made, corrected "as installed" plans shall be supplied to the owner and the authority having jurisdiction.	D	Open Item: No documentation was provided to verify this requirement.
134	Approval of Installations. The completed systen shall be tested by qualified personnel to meet the approval of the authority having jurisdiction. These tests shall be adequate to determine that the system has been properly installed and will function as intended. Only listed or approved equipment and devices shall be used in the systems.	D	Comply: Discharge tests were performed on the systems evaluated. The tests were satisfactory. Ref: Procedure No. 4; Technical Data No. 7.
		D	Open Item: No test information for zones 57 and 58 using the halon/CO_2 nozzles was available for review.
1341	Such tests should include a test for tightness up to the selector valve, and for continuity of piping with free unobstructed flow beyond the selector valve. The labeling of devices with proper designations and instructions shall be checked. Operational tests should be conducted on all devices except cylinder valves in multi-cylinder high pressure systems. Where conditions prevail that make it difficult to determine adequately the system requirements or design, a suitable discharge and analysis test should be made. See Sub-section 1313.	D	Open Item: The tests were not documented to the degree to verify all requirements of this code section. Ref: Procedure No. 4.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
14.	Operation and Control of System		Title
141	Methods of Actuation. Systems shall be classified as manual or automatic in accordance with the method of actuation.	D	Comply: The D.C. Cook FHA identifies the systems as automatic or manual in the "fire suppression" write-up for each fire zone. Ref: Licensing Document No. 1.
1411	A manual system is one in which human agency is required for actuation, although it may have other features that are automatic.		Information Only
1412	An automatic system is one which is actuated by automatic means. Such systems shall also have means for manual actuation.	W,D	Comply: Manual actuation is provided for all evaluated systems by electric pull stations. Manual mechanical means of actuation is also provided. Ref: Walkdown Checklist No. 1; Technical Data No. 1.
142	Detection of Fires. Fires or conditions likely to produce fire may be detected by visual (human senses) or by automatic means.		Information Only
1421	Visual detection may be used only with permission of the authority having jurisdiction, except in manually actuated systems where fire or conditions likely to produce fire can be readily detected by such means.		Information Only
1422	Automatic detection may be by any listed or approved method or device that is capable of detecting and indicating heat, flame, smoke, combustible vapors, or an abnormal condition in the hazard such as process trouble that	D	Comply: Detectors are adequately installed in the area/zones evaluated except as identified below. Ref: Technical Data No. 2.
		D	Does Not Comply: Detectors are not installed adequately in the following zones: 11, 10, 8, 7, 19, 26, 27, 45, 46C, 41, 42C, 42A, 38, 39, 60, 55.

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			They are spaced such that they do not provide area wide coverage. Ref: Technical Data No. 2.
1423	An adequate and reliable source of energy shall be used in detection systems.	D	Comply: The power sources for detection are reliable. Ref: Technical Data No. 1. Does Not Comply: Connections to the power sources are not in compliance with NFPA 72D. Ref: Technical Data No. 1.
143	Operating Devices. Operating devices include carbon dioxide releasing devices or valves, discharge controls, and shut-down equipment, all of which are necessary for successful performance of the system.		Information Only
1431	Operation shall be by listed or approved mechanical, electrical, or pneumatic means. An adequate and reliable source of energy shall be used.	W,D	Comply: The operation of the carbon dioxide systems is performed by listed equipment with the exception of the following: Ref: Walkdown Checklist No. 1; Technical Data No. 1.
		D	Does Not Comply: The ACI A909 panels are not listed. The Pyra-larm "EFR & GRC" panels are not in compliance with NFPA 72D. Ref: Technical Data No. 1.
1432	All devices shall be designed for the service they will encounter and shall not be readily rendered inoperative or susceptible to accidental operation. Devices shall be normally designed to function properly from -20° F. to 150° F. or marked to indicate temperature limitations.	W,D	Comply: The devices used are designed for this service. They are not normally susceptible to accidental operation. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 2.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1433	All devices shall be located, installed or suitably protected so that they are not subject to mechanical, chemical, or other damage which would render them inoperative.	W	Comply: Operating devices for the evaluated area/zones are located such that they are not readily subject to the damage described in this code requirement. Ref: Walkdown Checklist No. 1.
1434	The normal manual control for actuation shall be located so as to be conveniently and easily accessible at all times including the time of fire. This control shall cause the complete system to operate in its normal fashion.	W	Comply: The normal manual control for actuation is located conveniently (most usually outside the access door to the protected area) for all area/zones except for those identified below. Ref: Walkdown Checklist No. 1.
		W	Does Not Comply: The electric manual pull for zone 7 is located in zone 44N; the electric manual pull for zone 27 is located in zone 44S. In both cases personnel must travel through one additional fire zone to reach the manual pull station. Zones 7 and 27 are not radiation control acess areas. Zones 44N and 44S are in a radiation access control area. The shortest travel distance to a manual pull station for zones 7 and 27 would be through a radiation control access area. Ref: Walkdown Checklist No. 1.
		W	Does Not Comply: The manual pull for fire zones 56 and 57 (control room cable vaults) are also located outside their respective doors on the east wall. These doors communicate to a radiation controlled access zone. Travel through these doors is also not likely due to cable trays. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1435	All automatically operated valves controlling the release and distribution of carbon dioxide shall be provided with approved independent means for emergency manual operation. If the means for manual actuation of the system required in Sub-section 1412 provides approved positive operation independent of the automatic actuation, it may be used as an emergency means. The emergency means, preferably mechanical, shall be easily accessible and located close to the valves controlled. If possible, the system should be designed so that emergency actuation can be accomplished from one location. This does not apply to secondary high pressure cylinders.	W,D	Comply: All automatic valves may be operated pneumatically via a signal from the electric manual station or from the pilot control cabinet. Ref: Walkdown Checklist No. 1; Technical Data No. 3 & 5.
		W	Does Not Comply: In the following cases the valves are not located close to the manual pull stations: Zone 56 Zone 57 Ref: Walkdown Checklist No. 1.
1436	Manual controls shall not require a pull of more than 40 lbs. (force) nor a movement of more than 14 inches to secure operation.	W,D	Open Item: Documentation to verify this requirement was not available for review. Ref: Walkdown Checklist No. 1.
1437	Where gas pressure from cylinders is used as a means for releasing remaining cylinders and the supply consists of more than two cylinders not less than two cylinders shall be used for such operation.	W	Not Applicable: The actuation described in this requirement is not provided for systems protecting safety related areas as observed by walkdowns. Ref: Walkdown Checklist No. 1.
1438	All shut-down devices shall be considered integral parts of the system and shall function with the system operation.	W,D	Comply: The system description describes the shutdown devices. Shutdown devices function upon actuation of the CO_2 system. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & No. 3 Section 7.2.
1439	All manual operating devices shall be identified as to the hazard they protect.	W,D	Comply: All operating devices are identifed for the hazard they protect. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
144	Supervision. Supervision of automatic systems is advisable where the possible loss because of any delay of actuation may be high and/or where the detection or control systems are so extensive and complex that they cannot be readily checked by visual or other inspection. When supervision is provided it should be so arranged that there will be immediate indication of failure. The extent and type of supervision shall be approved by the authority having jurisdiction.	W,D	Comply: Local electrical supervision of circuits is adequate. Ref: Walkdown Checklist No. 1; Technical Data No. 1.
		D	Does Not Comply: Remote signaling of CO_2 signals to the control room does not have electrical supervision. Ref: Technical Data No. 1.
145	Alarms and Indicators. Alarms and/or indicators may be needed to indicate the operation of a system, hazards to personnel or failure of any supervised device or equipment. Such devices should be of such a type and should be provided in such numbers and at such locations as are necessary to accomplish satisfactorily their purpose subject to approval of the authority having jurisdiction. They may be audible, visual or olfactory.	W,D	Comply: Predischarge alarms, header pressuization alarms and alarms for loss of supervision (system trouble) are provided and alarm in the control room. Also, a wintergreen scent is provided in the pipeline for the discharge. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 3.
1451	A positive alarm or indicator should be provided to show that the system has operated and must be reserviced.	W, D	Comply: The control room receives an alarm upon system discharge which is not silenced (or reset) until the Cardox panel(s) have been reset. Procedures are also in place which dictate that the tank is filled when it falls below an acceptable level. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 3.
1452	An alarm should be provided to indicate the operation of automatic systems in case of an immediate personnel response is desired.	W, D	Comply: Detection signals which actuate the CO_2 system also alarm in the control room. Operation of the CO_2 system itself also alarms in the control room. Alarms are also indicated on the pull

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			stations at the entrances to the hazards via a lamp during system discharge. Ref: Walkdown Checklist No. 1; Technical Data No. 1.
1453	Alarms should be provided to give positive warning of a discharge where hazard to personnel may exist. Such alarms should function to warn against personnel entry into hazardous areas as long as such hazards exist or until such hazards are properly recognized. See Article 12.	W, D	Comply: A predischarge alarm is provided for each CO_2 zone. Alarms (discharge) are not completely reset until the Cardox panel is reset. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 3.
1454	Alarms indicating failure of supervised devices or equipment shall give prompt and positive indication of any failure and shall be distinctive from alarms indicating operation or hazardous conditions.	D	Comply: The control room receives alarms which indicate systems are abnormal. Ref: Technical Data No. 1.

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15.	Carbon Dioxide Supply		Title
151	Quantities. The amount of carbon dioxide in the system shall be at least sufficient for the largest single hazard protected or group of hazards which are to be protected simultaneously.	D	Comply: The 17 ton carbon dioxide supply is sufficient for the largest single hazard for 2 discharges. Ref: Technical Data No. 3 Section 8.5.
1511	Where hand hose lines may be used on a hazard protected by a fixed system, separate supplies shall be provided unless sufficient carbon dioxide is provided to insure that the fixed protection for the largest single hazard upon which the hose lines may be used will not be jeopardized. See Section 411.	D	Comply: Two discharges of the 17 ton system into the largest hazard still maintains a level of 39.6% of the tank capacity. Ref: Technical Data No. 3 Section 8.5.
1512	Where continuous protection is required, the reserve quantity shall be as many multiples of these minimum amounts as the authority having jurisdiction considers necessary.	D	Comply: See response to code section 151.
1513	Both primary and reserve supplies for fixed storage shall be permanently connected to the piping and arranged for easy change-over, except where the authority having jurisdiction permits an unconnected reserve.	W	Not Applicable: This requirement is applicable to high pressure storage cylinders which are arranged in separate banks. This arrangement does not provide protection for the area/zones evaluated. Ref: Walkdown Checklist No. 1.
152	Quality. Carbon dioxide used for initial supply and replenishment shall be of good commercial grade, free of water and other contaminents that might cause container corrosion or interfere with free discharge through nozzle orifices. In general, carbon dioxide obtained by converting dry ice to liquid will not be satisfactory unless it is properly processed to remove excess water and oil.	D	Comply: The carbon dioxide used to replenish the 17 and 7.5 ton carbon dioxide tanks meets these requirements. Ref: Technical Data No. 10.

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1521	The vapor phase shall be not less than 99.5 percent carbon dioxide with no detectable off taste or odor.	D	Comply: The carbon dioxide used to replenish the 17 and 7.5 ton carbon dioxide tanks meets these requirements. Ref: Technical Data No. 10.
1522	The water content of the liquid phase shall be not more than 0.01 percent by weight (minus 30° F. dew point).	D	Comply: The carbon dioxide used to replenish the 17 and 7.5 ton carbon dioxide tanks meets this requirement. Ref: Technical Data No. 10.
1523	Oil content shall be not more than 10 p.p.m. by weight.	D	Comply: The carbon dioxide used to replenish the 17 and 7.5 ton carbon dioxide tanks meets this requirement. Ref: Technical Data No. 10.
153	Replenishment. The time needed to obtain carbon dioxide for replenishment to restore systems to operating condition shall be considered as a major factor in determining the reserve supply needed.	D	Comply: The system is sized such that at least 2 complete discharges into the largest hazard may be accomplished. This establishes an adequate quantity of agent until replinishment is accomplished. Ref: Technical Data No. 3 Section 8.5.
154	Storage Containers. Storage containers and accessories shall be so located and arranged that inspection, testing, recharging and other maintenance is facilitated and interruption to protection is held to a minimum.	W	Comply: The 17 ton tank, refrigeration unit, etc. are located on the 609' elevation and are easily accessible. Recharging is accomplished via piping to the outside (back) of the plant which is easily accessed. Ref: Walkdown Checklist No. 1.
1541	Storage containers shall be located as near as possible to the hazard or hazards they protect, but they should not be located where they will be exposed to a fire or explosion in these hazards.	W	Comply: The carbon dioxide container is centrally located in the Auxiliary Building on the 609' elevation. The room in which it is located is also sprinklered. Ref: Walkdown Checklist No. 1.

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1542	Storage containers should not be located so as to be subject to severe weather conditions or be subject to mechanical, chemical or other damage.	W	Comply: The container is located in the radiation controlled entry area of the Auxiliary Building. It is not readily subjected to the damage described in this code section. Ref: Walkdown Checklist No. 1.
1543	When excessive climatic or mechanical exposures are expected, suitable guards or enclosures shall be provided.	W	Comply: The exposures described in this code section are not normally expected in the area where the carbon dioxide tank is located. Ref: Walkdown Checklist No. 1.
155	High Pressure Storage Containers. The carbon dioxide supply shall be stored in rechargeable containers designed to hold pressurized carbon dioxide in liquid form at atmospheric temperatures, corresponding to a nominal pressure of 850 psi at 70° F.	W	Not Applicable: High pressure storage containers are not protecting safety related areas. Code sections 1551 through 1555 are also not applicable since they establish requirements for high pressure storage cylinders. Ref: Walkdown Checklist No. 1.
1551	High pressure containers or cylinders shall be constructed, tested and marked in accordance with U.S. Department of Transportation specifications (in current effect upon date of manufacture and test) for DOT-3A, SAA-1800, or higher, seamless steel cylinders. Charged cylinders shall be tested for tightness before shipment in accordance with an approved procedure.	W	Not Applicable: See response to code section 155.
1552	High pressure cylinders used in fire extinguishing systems shall not be recharged without hydrostatic test (and remarking) if more than five years has elapsed from the date of last test. Cylinders continuously in service without discharging may be retained in service for a maximum of twelve years from the date of last hydrostatic test. At the end of twelve years, they shall be discharged and retested before returning them to service.	W	Not Applicable: See response to code section 155.

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1553	Each cylinder shall be provided with a safety device to relieve excess pressures, safely in advance of the rated cylinder test pressure. I.C.C. approved, frangible safety discs shall be accordingly fitted.	W	Not Applicable: See response to code section 155.
1154	When manifolded, cylinders shall be adequately mounted and suitably supported in a rack provided for the purpose including facilities for convenient individual servicing or content weighings. Automatic means shall be provided to prevent the loss of carbon dioxide from the manifold if the system is operated when any cylinder is removed for maintenance.	W	Not Applicable: See response to code section 155.
1555	Individual cylinders shall be used having a standard weight capacity such as 35, 50, 75 or 100 lbs. of carbon dioxide content. For very small systems smaller capacity cylinders may be used. Only interchangeable cylinders of one selected size shall be manifolded within a system to provide the required total supply.	W	Not Applicable: See response to code section 155.
1556	For local application systems general ambient storage temperatures shall not exceed 120° F nor be less than 32° F. unless the system is designed for proper operation with storage temperatures outside of this range. External heating or cooling may be used to keep the temperature within this range. When special cylinder charges are used the cylinders shall be appropriately marked.	W	Not Applicable. There are no local application CO_2 systems protecting safety related areas. Ref: Walkdown Checklist No. 1.
156	Low Pressure Storage Containers. Low pressure storage containers shall be designed to maintain the carbon dioxide supply at a nominal pressure of 300 psi corresponding to a temperature of approximately 0° F.	D	Comply: The Cardox low pressure storage container is designed to these parameters. Ref: Technical Data No. 3 Sections 7.5 & 7.6 and No. 5.

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STANDARD ON CARBON DIOXIDE EXTINGUISHING SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1561	The pressure container shall be made, tested, approved, equipped and marked in accordance with the current specifications of the American Society of Mechanical Engineers (A.S.M.E.) Code for Unfired Pressure Vessels. The design working pressure shall be at least 325 psi.	D	Comply: The Cardox low pressure storage container is designed to these parameters. Ref: Technical Data No. 3 Sections 7.5 & 7.6 and No. 5.
1562	In addition to the code requirements, each pressure container shall be equipped with a liquid level gauge, a pressure gauge, and a high-low pressure supervisory alarm set at approximately 315 and 250 psi. A special relief valve (in addition to code requirements) may be provided for controlled bleed-off at a pressure below the setting of the main safety valve.	W, D	Comply: The Cardox tank contains the components described in this code section. Ref: Walkdown Checklist No. 1; Technical Data No. 3 Sections 7.5 & 7.6 and No. 5.
1563	The pressure container shall be insulated and equipped with refrigeration and/or heating means if necessary. Heating need not be provided unless known meteorological data indicates the occurrence of ambient temperatures which will cool the contents of the tank sufficiently to reduce the pressure below 250 psi (approximately -10° F.).	W, D	Comply: The Cardox tank is provided with insulation and refrigeration. Heating is not required since the tank is located in an environment controlled area. Ref: Walkdown Checklist No. 1; Technical Data No. 3 Sections 7.5 & 7.6 and No. 5.
1564	The refrigeration system shall be capable of maintaining 0° F. in the pressure container under the lowest expected ambient temperature. Operation shall be automatically controlled within practical limits.	W, D	Comply: The refrigeration system installed at the plant meets the requirements of this code section. Ref: Walkdown Checklist No. 1; Technical Data No. 5.
1565	The heating system when required shall be capable of maintaining 0° F in the pressure container under the lowest expected ambient temperature. Operation shall be automatically controlled within practical limits.	D	Not Applicable: The carbon dioxide tank is not installed in a location where heating would be required. Ref: Technical Data No. 8.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
16.	Distribution Systems		Title
161	Piping. Piping shall be noncombustible and shall withstand the expected temperatures without deformation. Iron or steel pipe and fittings preferably should be galvanized inside and out. Copper or brass pipe or tubing may be used without additional corrosion protection. Black steel pipe may be used in noncorrosive atmospheres. Special corrosion-resistant materials or coatings may be required in severely corrosive atmospheres. Because of the low temperatures encountered during discharge, the pipe and fittings used should be made of material having suitable low temperature characteristics. Steel pipe conforming to ASTM Specification A-53 has been found to have satisfactory low temperature characteristics.	D	Comply: The piping for the carbon dioxide systems are steel ASTM A-106 Grade B. Ref: Technical Data No. 6.
1611	Ordinary cast iron pipe and fittings shall not be used.	D	Comply: The fittings are specified as ASTM A-105 or A-181 Grade I on II flanged carbon steel. Ref: Technical Data No. 6.
1612	Generally, welded joints, screwed or flanged fittings (malleable iron, steel, or ductile iron) are used. Flush bushings shall not be used. When hex bushings are used, more than one pipe size reduction is recommended to provide adequate strength. Suitable flared, compression type, or brazed fittings may be used with copper or brass tubing. Where brazed joints are used, the brazing alloy shall have a melting point of 1000° F. or higher.	W, D	Comply: The fittings in the facility are in compliance with this code requirement. No flush bushings were observed during walkdowns. Ref: Walkdown Checklist No. 1; Technical Data No. 6.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1613	In systems using high pressure supply, pipe and fittings shall have a minimum bursting pressure of 5000 psi. In the case of steel pipe, standard weight (Schedule 40) may be used in sizes up through 3/4 inch IPS and extra heavy (Schedule 80) should be used in sizes over 3/4 inch IPS. Extra heavy malleable iron fittings should be used through 2 inch IPS; and forged steel fittings in all larger sizes.	W	Not Applicable: See response to code section 155.
1614	In systems using low pressure supply, pipe and fittings shall have a minimum bursting pressure of 1800 psi. In the case of steel piping it is recommended that for piping under continuous pressure extra heavy pipe be used with forged steel fittings. Piping between the master valve and selector valves should be extra heavy using 300 lb. malleable iron screwed fittings or standard weight pipe with welded connections using standard weight welded fittings. On open end pipe, screwed connections may be used with standard weight pipe and 300 lb. malleable iron fittings.	D	Comply: The specification describes pipe and fittings which are related to this criteria. Ref: Technical Data No. 6.
162	Arrangement and Installation of Piping and Fittings. Piping shall be installed in accordance with good commercial practices.	W	Comply: The walkdown did not identify any areas where piping and fittings were not installed in accordance with good commercial practices. Ref: Walkdown Checklist No. 1.
1621	All piping shall be laid out to reduce friction losses to a reasonable minimum and care shall be taken to avoid possible restrictions due to foreign matter or faulty fabrication.	W, D	Comply: See response to code section 162. Ref: Technical Data No. 5, 7, & 9.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1622	The piping system shall be securely supported with due allowance for expansion and contraction and shall not be subject to mechanical, chemical, or other damage. Where explosions are possible, the piping system shall be hung from supports that are least likely to be displaced.	W, D	Comply: See response to code section 162. Ref: Technical Data No. 9.
1623	Pipe shall be reamed and cleaned before assembly, and after assembly the entire piping system shall be blown out before nozzles or discharge devices are installed.	D	Open Item: No documentation was available which could verify this code requirement.
1624	In systems where valve arrangement introduces sections of closed piping, such sections shall be equipped with pressure relief devices or the valves shall be designed to prevent entrapment of liquid carbon dioxide. The pressure relief devices shall operate between 2400 and 3000 psi on systems supplied with high pressure storage, and at 450 psi on systems supplied by low pressure storage. Where pressure operated cylinder valves are used, a means shall be provided to vent any cylinder gas leakage from the manifold but which will prevent loss of gas when the system operates.	W, D	Comply: Sections of closed piping are created due to the use of selector valves. However, the design of these valves permits for the depressurization of sections of closed piping as the liquid carbon dioxide expands into its vapor state. Ref: Walkdown Checklist No. 1; Technical Data No. 5 Part 3.
1625	All pressure relief devices shall be of such design and so located that the discharge of CO_2 therefrom will not injure personnel or be otherwise objectionable.	W, D	Comply: The pressure relief devices for the systems (except for those identified below) are installed so that venting should not cause injury or be objectionable. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
163	Valves. All valves shall be suitable for the intended use, particularly in regard to flow capacity and operation. They shall be used only under temperatures and other conditions for which they are listed or approved.	W, D	Comply: The valves/fittings, etc. are suitable for this use with the following exception. Ref: Walkdown Checklist No. 1. Open Item: No documentation could be found to verify the ratings or acceptability of the check valves. Installed to isolate the carbon dioxide systems from the Halon systems protecting the control room cable vaults (zones 57 & 58).
1631	Valves used in systems with high pressure storage and constantly under pressure shall have a minimum bursting pressure of 6000 psi while those not under constant pressure shall have a minimum bursting pressure of, at least, 5000 psi.	W	Not Applicable: See response to code section 155.
1632	Valves used in systems using low pressure storage shall withstand a hydrostatic test to 1800 psi without permanent distortion.	D	Open Item: No documentation was available to verify this requirement.
1633	Valves shall not be subject to mechanical, chemical or other damage.	W	Comply: The valves are installed along ceiling line and/or walls for the zones evaluated and are not readily subject to the damage described in this requirement. Ref: Walkdown Checklist No. 1.
1634	Valves shall be rated for equivalent length in terms of the pipe or tubing sizes with which they will be used. The equivalent length of cylinder valves shall include syphon tube, valve, discharge head and flexible connector.	D	Open Item: No documentation was available to verify this requirement.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
164	Discharge Nozzles. Discharge nozzles shall be suitable for the use intended and shall be listed or approved for discharge characteristics. The discharge nozzle consists of the orifice and any associated horn, shield, or baffle.	W	Comply: The nozzles are designed for this service. They are of corrosion resistant metal construction. Ref: Walkdown Checklist No. 1.
1641	Discharge nozzles shall be of adequate strength for use with the expected working pressures, be able to resist normal mechanical damage, and constructed to withstand expected temperatures without deformation.	W	Comply: The nozzles are designed for this service. They are of corrosion resistant metal construction. Ref: Walkdown Checklist No. 1.
1642	Discharge orifices shall be of corrosion-resistant metal.	W	Comply: The nozzles are designed for this service. They are of corrosion resistant metal construction. Ref: Walkdown Checklist No. 1.
1643	Discharge nozzles used in local application systems should be so connected and supported that they may not readily be put out of adjustment.	W	Not Applicable: There are no local application CO_2 systems providing protection for safety related areas. Ref: Walkdown Checklist No. 1.
1644	Discharge nozzles shall be permanently marked to identify the nozzle and to show the equivalent single orifice diameter regardless of shape and number of orifices. This equivalent diameter shall refer to the orifice diameter of the "Standard" single orifice type nozzle having the same flow rate as the nozzle in question. The marking shall be readily discernible after installation. The "Standard" orifice is an orifice having a rounded entry with a coefficient of discharge not less than 0.98 and flow characteristics as given in Tables 2 and 3. For equivalent orifice diameters, the code given in Table 1 may be used.	W	Comply: Nozzles which could be observed during walkdown contained the information necessary to satisfy this requirement. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1645	Discharge nozzles shall be provided with frangible discs or blow-out caps where clogging by foreign materials is likely. These devices shall provide an unobstructed opening upon system operation.	W	Comply: The zones evaluated did not present the likelihood of clogged nozzles. Ref: Walkdown Checklist No. 1.
165	Pipe and Orifice Size Determination. Pipe sizes and orifice areas shall be selected on the basis of calculations to deliver the required rate of flow at each nozzle.	D	Comply: See response to code section 1651.
		D	Open Item: No hydraulic calculations were found for the control room cable vault systems with the dual purpose Halon/CO_2 nozzles.
1651	The following equation or curves developed therefrom shall be used to determine the pressure drop in the pipe line: $$Q^2 = \frac{(3647)(D^{5.25}Y)}{L + 8.08(D^{1.25}Z)}$$ Q = Flow rate Fn lbs/min D = Inside pipe diameter (actual) in inches L = Equipment length of pipeline in feet Y & Z = Factors depending on storage and line pressure.	D	Comply: The systems were calculated by a vendor calculation. It is assumed that the calculations utilized the information in this code section. Additionally, discharge tests were performed on all systems. Ref: Procedure No. 4; Technical Data No. 7.
1652	For systems with low pressure storage, flow shall be calculated on the basis of an average storage pressure of 300 psia during discharge. The discharge rate for equivalent orifices shall be based on the values given in Table 2. Design nozzle pressures should not be less than 125 psia.	D	Comply: The systems were calculated by a vendor calculation. It is assumed that the calculations utilized the information in this code section. Additionally, discharge tests were performed on all systems. Ref: Procedure No. 4; Technical Data No. 7.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1653	For systems with high pressure storage, flow shall be calculated on the basis of an average storage pressure of 750 psia during discharge for normal 70° F. storage. The discharge rate through equivalent orifices shall be based on the values given in Table 3. Design nozzle pressures at 70° F. storage should not be less than 200 psia.	W	Not Applicable: See response to code section 155.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
17	Inspection, Maintenance and Instruction		Title
171	Inspection and Tests. At least annually all carbon dioxide systems shall be thoroughly inspected and tested for proper operation by a competent engineer or inspector. Regular service contracts with the manufacturer or installing company are recommended.	D	Does Not Comply: The systems are currently tested on an 18 month basis. Ref: Procedure No. 5-19.
1711	The goal of this inspection and testing shall be not only to insure that the system is in full operating condition but shall indicate the probable continuance of that condition until the next inspection.	D	Comply: The inspection/test procedure details a "puff test" which ensures that the system functions properly. Ref: Procedure No. 5-19.
1712	Suitable discharge tests shall be made when any inspection indicates their advisability.	D	Open Item: No documentation was available for review for this code requirement.
1713	The engineer's report with recommendations shall be filed with the owner.	D	Comply: The systems are technical specification and a file of their testing is maintained. Ref: Procedure No. 5-19.
1714	Between the regular service contract inspection or tests, the system shall be inspected visually or otherwise by approved or competent personnel, following an approved schedule.	D	Comply: An inspection/test of the controls is provided on a 6 month basis for the systems evaluated. Ref: Procedure No. 21.
1715	At least semiannually, all high pressure cylinders shall be weighed. If, at any time, a container shows a loss in net content of more than 10 percent, it shall be refilled or replaced.	W	Not Applicable: See response to code section 155.
1716	At least annually, the liquid level gages of low pressure containers should be checked for accuracy. If, at any time, a container shows a loss of more than 10 percent, it shall be refilled, unless the minimum gas requirements are still provided.	D	Open Item: No documentation was found to verify that the liquid level gages are checked annually.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
172	Maintenance. These systems shall be maintained in full operating condition at all times. Use, impairment, and restoration of this protection should be reported promptly to the authority having jurisdiction.	W, D	Comply: The test/maintenance requirements conform to this code requirement. Additionally, procedures are in place for system impairment. Ref: Procedure No. 1 & 5-19.
1721	Any troubles or impairments shall be corrected at once by competent personnel.	D	Open Item: No documentation to verify this requirement was available for review.
173	Instruction. All persons who may be expected to inspect, test, maintain, or operate carbon dioxide fire extinguishing systems shall be thoroughly trained and kept thoroughly trained in the functions they are expected to perform.	D	Comply: Personnel who are responsible for testing the systems are trained for the functions they perform. Ref: Procedure No. 2.
1731	Training programs approved by the authority having jurisdiction shall be established to accomplish this.	D	Comply: The training programs are approved by the appropriate groups within AEPSC. In this instance, AEPSC is the authority having jurisdiction. Ref: Procedure No. 2.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 2. TOTAL FLOODING SYSTEMS		Title
21	General Information		Title
211	Description. A total flooding system consists of a fixed supply of carbon dioxide permanently connected to fixed piping, with fixed nozzles arranged to discharge carbon dioxide into an enclosed space or enclosure about the hazard.		Information Only
212	Uses. This type of system may be used where there is a permanent enclosure about the hazard that is adequate to enable the required concentration to be built up, and to be maintained for the required period of time to insure the complete and permanent extinguishment of the fire in the specific combustible material or materials involved.		Information Only
2121	Examples of hazards that may be successfully protected by Total Flooding Systems include rooms, vaults, enclosed machines, ovens, containers, and the contents thereof.		Information Only
213	General Requirements. Total flooding systems shall be designed, installed, tested and maintained in accordance with the applicable requirements in the previous chapter and with the additional requirements set forth in this chapter.	D	Not applicable. This paragraph is verified by the verification of the code sections in this chapter and Chapter 1. All applicable code sections are verified.
22	Hazard Specifications		Title
221	Enclosure. Under this class of protection, a reasonably well enclosed space is assumed in order to minimize the loss of the extinguishing medium. The area of allowable unclosable openings depends upon the type of combustibles involved.		Information Only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2211	For flash or surface fires such as will be present with flammable liquids, the total square foot area of unclosable openings should not exceed 3 percent of the cubic foot volume of the space or 10 percent of the total square foot area of all sides, top and bottom of the enclosure, whichever is smaller. These unclosable openings shall be compensated for by additional carbon dioxide as specified in Sub-section 2351. If this area is exceeded the system should be tested to assure proper performance.	W	Comply: There are no unclosable openings of the size discussed in this code section in areas which have carbon dioxide systems designed for flash or surface fires. Ref: Walkdown Checklist No. 1.
2212	For deep seated fires such as will be involved with solids, unclosable openings should be restricted to small openings near or in the ceiling. If any other openings than ceiling openings are involved, the system should be tested to assure proper performance.	W, D	Comply: There are no unclosable openings except for the areas identified below. Ref: Walkdown Checklist No. 1; Drawing No. 2A-2L.
		W	Does Not Comply: Two reactor cable quadrants contain large openings in the ceiling. The walls forming a corridor in the switchgear rooms also contain gaps. Ref: Walkdown Checklist No. 1.
2213	To prevent fire from spreading through openings to adjacent hazards or work areas which may be possible reignition sources, such openings shall be provided with automatic closures or screening nozzles. The gas required for such protection shall be in addition to the normal requirement for total flooding. See Sub-section 3436. Where such confinement of gas is impracticable, protection shall be extended to include these adjacent hazards or work areas.	W, D	Comply: There are no unclosable openings except for the areas identified below. Ref: Walkdown Checklist No. 1; Drawing No. 2A-2L.
		W	Does Not Comply: Two reactor cable quadrants contain large openings in the ceiling. The walls forming a corridor in the switchgear rooms also containing gaps. Additional gas is not provided to compensate for this leakage. Ref: Walkdown Checklist No. 1.

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2214	In the case of process and storage tanks where safe venting of flammable vapors and gases cannot be realized the use of external local application systems outlined in Sub-section 3436 is required.	W	Not Applicable: The hazards described in this requirement are not provided with CO_2 protection in safety related areas. Ref: Walkdown Checklist No. 1.
222	Leakage and Ventilation. Since the efficiency of carbon dioxide systems depends upon the maintenance of an extinguishing concentration of carbon dioxide, leakage of gas from the space shall be kept to a minimum and compensated for by applying extra gas.	W, D	Comply: A review of system test results indicates that the concentrations are reached and held for a specified period of time. Ref: Walkdown Checklist No. 1; Procedure No. 4.
2221	Where possible, openings such as doorways, windows, etc. shall be arranged to close automatically before or simultaneously with the state of the carbon dioxide discharge or Subsections 2351 and 2441 shall be followed.	W, D	Comply: Openings in the evaluated area/zones are closed with the exception of the following. Ref: Walkdown Checklist No. 1; Drawing No. 2A-2L.
		W	Does Not Comply: One door in fire zone 18 is not provided with a closure to operate at system discharge. Also, 2 reactor cable quad's contain curtain type dampers in the ceiling which close upon operation of a fusible link. Ref: Walkdown Checklist No. 1.
2222	Where forced air ventilating systems are involved, they shall be preferably shut down and/or closed before or simultaneously with the start of the carbon dioxide discharge or additional compensating gas be provided. See Sub-section 2332.	W, D	Comply: Fans are shutdown as a part of the system operation. Ref: Walkdown Checklist No. 1; Technical Data No. 1.
223	Types of Fires. Fires which can be extinguished by total flooding methods may be divided into two categories: namely, (1) surface fires involving flammable liquids, gases and solids and (2) deep seated fires involving solids subject to smoldering.		Information Only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2231	Surface fires are the most common hazard particularly adaptable to extinguishment by total flooding systems. They are subject to prompt extinguishment when carbon dioxide is quickly introduced into the enclosure in sufficient quantity to overcome leakage and provide an extinguishing concentration for the particular materials involved.		Information Only
2232	For deep seated fires, the required extinguishing concentration must be maintained for a sufficient period of time to allow the smoldering to be extinguished and the material to cool to a point at which reignition will not occur when the inert atmosphere is dissipated. In any event, it is necessary to inspect the hazard immediately thereafter to make certain that extinguishment is complete and to remove any material involved in the fire.		Information Only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
23	Carbon Dioxide Requirements for Surface Fires		Title
231	General. The quantity of carbon dioxide for surface type fires is based on average conditions assuming fairly prompt extinguishment. A reasonable allowance for normal leakage is included in the basic volume factors but correction must be made for the type of material involved and any other special conditions.		Information Only
232	Flammable Materials. Proper consideration shall be given to the determination of the design concentration of carbon dioxide required for the type of flammable material involved in the hazard. The design concentration is determined by adding a suitable safety factor (20%) to the minimum effective concentration.	D	Comply: A design concentration of 34% is used for the areas where combustible liquids (oil) may be found, such as zones 13, 15, 16, 18 and 19. This concentration is consistent with Table 4 of NFPA 12-1968 Edition. Ref: Technical Data No. 7.
2321	Table 4 gives the theoretical minimum carbon dioxide concentration and the suggested minimum design carbon dioxide concentration to prevent ignition of some common liquids and gases.	D	Comply: See response to code section 232.
2322	For materials not given in the above table, the minimum theoretical carbon dioxide concentration shall be obtained from some recognized source or determined by test. If maximum residual oxygen values are available, the theoretical carbon dioxide concentration may be calculated by the following formula:	W	Not Applicable: The potential fuels found in the zones under discussion are covered by Table 4. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
233	Volume Factor. The volume factor used to determine the basic quantity of carbon dioxide to protect an enclosure containing a material requiring a design concentration up to 34 per cent shall be in accordance with Table 5.	D	Comply: The volume/agent quantity calculations used the values identified in Table 5 of the code requirement. Ref: Technical Data No. 7.
2331	In figuring the net cubic capacity to be protected, due allowance may be made for permanent nonremovable impermeable structure materially reducing the volume.		Information Only
2332	As the average small space has proportionately more boundary area per enclosed volume than a larger space, greater proportionate leakages are anticipated and accounted for by the graded volume factors in Table 5.		Information Only
2334	In two or more interconnected volumes where "free flow" of carbon dioxide can take place, the carbon dioxide quantity shall be the sum of the quantities calculated for each volume, using its respective volume factor from Table 5. If one volume requires greater than normal concentration (See Section 234), the higher concentration shall be used in all interconnected volumes.	W	Not Applicable: The hazard description in this requirement is not present in safety related areas which contain fuels subject to surface fires and therefore they are not subject to this requirement. Ref: Walkdown Checklist No. 1.
234	Material Conversion Factor. For materials requiring a design concentration over 34 per cent, the basic quantity of carbon dioxide calculated from the volume factor given in Section 233 shall be increased by multiplying this quantity by the appropriate conversion factor given in Figure 1.	D	Not Applicable: See response to code section 232.
235	Special Conditions. Additional quantities of carbon dioxide shall be provided to compensate for any special condition that may adversely affect the extinguishing efficiency.	W	Not Applicable: Special conditions requiring additional agent were not identified except as identified in code section 2212. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2351	Any openings that cannot be closed at the time of extinguishment shall be compensated for by the addition of not less than 1 pound of carbon dioxide per square foot of opening. This amount of carbon dioxide shall be applied through the regular distribution system. See Sub-section 2211.	W	Not Applicable: There are no unenclosable openings within the zones subject to this code section requirement except as identified in code section 2212. Ref: Walkdown Checklist No. 1.
2352	For ventilating systems which cannot be shut down, additional carbon dioxide shall be added to the space through the regular distribution system in an amount computed by dividing the volume moved during the liquid discharge period by the flooding factor. This shall be multiplied by the material conversion factor (determined in Section 234) when the design concentration is greater than 34 per cent.	W,D	Not Applicable: The configuration described in this requirement is not provided with CO_2 protection in safety related areas. Ref: Walkdown Checklist No. 1; Drawings No. 2A-2L.
2353	For applications where the normal temperature of the enclosure is above 200° F., a 1 per cent increase in the calculated total quantity of carbon dioxide is recommended for each additional 5° F. above 200° F.		Information Only: Also, this requirement is not applicable since the hazard described in this requirement is not present with CO_2 protection in safety related areas.
2354	For applications where the normal temperature of the enclosure is below 0° F., a 1 per cent increase in the calculated total quantity of carbon dioxide is recommended for each degree below 0° F.		Information Only: Also, this requirement is not applicable since the hazard described in this requirement is not present with CO_2 protection in safety related areas.
2355	Under normal conditions, surface fires are usually extinguished during the discharge period. Except for unusual conditions, it will not be necessary to provide extra carbon dioxide to maintain the concentration.		Information Only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
24	Carbon Dioxide Requirements for Deep Seated Fires		Title
241	General. The quantity of carbon dioxide for deep-seated type fires is based on fairly tight enclosures because the concentration must be maintained for a substantial period of time to assure complete extinguishment. Any possible leakage must be given special consideration since no allowance is included in the basic flooding factors.		Information Only
242	Combustible Materials. For combustible materials capable of producing deep seated fires, the required carbon dioxide concentrations cannot be determined with the same accuracy possible with surface burning materials. The extinguishing concentration will vary with the mass of material present because of the thermal insulating effects. Flooding factors have, therefore, been determined on the basis of practical test conditions.		Information Only
2421	The flooding factors in Table 6 have been established for specific hazards under average use and storage conditions.		Information Only
2422	Flooding factors for other deep-seated fires shall be justified to the satisfaction of the authority having jurisdiction before use. Proper consideration shall be given to the mass of material to be protected because the rate of cooling is reduced by the thermal insulating effects.	D	Comply: The fire zones which are subject to this code section requirement contain "Dry electrical, wiring insulation hazards in general" such as described in Table 6 of NFPA-12-1968 Edition. These zones are designed to 50% CO_2 concentration which is consistant with Table 6. Ref: Technical Data No. 7.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
243	Volume Consideration. The volume of the space shall be determined in accordance with Sub-section 2331. The basic quantity of carbon dioxide required to protect an enclosure shall be obtained by treating the volume of the enclosure by the appropriate flooding factor given in Section 242.	D	Comply: The appropriate flooding factors were applied to their volumes. Ref: Technical Data No. 7.
		D	Open Item: No documentation was found to verify the method of determining the hazard volume.
244	Special Conditions. Additional quantities of carbon dioxide shall be provided to compensate for any special condition that may adversely affect the extinguishing efficiency. See also Sub-sections 2352 and 2353.	D	Comply: The systems were all tested. Any zones which did not achieve the design concentration were discharged for a longer period of time until the design concentration was met. This time then became the system discharge time. Ref: Procedure No. 4.
2441	Any openings that cannot be closed at the time of extinguishment shall be compensated for by the addition of carbon dioxide equal in volume to the expected leakage volume during the extinguishing period. If leakage is appreciable, consideration shall be given to an extended discharge system as covered in Section 253. Also see Sub-section 2212.	W	Comply: See response to code section 2213.
		W	Does Not Comply: See response to code 2213.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
25	Distribution System		Title
251	General. The distribution system for applying carbon dioxide to enclosed hazards shall be designed with due consideration for the materials involved and the nature of the enclosure since these items may require various discharge times and rates of application.	W, D	Comply: Hydraulic calculations were performed to determine the orifice sizes. Tests were conducted to verify the system performance. Ref: Walkdown Checklist No. 1; Procedure No. 4; Technical Data No. 7.
252	Rate of Application. The minimum design rate of application shall be based on the quantity of carbon dioxide and the maximum time to achieve design concentration.	D	Comply: The calculations were performed by the vendor and are assumed to be in accordance with this requirement. Ref: Technical Data No. 7.
2521	For surface fires, the design concentration shall be achieved within one minute.	D	Does Not Comply: The discharge times for a design concentration of 34% for the zones which are designed to accomplish 34% subject to surface fires are all in excess of 1 minute. Ref: Procedure No. 4; Technical Data No. 7.
2522	For high pressure systems, if a part of the hazard is to be protected by total flooding, the discharge rate for the total flooding portion shall be computed as specified in Sub-section 3323.	W	Not Applicable. See response to code section 155.
2523	For deep-seated fires, the design concentration shall be achieved within seven minutes but the rate shall not be less than that required to develop a concentration of 30 per cent in 2 minutes.	D	Comply: The design concentration(s) for the zones subject to deepseated fires are all achieved within 7 minutes. The discharge times are short enough that 30% is also obtained within 2 minutes. Ref: Procedure No. 4.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
253	Extended Rate of Application. Where leakage is appreciable and the design concentration must be obtained quickly and maintained for an extended period of time, carbon dioxide provided for leakage compensation may be applied at a reduced rate.		Information Only
2531	This type of system is particularly applicable to enclosed rotating electrical apparatus, such as generators, motors and convertors, but it may also be used on ordinary total flooding applications where suitable.	W	Not Applicable: The walkdowns did not identify any hazards as described in this code requirement. Ref: Walkdown Checklist No. 1.
2532	The minimum design concentration shall be obtained within the time limits specified in Section 252.	W	Not Applicable: See response to code section 2531.
2533	The extended rate of discharge shall be sufficient to maintain the minimum concentration.	W	Not Applicable: See response to code section 2531.
2534	For enclosed rotating electrical equipment a minimum concentration of 30 per cent should be maintained for the deceleration period but not less than 20 minutes.	W	Not Applicable: See response to code section 2531.
254	Piping Systems. Piping shall be designed in accordance with Section 165 to deliver the required rate of application at each nozzle.	D	Comply: The systems were calculated by a listed vendor program. Additionally, discharge tests were performed on all systems. Ref: Procedure No. 4; Technical Data No. 7.
		D	Open Item: No hydraulic calculations were found for the control room cable vault systems with the dual purpose Halon/CO_2 nozzles.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2541	High pressure storage temperatures may range from 0°F to 130°F without requiring special methods of compensating for changing flow rates.	W	Not Applicable: See response to code section 155.
2542	For high pressure storage temperatures below 0°F or above 130°F, special design features may be required to assure proper flow rates.	W	Not Applicable: See response to code section 155.
255	Nozzle Sizing and Distribution. Nozzles used in connection with total flooding systems with either high or low pressure supply shall be of the type most suitable for the intended purpose and shall be properly loaded to achieve the best results.	W, D	Comply: Flow calculations were prepared for the area/zones. Discharge tests were satisfactorily performed for the protected areas. Ref: Procedure No. 4; Technical Data No. 7.
		D	Open Item: No documentation was found to verify the concentration and holding time of the agent for the control room cable vaults (zones 57 & 58) with the new nozzles installed for Halon protection.
2551	The type of nozzles selected and their placement shall be such that the discharge will not unduly splash flammable liquids or create dust clouds that might extend the fire, create an explosion or otherwise adversely affect the contents of the enclosure. Nozzles vary in design and discharge characteristics and shall be selected on the basis of their adequacy for the use intended.	W	Not Applicable: The hazards described in this code requirement are not provided in safety related areas. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
26	Venting Consideration		Title
261	General. The venting of flammable vapors and pressure build-up from the discharge of quantities of carbon dioxide into closed spaces should be considered. Venting of flammable vapors is covered in Sub-section 2214. The pressure venting consideration involves such variables as enclosure strength and injection rate.		Information Only
262	Pressure Relief Venting. Porosity and leakages such as at doors, windows, and dampers, though not readily apparent or easily calculated have been found to provide sufficient relief for the normal carbon dioxide flooding systems without the need for additional venting. Record storage rooms, refrigerated spaces, and duct work have also been found to need no additional venting when tested under their average system conditions.		Information Only
2621	For very tight enclosures, the area necessary for free venting may be calculated from the following formula, assuming the expansion of carbon dioxide to be 9 cu. ft./lb. where: X = Free venting area in sq. in. Q = Calculated carbon dioxide flow rate in lbs/min. P = Allowable strength of enclosure in lbs/sq. ft.		Information Only
2622	In many instances, particularly when hazardous materials are involved, relief openings are already provided for explosion venting. These and other available openings often provide adequate venting.		Information Only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2623	General construction practices provide the guide in Table 7 for considering the normal strength and allowable pressures of average enclosures.		Information Only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 3. LOCAL APPLICATION SYSTEMS		This entire chapter has been omitted since there are no systems of this type protecting safety related areas.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 4. HAND HOSE LINE SYSTEMS		Title
41	General Information		Title
411	Description. Hand hose line systems consist of a hose reel or rack, hose, and discharge nozzle assembly connected by fixed piping to a supply of carbon dioxide. A separate carbon dioxide supply can be provided for hand hose line use or carbon dioxide can be piped from a central storage unit which may be supplying several hose lines or fixed manual or automatic systems. See Sub-section 1511.		Information Only
412	Uses. Hand hose systems may be used to supplement fixed fire protection systems or to supplement first aid fire extinguishers for the protection of specific hazards for which carbon dioxide is a suitable extinguishing agent. These systems should not be used as a substitute for other fixed carbon dioxide fire extinguishing systems equipped with fixed nozzles, except where the hazard cannot adequately or economically be provided with fixed protection. The decision as to whether hose lines are applicable to the particular hazard shall rest upon the authority having jurisdiction.		Information Only
413	General Requirements. Hand hose line systems shall be installed and maintained in accordance with the applicable requirements of Chapters 1, 2, and 3 except as outlined below.	W, D	Comply: The hose lines installed to cover the specific pieces of equipment within their vicinity. Additionally, they are tested under their own procedures. Ref: Procedure No. 20.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
42	Hazard Specifications		Title
421	Hand hose line systems may be used to combat fires in all hazards covered under Chapter 1, except those which are inaccessible and beyond the scope of manual fire fighting.		Information Only
43	Location and Spacing		Title
431	Location. Hand hose line stations shall be placed such that they are easily accessible and within reach of the most distant hazard which they are expected to protect. In general, they shall not be located such that they are exposed to the hazard.	W	Comply: Hose stations are placed such that they are accessable and can reach the hazard which they are expected to protect. Ref: Walkdown Checklist No. 1.
432	Spacing. If multiple hose stations are used, they shall be spaced so that any area with the hazard may be covered by one or more hose lines.	W	Comply: Walkdowns verified that electrical equipment is within reach of the provided hose station and this is the equipment or hazard to be protected. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
44	Carbon Dioxide Requirements		Title
441	Rate and Duration of Discharge. The rate and duration of discharge and consequently the amount of carbon dioxide should be determined by the type and potential size of the hazard. A hand hose line should have a sufficient quantity of carbon dioxide to permit its use for at least 1 minute.	D	Comply: The CO_2 hose stations are supplied from the 17 ton CO_2 tank located in fire zone 44N. This supply is sufficient to meet the requirements of this code section. Ref: Technical Data No. 3 Section 8.5.
442	Provision for Use by Inexperienced Personnel. The possibility of these hose lines being used by inexperienced personnel must be considered and adequate provision made so that there will be a sufficient supply of carbon dioxide to enable them to effect extinguishment of the hazards they are likely to encounter.	D	Comply: See response to code section 441. The 17 ton supply is sufficient to compensate for use by inexperienced people. Ref: Technical Data No. 3.
443	Simultaneous Use of Hose Lines. Where simultaneous use of two or more hose lines is possible, a sufficient quantity of carbon dioxide should be available to supply the maximum number of nozzles that are likely to be used at any one time for at least one minute.	W, D	Comply: The CO_2 hose stations are located such that the likely maximum number in use should not exceed 3 hose stations. The 17 ton CO_2 supply is sufficient to meet the requirements of this code section. Ref: Technical Data No. 3 Section 8.5.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
45	Equipment Specifications		Title
451	Hose. Hose lines on systems with high pressure supply shall have a minimum bursting pressure of 5000 psi, and hose lines of systems with low pressure supply shall have a minimum bursting pressure of 1800 psi.	W	Not Applicable: See response to code section 155.
452	Discharge Nozzle Assembly. Hose lines shall be equipped with a discharge nozzle assembly which can be easily handled by one man and which contains a quick opening shut-off valve to control the flow of carbon dioxide through the nozzle in a suitable handle for directing the discharge. The attachment of the discharge nozzle assembly to the hose by means of a swivel connection is desirable for providing more ease of manipulation.	W	Comply: The hose lines are provided with a nozzle and valve such that flow may be controlled by a single individual. The handle provides a means to direct the discharge. Ref: Walkdown Checklist No. 1.
453	Hose Line Storage. The hose shall be coiled on a hose reel or rack such that it will be ready for immediate use without the necessity of coupling and may be uncoiled with a minimum of delay. If installed outdoors, it should be protected against the weather.	W	Comply: The hose, in all cases, is provided on a reel. None are installed outdoors. Ref: Walkdown Checklist No. 1.
454	Charging the Hose Line. Operation of hand hose line systems depends upon manual actuation and manual manipulation of a discharge nozzle. Speed and simplicity of operation is, therefore, essential for successful extinguishment.		Information Only
4541	All controls for actuating the system shall be located in the immediate vicinity of the hose reel.	W	Comply: The electric manual stations are located on the wall adjacent to each hose station. Ref: Walkdown Checklist No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4542	The carbon dioxide supply shall be located as close to the hose reel as possible so that liquid carbon dioxide will be supplied to the hose line with a minimum of delay after actuation.	W, D	Comply: The 17 ton CO_2 tank is centrally located in the auxiliary building so that the piping runs to hose stations are not excessive. Also, release vents are provided on the hose stations so that delay in discharge is decreased. Ref: Walkdown Checklist No 1; Technical Data No. 3 & 5.
4543	Except when in actual use, pressure should not be permitted to remain in the hose line.	D	Comply: The vendor supplied valves permit the release of excess pressure. Ref: Technical Data No. 5.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
46	Training		Title
461	Successful extinguishment of fire with hand hose lines is greatly dependent upon the individual ability and technique of the operator. All personnel who are likely to use this equipment at the time of a fire shall be properly trained in its operation and in the fire fighting techniques applicable to this equipment.	D	Comply: Fire brigade members are trained in the use of carbon dioxide fire fighting equipment. Ref: Procedure No. 3.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 5. STANDPIPE SYSTEMS AND MOBILE SUPPLY.		This entire chapter has been omitted since there are no systems of this type protecting safety related areas.

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CALCULATION/DESIGN COVER SHEET

Calculation/Design No 0120-108-003

Title: NFPA 12A - CODE COMPLIANCE VERIFICATION CHECKLIST

Client: AEP Project: CODE COMPLIANCE REVIEW

Job No: 0120-108-1375

Design Input/References: SEE SECTION 5.0.

Assumptions: SEE PI-FP-01, REVISION 1 CONDUCTING AND DOCUMENTING NFPA CODE COMPLIANCE REVIEWS. SEE IMPELL REPORT 09-0120-0123 CODE COMPLIANCE SUMMARY REPORT. SEE SECTION 2.0.

Method: SEE PI-FP-01, REVISION 1.
SEE SECTION 3.0.

Remarks: PAGE 5 IDENTIFIES THE AREAS/ZONES EVALUATED UNDER THE REQUIREMENTS OF THIS CODE

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	[signature]	5/14/98

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

For the purpose of this report, it is assumed that under most conditions the authority having jurisdiction was the architect/engineer (A/E) for the plant who is American Electric Power Service Corporation (AEPSC) unless other wise incicated.

3.0 METHODOLOGY

3.1 Reference Section 2.1.1 of Impell Project Instruction PI-FP-01, Revision 1.

3.2 An item identified in the Code Compliance Verification Checklist which "Does Not Comply" or is shown as an "Open Item" is further discussed in the Code Compliance Summary Report, Impell Report Number 09-0120-0123.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

5.0 REFERENCES

References

Ref No.	Document Number	Title	Rev. No.	Date
		Walkdown Verification Checklists		
1	0120-108-003A	Impell Calculation, NFPA 12A - Code Compliance Walkdown Verification Checklist	0	11/19/87
		Procedures		
1	PMI-2270	Fire Protection	16	07/09/87
2	12-PMP-2070-TRN-115	Fire Brigade Training Program	2	05/09/87
3	12-PMP-2070-TRN-108	Maintenance Skills Training Program	1	04/23/87
4	12THP4030.STP.224	"Control Room Cable Vault Halon Fire Suppression System Surveillance Test."	4	01/15/87
5	12MHP4030.STP.019	"Halon 1301 Tank Weight and Pressure for the Control Room Cable Vault Halon System."	1	09/12/85
		Technical Data		
1		Pyr-A-Lon 1301-Application Installation, Operation, and Maintenace Manual H-8, H-15, H-30, H-125, and H-250 Automatic Pre-Engineered Modular Fire Extinguishing Systems. UL EX3140, November, 1980.		11/80
2		ABCO Fire Protection, Inc. - "Halon 1301 Fire Protection System Located at Donald Cook Nuclear Power Plant," Vendor Calculations and Cutsheets."		07/16/84
3		Design Change Summary Report - RFC-12-2624, Revision 0-3 Attachment - letter dated 2/25/87 from H.R. Pauls to RFC.		02/25/87
4		Letter from ABCO to AEPSC Atten. Terry Cooper, dated 1/23/85.		01/23/85

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
5	0120-108-008	Impell Calculation NFPA 72E Code Compliance Verification Checklist 1974/1978/1982/1984	0	05/16/88
6	0120-108-007	Impell Calculation NFPA 72D Code Compliance Verification Checklist 1967/1979	0	05/16/88
7	RFC 2624	Control Rm. Cable Vault Modification Packet	0-3	
8	ROC from Dave Kipley to Bruce Gerwe	Ambient Conditions of Plant		12/03/87
9	RFC 2624	Drawing approval package from J. D. Grier to H. R. Pauls, Jr.		05/31/85
10	RFC 12-2149	P-250 Comp. Room Halon System Modification Packet		
11	SPECIFICATION DCCPH104QCS	Material Specification	4	11/09/72
12	SD-DCC-FP103	Fire Protection Systems - Miscellaneous	3	Draft
13	0120-108-003	Impell Calculation, NFPA 12A - Code Compliance Verification Checklist	0	04/18/88
14	90072-040-8X	Purchase Order (Halon)		02/10/88
15		Letter from B. J. Gerwe to Mr. David Kipley		03/09/88
		Licensing Documents		
1	DRP NO. 74	Donald C. Cook, FHA, Docket No. 50-316	1	01/30/87
		Drawings		
1	DK-NY-1433	Pytrotronics Drawing "Pipe Layout at I&M Power Co., Donald C. Cook Plant Computer Room, Unit 1 & 2."	1	01/26/79

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The following area/zones contain Halon 1301 Suppression systems which were evaluated to the requirements of this code:

Fire Area	Fire Zone	Description
UU	57	Control Room Cable Vault and Hot Shutdown Panel Cable Area
VV	58	Control Room Cable Vault and Hot Shutdown Panel Cable Area
BBB	71	Computer Room
BBB	72	Computer Room

The systems in these zones were evaluated using the 1977 edition of NFPA 12A which was the current edition during system installation.

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	CHAPTER 1. GENERAL		Title
1-1	Scope. This standard contains minimum requirements for halogenated agent fire extinguishing systems. It includes only the necessary essentials to make the standard workable in the hands of those skilled in this field. Portable halogenated agent extinguishers are covered in NFPA 10, Standard for Portable Fire Extinguishers. Only those skilled in this work are competent to design and install this equipment. It may be necessary for many of those charged with the purchasing, inspecting, testing, approving, operating, and maintaining this equipment to consult with an experienced and competent fire protection engineer in order to effectively discharge their respective duties.		Information Only
1-2	Purpose. This standard is prepared for use and guidance of those charged with the purchasing, designing, installing, testing, inspecting, approving, listing, operating, and maintaining halogenated agent extinguishing systems (Halon 1301), in order that such equipment will function as intended throughout its life.		Information Only
	Pre-engineered systems (packaged systems) consists of system components designed to be installed according to pretested limitations as approved or listed by a nationally recognized testing laboratory. Pre-engineered systems may incorporate special nozzles, flow rates, methods of application, nozzle placement, pressurization levels, and quantities of agent which may differ from those detailed elsewhere in this standard since they are designed for very specific hazards. All other requirements of	W, D	Comply: The Halon systems for the Unit 1 and 2 Computer Rooms (zones 71 and 72) are the only pre-engineered systems in the area/zones evaluated. They are installed such that the hazards are protected within the limitations of the established design guides. Specific compliance/non-compliance of these two systems to other code sections will be addressed within those code sections. Ref: Walkdown Checklist No. 1; Technical Data No. 1.

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	the standard apply. Pre-engineered systems shall be installed to protect hazards within the limitations which have been established by the testing laboratories where listed.		
1-3	Arrangement. This standard is arranged as follows: Introduction Chapter 1 - General Information and Requirements Chapter 2 - Total Flooding Systems Chapter 3 - Local Application Systems Appendix A - Explanatory Appendix B - Reference Publications Chapters 1 through 3 constitute the body of the standard and contain the rules and regulations necessary for properly designing, installing, inspecting, testing, approving, operating, and maintaining halogenated agent fire extinguishing systems. The Appendix contains educational and informative material that will aid in understanding and applying this standard.		Information Only
1-4	Definitions		Information Only: This entire section has been omitted.
1-4.2	Units		Title
1-4.2.1	Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI). Two units (litre and bar), outside of but recognized by SI, are commonly used in international fire protection.		Information Only

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1-4.2.2	If a value for measurement as given in the standard is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.		Information Only: This information will, however, be complied with as systems are reviewed. The first stated values will be used.
1-5	General Information and Requirements		Title
1-5.1	The information and requirements in Chapter 1 are generally common to all Halon 1301 (bromotrifluoromethane $CBrF_3$) systems.		Information Only
1-5.2	Halon 1301		Title
1-5.2.1	Halon 1301 is a colorless, odorless, electrically nonconductive gas that is an effective medium for extinguishing fires.		Information Only
1-5.2.2	According to present knowledge, Halon 1301 extinguishes fires by inhibiting the chemical reaction of fuel and oxygen. The extinguishing effect due to cooling, or dilution of oxygen or fuel vapor concentration, is minor.		Information Only
1-5.3	Use and Limitations		Title
1-5.3.1	Halon 1301 fire extinguishing systems are useful within the limits of this standard in extinguishing fires in specific hazards or equipment, and in occupancies where an electrically nonconductive medium is essential or desirable, where cleanup of other media presents a problem, or where weight vs. extinguishing potential is a factor.		Information Only
1-5.3.2	Some of the more important types of hazards and equipment that Halon 1301 systems may satisfactorily protect include: (a) Gaseous and liquid flammable materials.		Information Only

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	(b) Electrical hazards such as transformers, oil switches and circuit breakers, and rotating equipment.		
	(c) Engines utilizing gasoline and other flammable fuels.		
	(d) Ordinary combustibles such as paper, wood, and textiles.		
	(e) Hazardous solids.		
	(f) Electronic computers, data processing equipment and control rooms.		
1-5.3.3	Halon 1301 has not been found effective on the following:		Information Only
	(a) Certain chemicals or mixtures of chemicals such as cellulose nitrate and gunpowder which are capable of rapid oxidation in the absence of air.		
	(b) Reactive metals such as sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium.		
	(c) Metal hydrides.		
	(d) Chemicals capable of undergoing autothermal decomposition, such as certain organic peroxides and hydrazine.		
1-5.3.4	Specific limitations are placed on Halon 1301 total flooding systems. (See 2-1.1.3 and 2-1.1.4.)		Information Only: The referenced code sections will be verified.
1-5.3.5	Electrostatic charging of nongrounded conductors may occur during the discharge of liquified gases. In discharging Halon 1301 into or near potentially explosive		Information Only

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	atmospheres, see NFPA 77, Recommended Practice on Static Electricity. (See Appendix B.)		
1-5.4	Duration of Protection. It is important that an effective agent concentration not only be achieved but that it be maintained for a sufficient period of time to allow effective emergency action by trained personnel. This is equally important in all classes of fires since a persistent ignition source (e.g., an arc, heat source, oxyacetylene torch or "deep-seated" fire) can lead to a recurrence of the initial event once the agent has dissipated. Halon 1301 extinguishing systems normally provide protection for a period of minutes but are exceptionally effective for certain applications. Water supplies for standard sprinklers, on the other hand, are normally designed to provide protection for one-half to 4 hours duration but sprinklers may be less effective in controlling many fires. The designer, the buyer and the emergency force in particular shall be fully aware of the advantages and limitations of each, the residual risks being assumed and the proper emergency procedures.	W, D	Comply: A minimum Halon concentration of 5% was accomplished with a holding time (soaking) of 10 min. for the control room cable vaults (zones 57 & 58). Annunciation of Halon discharge is provided in the Control Room. Ref: Walkdown Checklist No. 1; Technical Data No. 3 & 4.
		D	Does Not Comply: The original test results for the computer rooms (zones 71 & 72) were not satisfactory. Ref: Technical Data No. 10.
1-5.5	Types of Systems		Title
1-5.5.1	There are two types of systems recognized in this standard: Total Flooding Systems and Local Application Systems.		Information Only
1-5.5.2	A Total Flooding System consists of a supply of Halon 1301 arranged to discharge into, and fill to the proper concentration, an enclosed space or enclosure about the hazard.		Information Only
1-5.5.3	A Local Application System consists of a supply of Halon 1301 arranged to discharge directly on the burning material.	W	Not Applicable: No local application Halon 1301 systems are installed within the safety related areas per walkdowns. Ref: Walkdown Checklist No. 1.

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1-5.6	Halon 1301 System. A Halon 1301 system may be used to protect one or more hazards or groups of hazards by means of directional valves. Where two or more hazards may be simultaneously involved in fire by reason of their proximity, each hazard shall be protected with an individual system with the combination arranged to operate simultaneously or be protected with a single system that shall be sized and arranged to discharge on all potentially involved hazards simultaneously.	W	Not Applicable: There were no Halon 1301 systems protecting multiple hazards by the use of directional valves within safety related areas observed during the walkdown. Ref: Walkdown Checklist No. 1.
1-6	Safety		Title
1-6.1	Hazards to Personnel		Title
1-6.1.1	Personnel may be exposed to Halon 1301 vapors in low concentrations for brief periods without serious risk. Exposure to high concentrations or for prolonged periods may produce dizziness, impaired coordination and disturbances in cardiac rhythm. Following the extinguishment of a fire by Halon 1301, the atmosphere may also contain combustion and decomposition products in quantities which may be hazardous to personnel. In addition, the effects of the noise, turbulence, high velocity and low temperature associated with the discharge of the agent shall be considered.	W, D	Comply: A walkdown verified that warning signs are in place. Administrative Procedures to prevent personnel entry into the four subject fire zones are in place due to the CO_2 protection. These procedures, although not specially designed to address Halon Protection, function to provide personnel awareness of the special conditions resulting from suppression system coverage. Warning alarms are provided in the protected areas for personnel evacuation. SCBA's are provided outside the entrance to the control room and are readily available for use for the subject fire zones. Ref: Procedure No. 1 Sect. 2.0 & 3.0.
1-6.1.2	Safety Requirements. In any proposed use of Halon 1301 where there is a possibility that people may be trapped in or enter into atmospheres made hazardous, suitable safeguards shall be provided to ensure prompt evacuation of and to prevent entry into such atmospheres and also to provide means for	W, D	Comply: See response to code section 1-6.1.1.

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	prompt rescue of any trapped personnel. Such safety items as personnel training, warning signs, discharge alarms, and breathing apparatus shall be considered.		
1-6.2	Electrical Clearances. All system components shall be so located as to maintain minimum clearances from live parts as shown in Table 1-6.2 and Figure 1-6.2.	W	Comply: There are no uninsulated or unenclosed live electrical components which are located within the subject hazards as observed during walkdowns. Ref: Walkdown Checklist No. 1.
	As used in this standard, "clearance" is the air distance between halon equipment, including piping and nozzles, and unenclosed or uninsulated live electrical components at other than ground potential.		Information Only
	The clearances given are for altitudes of 3,300 ft. (1007m) or less. At altitudes in excess of 3,300 ft. (1007m), the clearance shall be increased at the rate of 1 percent for each 330 ft. (100.7m) increase in altitude above 3,300 ft. (1007m).	D	Not Applicable: The D.C. Cook plant site and systems installations are below the specified altitude. Ref: Licensing Document No. 1.
	The clearances are based upon minimum general practices related to design Basic Insulation Level (BIL) values. To coordinate the required clearance with the electrical design, the design BIL of the equipment being protected shall be used as a basis, although this is not material at nominal line voltages of 161 kv or less.	W	Comply: There are no uninsulated or unenclosed live electrical components which are located within the subject hazards as observed during walkdowns. Ref: Walkdown Checklist No. 1.
	Up to electrical system voltages of 161 kv the design BIL kv and corresponding minimum clearances, phase to ground, have been established through long usage.		Information Only
	At voltages higher than 161 kv, uniformity in the relationship between design BIL kv and the various electrical system voltages has not been established in practice and is dependent upon several variables so that the	W	Comply: There are no uninsulated or unenclosed live electrical components which are located within the subject hazards as observed during walkdowns. Ref: Walkdown Checklist No. 1.

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	required clearances to ground shall be based upon the design BIL used rather than on the nominal line or ground voltage.		
	Possible design variations in the clearance required at higher voltages are evident in the Table, where a range of voltages is indicated opposite the various BIL test values in the high voltage portion of the Table. However, the clearance between uninsulated energized parts of the electrical system equipment and any portion of the halon system shall not be less than the minimum clearance provided elsewhere for electrical system insulations on any individual component.	W	Comply: There are no uninsulated or unenclosed live electrical components which are located within the subject hazards as observed during walkdowns. Ref: Walkdown Checklist No. 1.
1-7	Specifications, Plans and Approvals		Title
1-7.1	Specifications. Specifications for Halon 1301 fire extinguishing systems shall be prepared with care under the supervision of a competent engineer and with the advice of the authority having jurisdiction. The specifications shall include all pertinent items necessary for the proper design of the system such as the designation of the authority having jurisdiction, variances from the standard to be permitted by the authority having jurisdiction and the type and extent of the approval testing to be performed after installation of the system.	D	Comply: RFC's & Specifications were prepared and went through a checking/approval process. This assures that competent engineers supervise the process. Ref: Technical Data No. 3, 4, 7, 9, 10 & 11.
1-7.2	Plans		Title
1-7.2.1	Where plans are required, they shall be prepared with care under the supervision of a competent engineer and with the advice of the authority having jurisdiction.	D	Comply: Plans for the control room cable vaults (zones 57 & 58) and the computer rooms (zones 71 & 72) were prepared in a manner consistant with this code requirement. Ref: Technical Data No. 1, 2 & 9; Drawing No. 1.

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1-7.3.3	When such material changes from approved plans are made, corrected "as installed" plans shall be provided.	D	Open Item: No documentation could be found to verify this requirement.
1-7.4	Approval of Installations. The completed system shall be tested by qualified personnel to meet the approval of the authority having jurisdiction. Only listed or approved equipment and devices shall be used in the systems. To determine that the system has been properly installed and will function as specified, the following tests shall be performed:	D	Comply: The control room cable vaults (zones 57 & 58) were tested and found to be satisfactory. Ref: Technical Data No. 4.
		D	Does Not Comply: The computer room systems (zones 71 & 72) did not satisfactorily pass the initial test. Ref: Technical Data No. 10.
	(a) A thorough visual inspection of the installed system and hazard area. The piping, operational equipment, and discharge nozzles shall be inspected for proper size and location. The locations of alarms and manual emergency releases shall be confirmed. The configurations of the hazard shall be compared to the original hazard specification. The hazard shall be inspected closely for unclosable openings and sources of agent loss which may have been overlooked in the original specification.		
	(b) A check of labeling of devices for proper designations and instructions. Nameplate data on the storage containers shall be compared to specifications		
	(c) A test for mechanical tightness of the piping and associated equipment to assure that leakage will not occur and that there will be no hazardous pipe movements during discharge.		
	(d) Nondestructive operational tests on all devices necessary for proper functioning of the system, including detection and actuation devices.		

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1-8	Detection and Actuation		Title
1-8.1	Automatic detection and automatic actuation shall be used. Exception: Manual actuation may be used if acceptable to the authority having jurisdiction. Some points to be considered are hazards to personnel, undesirable side reaction, an increase in the hazard or other alternatives.	W, D	Comply: Automatic detection and actuation is provided for the four zones evaluated. Ref: Walkdown Checklist No. 1; Technical Data No. 12 Sect. 3.2, 5.3.1, 5.3.7 and 5.4.4.
1-8.2	Automatic Detection		Title
1-8.2.1	Automatic detection shall be by any listed or approved method or device that is capable of detecting and indicating heat, flame, smoke, combustible vapors, or an abnormal condition in the hazard such as process trouble that is likely to produce fire.	D	Comply: The detectors located in each evaluated fire zone are listed for this service. They are located in accordance with NFPA-72E. Ref: Technical Data No. 5.
1-8.2.2	Heat detectors installed on standard spacing are about equal to an ordinary sprinkler in response time. If detectors are installed at reduced spacing from that recognized in approvals or listings response time may be reduced. An adequate and reliable source of energy shall be used in detection systems.	W	Not Applicable: The walkdowns of the four hazard areas showed that heat detectors are not used for actuation of Halon systems. Ref: Walkdown Checklist No. 1.
1-8.2.3	Detecting equipment shall be installed, tested and maintained in accordance with NFPA 72E, Standard on Automatic Fire Detectors (see Appendix B).	D	Comply: See response to code section 1-8.2.1. Ref: Technical Data No. 5.
		D	Open Item: Detectors are cross-zoned for system actuation in the control room cable vaults. Each deep pocket is not provided with cross-zoned detectors resulting in a potential delayed response time. Ref: Technical Data No. 5.

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1-8.3	Operating Devices		Title
1-8.3.1	Operating devices include Halon 1301 releasing devices or valves, discharge controls, and shutdown equipment, all of which are necessary for successful performance of the system.		Information Only
1-8.3.2	Operation shall be by listed or approved mechanical, electrical, pneumatic means. An adequate and reliable source of energy shall be used.	D	Comply: The Ansul Automan II C panel used for the control room cable vaults (zones 57 and 58) and the pyrotronics panel used for the computer rooms (zones 71 and 72) are listed for this service. Ref: Technical Data No. 6.
		D	Does Not Comply: The ACI 7035 Panel used for the cable vaults (zones 57 and 58) is not listed for this service. Ref: Technical Data No. 6.
1-8.3.3	All devices shall be designed for the service they will encounter and shall not be readily rendered inoperative or susceptible to accidental operation. Devices shall be normally designed to function properly from -20°F to 150°F (-30°C to 65°C) or marked to indicate temperature limitations.	W, D	Comply: The devices are designed for this service. Except as identified in code section 1-8.3.2. Ref. Technical Data No. 5 & 6.
1-8.3.4	All devices shall be located, installed, or suitably protected so that they are not subject to mechanical, chemical, or other damage which would render them inoperative.	W	Comply: The operating devices for the hazard area(s) are installed so that they are not subject to the damage described in this code section. Ref: Walkdown Checklist No. 1.
1-8.3.5	The normal manual control for actuation shall be located so as to be conveniently and easily accessible at all times including the time of fire. This control shall cause the complete system to operate in its normal fashion.	W, D	Comply: The manual controls for actuation for the Unit 1 & 2 computer rooms (zones 71 & 72) are located at their respective doors and cause normal function of the system. Ref: Walkdown Checklist No. 1; Technical Data No. 6.

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		W	Does Not Comply: The manual actuation for the Control Room Cable Vaults/ Hot Shutdown Panel Cable Areas (fire zones 57 & 58) are located outside the door leading to an adjacent area/zone. These doors are not the primary egress and their use is difficult due to congestion of cable trays. Additionally, the manual actuation is located in a radiation controlled access, while the zones protected are not a radiation controlled access. Ref: Walkdown Checklist No. 1.
1-8.3.6	All automatically operated valves controlling agent release and distribution shall be provided with approved independent means for emergency manual operation. If the means for manual actuation of the system as allowed in 1-8.1 provides approved positive operation independent of the automatic actuation, it may be used as an emergency means. The emergency means, preferably mechanical, shall be easily accessible and located close to the valves controlled. Emergency actuation that can be accomplished from one location is desirable. This does not require the emergency manual control on "reserve" containers to control any selector valves or equipment beyond the containers.	W	Comply: Manual pull stations are provided for each of the four zones evaluated. Ref: Walkdown Checklist No. 1.
		D	Open Item: Operation of the extended discharge cylinders via operation of the manual control valve on the main cylinders for zones 57 and 58 cannot be conformed in the absence of electricity. Ref: Technical Data No. 6.
1-8.3.7	Manual controls shall not require a pull of more than 40 pounds (178 newtons) nor a movement of more than 14 inches (356mm) to secure operation.	D	Open Item: No documentation was found to adequately respond to this code requirement.
1-8.3.8	Where gas pressure from the system or pilot containers is used as a means for releasing the remaining containers the supply and discharge rate shall be designed for releasing all of the remaining containers.	W, D	Comply: The control cable vaults (zones 57 & 58) were hydraulically calculated with a computer program which used all cylinders. Ref: Walkdown Checklist No. 1; Technical Data No. 7.

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			Comply: The computer rooms (zones 71 & 72) are designed within the guidance of the listed design manual. Ref: Walkdown Checklist No. 1; Technical Data No. 1.
1-8.3.9	All devices for shutting down supplementary equipment shall be considered integral parts of the system and shall function with the system operation.	W, D	Comply: Fans into the control room cable vaults (zones 57 & 58) are shutdown upon system actuation. Zone 71 and 72 dampers close upon system discharge. Ref: Walkdown Checklist No. 1; Technical Data No. 6 & 15.
1-8.3.10	All manual operating devices shall be identified as to the hazard they protect.	W	Comply: The manual pull stations for the Unit 1 & 2 Computer Rooms (zones 71 & 72) are located in the room just inside the door and labelled for Halon system release. Ref: Walkdown Checklist No. 1.
		W	Does Not Comply: The manual actuation stations for the Control Room Cable Vault/Hot Shutdown Panel Areas (zones 57, 58) are not identified for the hazard they protect. Ref: Walkdown Checklist No. 1.
1-8.4	Supervision. Supervision of automatic systems is advisable where the possible loss because of any delay in actuation may be high and/or where the detection or control systems are so extensive and complex that they cannot be readily checked by visual or other inspection. When supervision is provided it shall be so arranged that there will be immediate indication of failure. The extent and type of supervision shall be approved by the authority having jurisdiction.	D	Comply: The local circuits are supervised for the four zones evaluated. The primary circuits for the cable vaults are electrically supervised. The secondary circuits (for extended discharge) are not electrically supervised. Although it is advisable that the secondary circuits are electrically supervised, the supervision provided meets the intent of this code section. Ref: Technical Data No. 5.

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1-8.5	Operating Alarms and Indicators		Title
1-8.5.1	Alarms or indicators or both are used to indicate the operation of the system, hazards to personnel, or failure of any supervised device. The type (audible, visual, or olfactory), number and location of the devices shall be such that their purpose is satisfactorily accomplished. The extent and type of alarms or indicator equipment or both shall be approved.	W, D	Comply: The computer rooms (zones 71 & 72) contain alarms within the protected hazard for system discharge. Ref: Walkdown Checklist No. 1; Technical Data No. 6.
		W, D	Open Item: The indication of system actuation into the protected hazard for the control room cable vaults (zones 57 & 58) could not be verified. Ref: Walkdown Checklist No. 1; Technical Data No. 6.
1-8.5.2	A positive alarm or indicator shall be provided to show that the system has operated.	D	Comply: A signal is sent to the control room to indicate: systems normal, solenoid abnormal, control abnormal, system operation and system discharge. Ref. Technical Data No. 6.
1-8.5.3	Alarms shall be provided to give positive warning of a discharge or pending discharge where a hazard to personnel may exist.	D	Comply: See response to code section 1-8.5.2.
1-8.5.4	Alarms indicating failure of supervised devices or equipment shall give prompt and positive indication of any failure and shall be distinctive from alarms indicating operation or hazardous conditions.	D	Comply: See response to code section 1-8.5.2.
1-8.5.5	Warning and instruction signs at entrances to and inside protected areas shall be provided.	W	Comply: Warning signs are in place for the four area/zones evaluated. They are placed so that they are easily seen and identifiable. Ref: Walkdown Checklist No. 1.

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1-9	Halon 1301 Supply		Title
1-9.1	Quantities		Title
1-9.1.1	The amount of Halon 1301 in the system shall be at least sufficient for the largest single hazard protected or group of hazards which are to be protected simultaneously.	W, D	Comply: The quantity of Halon for each subject fire zone has been calculated for the individual hazard. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 2; Drawing No. 1.
1-9.1.2	Where uninterrupted protection is required, the reserve quantity shall be as many multiples of these minimum amounts as the authority having jurisdiction considers necessary.	W, D	Comply: Additional quantities of Halon are located in Warehouse #2 outside the protected area. Ref: Walkdown Checklist No. 1; Technical Data No. 12 Section 5.3.8.
1-9.1.3	Both primary and reserve supplies for fixed storage shall be permanently connected to the piping and arranged for easy changeover, except where the authority having jurisdiction permits an unconnected reserve.	W, D	Comply: See response to code section 1-9.1.2.
1-9.2	Quality. The Halon 1301 shall comply with Military Specification MIL-M-12218B.	D	Open Item: No documentation was found to verify this code section.
1-9.3	Replenishment. The time needed to obtain Halon 1301 for replenishment to restore systems to operating condition shall be considered as a major factor in determining the reserve supply needed.	D	Comply: Procedures detail the reinstallation of the cylinders. Also, cylinders are maintained on plant site. Ref: Procedure No. 5; Technical Data No. 12 Section 5.3.8.
1-9.4	Storage Container Arrangement		Title
1-9.4.1	Storage containers and accessories shall be so located and arranged that inspection, testing, recharging and other maintenance is facilitated and interruption to protection is held to a minimum.	W	Comply: The cylinders for zone 71 are located in zone 70. The cylinders for zone 72 are located in zone 73. The cylinders for zone 57 are located in zone 44N. The cylinders for zone 58 are located in zone 45S.

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			They are located such that the maintenance activities described in this code section are not hindered and may be easily performed. Ref: Walkdown Checklist No. 1.
1-9.4.2	Storage containers shall be located as near as possible to the hazard or hazards they protect, but shall not be exposed to a fire in a manner that is likely to impair system performance.	W, D	Comply: The response to Code Section 1-9.4.1 identifies the cylinder locations. In all cases of the evaluated area/zones, the cylinders are separated by a substantial wall which serves as a fire area/zone boundary. Ref: Walkdown Checklist No. 1; Licensing Document No. 1.
1-9.4.3	Storage containers shall not be located so as to be subject to severe weather conditions or be subject to mechanical, chemical, or other damage. When excessive climatic or mechanical exposures are expected, suitable guards or enclosures shall be provided.	W	Comply: The response to Code Section 1-9.4.1 identifies the cylinder locations. These locations are in climatically controlled areas within the plant. The cylinders are located such that they are not readily subject to the damage described in this requirement. Ref: Walkdown Checklist No. 1.
1-9.5	Storage Containers		Title
1-9.5.1	The Halon 1301 supply shall be stored in containers designed to hold Halon 1301 in liquefied form at ambient temperatures. Containers shall not be charged to a filling density greater than 70 pounds per cubic foot (1121 kg/m^3). They shall be superpressurized with dry nitrogen to 360 psig ± 5% or 600 psig ± 5% total pressure at 70°F (25.84 bars ± 5% or 42.38 bars ± 5% total pressure at 21°C). Containers shall be distinctively and permanently marked with the type and quantity of agent contained therein, together with the degree of superpressurization.	W, D	Comply: The cylinders meet this requirement and they are marked with this information. Ref: Technical Data No. 1 & 2.

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1-9.5.2	The Halon 1301 containers used in these systems shall be designed to meet the requirements of the U.S. Department of Transportation or the Canadian Board of Transport Commissioners, if used as a shipping container. If not a shipping container, it shall be designed, fabricated, inspected, certified and stamped in accordance with Section VIII of the ASME *Unfired Pressure Vessel Code*; independent inspection and certification is recommended. The design pressure shall be suitable for the maximum pressure developed at 130°F (55°C) or at the maximum controlled temperature limit (see 1-9.5.8).	W, D	Comply: The cylinders are stamped with D.O.T. information. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 2.
1-9.5.3	A reliable means of indication, other than weighing, shall be provided to determine the pressure in refillable containers. The means of indication shall account for variation of container pressure with temperature.	W, D	Comply: A pressure gauge is provided for each Halon cylinder. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 2.
1-9.5.4	Halon 1301 containers shall not be recharged without hydrostatic test and remarking if more than five years have elapsed from the date of the last test. Containers shall be thoroughly dried before filling, especially after hydrostatic testing. Note 1: Charged containers will not be accepted for transportation if more than five years have elapsed since the date of the last hydrostatic test (see 1-9.5.2). Note 2: A likely source of agent contamination would be the presence of free water in the system container before filling with Halon 1301.	D	Comply: Plant procedures describe the interval of time between hydrostatic testing of Halon cylinders. The time interval is no longer than 5 years if discharged and not to exceed 20 years if not discharged. It is assumed that the testing agency follows proper hydrostatic test procedures prior to stamping the cylinders. Ref: Procedure No. 1 Attachment 1.

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1-9.5.5	When manifolded, containers shall be adequately mounted and suitably supported in a rack which provides for convenient individual servicing or content weighings. Automatic means shall be provided to prevent agent loss from the manifold if the system is operated when any containers are removed for maintenance.	W	Comply: Cylinders which are manifolded together each discharge through a check valve to prevent agent loss from the manifold given system operation when any containers are removed. Ref: Walkdown Checklist No. 1.
1-9.5.6	Each system shall have a permanent nameplate specifying the number, filling weight, and pressurization level of the containers.	W	Does Not Comply: None of the systems evaluated contained a system nameplate. Ref: Walkdown Checklist No. 1.
1-9.5.7	In a multiple cylinder system, all cylinders supplying the same manifold outlet for distribution of agent, shall be interchangeable and of one select size and charge.	W	Comply: All cylinders manifolded together (Units 1 & 2 CR Cable Vault/ Hot Shutdown Panel Areas (Zones 57 & 58) are interchangeable, one select size and charge. Ref: Walkdown Checklist No. 1.
1-9.5.8	Storage temperatures shall not exceed 130°F (55°C) nor be less than -20°F (-29°C) for total flooding systems unless the system is designed for proper operation with storage temperatures outside of this range. For local application systems, container storage temperatures shall be within a range from +32°F (0°C) to +130°F (55°C) unless special methods of compensating for changing flow rates are provided. External heating or cooling may be used to keep the temperature within desired ranges. When special container charges are used, the containers shall be appropriately marked.	W, D	Comply: The ambient temperatures in the area where cylinders are kept are within the limitations of this code requirement. Ref: Walkdown Checklist No. 1; Technical Data No. 8.
1-10	Distribution		Title
1-10.1	Piping		Title
1-10.1.1	Piping shall be of noncombustible material having physical and chemical characteristics, such that its deterioration under stress can be predicted with reliability. Special	D	Comply: The material for piping for the four systems were specified as ASTM A-106 grade B. Ref: Technical Data No. 11.

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	corrosion-resistant materials or coatings may be required in severely corrosive atmospheres. Examples of materials for piping and the standards covering these materials are: Ferrous Piping: Black or Galvanized Steel Pipe: ASTM A-53, or A-106, ANSI B-36.10. Nonferrous Piping (Drawn, Seamless), Copper: ASTM B-88. Flexible Metallic Hose: ANSI B140. The above listed materials do not preclude the use of other materials such as stainless steel or other pipe or tubing, which will also satisfy the requirements of this section. See Appendix A-1.10.1 for stress calculations. Schedule 40 steel pipe up to 4 in. nominal pipe size conforming to the above specifications is satisfactory for both the 360 psig (25.84 bars) and 600 psig (42.38 bars) charging pressures specified in this standard. Type M copper tubing conforming to the above specification is satisfactory for all 360 psig (24.84 bars) charging pressure. For 600 psig (42.38 bars) charging pressures Type M is satisfactory for nominal sizes up to 3/4 inch. Type L up to 1-1/2 inch size and Type K up to 2-1/2 inch size.		
1-10.1.2	Ordinary cast iron pipe, steel pipe conforming to ASTM A-120 or nonmetallic pipe shall not be used.	D	Comply: See response for Code Section 1-10.1.1.

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1-10.1.3	Flexible piping tubing or hoses (including connections) where used shall be of approved materials and pressure ratings.	W, D	Comply: Flexible tubing is used only for actuation of the subfloor system, dampers, and pressure switches for the systems protecting the Unit 1 & 2 computer rooms (Zones 71 & 72) flexible hoses are used in the systems for the Control Room Cable Vaults (zones 57 & 58) and are listed for this service. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 2.
1-10.2	Piping Joints		Title
1-10-2.1	The type of piping joint shall be suitable for the design conditions and shall be selected with consideration of joint tightness and mechanical strength. Example of suitable joints and fittings are screwed, flanged, welded, brazed, flared and compression.	W	Comply: The pipe joints observed during walkdowns for the four systems were consistent with this requirement. Ref: Walkdown Checklist No. 1.
1-10.2.2	Examples of materials used for fittings are: Malleable Iron 300 lb class only — ASTM A-197 Ductile Iron 300 lb class only — ASTM A-395 Steel — ASTM A-234 Exception: For 3/4 in. or smaller pipe sizes, 150 lb class fittings are acceptable. Pressure temperature ratings have been established for certain types of fittings. A list of ANSI Standards covering the different types of fittings is given in Table 126.1 of ANSI B-31.1.0. Where fittings not covered by one of these standards are used, the design recommendations of the manufacturer of the	D	Comply: The piping specification identifies the materials used for fittings. These materials are consistent with the requirements of this code section. Ref: Technical Data No. 11.

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	fittings shall not be exceeded. The above listed materials do not preclude the use of other materials which will satisfy the requirements of this section.		
1-10.2.3	Ordinary cast iron fittings shall not be used.	D	Comply: See response to Code Section 1-10.2.2.
1-10.2.4	All threads used in joints and fittings shall conform to ANSI B-2.1 (see Appendix B). Joint compound, tape or thread lubricant shall be applied only to the male threads of the joint.	D	Open Item: Information to verify this requirement was not available.
1-10.2.5	Welding and brazing alloys shall have a melting point above 1000°F (538°C).	D	Open Item: Documentation to verify this requirement was not found.
1-10.2.6	Where copper, stainless steel or other suitable tubing is joined with flared or compression type fittings, the pressure-temperature ratings of the manufacturer of the fitting shall not be exceeded.	W, D	Comply: See response to code section 1-10.1.3.
1-10.3	Arrangement and Installation of Piping and Fittings		Title
1-10.3.1	Arrangement and Installation of Piping and Fittings. Piping shall be installed in accordance with good commercial practice. Care should be taken to avoid possible restrictions due to foreign matter, faulty fabrication or improper installation.	W	Comply: The pipe runs for the four halon systems were installed consistent with the requirements of this code section. Ref: Walkdown Checklist No. 1.
1-10.3.2	The piping system shall be securely supported with due allowance for agent thrust forces, thermal expansion and contraction and shall not be subjected to mechanical, chemical, vibration or other damage. ANSI B-31.1.0 shall be consulted for guidance on this matter. Where explosions are likely, the piping shall be attached to supports that are least likely to be displaced.	W	Comply: The pipe runs for the computer rooms (zones 71 & 72) are very short. Both zones obtain support from ductwork supports. The piping for zones 57 and 58 is adequately supported. Ref: Walkdown Checklist No. 1.

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1-10.3.3	Piping shall be blown out before nozzles or discharge devices are installed.	D	Open Item: Documentation to verify this requirement was not available.
1-10.3.4	In systems where valve arrangement introduces sections of closed piping, such sections shall be equipped with pressure relief devices or the valves shall be designed to prevent entrapment of liquid. Where pressure-operated container valves are used, a means shall be provided to vent any container leakage from the manifold but which will prevent loss of the agent when the system operates.	W	Comply: This code requirement refers to systems which utilize zone valves, etc. Sections of closed piping were not found during walkdowns. Ref: Walkdown Checklist No. 1.
1-10.3.5	All pressure relief devices shall be of such design and so located that the discharge therefrom will not injure personnel or be otherwise objectionable.	W	Comply: The pressure relief devices for the the systems are installed on the cylinder valves. They are directed so that their operation should not injure personnel. Ref: Walkdown Checklist No. 1.
1-10.4	Valves		Title
1-10.4.1	All valves shall be suitable for the intended use, particularly in regard to flow capacity and operation. They shall be used only under temperatures and other conditions for which they are listed.	W, D	Comply: The cylinder valves are a part of the listed assembly for each evaluated system. They are installed in accordance with their limitations. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 2.
		W, D	Open Item: The listing of the in-line check valves installed to isolate the CO_2 system from the Halon system for the cable vaults (zones 57 and 58) piping could not be verified. Ref: Walkdown Checklist No. 1.
1-10.4.2	Valves shall be protected against mechanical, chemical, or other damage.	W	Comply: The valves are located so that they are not readily subjected to the damage described in this code section. Ref: Walkdown Checklist No. 1.

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1-10.4.3	Valves shall be rated for equivalent length in terms of the pipe or tubing sizes with which they will be used. The equivalent length of container valves shall be listed and shall include siphon tube, valve, discharge head and flexible connector.	D	Comply: The computer room systems are pre-engineered and the piping layouts, cylinder arrangement, etc., are within the guidelines of the U.L. listed design manual. The control room cable vaults have been analyzed by a computer program and the referenced equipment and program are U.L. listed. Ref: Technical Data No. 1 & 2.
1-10.5	Discharge Nozzles		Title
1-10.5.1	Discharge nozzles shall be listed for the use intended and for discharge characteristics. The discharge nozzle consists of the orifice and any associated horn, shield, or baffle.	W, D	Comply: The discharge nozzles used in the control room cable vaults (zones 57 & 58) are listed for this use. The nozzles for the Unit 1 and 2 Computer Rooms (zones 71 & 72) appear in the UL listed design manual for pre-engineered systems. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 7.
1-10.5.2	Discharge orifices shall be of corrosion-resistant metal.	W, D	Comply: The nozzles for the control room cable vaults (Zones 57 & 58) and the computer rooms (Zones 71 & 72) are designed and listed for this service and are therefore acceptable. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 2.
1-10.5.3	Discharge nozzles used in local application systems shall be accurately located and directed in accordance with the system design requirements as covered in 3.3. Discharge nozzles used in local application systems shall be so connected and supported that they may not readily be put out of alignment.	W	Not Applicable: No local application Halon 1301 systems were found within safety related areas during the walkdown. Ref: Walkdown Checklist No. 1.

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1-10.5.4	Discharge nozzles shall be permanently marked to identify the manufacturer and his part number. The marking shall be readily discernible after installation.	W, D	Comply: Due to the congestion in the Control Room Cable Vaults/Hot Shutdown Panel Areas this information was not readily obtainable from walkdown. Those nozzles observed did contain the information. A document review was used to verify the remaining nozzles. Ref: Walkdown Checklist No. 1; Technical Data No. 1 & 2.
1-10.5.5	Discharge nozzles shall be provided with frangible discs or blow-out caps where clogging by foreign materials is likely. These devices shall provide an unobstructed opening upon system operation.	W	Comply: The devices described in this code section are not necessary in the hazard areas evaluated. Ref: Walkdown Checklist No. 1.
1-10.6	Pipe and Orifice Size Determination		Title
1-10.6.1	Pipe sizes and orifice areas shall be selected to deliver the required rate of flow at each nozzle.	D	Comply: The computer calculations verify this requirement for the control room cable vaults. The computer room systems are installed per their pre-engineered guidelines for which they are listed/approved. Ref: Technical Data No. 1 & 2.
		D	Open Item: Calculations for the extended discharge nozzles installed in the control room cable vaults (zones 57 & 58) were not located, so this requirement could not be verified.
1-10.6.2	Flow shall be calculated on the basis of an average container pressure during discharge, taking into account the original pressurization level, storage filling density, and percent in piping for 70°F (21°C) storage temperature as shown in Figures A-1-10-6.2(d) and A-1-10.6.2(e).	D	Comply: The computer room systems (zones 71 and 72) are pre-engineered and the piping layouts, cylinder arrangement, etc. are within the guidelines of the design manual. Ref: Technical Data No. 1.

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		D	Open Item: Calculations for the extended discharge nozzles installed in the control room cable vaults (zones 57 & 58) were not located, so this requirement could not be verified.
1-10.6.3	The percent of agent in piping is defined by the following equation and shall not exceed 100 percent of the charged weight. percent in piping = Where: = Summation of (Vp ($\bar{p}$) values for all pipeline sections. Vp = Internal volume of each section of piping (cu. ft.). = Average pipeline density of agent for each section of piping (lbs./cu.ft.). W = Initial charge weight of Halon 1301 (lbs.). NOTE: Internal volume figures for steel pipe and tubing are given in Tables A-1-10.6.3(a) and A-1-10.6.3(b).	D	Comply: The computer calculations verify this requirement for the control room cable vaults. The computer room systems are installed per their pre-engineered guidelines for which they are listed/approved. Ref: Technical Data No. 1 & 2.
		D	Open Item: Calculations for the extended discharge nozzles installed in the control room cable vaults (zones 57 & 58) were not located, so this requirement could not be verified.
1-10.6.4	A balanced system is one in which a) Actual pipe length from container to each nozzle is equal to within 10% of the longest pipe length, and b) equivalent pipe length from container to each nozzle is equal to within ±10%, and c) design flow rate at each nozzle is equal. For balanced piping systems, Figures A-1-10.6.4(a) and A-1-10.6.4(b) may be used to calculate the pressure drop. When these		Information Only

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	curves are used a multiplication factor is applied to this pressure drop to correct for the percent in piping and filling density in accordance with Figures A-1-10.6.4(c) and A-1-10.6.4.(d).		
1-10.6.5	For unbalanced piping systems, pressure drop shall be calculated by means of the two-phase equation given below or by any other method approved by the authority having jurisdiction. This two-phase equation may also be used for calculating pressure drop in balanced piping systems. $Q^2 = \frac{1.0120^{5.25}\ Y}{L + 8.08D^{1.25}\ Z}$ Where: Q = Flow rate, lbs./second D = Inside pipe diameter, inches L = Equivalent length of pipe, feet Y&Z = Factors depending on density and pressure. NOTE: This flow equation contains a friction factor based on commercial steel pipe.	D	Comply: The control room cable vault systems (zones 57 & 58) were calculated using a manufacturer's Halon calculation program. Ref: Technical Data No. 2.
		D	Not Applicable: The computer room systems (zones 71 & 72) are pre-engineered with only 1 nozzle per cylinder. Ref: Technical Data No. 1.
		W	Not Applicable: The extended discharge cylinders for the control room cable vaults (zones 57 & 58) each supply only one nozzle. Ref: Walkdown Checklist No. 1.
1-10.6.6	Nozzle orifice sizes shall be selected to achieve the design flow rate. The discharge characteristics of the nozzle shall be provided in the manufacturer's listed design manual calculating pressure drop in balanced piping systems.	W, D	Comply: The computer room systems (zones 71 & 72) are pre-engineered and the piping layouts, cylinder arrangement, etc. are within the guidelines of the design manual. Ref: Walkdown Checklist No. 1; Technical Data No. 1.

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	Calculated terminal pressures shall not be less than 50 percent of the average container pressure during discharge as obtained from Figures A-1.10.6.2(d) and A-1.10.6.2(e).	D	Open Item: Calculations for the extended discharge nozzles installed in the control room cable vaults (zones 57 & 58) were not located, so this requirement could not be verified.
1-11	Inspection, Maintenance and Instructions		Title
1-11.1	Inspection and Tests		Title
1-11.1.1	At least annually, all systems shall be thoroughly inspected and tested for proper operation by competent personnel.	D	Does Not Comply: Currently a test is conducted on an 18 month basis for each system. Ref: Procedure No. 1 Attachment 1 and No. 4 Section 1.2.1.
1-11.1.2	The goal of this inspection and testing shall be to ensure that the system is in full operating condition.	D	Comply: A test referenced in 1-11.1.1 accomplishes operating condition of the system. Ref: Procedure No. 4.
1-11.1.3	Suitable discharge tests shall be made when inspection indicates their advisability.	D	Open Item: Documentation to verify this requirement could not be found.
1-11.1.4	The inspection report with recommendations shall be filed with the owner.	D	Comply: The results of system testing are transmitted for action via procedures for the control room cable vaults. Ref: Procedure No. 4.
		D	Open Item: Documentation to verify this requirment for the computer room systems (zones 71 & 72) was not found.
1-11.1.5	Between the annual inspections and tests, the system shall be inspected visually or otherwise by competent personnel, following an approved schedule and procedure.	D	Open Item: No documentation was found to verify this requirement.

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1-11.1.6	At least semiannually, the weight and pressure of refillable containers shall be checked. If a container shows a loss in net weight of more than 5 percent or a loss in pressure (adjusted for temperature) of more than 10 percent, it shall be refilled or replaced.	D	Comply: The control room cable vault halon cylinders are weighed and checked every 6 months. Ref: Procedure No. 5.
		D	The computer room halon cylinders are also weighed and checked every 6 months. Ref: Procedure No. 1 Attachment 1.
1-11.1.7	Factory charged nonrefillable containers which do not have a means of pressure indication shall be weighed at least semiannually. If a container shows a loss in net weight of more than 5 percent, it shall be replaced.	W	Not Applicable: The cylinders observed during walkdowns were all provided with a pressure gauge and are refillable. Ref: Walkdown Checklist No. 1.
1-11.1.8	The weight and pressure of the container shall be recorded on a tag attached to the container.	W	Does Not Comply: The information required in this code section (as applicable for maintenance) was not found on a tag for cylinders for any of the Halon Systems. Ref: Walkdown Checklist No. 1.
1-11.2	Maintenance		Title
1-11.2.1	These sytems shall be maintained in full operating condition at all times. Use, impairment, and restoration of this protection shall be reported promptly to the authority having jurisdiction.	D	Comply: The systems are maintained by procedures. The control room cable vaults (zones 57 & 58) are tech. spec. and their impairment is reported. Ref: Procedure No. 1 Section 8.4.
1-11.2.2	Any troubles or impairments shall be corrected at once by competent personnel.	D	Comply: See response to code section 1-11.2.1.
1-11.3	Instruction. All persons who may be expected to inspect, test, maintain, or operate fire extinguishing systems shall be thoroughly trained and kept thoroughly trained in the functions they are expected to perform.	D	Comply: The personnel who inspect/ test, etc. systems are trained for their duties. Ref: Procedure No. 3.

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	CHAPTER 2. TOTAL FLOODING SYSTEMS		Title
2-1	General Information		Title
2-1.1	Uses		Title
2-1.1.1	This type of systems may be used where there is a fixed enclosure about the hazard that is adequate to enable the required concentration to be built up and maintained for the required period of time to ensure the effective extinguishment of the fire in the specific combustible materials involved where the ambient temperature is above -70°F (-57°C).		Information Only
2-1.1.2	Total flooding systems may provide fire protection within rooms, vaults, enclosed machines, ovens, containers, storage tanks and bins. Where ambient temperatures exceed 900°F (482°C), see A-1.6.1(b).		Information Only
2-1.1.3	Halon 1301 total flooding systems shall not be used in concentrations greater than 10 percent in normally occupied areas. For the purposes of this standard, a "normally occupied" area is defined as an area intended for occupancy. Areas which may contain 10 percent Halon 1301 shall be evacuated immediately upon discharge of the agent. Where egress cannot be accomplished within one minute, Halon 1301 total flooding systems shall not be used in normally occupied areas in concentrations greater than 7 percent. (See A-1-6.1.)	D	Comply: The design concentration for the computer rooms is 6% @ 60°F. The design concentration for the control room cable vaults is approximately 7% at 60°F. The zones contain predischarge alarms. Ref: Technical Data No. 1, 2 & 7. Note: The Control Room Cable Vaults are not normally occupied areas.

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2-1.1.4	Halon 1301 total flooding systems utilizing concentrations greater than 10 percent but not exceeding 15 percent may be used in areas not normally occupied, provided egress can be accomplished within 30 seconds. Where egress cannot be accomplished within 30 seconds or concentrations greater than 15 percent must be used, provisions shall be made to prevent inhalation by personnel. (See A-1-6.1.)	D	Not Applicable: The design concentrations for all hazards evaluated are less than 10%. Ref: Technical Data No. 1 & 2; Drawing No. 1.
2-1.2	General Requirements. Total flooding systems shall be designed, installed, tested and maintained in accordance with the applicable requirements in Chapter 1 and with the additional requirements set forth in this chapter.	D	Comply: The systems evaluated comply with the code requirements except as noted in Chapter 1.
2-2	Hazard Specifications		Title
2-2.1	Types of Fires		Title
2-2.1.1	Fires which can be extinguished by total flooding methods may be divided into three categories: (a) Fires involving flammable liquids or gases. (b) Surface fires involving flammable solids. (c) Deep-seated fires, such as can occur with certain Class A materials subject to spontaneous heating, smoldering, and high heat retention.		Information Only
2-2.1.2	Flammable liquid and gas fires are subject to prompt extinguishment when Halon 1301 is quickly introduced into the enclosure in sufficient quantity to provide an extinguishing concentration	W	Not Applicable: There are no hazards of this nature protected by Halon 1301 in safety related areas as observed during walkdowns. Ref: Walkdown Checklist No. 1.

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	for the particular materials involved. NFPA 69, Standard on Explosion Prevention Systems (see Appendix B), shall be referred to when possible flammable concentrations of gases make explosion protection techniques necessary.		
2-2.1.3	Surface fires associated with the burning of solid materials are also quickly extinguished by Halon 1301. In many solid materials, smoldering combustion may continue at the surface of the fuel after extinguishment of the flames. These surface embers will normally be extinguished by low concentrations of Halon 1301 maintained for short periods of time.		Information Only
2-2.1.4	Deep-seated fires may become established beneath the surface of a fibrous or particulate material. This may result from flaming combustion at the surface or from ignition within the mass of fuel. Smoldering combustion then progresses slowly through the mass. A fire of this kind is referred to in this standard as a "deep-seated" fire. The burning rate of these fires can be reduced by the presence of Halon 1301, and they may be extinguished if a high concentration can be maintained for an adequate soaking time. However, it is not normally practical to maintain a sufficient concentration of Halon 1301 for a sufficient time to extinguish a deep-seated fire.		Information Only
2-2.2	Enclosure		Title
2-2.2.1	In the design of total flooding systems, the characteristics of the enclosure must be considered as follows:		Information Only

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2-2.2.2	For all types of fires, the area of unclosable openings shall be kept to a minimum. These openings shall be compensated for by additional quantities of agent according to the design procedures outlined in A-2.5.3. The authority having jurisdiction may require tests to assure proper performance as defined by this standard.	W, D	Comply: See responses to code section 2-2.2.3.
2-2.2.3.	To prevent fire from spreading through openings to adjacent hazards or work areas and to make up for leakage of the agent, openings shall be compensated for with automatic closures, screening nozzles or additional agent, and shall be arranged to operate simultaneously with system discharge. The agent required by screening nozzles shall be in addition to the normal requirement for total flooding. Where reasonable of confinement of agent is impracticable, protection shall be extended to include the adjacent hazards or work areas.	W, D	Comply: The duct openings in the Unit 1 and 2 CR Cable Vault/Hot Shutdown Panel Areas (zones 57 & 58) are provided with dampers that close upon Halon system actuation. Fans are also shutdown. Ref: Walkdown Checklist No. 1; Technical Data No. 6.
		D	Comply: The duct openings in the Unit 1 and 2 computer rooms (fire zones 71 and 72) are provided with dampers that close upon halon system actuation. Ref: Technical Data No. 15.
2-2.2.4	For deep-seated fires, forced air ventilating systems shall be shut down or closed with the start of agent discharge; or, additional compensating gas shall be provided. (See A-2-5.3.)	W, D	Comply: See response to code section 2-2.2.3.

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2-2.2.5	For surface fires, forced air ventilation may also be required to be shut down or closed with the start of agent discharge; or, additional compensating gas may need to be provided. (See A-2-5.3.)	W	Not Applicable: "Surface fires" refers to the characteristics of flammable/combustible liquids. These hazards were not encountered in the subject fire zones during walkdowns. Ref: Walkdown Checklist No. 1.
2-3	Halon 1301 Requirements for Liquid and Gas Fires		Title
2-3.1	General. The quantity of Halon 1301 for fires involving flammable liquids and gases is based upon normal conditions with the extinguishing system meeting the requirements specified herein.		Information Only
2-3.2	Flammable Materials		Title
2-3.2.1	In the determination of the design concentration of Halon 1301, proper consideration shall be given to the type and quantity of flammable material involved, the conditions under which it normally exists in the hazard, and any special conditions of the hazard itself. For a particular fuel, either of two minimum levels of Halon 1301 concentration may apply, i.e., flame extinguishment or inerting. Note: Appendix A-2-3 contains additional guidelines for determining which concentration level to use for a particular hazard.	W	Comply: The design concentration was reviewed via design documents. The hazards evaluated contained Class A & C combustibles. No Class B flammables/combustibles were located. Ref: Walkdown Checklist No. 1.
2-3.2.2	Flame Extinguishment		Title
	(a) Applicability of Flame Extinguishment Concentrations. The minimum design concentration required to extinguish normal fires involving certain flammable		Information Only

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	gases and liquids at atmospheric pressure are applicable if it can be shown that a probable explosive atmosphere cannot exist in the hazard either before or as a result of the fire. An explosion potential is improbable when either of the following conditions apply: (1) The quantity of fuel permitted in the enclosure is less than that required to develop a maximum concentration equal to one-half of the lower flammable limit. Additional information is given in Appendix A-2-1 and A-2-3. (2) The volatility of the fuel before the fire is too low to reach the lower flammable limit in air (maximum ambient temperature or fuel temperature does not exceed the closed cup flash point temperature), and fire may be expected to burn less than 30 seconds before extinguishment.		
	(b) Temperature Sensitivity. The flame extinguishing concentration required for some fuels depends on the fuel temperature. All fuels shall be tested at at least two temperatures to determine temperature sensitivity. (See Appendix A-2-3.)	W	Not Applicable: The Halon 1301 installations within the safety related areas do not require this testing since they are protecting Class A & C combustibles as witnessed during walkdowns. Ref: Walkdown Checklist No. 1.
	(c) Special Fire Considerations. Where high temperatures or pressures exist or may result from delayed system activation and for configurations other than simple pool or gas jet fires, added tests specific to the intended application shall be made.		

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	(d) Typical Design Concentrations. Table 2-3.2.2 gives minimum design concentrations required to extinguish normal fires involving several flammable liquids and gases.		Information Only
2-3.2.3	Inerting		Title
	(a) Applicability of Inerting Concentrations. Inerting concentrations shall be used when the conditions of 2-3.2.2 are not or cannot be met. Such concentrations are sufficient to "inert" the atmosphere against all proportions of fuel in air. Specifically, they shall be used in the following situations:	W	Not Applicable: The types of fuels which require the design concentrations outlined in this code section were not located in the hazards evaluated as observed during walkdowns. Ref: Walkdown Checklist No. 1.
	(1) The quantity of fuel in the enclosure is greater than that permitted in 2-3.2.2(a)(1); and,		
	(2) The volatility of the fuel is greater than that permitted in 2-3.2.2(a)(2) or		
	(3) The system response is not rapid enough to detect and extinguish the fire before the volatility of the fuel is increased to a dangerous level as a result of the fire.		
	Note: Table A-2.3.2.3 gives minimum design concentrations for inerting several flammable liquids and gases.		

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2-3.2.4	Design flame extinguishment concentrations not given in 2-3.2.2 shall be obtained by test plus a 20 percent safety factor. Minimum design concentrations shall be 5 percent. Design inerting concentrations shall be determined by test plus a 10 percent safety factor.	W	Not Applicable: The hazards associated with these requirements are not in the areas evaluated. Ref: Walkdown Checklist No. 1.
2-3.2.5	For combinations of fuels, the flame extinguishment or inerting value for the fuel requiring the greatest concentration shall be used unless tests are made on the actual mixture.	W	Not Applicable: The hazards associated with these requirements are not in the areas evaluated. Ref: Walkdown Checklist No. 1.
2-3.2.6	Where an explosion potential exists due to the presence of gaseous, volatile or atomized fuels either before or following a fire, NFPA 68, Guide for Explosion Venting and NFPA 69, Standard on Explosion Prevention Systems (see Appendix B) covering vapor detection and explosion venting and suppression shall be consulted. In particular, extreme caution shall be taken following inerting of a rich fuel air mixture since compartment leakage or ventilation will cause the mixture to pass through the explosive range of concentrations when fresh air is admitted.	W	Not Applicable: These types of fuels are not present in the Halon 1301 protected areas within the safety related areas as observed during walkdowns. Ref: Walkdown Checklist No. 1.
2-4	Halon 1301 Requirements for Fires in Solid Materials		Title
2-4.1	General. Flammable solids may be classed as those which do not develop deep-seated fires, and those which do. Materials which do not become deep-seated undergo surface combustion only and may be treated much as a flammable liquid fire. Most materials which develop deep-seated fires do so after exposure to flaming combustion for a certain length of time which varies with the material. In others, the fire may begin as deep-seated through internal ignition, such as spontaneous heating.		Information Only

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2-4.2	Solid Surface Fires. Almost all flammable solids begin burning on the surface. In many materials, such as unfilled plastics (without filler materials), surface combustion is the only type that occurs. These fires are readily extinguished with low concentrations, (e.g., 5 percent) of Halon 1301. Although glowing embers may remain at the surface of the fuel following extinguishment of flames, these embers will be completely extinguished within a short time (e.g., 10 minutes) provided the Halon 1301 concentration is maintained around the fuel for this time (called "soaking" time).		Information Only
2-4.3	Deep-Seated Fires		Title
2-4.3.1	Halon 1301, like other halogenated hydrocarbons, chemically inhibits the propagation of flame. However, although the presence of Halon 1301 in the vicinity of a deep-seated fire will extinguish the flame, thereby greatly reducing the rate of burning, the quantity of agent required for complete extinction of all embers is difficult to assess. It depends on the nature of the fuel, its state of comminution, its distribution within the enclosure, the time during which it has been burning, the ratio of the area of the burning surface to the volume of the enclosure, and the degree of ventilation in the enclosure. It is usually difficult or impractical to maintain an adequate concentration for a sufficient time to ensure the complete extinction of a deep-seated fire (see Appendix A-2-4).		Information Only

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2-4.3.2	Where the solid material is in such a form that a deep-seated fire can be established before a flame extinguishing concentration has been achieved, provision shall be made to the satisfaction of the authority having jurisdiction for means to effect complete extinguishment of the fire (see Appendix A-2-4).	W, D	Comply: The potential of deep-seated fires in the hazards evaluated is present. The design for zones 57 & 58 includes an extended discharge to maintain the concentration. Test results were also satisfactory. Ref: Technical Data No. 3 & 12.
2-5	Determination of Halon 1301 Quantity for Total Flooding Systems		Title
2-5.1	General. The Halon 1301 concentration requirements established in 2-3 and 2-4 are converted into agent weight requirements through mathematical computations considering the volume of the hazard and the specific volume of the superheated Halon 1301 vapor. In addition to the concentration requirements, additional quantities of agent may be required to compensate for unclosable openings, forced ventilation or other special conditions which would affect the extinguishing efficiency.	W, D	Comply: See responses to code section 2-2.2.3 and 2-5.3.
2-5.2	Total Flooding Quantity. Figure 2-5.2 depicts the specific volume of superheated Halon 1301 vapor at various temperatures. The amount of Halon 1301 required to achieve the design concentration is calculated from the following formula: $W = \frac{V}{s}\left(\frac{C}{100 - C}\right)$	D	Comply: The listed design manual and vendor's computer program utilize the values presented in this code requirement. Ref: Technical Data No. 1 & 2; Drawing No. 1.

W = Weight of Halon 3101 required, pounds (kg).
s = Specific volume superheated Halon 1301, cubic feet/pound (m^3/kg).
C = Halon 1301 concentration, percent by volume.
V = Volume of hazard, cubic feet (m^3).

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	This calculation includes an allowance for normal leakage from a "tight" enclosure due to agent expansion. Since the amount of gas and, therefore, the concentration produced by a given weight of Halon 1301 is greatly affected by the temperature it encounters, the specific volume of superheated Halon 1301 vapor for the lower operating minimum anticipated ambient temperature limit shall be used in the design of a Halon 1301 total flooding system. Table 2-5.2 is a tabulation of the Halon 1301 weight per cubic foot of hazard volume required to produce the specified concentration of various hazard temperature conditions. All Halon 1301 total flooding systems shall be capable of producing the required concentration of agent under the conditions of maximum net volume (gross volume of the hazard minus the volume occupied by solid objects), maximum ventilation and minimum anticipated ambient temperature. In areas where wide variations in net volume are encountered under normal operations such as storage rooms, warehouses, etc., or where wide variations in ambient temperatures are experienced as in unheated rooms, the agent concentration generated under these extremes shall be calculated to determine compliance with 2-1.1.3 and 2-1.1.4.		
2-5.3	Special Conditions. Additional quantities of Halon 1301 shall be provided to compensate for any special conditions, such as unclosable openings, forced ventilation, or other causes of agent loss. It shall be the responsibility of the system designer to show that such conditions have been taken into account in the design of a system.	W, D	Comply: Agent leakage occurs in the Unit 1 & 2 Control Room Cable Vaults/Hot Shutdown Panel Areas. An extended discharge system was added to compensate for leakage. A discharge test verified the acceptability of the design. Ref: Walkdown Checklist No. 1; Technical Data No. 4 & 6.

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2-6	Distribution System		Title
2-6.1	General. The distribution system for applying Halon 1301 to enclosed hazards shall be designed with due consideration for the materials involved, the type of burning expected, and the nature of the enclosure. These factors all may affect the discharge times and rates of application.	W, D	Comply: The nozzle placement in the Unit 1 & 2 Control Room Cable Vault/ Hot Shutdown Panel Areas may be such that Halon may not disperse throughout the hazard. The Halon system discharge tests indicate, however, that the systems are adequate in nozzle locations. Ref: Walkdown Checklist No. 1; Technical Data No. 3, 4 & 6.
		D	Comply: The nozzle placement in the computer rooms is consistent with the design guidelines given in the UL listed pre-engineered manual. Ref: Technical Data No. 1.
2-6.2	Rate of Application	Title	
2-6.2.1	The minimum design rate of application shall be based on the quantity of agent required for the desired concentration and the time allotted to achieve the desired concentration.	D	Comply: The vendor computer programs utilizes these values. The pre-engineered design manual also takes these into consideration. Ref: Technical Data No. 1 & 2.
2-6.2.2	Discharge Time. The agent discharge shall be substantially completed in a nominal 10 seconds or a shorter time if practicable, unless a longer discharge time is specifically permitted by the authority having jurisdiction. This period shall be measured as the interval between the first appearance of liquid at the nozzle and the time when the discharge becomes predominantly gaseous. This point is distinguished by a marked change in both the sound and the appearance of the discharge.	D	Comply: The systems for the Computer Rooms (zones 71 & 72) are designed in accordance with their manual. The manual is UL listed, so discharge should occur within 10 seconds. Ref: Technical Data No. 1.
		D	Does Not Comply: The initial discharge times for the control room cable vaults (zones 57 & 58) are in excess of 45 seconds. Ref: Technical Data No. 12 Section 5.3.7.

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2-6.3	Extended Application Rate		Title
2-6.3.1	Where leakage is appreciable and the design concentration must be obtained quickly and maintained for an extended period of time, agent quantities provided for leakage compensation may be applied at a reduced rate.	D	Comply: A separate, independent extended discharge system is provided for the control room cable vaults (zones 57 & 58). Ref: Technical Data No. 12 Section 5.3.1.
2-6.3.2	This type of application is particularly suitable to enclosed rotating electric apparatus, such as generators, motors and convertors, and also may be needed for total flooding protection of deep-seated fires.		Information Only
2-6.3.3	The initial discharge shall be completed within the limits specified in 2-6.2.	D	Comply: The computer rooms (zones 71 & 72) are installed in accordance with the design manual. Ref: Technical Data No. 1; Drawing No. 1.
		D	Does Not Comply: The initial discharge times for the control room cable vaults (zones 57 & 58) are in excess of 45 seconds. Ref: Technical Data No. 12 Section 5.3.7.
2-6.3.4	The rate of extended discharge shall be sufficient to maintain the desired concentration for the duration of application.	D	Comply: The test results confirm the concentration is maintained. This requirement is only applicable to the control room cable vaults (zones 57 & 58) Ref: Technical Data No. 3 & 4.
2-6.4	Piping and Supply. Piping shall be designed in accordance with the requirements outlined in Chapter 1 to deliver the required rate of application at each nozzle.	D	Comply: The calculations for the systems in the control room cable vaults (zones 57 and 58) identify pipe sizes for the discharge rate. The systems for the computer rooms (zones 71 and 72) are consistent with designing guidelines. Ref: Technical Data No. 1 & 2.

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STANDARD ON HALON 1301

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2-6.5	Nozzle Choice and Location		Title
2-6.5.1	Nozzles used with total flooding systems shall be of the type listed for the intended purpose, and shall be located with the geometry of the hazard and enclosure taken into consideration.	D	Comply: The nozzles for all the systems evaluated are listed for this service. The halon concentration tests for the control cable vaults indicate acceptability of their location. The computer room nozzles are located in accordance with the listed spacing criteria in the design manual. Ref: Technical Data No. 1 & 2.
2-6.5.2	The type of nozzles selected, their number, and their placement shall be such that the design concentration will be established in all parts of the hazard enclosure, and such that the discharge will not unduly splash flammable liquids or create dust clouds that might extend the fire, create an explosion, or otherwise adversely affect the contents of the enclosure. Nozzles vary in design and discharge characteristics and shall be selected on the basis of their adequacy for the use intended. Nozzles shall be placed within the hazard area in compliance with listed limitations with regard to spacing, floor coverage and alignment.	W, D	Comply: The nozzles for all the systems evaluated are listed for this service. The halon concentration tests for the control cable vaults (zones 57 and 58) indicate acceptability of the nozzle locations. The nozzles for the computer rooms (zones 71 and 72) are located in accordance with the listed spacing criteria in the design manual. Ref: Walkdown Checklist No. 1; Technical Data No. 1, 2, 4 & 12.
2-7	Venting Consideration		Title
2-7.1	General. Venting of an enclosure may be necessary to relieve pressure build-up due to the discharge of large quantities of Halon 1301. Appropriate pressure relief depends on the injection rate of the Halon 1301 and enclosure strength.	D	Comply: This requirement is not applicable. Extended discharge of Halon 1301 into the Control Room Cable Vaults is provided to make up for leakage. Dampers are provided in the computer rooms. Although relatively tight, some leakage of gas will occur prior to room over pressurization.

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IMPELL CORPORATION

NFPA 12A - Code Compliance Verification Checklist D.C. Cook Units 1 & 2

JOB NO 0120-108
CALC NO 0120-108-003

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 12A-1977
STANDARD ON HALON 1301

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2-7.2	Pressure Relief Venting		Title
2-7.2.1	Porosity and leakages such as around doors, windows and dampers, though not readily apparent or easily calculated, will usually provide sufficient relief for Halon 1301 flooding systems without need for additional venting. Record storage rooms, refrigerated spaces and duct work also generally need no additional venting.		Information Only
2-7.2.2	For very tight enclosures, the area necessary for free venting may be calculated from the following formula, taking the specific volume of Halon 1301 vapor at 70°F to be 2.56 cubic feet per pound: (0.160 m^3/kg at 21°C): $x = \frac{13.2\ Q}{P}$ x = Free venting area, sq. in. Q = Halon 1301 injection rate, lb. per sec. P = Allowable strength of enclosure, lb./sq. ft. For SI Units: $x = \frac{410\ Q}{P}$ x = Free venting area, sq. mm Q = Halon 1301 injection rate, kg/s P = Allowable strength of enclosure, bars-gauge		Information Only
2-7.2.3	In many instances, particularly when hazardous materials are involved, relief openings are already provided for explosion venting. These and other available openings often provide adequate venting.		Information Only

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NFPA 12A - Code Compliance Verification
Checklist D.C. Cook Units 1 & 2

IMPELL CORPORATION

JOB NO 0120-108
CALC NO 0120-108-003

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 12A-1977
STANDARD ON HALON 1301

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2-7.2.4	Table 2-7.2.4, based on general construction practices, provides a guide for considering the normal strength and allowable pressure of average enclosures.		Information Only

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NFPA 12A - Code Compliance Verification Checklist
D.C. Cook Units 1 & 2

IMPELL CORPORATION

JOB NO 0120-108
CALC NO 0120-108-003

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 12A-1977
STANDARD ON HALON 1301

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
CHAPTER 3. LOCAL APPLICATION SYSTEMS			This entire chapter has been omitted since there are no systems of this type installed at D.C. Cook for protection of safety related areas.

REV 0 | BY MK | DATE 4/8/88 | CHECKED [illegible] | DATE 4/18/88

IMPELL CORPORATION

NFPA 12A - Code Compliance Verification Checklist D.C. Cook Units 1 & 2

JOB NO 0120-108
CALC NO 0120-108-003

CALCULATION/PROBLEM COVER SHEET

Calculation/Problem No: 0120-108-004

Title: NFPA 13 - CODE COMPLIANCE VERIFICATION CHECKLIST

Client: AEP **Project:** CODE COMPLIANCE REVIEW

Job No: 0120-108-1375

Design Input/References: REFERENCES FOR 1971 EDITION ON PAGES 3-8. REFERENCES FOR 1983 EDITION ON PAGES A2 – A7

Assumptions: SEE PI-FP-01, REVISION 1 CONDUCTING AND DOCUMENTING NFPA CODE COMPLIANCE REVIEWS. SEE IMPELL REPORT 09-0120-0123 CODE COMPLIANCE SUMMARY REPORT. SEE SECTION 2.0.

Method: SEE PI-FP-01, REVISION 1. SEE SECTION 3.0.

Remarks: PAGE 9 IDENTIFIES THE AREAS/ZONES EVALUATED UNDER THE REQUIREMENTS OF THE 1971 EDITION. PAGE A8 IDENTIFIES THE AREAS/ZONES EVALUATED UNDER THE REQUIREMENTS OF THE 1983 EDITION.

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	David E. Wigg	5/14/92

EDS 8008 5/78

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

For the purpose of this report, it is assumed that under most conditions the authority having jurisdiction was the architect/engineer (A/E) for the plant who is American Electric Power Service Corporation (AEPSC) unless other wise incicated.

3.0 METHODOLOGY

3.1 Reference Section 2.1.1 of Impell Project Instruction PI-FP-01, Revision 1.

3.2 An item identified in the Code Compliance Verification Checklist which "Does Not Comply" or is shown as an "Open Item" is further discussed in the Code Compliance Summary Report, Impell Report Number 09-0120-0123.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

5.0 REFERENCES

References

Ref No.	Document Number	Title	Rev. No.	Date
		Walkdown Verification Checklists		
1	0120-108-004D	Impell Calculation, NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Pre-Action/High Roof Area, Zone 32)	0	11/17/87
2	0120-108-004E	Impell Calculation, NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Pre-Action/Drumming Area, Zone 3)	0	11/17/87
3	0120-108-004F	Impell Calculation, NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Wet Pipe/C.R. Cable Vault, Zone 58)	0	11/17/87
		Procedures		
1	PO-050-508	Fire Protection-Water Preoperational Test Procedure	0	07/03/74
2	12 MHP 4030.STP.020	Inspection of the Fire Protection System Deluge and Preaction Spray Headers in the Auxiliary Building	3	03/06/86
3	12 THP 4030.STP.223	Fire Protection Water System Test	6	09/11/87
4	12 OHP 4030.STP.120	Fire Protection System - Water and Carbon Dioxide	11	01/30/87
		Technical Data		
1		Letter From: R.J. Daley To: R.W. Jurgensen Instruction Book, "Grinnel and Star Fire Systems Equipment"		07/15/74
2	SD-DCC-FP101	System Description, Fire Protection System-Water	2	Draft
3		Specification for Fire Protection Systems of D.C. Cook Nuclear Plant	0	04/02/71

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
4	DCCPM104QCS	Piping Specification	4	11/09/72
5	DCCPM102QCS	Shop and Field Fabrication and Erection	4	05/24/73
6	RFC DC-01-2680	Appendix R Sprinkler System Modification Packet	0	09/17/85
7		Instruction Manual for Appendix "R" Sprinkler Additions - RFC's 01-2680 and 02-2695 (Phoenix Contractors)		
8	DCCFP109QCS	Fabrication and Installation of App. R Sprinkler Systems, Specification for RFC's DC-02-2695 and DC-01-2680 PSI (Power Systems Inc.)	0	02/10/84
9	RFC #02-2695 RFCDL REF #52	Hydraulic Calculations (Phoenix Contractors)		08/--/84
10	DCCFP108QCS	Design of App. R Sprinkler Systems, Specification for RFC's DC-02-2695 and DC-01-2680 (Phoenix Contractors)	2	02/10/84
11	0120-108-007	Impell Calculation, NFPA 72D Code Compliance Verification Checklist	0	05/16/88
12	0120-108-008	Impell Calculation, NFPA 72E Code Compliance Verification Checklist	0	05/16/88
13		Telecopy from Al Hall to D. Hoover		12/14/87
14		AMI's Recommendations for Carbon Filters		09/--/77
15	ROC from D. Kipley to B. Gerwe	Ambient Conditions of Plant		12/03/87
16		Hydraulic Calculation for "The Hydrogen Bulk Storage Tanks" (Grinnell)	1	12/18/71

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
17	RFC #12-2231 RFCDL REF #53	Hydraulic Calculations (Phoenix Contractors)		04/26/79
18	0120-108-004	Impell Calculation, NFPA 13 Code Compliance Verification Checklist	0	04/25/88
19	DCC-FP-103	Fire Protection Systems - Miscellaneous	3	08/26/87
		Licensing Documents		
1	DRP No. 74	Donald C. Cook, FHA Docket No. 50-316	1	01/30/87
		Drawings		
1	Hodgman DHG 127-1	Control Room Cable Vault Sprinkler Piping Planview	2	06/18/75
2	DHG 46-032-71M-18	High Roof Area Sprinkler Piping Planview (Grinnell)	5	03/03/72
3	DHG 46-032-71M-16	Drumming Area Sprinkler Piping Planview (Grinnell)	5	02/28/72
4	DHG 12-5152N-2	Flow Diagram Fire Protection - Water System Details - Yard Piping	2	07/01/87
5	DHG 12-5152L-2	Flow Diagram Fire Protection - Water System Details - Turbine Bldg.	2	02/25/87
6	DHG 12-5152A-1	Flow Diagram Fire Protection - Water Piping at Pumps	1	01/22/87
7	DHG HB-1181	Filter Unit Fire Hose Connection RFC-12-2463, 2465	A	08/20/81
8	DHG 46-032-71M-17	"Hydrogen Storage Tanks and Valve Header for High Roof, Drumming Area, and Outside Tanks" (Grinnell)	4	12/17/71

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
9	DHG DC 1 & 2-MFP-PHX-FILE-015000	DHG DC 1 & 2-MFP-PHX-FILE-015000 Contractor's Access Sprinkler Drawing from RFC-12-1437	2	12/07/81
10	DHG DC-2-MFP-RD22695-009-002 (AEPSC No.)	Elev. 633'-0 Aux. Bldg. East Piping Corridor (Phoenix DHG)	7	06/19/84
11	DHG DC-2-MFP-RD22695-010-002 (AEPSC No.)	Elev. 633'-0 Aux. Bldg. North Piping Corridor (Phoenix DHG)	8	06/19/84
12	DHG DC-2-MFP-RD22695-008-001 (AEPSC No.)	Elev. 633'-0 Aux. Bldg. South Piping Corridor (Phoenix DHG)	8	06/11/84
13	DHG DC-2-MFP-RD22695-025-000 (AEPSC No.)	Inspectors Test Detail Elev. 633'-0 Aux. Bldg. N. Corridor (Phoenix DHG)	2	06/13/84
14	DHG DC-2-MFP-RD22695-017-001 (AEPSC No.)	Details & Sections Elev. 633'-0 Bldg N. Corridor (Phoenix DHG)	2	06/14/84
15	DHG DC-2-MFP-RD22695-007-001 (AEPSC No.)	Elev. 633'-0 Turbine Bldg. Supply Piping Details (Phoenix DHG)	2	06/04/84
16	DHG DC-2-MFP-RD22695-023-001 (AEPSC No.)	Elev.. 620'-6 Aux. Bldg. HVAC Room Unit #1 (Phoenix DHG)	2	06/13/84
17	DHG DC-2-MFP-RD22695-022-002 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. - Fire Protection Piping	8	07/02/86
18	DHG DC-2-MFP-RD22695-022-001 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. - Fire Protection Piping (Phoenix DHG)	6	06/19/84
19	DHG DC-2-MFP-RD22695-024-001 (AEPSC No.)	RFC-02-2695 Elevation 609 Turbine Bldg. Riser Diagram (Phoenix DHG)	3	06/15/84
20	DHG DC-2-MFP-RD22695-020-001 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. Section Views (Phoenix DHG)	6	06/19/84
21	DHG DC-2-MFP-RD22695-006-002 (AEPSC No.)	Elev. 609'-0 Turbine Bldg. Supply Piping Details (Phoenix DHG)	4	06/05/84
22	DHG DC-1 & 2-MFP-RFC-RFC-2621-001-001 (AEPSC No.)	As-Built for Aux. Bldg. 587' & 609'	2	-----

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
23	DHG DC-2-MFP-RD22695-021-002 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. East/West Piping Corridors (Phoenix DHG)	3	07/02/86
24	DHG DC-2-MFP-RD22695-019-001 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. - CCW Fire Protection - Sidewall Sprinklers (Phoenix DHG)	7	06/19/84
25	DHG DC-2-MFP-RD22695-005-004 (AEPSC No.)	Units 1 & 2 Aux. Feed Pump Corridor Sprinkler System (Phoenix DHG)	6	06/13/84
26	DHG DC-2-MFP-RD22695-004-004 (AEPSC No.)	Unit 2 Emerg. DG Pump/Corridor Sprinkler System (Phoenix DHG)	6	06/13/84
27	DHG DC-2-MFP-RD22695-003-004 (AEPSC No.)	South Stair of Aux. Bldg. Elev. 587'-0 Sprinkler Water Curtain (Phoenix DHG)	4	05/14/84
28	DHG DC-2-MFP-RD22695-016-003 (AEPSC No.)	RFC-02-2695 Elev. 587'-Inspection Test Conn. (Phoenix DHG)	4	06/13/84
29	DHG DC-2-MFP-RD22695-002-004 (AEPSC No.)	North Stair of Aux. Bldg. Elev. 587'-0 Sprinkler Water Curtain (Phoenix DHG)	6	06/10/84
30	DHG DC-1 & 2-MFP-RFC-2621-002-001 (AEPSC No.)	As-Builts for Aux. Bldg. 587' & 609' (Phoenix DHG)	3	-----
31	DHG DC-1 & 2-MFP-RFC-2621-003-001 (AEPSC No.)	As-Builts for Aux. Bldg. 587' & 609' (Phoenix DHG)	2	-----
32	DHG DC-1 & 2-MFP-RFC-2621-004-001 (AEPSC No.)	As-Builts for Aux. Bldg. 587' & 609' (Phoenix DHG)	2	-----
33	DHG DC-1 & 2-MFP-RFC-2621-005-001 (AEPSC No.)	As-Builts fo Aux. Bldg. 537' & 609' (Phoenix DHG)	4	06/01/84
34	DHG DC-2-MFP-RD22695-001-004 (AEPSC No.)	East Stair of Aux. Bldg. Elev. 573'-0 & 587'-0 Sprinkler Water Curtain (Phoenix DHG)	6	06/13/84

References
(Continued)

Ref No.	Document Number	Title	Rev. No.	Date
35	DWG 2-5152K-1	Flow Diagram, Fire Protection - Water System Details - Turbine Bldg. & Screen House	1	02/25/87
36	DWG 12-5152E-2	Flow Diagram, Fire Protection - Water Charcoal Filters	2	07/07/87
37	DWG 12-5401-7	Aux. Bldg. Fire Protection Piping to Charcoal Filters	6	01/22/86
38	DWG 12-5401A-6	Aux. Bldg. Fire Protection Piping to Charcoal Filters	5	01/10/78
39	DWG 1-5152J	Flow Diagram, Fire Protection - Water System Details - Turbine Bldg. & Screen House	0	10/06/86
40	DWG 46-032-71M-15	Grinnell Sprinkler Drawing for Unit 1 Auxiliary Feed Pump Room	0	09/24/71
41	DWG Phoenix T-591-M	Unit 1 Emergency DG Ramp	0	03/08/84
42	Hodgman DWG 121-15	Unit 2 AFW Pump Initial Installation DWG	1	05/01/75
43	DWG 12-5152D	Flow Diagram, Fire Protection - Water Aux. and Containment Buildings	0	10/06/86

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IMPELL CORPORATION

NFPA 13 - Code Compliance Verification
Checklist D. C. Cook Units 1 & 2

JOB NO 0120-108-1375
CALC NO 0120-108-004

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CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1971
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)

The sprinkler systems of D.C. Cook were orignially designed under the jurisdiction of the 1971 Edition of NFPA 13. Over the course of D.C. Cook's history, modifications to the sprinkler systems were performed. The last of these modifications were completed under the jurisdiction of the 1983 Edition of NFPA 13. For the purpose of this evaluation only the original (1971) and last (1983) Editions of NFPA 13 in effect during the system design/installation phase were utilized. Systems which had no modifications following the initial design were evaluated against the requirements of the 1971 Edition. Systems which were modified following the initial design, or designed after the initial design, regardless of what year, were evaluated against the requirements of the 1983 Edition. Changes in the code editions between 1971 and 1983 were not substantial to warrant a separate evaluation for each edition. Additionally, the deviations/open items identified in the evaluation could not be fully addressed by utilizing interm code editions.

THE FOLLOWING SYSTEMS WERE EVALUATED UNDER THE REQUIREMENTS OF NFPA 13, 1971 EDITION:

SYSTEM	FIRE ZONE	AREA
PRE-ACTION	3	DRUM STORAGE AREA
PRE-ACTION	32	AUX. BLDG CRANE BAY (HIGH ROOF) AREA
WET PIPE	58	UNIT 2 CONTROL ROOM CABLE VAULT

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IMPELL CORPORATION

NFPA 13 - Code Compliance Verification
Checklist D. C. Cook Units 1 & 2

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CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1971
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 1. GENERAL INFORMATION		Title
1000	Foreward		Title
1010	Definition of a Sprinkler System		Title
1011	A sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply, such as a gravity tank, fire pump, reservoir or pressure tank and/or connection by underground piping to a city main. The portion of the sprinkler system above ground is a network of specially sized or hydraulically designed piping installed in a building, structure or area, generally overhead, and to which sprinklers are connected in a systematic pattern. The system includes a controlling valve and a device for actuating an alarm when the system is in operation. The system is usually activated by heat from a fire and discharges water over the fire area. NOTE: The design and installation of water supply facilities such as gravity tanks, fire pumps, reservoirs or pressure tanks, and underground piping are covered by NFPA Standards No. 22, Water Tanks For Private Fire Protection; No. 20, Installation of Centrifugal Fire Pumps and No. 24, Outside Protection.		Information Only
1020	Scope		Title
1021	This Standard is in general the minimum for the installation of sprinkler systems for fire protection in buildings housing one or		Information Only

CODE COMPLIANCE VERIFICATION CHECKLIST
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STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	more of the following or similar Light, Ordinary or Extra Hazard Occupancies, except where additional rules are amendatory to this standard for Extra Hazard Occupancies as covered by separate standards.		
1030	Other Pamphlets		Title
1031	Separately published standards referred to herein deal with fire pumps, tanks, and various other related features. A selected list of other publications related to the installation of sprinkler systems is published at the end of this Standard.		Information Only
1040	Maintenance		Title
1041	A sprinkler system installed under this Standard must be properly maintained for efficient service. The owner is responsible for the condition of his sprinkler and must use due diligence in keeping the system in good operating condition.	W, D	Comply: For the drumming area and the high roof area maintenance procedures are provided. Ref: Walkdown Checklist No. 1 & 2; Procedure No. 1-4.
		W, D	Does Not Comply: Procedures do not include a test checklist for the control room cable vault. Note: The fire hazards analysis (Rev. 1) does not rely upon the wet pipe sprinkler system for controlling fires in the control room cable vault. Although the sprinkler system is still functional, any deviations from the code does not impact the safety features of the area since both Halon and CO_2 systems are also provided.
1042	The installing contractor shall provide the owner with:	D	Comply: Documents are provided for drumming area and the high roof area. Ref: Technical Data No. 1.
	(a) Instruction charts describing operation and proper maintenance of sprinkler devices.	D	Does Not Comply: For the control room

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	(b) Published pamphlet on Care Maintenance of Sprinkler Systems. (NFPA No. 13A.)		cable vault documentation is not provided.
1050	Impairments		Title
1051	Before shutting off a section of the fire service system to make sprinkler system connections, notify the authority having jurisdiction, plan the work carefully, and assemble all materials to enable completion in shortest possible time. Work started on connections should be rushed to completion without interruption, and protection restored as promptly as possible. During the impairment, provide emergency hose lines; additional fire pails and extinguishers, and maintain extra watch service in the areas affected.		Information Only: This requirement discusses action to be taken while new systems are being installed. Mitigations for system impairments are controlled by plant procedures.
1052	When changes involve shutting off water from any considerable number of sprinklers for more than a few hours, temporary water supply connections should be made to sprinkler systems so that reasonable protection can be maintained. In adding to old systems or revamping them, protection should be restored each night so far as possible. The members of the private fire brigade as well as public fire department should be notified as to conditions.		Information Only: This requirement discusses action to be taken while new systems are being installed. Mitigations for system impairments are controlled by plant procedures.
1100	Preparation of Building		Title
1110	General		Title
1111	All needless ceiling sheeting, hollow siding, tops of high shelving, partitions or decks should be removed. Sheathing of paper and similar light flammable materials is particularly objectionable.		Information Only: This requirement discusses system installation during construction, and is not applicable to retrofitting since the building is no longer under construction.

CODE COMPLIANCE VERIFICATION CHECKLIST
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STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1112	Necessary "stops" to check draft, necessary new partitions, closets, decks, etc., should be put in place, or provided for so that the sprinkler equipment may conform to same.		Information Only: This requirement discusses system installation during construction, and is not applicable to retrofitting since the building is no longer under construction.
1113	Frequently, additional sprinkler equipment can be avoided by cutting down the width of decks or galleries and providing proper clearances. (See Paragraphs 4313, 4315, and 4318.) Slatting of decks and walkways as a substitute for automatic sprinklers thereunder is not acceptable. The use of cloth or paper dust tops for rooms forms obstruction to water distribution. If employed, the area below should be sprinklered.		Information Only: This requirement discusses system installation during construction, and is not applicable to retrofitting since the building is no longer under construction.
1114	Cutting holes through partitions, either solid or slatted, to allow sprinklers on one side thereof to distribute water to the other side is not effectual.		Information Only: This requirement discusses system installation during construction, and is not applicable to retrofitting since the building is no longer under construction.
1115	Where wood cornices on masonry buildings face an exposure they should be replaced with a parapet, or the projecting woodwork should be cut away and metal flashing extended to cover the exposed edge of planking, or suitable sprinkler protection should be provided.		Information Only: This requirement discusses system installation during construction. It may not be applicable to retrofitting since the building is no longer under construction.
1120	Separation of Sprinklered and Nonsprinklered Areas		Title
1121	The installation of sprinklers throughout premises is necessary for the protection of life and property, however, when buildings or portions of buildings are of combustible construction or contain combustible material, standard cutoff shall be provided to separate the areas which are sprinkler protected from adjoining unsprinklered areas. All openings		Information Only: Fire area boundaries and areas requiring sprinkler protection are determined by requirements enforced by the USNRC, i.e. BTP 9.5-1 Appendix A and 10CFR50 Appendix R, etc. The plant has been/will be reviewed by the USNRC for areas of sprinkler coverage.

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IMPELL CORPORATION

NFPA 13 - Code Compliance Verification
Checklist D. C. Cook Units 1 & 2

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STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	shall be protected in accordance with applicable standards and no sprinkler piping should be placed in an unsprinklered area unless the area is permitted to be unsprinklered by this Sprinkler Standard.		Additionally, the sprinkler coverage is addressed in the FSSA, FHA, evaluations, etc.
1130	Vertical and Horizontal Drafts		Title
1131	Floor or wall openings tending to create vertical or horizontal drafts, or other structural conditions that would delay the prompt operation of automatic sprinklers by preventing the banking up of the heated air from the fire, should be properly "stopped" in order to permit control of fire at any point by local sprinklers.		Information Only: The area boundaries are under the jurisdiction of criteria reviewed by the USNRC, i.e. BTP 9.5-1 Appendix A and 10CFR50 Appendix R. Non-rated features are addressed in other documents such as engineering evaluation, FHA, etc.
1132	Where moving stairways, large monumental staircases, or similar floor openings are unenclosed, the floor openings involved shall be protected by draft stops in combination with close spaced sprinklers. The draft stops should be located immediately adjacent to the opening, should be 18 inches deep and should be substantially noncombustible material. Sprinklers spaced not more than 6 feet apart, should be placed 6 inches to 12 inches from the draft stop on the side away from the opening to form a water curtain. Sprinklers in this water curtain should be hydraulically designed to provide a discharge of 3 gallons per minute per lineal foot of water curtain, measured horizontally around the opening, with no sprinkler discharging less than 15 gpm. Normal 1/2 inch orifice closed head systems using sprinklers of Ordinary Temperature Classification are adequate for this purpose. Where sprinklers are closer than 6 feet, cross baffles should be provided per Paragraph 4329. Where sprinklers in the normal ceiling pattern are closer than 6 feet from the water curtain, it may be preferable to locate the water curtain sprinklers in recessed baffle pockets.		Information Only: The area boundaries are under the jurisdiction of criteria reviewed by the USNRC, i.e. BTP 9.5-1 Appendix A and 10CFR50 Appendix R. Non-rated features are addressed in other documents such as engineering evaluations, FHA, etc.

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	NOTE: In totally sprinkler protected buildings containing light or ordinary hazard occupancy this method provides some degree of safeguard against the passage of fire through floor openings. It is not, however, equivalent to a proper enclosure. (See also NFPA No. 101 Life Safety Code for requirements for means of egress.)		
1133	Where required by the authority having jurisdiction in buildings of large single area, substantial curtains preferably of noncombustible material extending down 24 inches or more below the ceiling shall be provided to separate sprinkler systems or subdivide areas. (See Fig. 1133.) (See guide for Smoke and Heat Venting, NFPA No. 204.)		Information Only: Although walkdowns show that all areas are adequately separated by bays formed by beam construction, there are no documents (from the authority having jurisdiction) requiring the application of this code section.
1140	Floors		Title
1141	Flooring should preferably be made tight and waterproof.	D	Open Item: Documentation could not be found which would verify that the floors have been waterproofed. Flooding criteria, which discusses the impact of water on safety related systems, is presented in a NRC IE Information Notice 83-41 study.
1142	Some of the more common defects, assuming that the floor itself is tight, are cracks at side walls, openings around pipes or conduits, and small unprotected openings cut through floor for various purposes. These can be made tight by flashing, metal plates, etc.. Such small openings that cannot be completely stopped off may be curbed to prevent water running through.		Information Only: See response to code section 1141.
1143	Waterproofing of floors is highly desirable, especially if goods or machinery are of considerable value and susceptible to water		Information Only: See response to code section 1141.

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	damage. There are various methods of making floors reasonably watertight, depending on the type of construction.		
1144	Scuppers or floor drains are also desirable in many types of buildings or occupancies. It is of importance to get any water off of floors as soon as possible after fire is extinguished and scuppers will facilitate doing this.		Information Only: See response to code section 1141.
1145	The recommendation that floors should be made tight is important; first, to prevent easy spread of fire from one floor to another, and second, to prevent water from sprinklers or hose streams from running through floors and damaging property on floors below.		Information Only: See response to code section 1141.
1150	Accessory Construction		Title
1151	Sprinkler equipments may require: Dry-pipe valve enclosures (see Section 5258); boxing to prevent freezing of tank risers, etc. (see Figure 3111); ladders; protection of yard hydrants, sprinkler risers and post indicators against mechanical damage, etc.. This work should be promptly attended to if not let with the sprinkler contract.	W	Not Applicable: Walkdowns verified that all valves are readily accessible and not in an area subject to damage or freezing. Ref: Walkdown Checklist No. 1 - 3.
1160	Protection Against Exposure		Title
1161	Exposure protection should be provided wherever conditions are such that a sprinklered building is exposed to fire from without. (See Chapter 5, Outside Sprinklers for Protection Against Exposure Fires.)	W	Not Applicable: There is no protection of the type described in this requirement for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
1200	Classification of Sprinkler Systems		Title
1201	This Standard covers automatic sprinkler systems of the types described below, also systems of outside sprinklers for protection against exposure fires covered specifically		Information Only

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	in Chapter 6. Manually operated deluge systems, used for certain special hazard conditions, are not specifically covered in this Standard but certain provisions of this Standard will be found applicable. The types of automatic sprinkler systems are listed in Sections 1210-1271, inclusive.		
1210	Wet-Pipe Systems (See Section 5100.)		Information Only: See the referenced code sections.
1220	Dry-pipe Systems (See Section 5200.)		Information Only: There are no dry-pipe systems for protection of safety related areas.
1230	Pre-Action Systems (See Section 5300.)		Information Only: See the referenced code sections.
1240	Deluge Systems (See Section 5300.)		Information Only: See the referenced code sections.
1250	Combined Dry-pipe and Pre-Action Systems (See Section 5400.)		Information Only: There are no combined systems for protection of safety related areas.
1260	Limited Water Supply Systems (See Section 5600.)		Information Only: It is assumed that the water supply for systems protecting safety related areas is not limited.
1270	Sprinkler Systems:- Special Types		Title
1271	Sprinkler systems employing limited water supplies, reduced pipe sizes and other departures from the requirements for standard systems contemplated by these rules shall not be classified as standard sprinkler systems. Systems of this type may include those pressurized with air or nitrogen. The authority having jurisdiction may recognize the degree of protection afforded by special types of sprinkler systems.	W	Not Applicable: There are no systems of this type installed for safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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1300	Classification of Occupancies		Title
1310	Light Hazard Occupancies		Title
1311	Light Hazard Occupancies include buildings housing occupancies as listed in this portion of the Code.		Information Only
1312	The rules for installation of sprinkler systems in Light Hazard Occupancies shall apply to all portions of the occupancies listed above or similar light hazard occupancies, except that in certain sections of the above occupancies such as attics, basements, kitchens, laundries, storage areas, and work rooms, ordinary hazard spacing with light hazard pipe sizing and water supplies shall be required. Finished rooms that may be located in attics or basements such as living quarters, bars, lounges, etc. may be treated as Light Hazard Occupancy.	D	Not Applicable: The drawings show that the areas in question were sized according to an extra hazard occupancy pipe schedule. See response to code section 1332. Ref: Drawing No. 1-3.
1313	The rules for installation of sprinkler systems in Light Hazard Occupancies may also apply in small stores and similar occupancies incidental to the properties listed above, provided such occupancies do not individually exceed 3,000 square feet in floor area in any one store in any floor and provided floor openings are properly protected.		Information Only
1314	It is important that sprinkler systems designed for Light Hazard Occupancies shall not be installed in any building, the occupancy of which is likely to be changed subsequently to a classification not so listed.	D	Not Applicable: See response to code section 1312.
1320	Ordinary Hazard Occupancies		Title
1321	Ordinary Hazard Occupancies include buildings housing occupancies such as listed in this portion of the Standard.		Information Only

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1322	Where hazards in those buildings or portions of buildings of the above occupancies are severe, the authority having jurisdiction shall be consulted for special rulings regarding water supplies, types of equipment, pipe sizes, types of sprinklers and sprinkler spacing.	D	Not Applicable: See response to code section 1312.
1330	Extra Hazard Occupancies		Title
1331	Extra Hazard Occupancies include only those buildings or portions of buildings housing occupancies where the hazard is severe as determined by the authority having jurisdiction. These include occupancies such as listed in this portion of the Study.		Information Only
1332	Where severe hazards are not otherwise adequately protected, the authority having jurisdiction should be consulted for special rulings regarding water supplies, types of equipment, supplementary systems if required, pipe sizes, types of sprinklers, and sprinkler spacing.		Information Only: The systems evaluated per this code have been accepted by the authority having jurisdiction, except for the C.R. Cable Vault for which there are no documents. Note: The fire hazards analysis (Rev. 1) does not rely upon the wet pipe sprinkler system for controlling fires in the control room cable vault. Although the sprinkler system is still functional, any deviations from the code does not impact the safety features of the area since both Halon and CO_2 systems are also provided.
1400	Design and Installation		Title
1410	Devices and Materials		Title
1411	The authority having jurisdiction should be consulted as to approved devices and materials.		Information Only
1412	Normally, only new materials and devices shall be employed in the installation of sprinkler systems. Second-hand sprinklers shall not be	D	Open Item: No documentation provided for verification of this code section.

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	used. When special conditions warrant, listed devices such as alarm valves, retarding chambers, circuit closers, water motor devices, dry pipe valves, and quick opening devices, etc., may be re-used, but if re-used they shall be reconditioned by the original manufacturer. On request of the authority having jurisdiction, the original manufacturer shall furnish a certificate, stating that such specified devices have been reconditioned and tested and are considered satisfactory for re-use.		
1413	For the installation of fire pumps, gravity and pressure tanks, valves and other related devices, see separately published Standards or Publications listed in Appendix F of this Sprinkler Standard.		Information Only
1420	Workmanship		Title
1421	Sprinkler system layout and installation should be entrusted to none but fully experienced and responsible parties. sprinkler system installation is a trade in itself. Inspectors cannot be expected to act as working superintendents or correct errors.		Information Only
1430	Preliminary Plans		Title
1431	Before an equipment is installed or remodeled, in order to avoid error or subsequent misunderstanding, preliminary layouts shall be submitted for approval to the authority having jurisdiction. Any material deviation from approved plans will require special permission. Preliminary layouts should show items listed in this section of the Standard.	D	Comply: Specifications require approval (of data sheets and field drawings) by owner and N.E.P.I.A. Ref: Technical Data No. 3 Section 1:04.
1440	Working Plans		Title
1441	Before an equipment is installed or remodeled, complete working plans shall be submitted for	D	Comply: See response to code section 1431.

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	approval to the authority having jurisdiction. Any material deviation from approved plans will require special permission.		
1442	Submission of working plans for approval before starting installation will avoid subsequent expensive changes, and give owners and contractors the benefit of the latest fire protection engineering experience.		Information Only
1443	Working plan should be drawn to an indicated scale, on sheets of uniform size, with plan of each floor, made so that they can easily be duplicated, and show the following data as listed in this section of the Standard.	D	Comply: The drawing shows all required information applicable to each system. Ref: Drawing No. 1-3.
1450	Standard Plan Symbols		Title
1451	The Standard Plan Symbols are as follows. (See this section of the Standard.)		Information Only
1460	Sprinkler Systems in Buildings Subject to Flood		Title
1461	Where sprinklers are installed in buildings subject to recurring floods, special attention shall be given (1) to the arrangement of piping and location of valves so that valves will be accessible during high water, (2) to the location of alarm devices and equipment so as to keep as much of the equipment as possible operable during high water, and (3) to the location and protection of pumps and air compressors and their power supply so as to provide every reasonable safeguard against interruption.	W	Not Applicable: Areas are not subject to flooding. Ref: Walkdown Checklist No. 1 - 3.
1500	Approval of Sprinkler Systems		Title
1510	Request for Inspection		Title
1511	Before asking final approval of an automatic sprinkler equipment by the authority having	D	Open Item: Documentation not provided for review.

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	jurisdiction the installation company should furnish a written statement to the effect that the work covered by its contract has been completed and tested in accordance with the approved specifications and plans. (See Section 1700.)(Sic)		
1600	Acceptance Tests		Title
1610	Conduct of Tests		Title
1611	All tests should be made by contractor in presence of inspector of the authority having jurisdiction. When inspector is not available and permission is granted by the authority having jurisdiction, tests may be witnessed by owner or his representative and test certificate signed by same.	D	Open Item: Although the specifications require the presence of N.E.P.I.A. during all tests for approval, final test certificates are not provided for review. Ref: Technical Data No. 3 Section 1:03.
1620	Flushing of Underground Connections		Title
	Underground mains and lead-in connections to system risers shall be flushed thoroughly before connection is made to sprinkler piping in order to remove foreign materials which may have entered the underground during the course of the installation. Underground mains supplying wet pipe, dry pipe or pre-action sprinkler systems should be flushed at a rate of flow of not less than 750 gallons per minute for 6-inch pipe, 1,000 gallons per minute for 8-inch pipe, 1,500 gallons per minute for 10-inch pipe and 2,000 gallons per minute for 12-inch pipe. The minimum rate of flow for flushing underground connections to open sprinkler, deluge, and hydraulically designed systems should not be less than the water demand rate of the system which is determined by system design. For all systems, the flushing operations should be continued for a sufficient time to insure thorough cleaning. When planning the	D	Does Not Comply: The installation specifications do not require the lead-in connections to be flushed. However, precautions are to be taken to keep piping clean from internal dirt and debris. Ref: Technical Data No. 3 Section 1:07.3. Also, strainers are provided at the pumps, and flushing connections provided at all automatic valve manifolds.

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	flushing operations, consideration shall be given to disposal of the water issuing from the test outlets. If the water supply will not produce the stipulated flow rate, the maximum flow rate available should be obtained by employing adequate discharge means.		
1630	Hydrostatic Tests		Title
1631	Test Pressure. All new systems including yard piping shall be tested hydrostatically at not less than 200 pounds per square inch pressure for two hours, or at 50 pounds per square inch in excess of the maximum static pressure when the maximum static pressure is in excess of 150 pounds.	D	Open Item: The Piping specifications require hydrostatic testing of 1 1/2 times the design pressure, however test certificates are not provided for review. Ref: Technical Data No. 5 Section 3.4.3.
1632	Permissible Leakage. The inside sprinkler piping should be installed in such a manner that there will be no visible leakage when the system is subjected to the hydrostatic pressure test. Refer to Outside Protection Standard (NFPA No. 24) for permissible leakage in underground mains and lead-ins. The amount of leakage may be measured by pumping from a calibrated container.	W, D	Open Item: Piping specifications require repair of any leaks during hydrostatic tests, however test certificates are not provided for review. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 5 Section 3.4.1.
1633	Fire Department Connection. Piping between the check valve in the fire department inlet pipe and the outside connection should be tested the same as the balance of the system.	W	Not Applicable: The components discussed in this requirement are not installed at the plant in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
1634	Corrosive Chemicals. Brine or other corrosive chemicals shall not be used for testing systems.	D	Not Applicable: The lake water used is free of the pollutants described in this requirement but the test procedures do not specify the water quality. Ref: Procedure No. 1-3.

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1635	To prevent the possibility of serious water damage in case of a break, pressure should be maintained by a small pump, the main controlling gate meanwhile being kept shut.	D	Comply: Pressure is maintained by the 50 gpm pressure pegging pump. Ref: Technical Data No. 2 Section 3.4.3.
1636	Test Gasket. In testing extensions to old systems a special type of self-indicating blank shall be used whenever a blank gasket has to be used for testing purposes. This testing blank shall have lugs painted red protruding beyond the flange in such a way as to clearly indicate its presence. Sprinkler installing companies shall have all blank gaskets numbered so as to keep track of their use and assure their return after the work is completed.	D	Not Applicable: The systems reviewed under this code evaluation are original installations and are on independent risers. Ref: Drawing No. 1-3.
640	Tests of Dry-pipe Systems		Title
1641	Hydrostatic Test. New dry-pipe systems shall be tested hydrostatically as specified in Paragraph 1631, except that at seasons of the year which will not permit testing with water they shall be tested for two hours with at least 50 lbs. per sq. in. air pressure. The clapper of a differential-type dry-pipe valve shall be held off its seat during any test at a pressure in excess of 50 lbs. per sq. in., to prevent injuring the valve.	W	Not Applicable: There are no dry pipe systems (the type discussed in Sections 1640 thru 1643) installed for protection of safety related areas. Ref: Walkdown Checklist No. 1 - 3.
1642	Air Test. In dry-pipe systems, an air pressure of 40 lbs. per sq. in. shall be pumped up, allowed to stand 24 hours, and all leaks which allow a loss of pressure of over 1-1/2 pounds for the 24 hours shall be stopped.	W	Not Applicable: See response to code section 1641.
1643	Operating Test of Dry-pipe Valve. A working test of the dry-pipe valve and quick opening device, if installed, should be made before acceptance.	W	Not Applicable: See response to code section 1641.

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1650	Tests of Drainage Facilities		Title
1651	Tests of drainage facilities shall be made by opening the main drain valve while the control valve is wide open.	D	Comply: Procedures for tests of drainage are available for the drumming and high roof areas, but not for the C.R. Cable Vault. However, walkdowns show that drain valves are provided for the C.R. Cable Vault. Ref: Procedure No. 4.
1700	Contractor's Material and Test Certificate Sprinkler Systems - Water Spray Systems (Certificates and requirements appear on pages 24 - 29 of the code.)	D	Open Item: Documentation not provided for review.

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	CHAPTER 2. WATER SUPPLIES		Title
2000	General Provisions		Title
2010	Number and Type		Title
2011	Every automatic sprinkler system shall have at least one automatic water supply of adequate pressure, capacity and reliability. The necessity for a second supply will depend on various factors such as those mentioned below.	D	Comply: There are 5 fire pumps available for the sprinkler systems. Ref: Technical Data No. 2 Section 1.2.
2012	The authority having jurisdiction shall be consulted in every case as to the water supplies which will be required. The water supply needed for various occupancies, including extra hazard occupancies, must be determined by a study of the conditions obtaining in each case, giving primary consideration to the number of sprinklers which may be expected to operate from any one fire plus quantities needed simultaneously for hose streams.	D	Comply: The water supply source is Lake Michigan. Ref: Technical Data No. 2 Section 1.2.
2013	Determination of the water supply needed for extra hazard occupancies will require special consideration of the four factors: (1) Number of sprinklers that may operate, (2) amount or rate of discharge, (3) required time of sprinkler discharge, and (4) amount of water needed simultaneously for hose streams.		Information Only: See response to code section 2012.
2014	Where the occupancy presents a possibility of intense fires requiring extra heavy discharge, this may be obtained by an increase in the pressure and volume of the water supply, by the use of large orifice sprinklers, by a closer spacing of sprinklers, by the use of larger pipe sizing, or by a combination of these methods. In such cases, consideration should be given to hydraulically designed systems. See Chapter 7.	D	Not Applicable: See response to code section 1312 and 1332. Ref: Drawing No. 1-3.

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2015	Where separately published standards on various subjects contain specific provisions for water supplies, these should be consulted. (See Appendix for availability of Standards.)		Information Only
2016	See Chapter 7 for special provisions applicable to determination of water supply requirements for hydraulically designed systems.	D	Not Applicable: See response to code section 1312. Ref: Drawing No. 1-3.
2100	Guide to Water Supply Requirements for Sprinkler Systems		Title
2110	Guide Table		Title
2111	Guide Table 2111 is given as a general guide to determine the volume of water and pressure normally required, subject to approval of the authority having jurisdiction. THE TABLE IS TO BE USED ONLY WITH EXPERIENCED JUDGMENT, and the requirements for hose streams are to be added to the quantities given.		Information Only
2120	Important Factors to Consider in Applying the Guide to Water Supply Requirements for Sprinkler Systems and Determination of Occupancy Classification	Title	
2121	The water supply requirement for sprinkler protection is determined by the number of sprinklers expected to operate in event of fire. The primary factors affecting the number of sprinklers which might open are: (1) occupancy, (2) combustibility of contents, (3) areas shielded from proper distribution of water, (4) height of stock piles, (5) type of ceiling obstruction, (6) ceiling heights, (7) unprotected vertical openings, (8) undesirable draft conditions and (9) size of undivided areas.		Information Only

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2122	Where unfavorable features are prominently present, the water supply requirements should be increased.		Information Only
2123	In the following tables the occupancy referred to is the occupancy of the individual building being protected. (Refer to Standard Section 2124, 2125, 2126, 2127, and 2128.)		Information Only
2129	Where severe hazards are not otherwise adequately protected, the authority having jurisdiction should be consulted for special rulings regarding water supplies, type of equipment, supplementary systems if required, pipe sizes, types of sprinklers, and sprinkler spacing.	W	Not Applicable: Walkdowns showed that there are no severe hazards present. Ref: Walkdown Checklist No. 1 - 3.
2200	Connections to Water Works Systems		Title
2210	Acceptability		Title
2211	A connection from a reliable water works system, of adequate capacity and pressure, is preferable as a single or a primary supply.	D	Not Applicable: See response to code sections 2011 and 2012. Ref: Technical Data No. 2.
2212	Size of Mains. Connections should be made to street mains of ample size. Street mains preferably should be not smaller than 6 inches. Connections to dead end mains should be avoided.	D	Not Applicable: There are no connections to street mains. See response to code section 2012. Ref: Technical Data No. 2.
2213	Pressure Regulating Valves. Pressure regulating valves should not be used except by special permission of the authority having jurisdiction.	D	Comply: There are no pressure regulating valves. Ref: Drawing No. 1-3.
2214	Meters. Where meters are used they shall be of approved type.	W	Not Applicable: There are no meters used. Ref: Walkdown Checklist No. 1 - 3.

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2220	Testing of Water Supply		Title
2221	To determine the value of public water as a supply for automatic sprinkler systems, it is generally necessary to make a flow test to determine how much water can be discharged at a residual pressure at grade sufficient to give the required residual pressure under the roof (with the volume flow hydraulically translated to the base of the riser) — i.e., a pressure head represented by the height of the building plus the required residual pressure.		Information Only
2222	The proper method of making such test is to use two hydrants in the vicinity of the property. The static pressure should be measured on the hydrant in front of or nearest to the property and the water allowed to flow from the hydrant next nearest the property; preferably the one farthest from the source of supply if main is fed only one way. The residual pressure will be that indicated at the hydrant where water is not flowing.		Information Only
2223	Referring to Fig. 2223, the method of conducting the flow tests is as follows: (1) Attach gauge to hydrant (A) and obtain static pressure. (2) Either attach second gauge to hydrant (B) or use pilot tube at outlet. Have hydrant (B) opened wide and read pressure at both hydrants. (3) Use the pressure at (B) to compute the gallon flowing and read the gauge on (A) to determine the residual pressure or that which will be available on the top line of sprinklers in the property.		Information Only

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JOB NO 0120-108-1375
CALC NO 0120-108-004

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2224	Water pressure in pounds for given height in feet equals height multiplied by 0.434.		Information Only
2225	In making flow tests, whether from hydrants or from nozzles attached to hose, always measure the size of the orifice. While hydrant outlets are usually 2-1/2 in., they are sometimes smaller and occasionally larger. The Underwriters' play pipe is 1-1/3 in. and 1-3/4 in. with tip removed, but occasionally nozzles will be 1 in. or 1-1/4 in. and with the tip removed the opening may be only 1-1/2 in.		Information Only
2226	The pilot tube should be held approximately one-half the diameter of the hydrant or nozzle opening away from the opening. It should be held in the center of the stream, except that in using hydrant outlets the stream should be explored to get the average pressure.		Information Only
2230	Reliability		Title
2231	In addition to flow tests, consideration should also be given to reliability of public water supply taking into account probable minimum pressure condition prevailing during such periods as at night, or during summer months when heavy draft may occur, also possibility of interruption by floods, or ice conditions in winter.	W, D	Not Applicable: D.C. Cook maintains its own private fire water supply. Public water supply is not used. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 2.
2300	Gravity Tanks		Title
2310	Acceptability		Title
2311	An elevated tank of adequate capacity and elevation makes a good primary supply, and may be acceptable as a single supply. (See NFPA No. 22, Standard for Water Tanks for Private Fire Protection.)	W	Not Applicable: The type of components discussed in this requirement are not provided for safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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2320	Capacity and Elevation		Title
2321	The size of the gravity tank should be at least large enough to supply the quantity of water required by guide Table 2111 for a period of 60 minutes for Light Hazard Occupancy, and 60 to 100 minutes for Ordinary Hazard Occupancy. The elevation of the tank and arrangement of underground supply piping should be sufficient so that the required delivery rate will be available at the base of the sprinkler riser at sufficient pressure to furnish the required residual pressure under the roof. Where fire department response is such as to ensure use of the fire department connection, or in the case of buildings of limited area, the size of the tank may be reduced by special permission of the authority having jurisdiction. Where a tank serves only as a secondary supply, capacity and elevation may be reduced by permission of the authority having jurisdiction.	W	Not Applicable: There are no components of the type discussed in this requirement installed for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
2400	Pumps		Title
2410	Acceptability		Title
2411	A fire pump installation consisting of pump, driver and suction supply, when of adequate capacity and reliability, and properly located makes a good secondary supply. An automatically controlled fire pump taking water from a water main of adequate volume, or taking draft under a head from a reliable storage of adequate capacity, may under certain conditions be accepted by the authority having jurisdiction as a single supply. (See NFPA No. 20, Centrifugal Fire Pumps.)		Information Only

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2420	Supervision		Title
2421	Where a centrifugal pump constitutes the sole sprinkler supply, it should be provided with supervisory service from an approved central station system or from an approved proprietary system or their substantial equivalent, which shall provide means for positive indication at the central office that the pump has operated normally. The above to be in addition to the supervision of power supply and other features that my be required by the authority having jurisdiction. These pumps should be operated at least monthly by the supervisory service representative, and at more frequent intervals where the authority having jurisdiction so requires..	D	Not Applicable: The fire protection water system description shows 5 fire pumps available. Ref: Technical Data No. 2 Section 1.2.
2422	See sections dealing with sprinkler equipment supervisory and water flow alarm services in the Standard for Central Station Protective Signaling Systems, Watchman, Fire Alarm and Supervisory Service (NFPA No. 71), the Standard for Local Protective Signaling Systems, (NFPA No. 72A), the Standard for Auxiliary Protective Signaling Systems (NFPA No. 72B), Remote Station Protective Signaling Systems for Fire Alarm and Supervisory Service (NFPA No. 72C), or the Standard for Proprietary Protective Signaling Systems (NFPA No. 72D). See also separately published Standard for the Installation of Centrifugal Fire Pumps (NFPA No. 20), and Outside Protection (NFPA No. 24).		Information Only
2500	Pressure Tank		Title; Not Applicable; Entire code section omitted.
2600	Fire Department Connections		Title

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	nationally recognized testing laboratory and are installed in accordance with the instructions contained in each package of the ceiling material. (a) In light hazard occupancies where spacing of sprinklers of either standard or old style is not wider than 10 by 10 feet, a minimum clearance of at least 18 inches should be provided between the sprinkler deflectors and the upper surface of the open grid ceiling. Where spacing is wider than 0 by 10 feet but not wider than 10 by 12 feet, a clearance of at least 24 inches should be provided from standard sprinklers and at least 36 inches from old-style sprinklers. (b) In ordinary hazard occupancies, open grid ceilings should be installed beneath sprinklers only where such use is approved by the authority having jurisdiction, and should be installed beneath standard sprinklers only. Where sprinkler spacing is not wider than 10 by 10 feet, a minimum clearance of at least 24 inches should be provided between the sprinkler deflectors and the upper surface of the open grid ceiling. Where spacing is wider than 10 by 10 feet, a clearance of at least 36 inches should be provided.		
4322	Translucent Ceilings. Translucent ceilings shall not be installed beneath sprinklers unless such ceilings are listed by a nationally recognized fire testing laboratory and are installed in accordance with their listing. The authority having jurisdiction should be consulted in all cases.	W	Not Applicable: These conditions do not exist in safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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4323	Vaults		Title
	(a) Fur Vaults	W	Not Applicable: These conditions do not exist in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
	(1) Sprinklers in fur storage vaults should be located centrally over the aisles between racks and should be spaced not over 5 feet apart along the aisles.		
	(2) Where sprinklers are spaced 5 feet apart along the sprinkler branch lines, pipe size may be in accordance with the following schedule: 1-inch pipe . . . . . 4 sprinklers 1-1/4 inch pipe . . . . 6 sprinklers 1/1/2 inch pipe . . . 10 sprinklers 2-inch pipe . . . . . 20 sprinklers 2-1/2 inch pipe . . . 40 sprinklers 3-inch pipe . . . . . 80 sprinklers		
	(3) Sprinklers shall be of approved old style having orifice sizes selected to provide as closely as possible but not less than 20 gallons per minutes per sprinkler, based on the water pressure available		
	(b) Safe deposit or other vaults of fire-resistive construction will not ordinarily require sprinkler protection when used for the storage of records, files and other documents, when stored in metal cabinets or on metal shelving.	W	Not Applicable: These conditions do not exist in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
4324	Machinery and Small Enclosures	W	Not Applicable: The conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
	(a) Sprinklers should be installed under stairs, inside elevator wells, in belt, cable, pipe, gear and pulley boxes, in		

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	For smaller beltways and conveyor enclosures, pipes may be run outside the enclosures and sprinklers installed in dome-shaped covers about 10 inches in diameter. Where sprinklers can be nippled into the boxing without forming an obstruction, this should be done and dome-shaped covers omitted.		
4326	Picker Trunks. Sprinklers in picker trunks should be not over 7 feet apart, except in wide trunks, requiring more than one line, where sprinklers may be spaced 8 feet apart.	W	Not Applicable: There are no systems of this type installed in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
4327	Paper Mill Machinery (a) Sprinklers should be installed under hoods over paper machines. Sprinkler piping may be run above hoods over paper machines, dry cans, and similar equipment where dripping of condensation from sprinkler piping must be avoided, and the sprinklers nippled through. The lower sprinklers under the hoods should be located just outside of the line of the cylinders or rolls. (b) Automatic sprinkler protection is needed in certain types of economizers such as used in paper mills. Where economizers are subject to freezing temperatures, special types of sprinkler protection should be provided.	W	Not Applicable: There are no systems of this type installed in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
4328	Commercial-Type Cooking Equipment and Ventilation Systems (a) In cooking areas protected by automatic sprinklers, sprinklers shall be provided to protect type cooking equipment and ventilation systems that are designed to carry away grease laden vapors unless otherwise protected. (See Standard for Vapor Removal from Commercial Cooking	W	Title Not Applicable: There are no systems of this type installed in safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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	Equipment, NFPA No. 96). Sprinklers shall be so located as to give complete coverage of cooking surfaces, within exhaust ducts, within exhaust hood plenum chamber, and under filters, if any.		
	(b) Sprinklers with temperature classifications of Intermediate, High or Extra High usually will be required as determined by use of a temperature measuring device. Sprinkler systems shall be designed so that a cooking surface fire will operate sprinklers protecting the cooking surface prior to or simultaneously with sprinklers protecting the plenum chamber and ventilation ducts. This may be accomplished by installing sprinklers in the plenum chamber and ducts at least two temperature ratings higher that those protecting the cooking surfaces and not less than 325°F or by use of thermal control valves.		
	(c) Distance between sprinklers shall not exceed 10 feet within and under exhaust hoods and in horizontal ducts. The first sprinkler in a horizontal duct shall be installed at the duct entrance.		
	(d) One standard 1/2-inch orifice pendent sprinkler with the frane parallel to the front edge of the deep fat fryer(s) shall b centered over each single or pair of fryers and should be arranged to operate at not less than 30 psi. However, a single sprinkler shall not protect more than 30 inches of deep fat fryer surface in any dimension and the provisions of 4328(d) should not be applied in the protection of individual deep fat fryers exceeding this size.		

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	Sprinklers protecting deep fat fryers shall have their deflectors located at least 1 inch below the lower edge of the hood, and not less than 2 feet nor more than 3 feet 6 inches above the deep fat fryer cooking surface.		
	(e) Other sprinklers shall be arranged so that their runoff does not fall into deep fat fryers. This may be accomplished by the use of a shield or unducted hood placed above the deep fat fryer. The shield or hood should be placed above the sprinkler protecting the deep fat fryer and so located that it will not interfere with the sprinkler discharge.		
	(f) One sprinkler shall be installed at the top of each vertical riser and an additional sprinkler shall be installed under any offset. Subject to the approval of the authority having jurisdiction, sprinklers may be omitted from a vertical riser located outside of a building provided the riser does not expose combustible material or the interior of a building and the horizontal distance between the hood outlet and the vertical riser is at least 25 feet.		
	(g) Sprinklers and piping located at the top of a vertical riser, near the extremity of an exhaust duct, or in other areas subject to freezing shall be properly protected against freezing by approved means.		

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	(h) Automatic sprinklers protecting commercial-type cooking equipment and ventilation systems should be controlled by separate, readily accessible indicating type control valves that are properly identified (see Paragraph 3491).		
	(i) Release devices shall be checked at least twice a year for proper operation. Fusible links and automatic sprinklers shall be replaced annually. Other actuating devices shall be properly cleaned.		
4329	Baffles. Baffles should be installed wherever sprinklers are less than 6 feet apart to prevent the sprinkler first opening from wetting adjoining sprinklers, thus delaying their operation. Baffles should be located midway between sprinklers and arranged to baffle the actuating elements. Baffles may be of sheet metal, about 8 inches wide and 6 inches high. When placed on branch line piping, the top of baffles should extend 2 to 3 inches above the deflectors.	W	Not Applicable: The conditions described in this section do not exist. Ref: Walkdown Checklist No. 1 - 3.
4330	Small Rooms. In small rooms such as rest rooms, toilets, closets and offices with smooth ceilings, sprinklers may be located a maximum distance of 7 ft. 6 in. from any two walls of this room providing the total area of the room divided by the number of sprinklers does not exceed the limitation of Paragraphs 4131 and 4132. The maximum area of such a room is defined as 800 sq. ft. for Light Hazard and 520 sq. ft. for Ordinary Hazard Occupancies.	W	Not Applicable: The conditions described in this section do not exist. Ref: Walkdown Checklist No. 1 - 3.
4400	Sidewall Sprinklers (See Section 3630)		Title

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4410	Distance Between the Branch Lines and Sprinklers on the Branch Lines		Title
4411	Distance Between the Branch Lines. Rooms having widths in excess of 15 feet up to 30 feet shall have sprinklers on two opposite walls with spacing as elsewhere required in Section 4400 and sprinklers regularly staggered. Contruction may necessitate additional branch lines of sprinklers in rooms over 20 feet in width. (See Fig. 4411.)	W	Not Applicable: Walkdowns show that there are no side wall sprinklers. Ref: Walkdown Checklist No. 1 - 3.
4412	Distance Between the Sprinklers on the Branch Lines. Sidewall sprinklers should be located not more than 10 feet apart on walls for ordinary hazard occupancies and not more than 14 feet apart for light hazard occupancies. The installation of sidewall sprinklers other than beneath smooth ceilings will require special rulings.	W	Not Applicable: The conditions described in this section do not exist. Ref: Walkdown Checklist No. 1 - 3.
4420	Protection Area Limitations for Light Hazard Occupancy		Title
4421	With noncombustible smooth ceiling, the protection area allotted per sprinkler shall not exceed 196 square feet with the distance between sprinklers on lines not in excess of 14 feet.	D	Not Applicable: The drawings show that the areas in question were sized according to an extra hazard occupancy pipe schedule. Ref: Drawing No. 1 - 3.
4422	With combustible smooth ceiling sheathed with plasterboard, metal, or wood lath and plaster the protection area allotted per sprinkler shall not exceed 168 square feet with the distance between sprinklers on lines not in excess of 14 feet. Where sheathing is combustible such as wood, fiberboard or other combustible material, the protection area allotted per sprinkler shall not exceed 120 square feet with the distance between sprinklers on lines not in excess of 14 feet.	D	Not Applicable: The drawings show that the areas in question were sized according to an extra hazard occupancy pipe schedule. Ref: Drawing No. 1 - 3.

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4430	Protection Area Limitations for Ordinary Hazard Occupancy		Title
4431	With noncombustible smooth ceiling the protection area allotted per sprinkler shall not exceed 100 square feet with the distance between sprinklers on lines not in excess of 10 feet.	D	Not Applicable: The drawings show that the areas in question were sized according to an extra hazard occupancy pipe schedule. Ref: Drawing No. 1 - 3.
4432	With combustible smooth ceiling sheathed with plasterboard, metal, wood lath and plaster, wood, fiberboard or other combustible material, the protection area per sprinkler shall not exceed 80 square feet per sprinkler with the distance between sprinklers on lines not in excess of 10 feet.	D	Not Applicable: The drawings show that the areas in question were sized according to an extra hazard occupancy pipe schedule. Ref: Drawing No. 1 - 3.
4440	Position of Sidewall Sprinklers		Title
4441	Ordinarily, deflectors should be at a distance from walls and ceilings not exceeding 6 inches and never less than 4 inches.	W	Not Applicable: See response to code section 4411.
4442	Special consideration should be given to placing sidewall sprinklers so that they will be favored to the greatest possible extent in receiving the heat from a fire and at the same time most effectively distribute the water discharged by them. This is likely to be particularly important where heavy decorative molding is encountered near the junction of walls and ceilings.	W	Not Applicable: See response to code section 4411.
4443	Where the ceiling above and the wall to the rear of sidewall sprinklers are smooth and at right angles to each other, good results are obtainable with the sprinklers placed vertical.		Information Only

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4444	Where the ceiling contour is sloping or there is other reason for greater than ordinary ceiling protection due to construction, occupancy, etc., increased ceiling coverage is obtainable by tilting the sprinklers to conform with the ceiling slope.		Information Only

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2610	When Required		Title
2611	A connection through which a fire department can pump water into the sprinkler system makes a desirable auxiliary supply. For this purpose, one or more fire department connections shall be provided in all cases except where permission of the authority having jurisdiction is obtained for their omission.	W	Not Applicable. There are no components of the type described in Sections 2600 thru 2675 installed for the safety related areas and will therefore not be verified. Ref: Walkdown Checklist No. 1 - 3.
2620	Size		Title
2621	Pipe size shall not be less than 4 inches for fire engine connection and not less than 6 inches for fireboat connections, except that 4-inch pipe may be used to connect a single hose connection to a 3-inch or smaller riser.	W	Not Applicable: See response to code section 2611.
2630	Arrangement (See Paragraph 3424.)		
2631	On wet pipe systems with a single riser the connection shall be made on the system side of gate, check and alarm valves in the riser.	W	Not Applicable: See response to code section 2611.
2632	On dry pipe systems with a single riser the connection shall be made between the gate valve and the dry pipe valve.	W	Not Applicable: See response to code section 2611.
2633	On systems with two or more risers the connection shall be made on the system side of all shut-off valves controlling other water supplies, but on the supply side of the riser shut-off valves so that with any one riser off, the connection will feed the remaining sprinklers.	W	Not Applicable: See response to code section 2611.

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2640	Valves		Title
2641	An approved straightway check valve shall be installed in each fire department connection, located as near as practicable to the point where it joins the system.	W	Not Applicable: See response to code section 2611.
2642	There shall be no shut-off valve in the fire department connection.	W	Not Applicable: See response to code section 2611.
2650	Support		Title
2651	Fire department connections shall be properly supported.	W	Not Applicable: See response to code section 2611.
2660	Drainage		Title
2661	The piping between the check valve and the outside hose coupling shall be equipped with an approved automatic drip arranged to discharge to a proper place.	W	Not Applicable: See response to code section 2611.
2670	Hose Connections		Title
2671	Hose connections shall be of approved type.	W	Not Applicable: See response to code section 2611.
2672	Hose coupling threads shall conform to those used by the local fire department. National (American) Standard Fire Hose Coupling Screw Threads shall be used whenever they will fit the local fire department hose.	W	Not Applicable: See response to code section 2611.
2673	Hose connections shall be equipped with standard caps, properly secured and arranged for easy removal by fire departments.	W	Not Applicable: See response to code section 2611.
2674	Hose connections should be on the street side of building and shall be located and arranged so that hose lines can be readily and	W	Not Applicable: See response to code section 2611.

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	conveniently attached to the inlets without interference from any nearby objects including buildings, fences, posts, or other fire department connections.		
2675	Hose connections shall be designated by a sign having raised letters at least one inch in size cast on plate or fitting reading for service designated: Viz. — "AUTO-SPKR." or "OPEN SPKR."	W	Not Applicable: See response to code section 2611.
2700	Size and Arrangement of Water Supply Connections		Title
2710	Size		Title
2711	Piping from water supply to the sprinkler riser should be at least as large as the riser but should not be less than 4 inches.	W, D	Comply: The referenced drawings show that the piping to risers are 4" minimum. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 4 & 5.
2712	In private underground piping systems for buildings of other than Light Hazard Occupancy, any dead-end pipe which supplies both sprinklers and hydrants should be not less than 8 inches in size.	W	Not Applicable: The condition described in this code section does not exist for these areas. Ref: Walkdown Checklist No. 1 - 3.
2720	Connection Between Underground and System Piping		Title
2721	The connection between the system piping and underground shall be made with a cast iron flanged piece, properly strapped, or fastened by other approved devices.	W	Not Applicable: The condition described in this code section does not exist for these areas. Ref: Walkdown Checklist No. 1 - 3.
2722	Where riser is close to outside wall underground fittings of proper design and type should be used in order to avoid pipe joints being located in or under the wall. (See separately published Standard on Outside Protection,, NFPA No. 24.)	W	Not Applicable: The condition described in this code section does not exist for these areas. Ref: Walkdown Checklist No. 1 - 3.

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2730	Interconnection of Water Supplies		Title
2731	All main water supplies should be connected with the sprinkler system at the base of the riser, except that where a gravity or pressure tank, or both, constitutes the only automatic source of water supply, special permission may be given to connect the tank or tanks with the sprinkler system at the top of the riser.	W, D	Comply: Walkdowns and drawings show that all water supplies are connected at the base of the riser. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 4 & 5. Note: There are no gravity tanks or pressure tanks.
2732	Where a gravity tank and a pressure tank are connected to a common riser approved means shall be provided to prevent residual air pressure in the pressure tank (after water has been drained from it) from holding the gravity tank check valve closed, a condition known as air lock. Under normal conditions, air lock may be conveniently prevented in new equipment by connecting the gravity tank and pressure tank discharge pipes together 45 feet or more below the bottom of the gravity tank and placing the gravity tank check valve at the level of this connection.	W	Not Applicable: There are no components of this type installed for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
2800	Water Supply Test Pipes and Gauges		Title
2810	Test Pipes		Title
2811	Suitable test pipes, which may also be used as drain pipes, shall be provided at such locations as will permit flowing rests to be made to ascertain whether water supplies and connections are in order. Such test pipes should be not less than the sizes specified in Section 3220 and equipped with a shut-off valve. They shall be so installed that the valve may be opened wide for a sufficient time to assure a proper test without causing any water damage. The authority having jurisdiction shall be consulted as to the location and arrangement of test pipes. (See Sections 3220 and 3240.)	W, D	Comply: Walkdowns and drawings show show that each system is provided with suitable test pipes. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 1-3.

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2820	Gauges		Title
2821	At or near each such test pipe a pressure gauge shall be installed with a connection not smaller than 1/4 inch made to the main pipe. This gauge connection shall be equipped with a shut-off valve and with provision for draining. A plugged outlet 1/4 inch in size should be located between each valve and gauge, for the purpose of installing the inspector's gauge.	W, D	Comply: Walkdowns and drawings show that a pressure gauge and shut-off valve is provided for each system. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 4 & 5.
2822	The required pressure gauges shall be of approved type and shall have a maximum limit not less than twice the normal working pressure at the point where installed. They shall be so installed as to permit easy removal, and shall be located where they will not be subject to freezing.	W, D	Comply: A walkdown verified acceptable pressure gauges for the C.R. Cable Vault, and documentation is acceptable for the drumming area and the high roof area. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 3 & 4.
		W	Does Not Comply: High roof area - lower gauge on riser has a maximum limit of 200 psi. The normal working pressure is 150-160 psi. Ref: Walkdown Checklist No. 1.
2900	Special Provisions		Title
2910	Domestic Connections		Title
2911	Connections for domestic water service should be made on the water supply side of the check valve in the water supply main so that the use of the fire department connection will not subject the domestic water system to high pressure. If the domestic consumption will significantly reduce the sprinkler water supply, an increase in the size of the pipe supplying both the domestic and sprinkler water may be justified.	W	Not Applicable: There are no components of this type installed for safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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2920	Water Hammer		Title
2921	Where connections are made from water mains, subject to severe water hammer (especially where pressure is in excess of 100 pounds), it may be desirable to provide either a relief valve, properly connected to a drain, or an air chamber in the connection. If an air chamber is used it should be located close to where the pipe comes through the wall and on the supply side of all other valves and so located as to take the full force of water hammer. Air chambers shall have a capacity of not less than 4 cubic feet, shall be controlled by an O. S. & Y. gate valve, and shall be provided with a drain at the bottom, also an air vent with control valve and plug to permit inspection.	W	Not Applicable: Conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
2930	Penstocks, Flumes, Etc.		Title
2931	Water supply connections from penstocks, flumes, rivers or lakes should be arranged to avoid mud and sediment, and should be provided with approved double removable screens or approved strainers installed in an approved manner.	D	Comply: Documents show that strainers are provided. Ref: Technical Data No. 2 Section 4.2.11; Drawing No. 6.

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	CHAPTER 3. SYSTEM COMPONENTS		Title
3000	Piping		Title
3001	Piping Specifications		Title
3002	Pipe and tube used in sprinkler systems should be of the materials listed in Table No. 3002. The chemical properties, physical properties and dimensions of the materials listed in Table No. 3002 should conform at least to the standards cited in the table. Pipe and tube used in sprinkler systems should be designed to withstand a working pressure of not less than 175 psi. Whenever the work pipe is used, it shall be understood to also mean tube. (Refer to Standard.)	D	Comply: The drawings show that all pipes are standard black steel or galvanized steel pipe. Allowable substitute materials are listed in the specifications. Ref: Technical Data No. 5 Section 4.1.2; Drawing No. 1-3.
3003	Other types of pipe or tube may be used, but only those investigated and listed for this service by a nationally recognized testing and inspection agency and acceptable to the authority having jurisdiction.	D	Comply: See response to code section 3002.
3010	Definitions (See Figure 3010.)		Information Only
3020	Pipe Schedules		Title
3021	The number of automatic sprinklers on a given size pipe on one floor of one fire section should not exceed the number given in the following schedules for a given occupancy.		This code section will be addressed according to the occupancy of the area in sections 3022 through 3054.
3022	When closed head systems are hydraulically designed in accordance with the provisions of Chapter 7, the pipe schedule provisions of Paragraphs 3020 through 3051 do not apply.	D	Comply: C.R. Cable Vault - 4,777.5 sq ft High Roof Area - 5,184.0 sq ft Drumming Area - 3,373.5 sq ft Ref: Drawing No. 1-3.

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	The maximum floor area to be protected by one system on any one floor of one fire section shall be as follows: Light Hazard 52,000 sq. ft. Ordinary Hazard and Type II Storage* 52,000 sq. ft. Ordinary Hazard, Type I Storage* 40,000 sq. ft. Extra Hazard 25,000 sq. ft. * As defined in Appendix A, Chapter 1. Sprinkler spacing rules contained in Chapter 4 still apply.		
3023	Size of Risers. Each system riser should be of sufficient size to supply all the sprinklers on the riser on any one floor of one fire section as determined by the standard schedules of pipe sizes. There should be one or more risers in each building and in each section of the building divided by fire walls. Where the conditions warrant, the sprinklers in an adjoining building or section cut off by fire walls may be fed from a system riser in another fire section or building.		Information Only
3024	Slatted Floors and Large Floor Openings. Buildings having slatted floors, or large unprotected floor openings without approved stops, should be treated as one room with reference to the open sizes, and the feed main or risers should be of the size required for the total number of sprinklers.	W	Not Applicable: Walkdowns showed that the conditions in question do not exist in the applicable areas. Ref: Walkdown Checklist No. 1 - 3.
3025	Mezzanines and Large Platforms. In buildings having mezzanine floors, large platforms, or large openings between floors which cannot be	W	Not Applicable: See response to code section 3024.

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	closed or satisfactorily cut off, the possibility that all or most of the sprinklers might be opened by a single fire should be considered in determining the size of the risers. Where occupancy and construction are exceptionally good, and where there is little likelihood of a fire spreading beyond the vicinity of its origin, the size of the feed main should be based on the total number of sprinklers in the main area plus half the number in the area not cut off.		
3026	Long Runs of Pipe. Where the construction or conditions introduce unusually long runs of pipe or many angles, in risers or feed mains, an increase in pipe size over that called for in the schedules may be required to compensate for increased friction losses.		Information Only
3030	Schedule for Light Hazard Occupancies		Title
3031	Branch lines should not exceed 8 sprinklers on either side of a cross main. Pipe sizes should be as follows, except as modified by Paragraphs 3032, 3033, and 3062. Steel 1 in. pipe — 2 sprinklers 1-1/4 in. pipe — 3 sprinklers 1-1/2 in. pipe — 5 sprinklers 2 in. pipe — 10 sprinklers 2-1/2 in. pipe — 30 sprinklers 3 in. pipe — 60 sprinklers 3-1/2 in. pipe — 100 sprinklers 4 in. pipe — See Paragraph 3032	D	Not Applicable: The drawings show that the areas in question were sized according to an extra hazard occupancy pipe schedule. Ref: Drawing No. 1-3.

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	Copper 1 in. pipe 2 sprinklers 1-1/4 in. pipe 3 sprinklers 1-1/2 in. pipe 5 sprinklers 2 in. pipe 12 sprinklers 2-1/2 in. pipe 40 sprinklers 3 in. pipe 65 sprinklers 3-1/2 in. pipe 105 sprinklers 4 in. pipe See Paragraph 3032		
	The area protected by any one system on any one floor on one fire section shall not exceed 52,000 square feet.	D	Not Applicable: See response to code section 3031.
3032	The area served by any one 4-inch pipe or tube size on any one floor of one fire section shall not exceed 52,000 square feet.	D	Not Applicable: See response to code section 3031.
3033	Each large area requiring more than 100 sprinklers and without subdividing partitions (not necessarily fire walls) should be supplied by feed mains or risers sized for ordinary hazard occupancies.	D	Not Applicable: See response to code section 3031.
3034	Where sprinklers are installed above and below a ceiling and such sprinklers are supplied from a common set of branch lines, such branch lines should not exceed 8 sprinklers above and 8 sprinklers below the ceiling on either side of the cross main. Pipe sizing up to and including 2-1/2 inch should be as shown in the following schedule: Number of Sprinklers Above and Below Steel 1 in. 2 sprinklers 1-1/4 in. 4 sprinklers	D	Not Applicable: See response to code section 3031.

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	1-1/2 in. 7 sprinklers 2 in. 15 sprinklers 2-1/2 in. 50 sprinklers Copper 1 in. 2 sprinklers 1-1/4 in. 4 sprinklers 1-1/2 in. 7 sprinklers 2 in. 18 sprinklers 2-1/2 in. 65 sprinklers For example, a 2-1/2 inch steel pipe, which is permitted to supply 30 sprinklers in one fire area, may supply a total of 50 sprinklers where not over 30 sprinklers are above or below the ceiling. Where the total number of sprinklers above and below the ceiling exceeds 50, the pipe supplying more than 40 sprinklers should be increased to 3 inch, and sized thereafter according to the schedule shown in Paragraph 3031 for the number of sprinklers above or below the ceiling, whichever is larger.		
3040	Schedule for Ordinary Hazard Occupancies		Title
3041	Branch lines should not exceed 8 sprinklers on either side of a cross main. Pipe sizes should be as follows, except as modified by Paragraphs 3042, 3043, and 3062. Steel 1 in. pipe 2 sprinklers 1-1/4 in. pipe 3 sprinklers 1-1/2 in. pipe 5 sprinklers 2 in. pipe 10 sprinklers 2-1/2 in. pipe 20 sprinklers 3 in. pipe 40 sprinklers	D	Not Applicable: The drawings show that the areas in question were sized according to an extra hazard occupancy pipe schedule. Ref: Drawing No. 1-3.

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	3-1/2 in. pipe — 65 sprinklers 4 in. pipe — 100 sprinklers 5 in. pipe — 180 sprinklers 6 in. pipe — 275 sprinklers 8 in. pipe — See Paragraph 3032		
	Copper 1 in. pipe — 2 sprinklers 1-1/4 in. pipe — 3 sprinklers 1-1/2 in. pipe — 5 sprinklers 2 in. pipe — 12 sprinklers 2-1/2 in. pipe — 25 sprinklers 3 in. pipe — 45 sprinklers 3-1/2 in. pipe — 75 sprinklers 4 in. pipe — 115 sprinklers 5 in. pipe — 180 sprinklers 6 in. pipe — 300 sprinklers 8 in. pipe — See Paragraph 3032		
	The area protected by any one system on any one floor of one fire section shall not exceed 52,000 square feet. This permits exceeding the number of sprinklers specified above for 8-inch pipe, except that for Type I Storage (as defined in Appendix A, Chapter 1) the area protected by one system shall not exceed 40,000 square feet.		
3042	The area served by any one 8-inch pipe or tube size on any one floor of one fire section shall not exceed 52,000 square feet except that for Type I storage (as defined in Appendix A, Chapter 1) the area served by any one 8-inch pipe or tube size shall not exceed 40,000 square fee. Where single systems cover both Type I Storage and Ordinary Hazard areas, storage area covered shall not exceed 40,000 square feet and total area covered shall not exceed 52,000 square feet.		Not Applicable: See response to code section 3041.

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3043	Where the distance between sprinklers on the branch lines exceeds 12 feet or the distance between the branch lines exceed 12 feet, the number of sprinklers should be as follows for given sizes of pipe: Steel 2-1/2 in. — 15 sprinklers 3 in. — 30 sprinklers 3-1/2 in. — 60 sprinklers Copper 2-1/2 in. — 20 sprinklers 3 in. — 35 sprinklers 3-1/2 in. — 65 sprinklers For other pipe and tube sizes, follow Paragraph 3041.		Not Applicable: See response to code section 3041.
3044	Where sprinklers are installed above and below a ceiling and such sprinklers are supplied from a common set of branch lines, such branch lines should not exceed 8 sprinklers above and 8 sprinklers below the ceiling on either side of the cross main. Pipe sizing up to and including 3 inch should be as shown in the following schedule: Number of Sprinklers Above and Below Steel 1 in. — 2 sprinklers 1-1/4 in. — 4 sprinklers		Not Applicable: See response to code section 3041.

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	1-1/2 in. 7 sprinklers 2 in. 15 sprinklers 2-1/2 in. 30 sprinklers 3 in. 60 sprinklers Copper 1 in. 2 sprinklers 1-1/4 in. 4 sprinklers 1-1/2 in. 7 sprinklers 2 in. 18 sprinklers 2-1/2 in. 40 sprinklers 3 in. 65 sprinklers For example, a 3-inch steel pipe, which is permitted to supply 40 sprinklers in one fire area, may supply a total of 60 sprinklers where not over 40 sprinklers are above or below the ceiling. Where the total number of sprinklers above and below the ceiling exceeds 60, the pipe supplying more than 60 sprinklers should be increased to 3-1/2 inch, and sized thereafter according to the schedule shown in Paragraph 3031 for the number of sprinklers above or below the ceiling, whichever is larger.		
3050	Schedule for Extra Hazard Occupancies		Title
3051	Branch lines should not exceed 6 sprinklers on either side of cross main. The following pipe schedules are given only as a guide for installations having no unusual features.	W, D	Comply: High Roof Area. C.R. Cable Vault. Ref: Walkdown Checklist No. 1 & 3; Drawing No. 2 & 3.
		D	Does Not Comply: Drumming Area - drawing shows 8 sprinklers on one branch line. Ref: Drawing No. 3.

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	Steel 1 in. pipe — 1 sprinklers 1-1/4 in. pipe — 2 sprinklers 1-1/2 in. pipe — 5 sprinklers 2 in. pipe — 8 sprinklers 2-1/2 in. pipe — 15 sprinklers 3 in. pipe — 27 sprinklers 3-1/2 in. pipe — 40 sprinklers 4 in. pipe — 55 sprinklers 5 in. pipe — 90 sprinklers 6 in. pipe — 150 sprinklers 8 in. pipe — See Paragraph 3032		
	Copper 1 in. pipe — 1 sprinklers 1-1/4 in. pipe — 2 sprinklers 1-1/2 in. pipe — 5 sprinklers 2 in. pipe — 8 sprinklers 2-1/2 in. pipe — 20 sprinklers 3 in. pipe — 30 sprinklers 3-1/2 in. pipe — 45 sprinklers 4 in. pipe — 65 sprinklers 5 in. pipe — 100 sprinklers 6 in. pipe — 170 sprinklers 8 in. pipe — See Paragraph 3032		
	The area protected by any one system on any one floor of one fire section shall not exceed 25,000 square feet. This permits exceeding the number of sprinklers specified above for 8-inch pipe.		
3052	The area served by any one 8-inch pipe or tube size on any one floor of one fire section shall not exceed 25,000 square feet.	D	Not Applicable: The drawings show that 8 inch pipes are not used. Ref: Drawing No. 1-3.
3053	For open sprinkler and deluge systems pipe schedule, see Paragraph 5371.		Information Only

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3054	For unusually severe conditions of occupancy or area, the above pipe schedule may be inadequate and it is recommended that the systems be designed hydraulically in accordance with the provisions of Chapter 7.		Information Only
3060	Special Provisions Applicable to Piping		Title
3061	Location of Risers. Figure 3061 shows typical riser locations. Center-central or side-central feed is recommended.		Information Only
3062	Branch Lines. When the occupancy is classified as Light or Ordinary Hazard Occupancy and when more than 8 sprinklers on a branch line are necessary, lines may be increased to 9 sprinklers by making the two end lengths 1 inch and 1-1/4 inch, respectively, and the sizes thereafter standard. In special cases, 10 sprinklers may be placed on a branch line by making the two end lengths 1 and 1-1/4 inch respectively and feeding the tenth sprinkler by a 2-1/2 inch pipe.		Information Only
3063	Intermediate sprinklers in storage racks having Type I storage as defined in Appendix A shall be supplied by a separate feed main which may be connected to the overhead system covering the area involved. Alarm devices shall be arranged so that a single alarm sounds for the area covered by the overhead system involved. Separate accessible control valves and drain shall be provided for the feed mains supplying intermediate sprinklers and also for the overhead system.	W	Not Applicable: There are no systems of this type for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3064	Provision for Flushing System. Provision should be made to facilitate flushing of system piping by providing flushing connections consisting of a threaded capped	D	Comply: Drawings show flushing connections for each system. Ref: Drawing No. 1-4.

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	nipple 4 inches long on the end of cross mains. All cross mains shall terminate in 1-1/4 inch or larger pipe. The nipples should be the same diameter as the end pipe but not larger than 2 inches. (See Figure 2064.) Flushing connections will ordinarily not be required for concealed piping systems, but will be required on deluge systems.		
3065	Branch Lines Having Two Sprinklers Only. Where cross mains supply numerous branch lines of only two sprinklers each, conditions approach those of long single branch lines and such two sprinkler branch line should usually be centrally supplied; in addition, the following shall apply: (a) Ordinary Hazard: Where cross mains supply no more than ten branch lines of only two sprinklers each, follow Paragraphs 3041 and 3042. Branch lines up to 14 in number may be fed from one end, provided that 2-inch pipe does not supply more than eight sprinklers and 2-1/2 inch pipe does not supply more than 16 sprinklers. [See Figure 3065(a).] (b) Extra Hazard; Where cross mains supply no more than eight branch lines of no more than two sprinklers each, follow Paragraph 3051. Branch lines up to 14 in number may be fed from one end, provided that 2-1/2 inch pipe does not supply more than 12 sprinklers, and 3-inch pipe does not supply more than 20 sprinklers.	W, D	Not Applicable: Walkdowns and document reviews show that this arrangement is not used in any of these areas. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 1-3.
3066	Stair Towers. Stairs, towers or other such construction with incomplete floors, if piped on independent risers, should be treated as	W	Not Applicable: Walkdowns showed there are no stair towers. Ref: Walkdown Checklist No. 1 - 3.

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	one area with reference to pipe sizes, i.e., feed main should be of sufficient size to accommodate the total number of sprinklers.		
3067	Return Bends. Where piping on wet systems is concealed, with sprinklers installed in pendent position below a ceiling, return bends will be required when the water supply to the sprinkler systems is from a raw-water source, mill pond, or from open top reservoirs. Return bends should be connected to the tops of branch lines in order to avoid accumulation of sediment in the drop nipples. In new systems, the return bend pipe and fittings should be 1 inch in size. In revamping existing systems, where it is not necessary to retain sprinklers in the concealed space, 1/2-inch or 3/4-inch close nipples inserted in the existing sprinkler fittings may be used with 1-inch pipe and fittings for the other portions of the return bend. Where water supply is potable, return bends will not be required.	W	Not Applicable: Walkdowns showed that there is no concealed piping for any area. Ref: Walkdown Checklist No. 1 - 3.
3068	Piping in Concrete. Where piping is installed in cinder concrete it shall be placed in properly constructed ducts or thoroughly encased in portland cement or its equivalent. In no case shall the piping system be installed so as to form a part of the floor arch reinforcement.	W	Not Applicable: Walkdowns showed that this condition does not exist in any area. Ref: Walkdown Checklist No. 1 - 3.
3069	Sleeves for Pipe Risers (See Figure 3069)	W, D	Comply: Drawings show that sleeves are provided for piping through floors in the drumming area and the C.R. Cable Vault. Ref: Walkdown Checklist No. 2 & 3; Drawing No. 1 & 3.
	(a) Sprinkler piping passing through floors of concrete or waterproof construction should have properly designed substantial thimbles or sleeves projecting three to six inches above the floor to prevent possible floor leakage. The space between the pipe and sleeve should be caulked with oakum or equivalent	W	Not Applicable: There are no pipes through floors for the high roof area. Ref: Walkdown Checklist No. 1.

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	material. If floors are of cinder concrete, thimbles or sleeves should extend all the way through to protect the piping against corrosion. (b) It is desirable that ordinary floors through which pipes pass should be made reasonably tight around the risers. (See Section 1140.)		
3070	Dry Pipe Underground. When necessary to place pipe which will be under air pressure underground, the pipe should be steel or wrought iron and protect against corrosion (see Section 3130), or it may be gasketed joint cast-iron pipe.	W	Not Applicable: There are no systems of this type installed for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3071	Domestic Connections. Sprinkler piping shall not be used in any way for domestic water service. Circulation of water in sprinkler pipes in objectionable, owing to increased corrosion, deposit of sediment, and condensation drip from pipes. (See Section 2910.)	W	Not Applicable: This type of configuration is not provided for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3072	Hand Hose Connections (Small). Hand hose, to be used for fire purposes only, may be attached to sprinkler pipes within a room subject to the following restrictions. (a) Piping shall be 1 inch size for runs up to 20 feet and 1-1/4 inch size for runs between 20 and 80 feet. (b) Hose shall not be larger than 1-1/2 inch. (c) Nozzle discharge shall not exceed the discharge from one nominal 1/2 inch orifice sprinkler. (See Paragraph 3641.) (d) Hose should not be connected to any sprinkler pipe smaller than 2-1/2 inch and never attached to a dry-pipe	W	Not Applicable: This type of connection is not provided for safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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	system. For details of hand hose installation, see Standard for the Installation of Standpipe and Hose Systems (NFPA No. 14).		
3073	Hose Connections for Fire Department Use. In buildings of Light or Ordinary Hazard Occupancy 2-1/2 inch hose valves for fire department use may be attached to wet pipe sprinkler systems subject to the following restrictions: (a) The riser and hose valves shall be located in a fire-resistive stair enclosure. (b) Sprinklers shall be under control of separate floor control valves located in the fire-resistive stair enclosure. (c) The minimum size of the riser shall be 6 inch. (d) The water supply shall be adequate for sprinklers and standpipes combined.	W	Not Applicable: This type of connection is not provided for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3080	System Test Pipes		Title
3081	Wet Systems. A test pipe of not less than 1-inch diameter terminating in a smooth bore corrosion resistant outlet giving a flow equivalent to one sprinkler shall be provided. This test pipe shall be provided for each system through a pipe not less than 1 inch in diameter, in the upper story, and the connection should preferably be piped from the end of the most remote branch line. The discharge should be at a point where it can be readily observed. In locations where it is not practical to terminate the test pipe outside the building, the test pipe may terminate into a drain, subject to the approval of the authority having	W, D W	Comply: For control room cable vault, see response to code section 2811. Not Applicable: For drumming area and the high roof area, both are pre-action systems. Ref: Walkdown Checklist No. 1 & 2.

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	jurisdiction. In this event, the test connection shall be made using an approved sight test connection containing a smooth bore corrosion resistant orifice giving a flow equivalent to one sprinkler. (See Figure 3081.) The test valve shall be located at an accessible point, and preferably not over seven feet above the floor. The control valve on the test connection shall be located at a point not exposed to freezing.		
3082	Dry Pipe Systems. A 1-inch inspector's test with a smooth bore corrosion resistant outlet giving a flow equivalent to one sprinkler shall be installed on the end of the most distant sprinkler line in the upper story and be equipped with a 1 inch shut-off valve and cast-iron plug. (See Figure 3082.)	W, D	Comply: For the drumming area and the high roof area, see response to code section 2811.
		W	Not Applicable: The control room cable vault area contains a wet-pipe sprinkler system. Ref: Walkdown Checklist No. 3.
3090	Joining of Pipe and Fittings		Title
3091	All threaded fittings and pipe shall have threads cut to ANSI Standard B2.1. Care should be taken that the pipe does not extend into the fitting sufficiently to reduce the waterway.	D	Open Item: Documentation (procedures or specifications) not provided for review.
3092	Pipe shall be properly reamed after cutting to remove all burrs and fins.	D	Open Item: See response to code section 3091.
3093	Joint compound shall be applied to the threads of the pipe and not in the fitting.	W, D	Open Item: See response to code section 3091. Ref: Walkdown Checklist No. 1 - 3.
3094	Other types of joints must be made or installed in accordance with the requirements of the listing thereof by a nationally recognized testing and inspection agency.	D	Open Item: See response to code section 3091.

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3095	Brazed joints for the connection of pipe or tube and fittings may be used. The fire hazard of the process shall be suitably safeguarded.	W, D	Open Item: See response to code section 3091. Ref: Walkdown Checklist No. 1 - 3.
3100	Protection of Piping Against Freezing (3110), Corrosion (3130) and Earthquake Damage (3150)		Title
3110	Protection Against Freezing		Title
3111	Supply Pipes		Title
3112	Where supply pipes or risers pass through low unheated basements or open spaces under buildings, so as to be exposed to frost, they shall be properly protected by a method outlined in Paragraphs 3113, 3114 or 3115.	W	Not Applicable: Walkdowns show that the systems involved are not subject to the hazards described in this code section. Ref: Walkdown Checklist No. 1 - 3.
3113	An acceptable method, especially where the space is over 18 inches high, is by an enclosure properly heated or filled with heavy earth or other suitable insulating material. The enclosure should extend below the bottom of the pipe and through the top flooring of the ground floor. In severe climates, where space is filled, the enclosure should be of sufficient size to permit a filling of not less than four feet, all around the pipe. The enclosure should preferably be of brick, but may be of wood, and if the latter, should be at least double walled with tar paper between. If wood is used, it shall be of a kind that will endure underground or be treated with creosote or other acceptable preservative.	W	Not Applicable: See response to code section 3112.
3114	Where the space is not more than 18 inches high, the flooring of ground floor may be cut away and the space around the pipe enclosed according to either of the above methods, except that the area may be reduced so that there will be not less than one foot clear	W	Not Applicable: See response to code section 3112.

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	space all around the pipe, thus exposing pipe to the heated room above. The opening at floor level should not be covered except by a metal grid.		
3115	Care should be taken in laying the underground connection, to extend it sufficiently far into the building to give the required spaces called for above. The pipe may be offset, if desired, at or above the floor level		Information Only
3120	Feed Mains in Unheated Areas		Title
3121	Where necessary to extend feed mains of wet pipe systems through an open area or through cold rooms, passageways or other areas exposed to frost, the pipe shall be adequately protected against freezing by insulating coverings, frostproof casings, or other suitable means.	W	Not Applicable: There are no systems of this type installed for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3130	Protection of Pipe Against Corrosion		Title
3131	Where corrosive conditions exist, types of pipe, tube, fittings, hangers, and protective coatings that resist corrosion should be used.	W	Not Applicable: Sprinkler systems are not in a corrosive environment. Ref: Walkdown Checklist No. 1 - 3.
3132	Galvanized steel pipe or copper tube may be required in overhead feed main running from one building to another where exposed to the weather unless black steel pipe is otherwise protected against corrosion.	W	Not Applicable: See response to code section 3131.
3133	Where it may be necessary to use wrought iron or steel pipe underground as a connection from a system to sprinklers in a detached building, the pipe should be protected against corrosion before being buried. Galvanized pipe tarred, or black pipe wrapped and tarred, are acceptable.	W	Not Applicable: See response to code section 3131.

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3134	In some places it is satisfactory to rely solely on the protective value of a paint coating, this is to be maintained by repainting at intervals from one to five years, the period depending on the severity of the exposure.	W	Not Applicable: See response to code section 3131.
3135	If corrosive conditions are not of great intensity and the degree of humidity is not abnormally high, good results can be obtained by using two field coats of some high-grade paint such as sublimed blue lead in linseed oil, red lead in linseed oil or red lead in spar varnish. In locations where metal cannot be protected from attack or kept dry to receive the first field coating, a shop priming coat should be specified, this to be touched up promptly after installation and the whole to be finished with one or preferably two final coats. It is desirable under such conditions to vary colors for successive coats in order to ensure adequate coverage. For instance, use red oxide inhibitive type paint for the shop or priming coat, and sublimed blue lead and/or 50 per cent red lead - 50 per cent spar varnish for finishing.	W	Not Applicable: See response to code section 3131.
3136	In applying, keep paint thoroughly stirred and apply only when surface is clean and dry - never in a damp or cold atmosphere.		Information Only
3137	When a protective coating is applied to old piping, be sure to first remove all corrosion, scale and grease. Otherwise, little benefit will be derived from the coating. Piping should be carefully examined at frequent intervals and if evidence of pitting, checking, blistering, or other failure is noted, the pipe should be cleaned and another coat of protective paint applied.		Information Only

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3138	In locations where appearance is not a factor and where temperatures do not greatly exceed 100°F., a coat of one of the inhibitive types of grease will give good protection. This type of material comes in the form of a light petrolatum and can be readily applied with a brush after installation work has been completed.		Information Only
3139	When moisture conditions are extremely severe but corrosive fumes are not much of a factor, copper tube or galvanized steel pipe, fittings and hangers may be suitable. The threaded ends of steel pipe should be sealed in with a suitable coating such as asphalt base liquid and canvas. This form of protection involves painting the band of the fitting and the pipe for a distance of 4 inches to 6 inches with a heavy asphalt compound. Strips of lightweight canvas cut to a width of about 2 inches should be wrapped over the end of the fitting and on the surface of the pipe for a distance of about 4 inches from the face of the fitting. The canvas surfaces should in turn be sealed in with a follow-up coat of the asphalt compound.		Information Only
3140	In instances where the piping is not readily accessible and where the exposure to corrosive fumes is severe, either a protective coating of high quality should be employed or resort should be made to the use of some form of corrosion resisting material. This is not intended to call for protection of concealed piping installed under normal conditions.	W	Not Applicable: The conditions described in this requirement are not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3141	In the list of special coatings are the following: (a) A priming application of a mixture of beeswax and ozokerite dissolved in turpentine and carbon-tetrachloride,	W	Not Applicable: The conditions described in this requirement are not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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	then a wrapper of lightweight canvas and finally a seal-in coating of the wax mixture. (b) Where high temperatures and rapid oxidation are not a factor, a priming coat of chlorinated rubber paint, then a complete wrapping with electrician's rubber splicing tape and a follow-up seal-in coating of rubber paint. (c) Factory asphalt or bituminous coated and wrapped wrought pipe with coated fittings. The coating provided on this class of material gives excellent protection but great care must be used in thoroughly sealing-in all areas where the coating may be broken or damaged during installation..		
3142	Cast-iron pipe of the type which can be threaded is now available and is advantageous for use where corrosion is severe. This comes in wrought pipe size and with a wall thickness equal to that of extra-heavy wrought material. This is made from special alloyed irons and affords good resistance to rusting and to attack by corrosive atmospheric conditions. Such material should be protected by paint, asphalt asbestos type coating, or grease to retard or prevent surface attack. The combination of iron pipe and iron fittings is effective due to the heavy thickness of the pipe wall, the similarity of the metal at the joints, and the particularly good bond which the cast pipe provides for the paint or other coatings applied to it.	W	Not Applicable: The conditions described in this requirement are not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3143	A silicon-bronze alloy should be used in the form of rod, strap, or castings for hangers employed wherever corrosive attack is severe and when galvanized metal is not used. This	W	Not Applicable: The conditions described in this requirement are not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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	strong corrosion resisting type of bronze can be substituted for steel without increase in size or change in design of the ordinary hanger.		
3150	Protection of Piping Against Damage Due to Earthquakes		Title
3151	Flexibility		Title
3152	Breakage of sprinkler piping caused by building movement can be greatly lessened and in many cases prevented by increasing the flexibility between major parts of the sprinkler system. One part of the piping should never be held rigidly and another be free to move without provision for relieving the strain. Flexibility can be provided by the use of flexible couplings at critical points and allowing clearances at walls and floors. If too freely hung, however, sections of the sprinkler system will oscillate excessively or shift out of line. This action can be prevented by anchors or hangers which will damp oscillations or check movement, but not rigidly hold piping.	D	Not Applicable: The ISO Earthquake Zone Map indicates that this area has an extremely low potential for earthquakes and therefore the systems need not be designed to the criteria in code sections 3150-3156. The support of the system, i.e. hangers, was approved by N.E.P.I.A. Ref: Appendix A of this code and and Technical Data No. 3.
3153	The top and bottom of risers are critical points where the installation of approved flexible couplings is advisable. In a multi-story building a flexible coupling may be advisable also at the floor and another at the ceiling line in an intermediate story if structural weakness or unusual flexibility is present. A pair of couplings should usually be provided on a monitor riser. A pair of approved flexible couplings with a length of pipe between, readily permits a considerable horizontal offset in any direction. Piping crossing the joint between two buildings	D	Not Applicable: See response to section 3152.

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	usually needs a pair of flexible couplings as the buildings will vibrate differently unless identical in all respects. Flexible couplings may be omitted at pipes less than 3-1/2 inch diameter.		
3154	One to two inch clearance should be provided around pipes at all floors. In one-story buildings the space at the ground floor can be filled with asphalt mastic. In multi-story buildings a sleeve should be cast in concrete floors, extending three to six inches above the top of the wearing surface and capped with a pipe collar, to prevent passage of water, smoke or fire. Tight metal collars are advisable about pipes to cover such holes through wooden floors in multi-story buildings.	D	Not Applicable: See response to section 3152.
3155	Riser drains, fire department connections and auxiliary piping should not be cemented into nearby walls or floors, if they can throw a strain on riser piping. Similarly, pipes which pass horizontally through walls should not be cemented solidly in them, or strains will accumulate at this point. Holes through fire walls should be packed with mineral wool or other suitable material held in place with pipe collars on each side. Pipes passing through foundation walls or pit walls in soft ground should have clearance with these walls but holes should be made watertight.	D	Not Applicable: See response to section 3152.
3156	Tank riser or discharge pipes should be treated the same as sprinkler risers for their portion within a building. The discharge pipe of tanks on buildings shall have a control valve above the roof line so any pipe-break within the building can be controlled.	D	Not Applicable: See response to section 3152.

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3160	Sway Bracing		Title
3161	Feed and cross mains must be braced to prevent excessive oscillation. The tops of risers shall be secured against drifting in any direction. Branch lines will not require bracing.	D	Comply: Feed and cross mains are adequately braced. System hangers were approved by N.E.P.I.A. Technical Data No. 3 Section 1:08.1.
3162	It is the intent to laterally brace the piping so that it will withstand a force equal to 50 per cent of the weight of the piping, valve attachments and water. It is felt that if the lateral bracing is designed to withstand this force without breaking or permanently deforming, the system will be reasonably safe from earthquake forces.		Information Only
3163	All piping outside of buildings which is not buried shall be securely anchored to prevent swaying.	W	Not Applicable: There is no piping outside of buildings for these systems. Ref: Walkdown Checklist No. 1 - 3.
3164	Where a system is hung with U-type hangers, they will satisfy most of the requirements for sway bracing except, in general, the longitudinal hanger as numbered "1" in Figure 3164 will be necessary in addition. U-type hangers are better lateral braces when the legs are bent out 10°		Information Only
3165	Where a system is hung with single rods it will generally be necessary to provide all sway bracing by the installation of special hangers. (Very short rods, less than 6 inches, are fairly satisfactory.)		Information Only
3166	Large piping should not be held by small branches. The piping should not be fastened to two dissimilar parts of the building such as a wall and a roof which will move differently.		Information Only

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3167	Transverse braces may also act as longitudinal braces if they are within 24 inches of the center line of the pipe being braced longitudinally, except that branch lines cannot hold cross mains. In general, the last piece of pipe at the end of a feeder or cross main will require a transverse brace suitable for the loads involved. Earthquake braces should not be connected to a pair of companion flanges.		Information Only
3168	In most cases especially placed U-type hangers, or pipe clamps with rods or angle braces, will satisfy bracing requirements. Any properly detailed design will be acceptable. Figure 3168 illustrates some acceptable arrangements of sway bracing.		Information Only
3169	In the design of sway braces, the slenderness ratio l/r should not exceed 200 where "l" is the distance between the center lines of supports and "r" is the least radius of gyration, both in inches. For example, a flat bar 2 inches x 3/8 inch should not be over 1 foot 9 inches between fastenings. The maximum length of shapes used for sway bracing is shown in Table 3169.		Information Only.
3200	Drainage		Title
3210	Pitching of Piping for Drainage		Title
3211	All sprinkler pipe and fittings shall be so installed that the system may be thoroughly drained. Where practicable, all piping should be arranged to drain to the main drain valve.	W, D	Comply: Drawings require that all piping be pitched to properly drain. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 2, 3, & 8.
		D	Open Item: Documentation for the C.R. Cable Vault is not provided for review.

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3212	Pipe shall be straightened before installation to prevent pockets which would interfere with proper drainage.	W	Open Item: Due to the congestion in the control room cable vault, this information was not readily obtainable from plant walkdowns. Workmanship during the initial installation cannot be reviewed. Due to the lack of accessibility to the sprinkler heads in this drumming area and the high roof area, this information was not readily obtainable from plant walkdowns. Ref: Walkdown Checklist No. 1 - 3.
3213	On wet pipe systems sprinkler pipes shall be pitched not less than 1/4 inch in 10 feet.	W	Not Applicable: The high roof and drumming areas have pre-action systems. Ref: Walkdown Checklist No. 1 & 2.
		D	Open Item: Documentation for the C.R. Cable Vault is not provided for review.
3214	On dry pipe systems sprinkler pipe on branch lines shall be pitched at least 1/2 inch in 10 feet and the pipe of cross and feed mains shall be given a pitch of not less than 1/4 inch in 10 feet. A pitch of 3/4 inch to 1 inch should be provided for short branch lines and 1/2 inch in 10 feet for cross and feed mains in refrigerated areas and in buildings of light construction where floor may settle under heavy loads.	D	Comply: Drawings show that the pre-action systems are properly pitched to drain. Ref: Drawing No. 2, 3 & 8.
3215	Where settling may occur and deprive a dry pipe system of its drainage, ends of lines should not be raised to violate Section 4200. The drainage should be restored by shortening the vertical piping.	W	Not Applicable: There are no dry pipe systems protecting safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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3220	System or Main Drain Connections and Drain Valves (See Figure 3220.)		Title
3221	Provisions shall be made to properly drain all parts of the system.	W	Comply: Entire system provided with adequate provisions for draining each system. Ref: Walkdown Checklist No. 1 - 3.
3222	On all risers 4 inches or larger, 2-inch drain pipes and valves shall be provided.	W	Comply: See response to code section 3221.
3223	On risers 2-1/2 inches to 3-1/2 inches inclusive, drain pipes and valves not smaller than 1-1/4 inch shall be provided.	D	Not Applicable: All systems are provided with risers 4 inches or larger. Ref: Drawing No. 1-3.
3224	On small risers, drain pipe and valves not smaller than 3/4 inch shall be provided.	D	Not Applicable: All systems are provided with risers 4 inches or longer. Ref: Drawing No. 1 - 3.
3225	All sectional control valves shall have a drain valve of suitable size so located as to drain that portion of the system controlled by the cut-off valve.	W	Comply: See response to code section 3221.
3226	The test valves required by Paragraph 2811 may be used as the main drain valves.	W	Comply: See responses to code sections 3221 and 2811.
3230	Auxiliary Drains. (See Fig. 3230)		Title
3232	Auxiliary drains on wet pipe and deluge systems shall not be smaller than as follows: 2-inch and smaller supply pipe - 3/4-inch drain	W	Not Applicable: Walkdowns show that there are no auxiliary drains. Ref: Walkdown Checklist No. 1 - 3.
	2-1/2-inch supply pipe - 1-inch drain 3-inch and larger supply pipe - 1-1/4-inch drain	W	Not Applicable: The high roof and drumming areas contain pre-action systems. Ref: Walkdown Checklist No. 1 & 2.

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3233	On wet pipe and deluge systems, all trapped sprinklers in excess of five shall be provided with drain valve and cast-iron plug or nipple and cap; where in excess of twenty, sprinklers shall be provided with drain valve and drain connection. For five or less sprinklers a brass drain plug or nipple and cap shall be provided.	W, D	Not Applicable: The high roof and drumming areas contain pre-action systems. The drawing shows that the control room cable vault does not contain trapped sprinklers. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 1.
3234	On dry-pipe systems, where three or less sprinklers are trapped, a 1/2 inch renewable disc drain valve, plugged with a cast-iron plug or with a nipple and cap shall be installed.	D	Comply: Drawing for the drumming area shows that a plug is provided for all trapped sprinklers. Ref: Drawing No. 3.
		D	Not Applicable: Drawing for the high roof area shows that there are no trapped sprinklers. The control room cable vault has a wet pipe system. Ref: Drawing No. 1 & 2.
3235	On dry-pipe systems, where more than three sprinklers are trapped, a two-valve drum drip should be installed, if possible, in a warm location. (See Paragraph 3237.)	D	Not Applicable: Drawings for the drumming area and high roof area show that the condition described in this code section does not exist. The control room cable vault has a wet pipe system. Ref: Drawing No. 1 - 3.
3236	On dry-pipe systems, where more than twenty sprinklers are trapped, a two-valve drum drip and a 1-1/4-inch draw-off valve shall be provided with drain properly piped to eliminate possibility of causing water damage. (See Paragraph 3237.)	D	Not Applicable: Drawings for the drumming area and high roof area show that the condition described in this code section does not exist. The control room cable vault has a wet pipe system. Ref: Drawing No. 1 - 3.
3237	Drum Drips. Drum drip should be approximately 1/2-gallon capacity and provided with either a 3/4-inch gate, globe or angle valve on each side of the drum drip. Lower valve on the drum drip shall be plugged with a cast-iron plug or with a nipple and cap.	W	Not Applicable: There are no drum drips incorporated as part of the sprinkler sytems. Ref: Walkdown Checklist No. 1 - 3.

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3238	Tie-In Drains. Pipe sizes for branch line tie-in drains should be one inch for twenty or less sprinklers, and 1-1/4 inch for more than twenty sprinklers with 1-1/4-inch drop to 1-1/4-inch or larger branch line pipe on floor below.	D	Not Applicable: Tie-in drains are not necessary for this system. Ref: Drawing No. 1 - 3.
3240	Discharge of Drain Valves		Title
3241	Each drain pipe should preferably discharge outside the building at a point visible from the drain valve and free from the possibility of causing water damage. Where it is not possible to discharge outside the building wall, the drain should be piped to a sump, which in turn should discharge by gravity or be pumped to a waste water drain or sewer. Direct interconnections should not be made between sewers and sprinkler drains of systems supplied with public water. The drain discharge should be in conformity with any local health or water department regulations, or sanitary code. The drain connection should be of a size to carry off water from open drains while they are discharging under normal water pressures.	W	Comply: For the drumming area and the high roof area, the drain discharge is acceptable. Ref: Walkdown Checklist No. 1 & 2.
		W	Does Not Comply: For the C.R. cable vault, the drain from the retard chamber discharges to the floor which contains numerous unsealed penetrations. Ref: Walkdown Checklist No. 3.
3242	Where drain pipes are buried underground, either cast-iron or galvanized pipe should be used.	D	Not Applicable: There are no underground drain pipes. Ref: Drawing No. 1-3.
3243	Drain pipes should not terminate in blind spaces under the building.	W, D	Comply: Drawings show that drain pipe locations and configuration are adequate. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 1-3.
3244	Drain pipes when exposed should be fitted with a hood or down turned elbow to prevent obstruction.	W, D	Comply: See response to code section 3243.

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3245	Drain pipes shall be so arranged as not to expose any part of the sprinkler system to frost. All drains should have at least 4 feet of pipe beyond the valve, in a warm room.	W, D	Comply: See response to code section 3243.
3246	Approved angle valves should be used on all main drains. Wherever possible, drains should be located in a warm place.	W, D	Comply: Approved angle valves are provided on the main drains for all areas. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 1.
3300	Fittings		Title
3310	Type of Fittings		Title
3311	Fittings shall be of a type specifically approved for sprinkler systems and of a design suitable for the working pressures involved, but not less than 175 psi cold water pressure.	D	Comply: All pipe fittings are standard malleable iron for the drumming area and the high roof area. Pipe fittings for the C.R. Cable Vault are black cast iron, screwed or flanged. Ref: Drawing No. 1 - 3. All piping and fittings were installed per AEP specifications. Ref: Technical Data No. 4.
3312	If fittings are of cast iron, extra heavy pattern shall be used in sizes larger than 2 inches where the normal pressure in the piping system exceeds one hundred and seventy-five pounds.	D	Comply: See response to code section 3311.
3313	If fittings are of malleable iron, standard weight pattern will be acceptable in sizes up to 6 inches inclusive when the normal pressure in the pipe system does not exceed three hundred pounds.	D	Comply: See response to code section 3311.
3314	Fittings made of materials other than cast iron or malleable iron and specifically approved for use in sprinkler systems may be used at piping system pressures up to the working pressure limits specified in their approval.	D	Not applicable: See response to code section 3311.

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3315	Where water pressures are 175 to 300 lbs. the ANSI Standards permit the use of "Standard Wall" pipe and "extra heavy" valves. Until pressure ratings for valves are standardized, the manufacturers' ratings should be observed.	D	Comply: See response to code section 3311.
3316	Welded Piping. All inside piping shall be joined by means of screwed, flanged or flexible gasketed joints or other acceptable fittings. Cross main headers, sections of feed mains, or risers may be shop welded using acceptable welding fittings with screwed branch outlets. Welding and brazing shall conform to American National Standard for Pressure Piping, B 31.1.0 - 1967. Welding and torch cutting shall not be permitted as a means of installing or repairing sprinkler systems.	W, D	Comply: See response to code section 3311. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 4 Section 2.1.1.
3317	Welding fittings should comply with USA Standard B16.9 - 1964, USA Standard B16.25 - 1964 and ASTM Designation A-234-65.	D	Comply: See response to code section 3311. Ref: Technical Data No. 4 Section 3.1.4 and Class A Sheet 1 of 9.
3318	Where risers are 3 inches in size or larger, a flange joint shall be used at the riser at each floor. (See Fig. 3317.)	W	Comply: Risers 4 inches and larger have flanged joints. Ref: Walkdown Checklist No. 1 - 3.
3319	Certification of Welders and Brazers. Welders or brazers shall be certified by contractor as being qualified for welding and/or brazing in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators 1968 Edition. (See Appendix E.)	D	Comply: Each welder's certificate of qualification is part of the specification. Ref: Technical Data No. 4 Section 2.2.2.
3320	Couplings and Unions		Title
3321	Couplings and unions should not be used except where pipe is more than 20 feet in length between fittings. Screwed unions shall not be	W, D	Comply: See response to code section 3311. Ref: Walkdown Checklist No. 1 - 3.

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	used on pipe larger than 2 inches. Couplings and unions of other than screwed type shall be of types approved specifically for use in sprinkler systems. In special cases, unions or couplings may be used to facilitate installation.		
3322	Approved flexible connections are permissible and encouraged for sprinkler installations in racks to reduce possibility of physical damage. When flexible tubing is used it should be located so that it will be protected against mechanical injury.	W	Not Applicable: There are no systems of this type in which these components are used in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3330	Reducers, Bushings		Title
3331	A one-piece reducing fitting of good design should be used wherever a change is made in the size of pipe. Bushings introduce a point of weakness and should be used in reducing the size of openings of fittings only when standard fittings of the required size are not available. The use of bushings is further subject to the provisions of Paragraphs 3332, 3333, and 3334.	W, D	Comply: Walkdowns and documents show only one piece reducing fittings. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 1 - 3.
3332	Bushings are not permitted in elbow fittings.	W	Comply: Condition described in code not used. Ref: Walkdown Checklist No. 1 - 3.
3333	Bushings are not permitted when the reduction in size of the outlet is less than 1/2 inch.	W	Comply: Condition described in code not used. Ref: Walkdown Checklist No. 1 - 3.
3334	Bushings are not permitted in more than one outlet of any tee fitting or any two outlets of a cross fitting.	W	Comply: Condition described in code not used. Ref: Walkdown Checklist No. 1 - 3.

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3400	Valves		Title
3410	Types of Valves To Be Used		Title
3411	All valves on connections to water supplies and in supply pipes to sprinklers shall be approved outside screw and yoke (O.S.&Y.) or approved indicator type. Underground gate valves of approved type equipped with approved indicator post comply with this requirement. Such valves should be supervised so that closing will result in an alarm.	W, D	Comply: Valves used for these systems meet the requirements of this code section. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 2 Sections 7 & 9 and No. 3 Section 1:11; Drawing No. 1 - 5.
3412	Drain valves and test valves shall be of approved type.	W, D	Comply: The valves used in these areas meet the requirement of the code section. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 1.
3413	Check valves shall be of approved straightway type and may be installed in a vertical or horizontal position.	W, D	Comply: See response to code section 3412.
3420	Valves Controlling Water Supplies		Title
3421	Each system shall be provided with a gate valve so located as to control all sources of water supply except fire department connections when arranged as specified in Section 2630.	W, D	Comply: Walkdowns and documents show that each system is provided with a gate valve. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 1.
3422	At least one gate valve shall be installed in each source of water supply except fire department connections.	W, D	Comply: See responses to code section 3421.
3423	Where there is more than one source of water supply, a check valve shall be installed in each connection, except that where cushion tanks are used with automatic fire pumps no check valve is required in the cushion tank connection.	W	Comply: Although there is a single supply source (Lake Michigan), check valves are provided in each connection. Ref: Walkdown Checklist No. 1 - 3.

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3424	Where there is but one water supply connection a check valve shall be installed if there is likelihood of water circulation, or if there is a fire department connection on the system.	W, D	Comply: See response to code section 3423.
3425	Where a system having only one dry-pipe valve is supplied with city water and fire department connection it will be satisfactory to install the main check valve in water supply connection in a vertical position immediately inside of the building/ in case there is no outside control the system gate should be placed at the wall flanged ahead of all fittings. Such an arrangement eliminates a pit and in most cases one additional cast-iron socket quarter bend.	W	Not Applicable: The components discussed in this requirement are not installed for protection of safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3426	Where either a wet or dry pipe sprinkler system is supplied by city water and a fire department connection and has more than one riser with O.S.&Y. gate valve in each, and the whole system is controlled by one outside post indicator valve, it will be satisfactory to install the main check valve in the water supply connection immediately inside building. (See Paragraph 2633.)	W	Not Applicable: There are no fire department connections. Ref: Walkdown Checklist No. 1 - 3.
3427	Where a wet pipe sprinkler system is supplied by city water and a fire department connection with only one riser, the alarm valve will be considered as a check valve and an additional check valve will not be required.	W	Not Applicable: There are no fire department connections. Ref: Walkdown Checklist No. 1 - 3.
3428	A gate valve should be installed on each side of each check valve under conditions other than described in Paragraphs 3425, 3426, and 3427, except that in the discharge pipe from a pressure tank or a gravity tank of less than 15,000 gallons capacity no gate valve need be installed on the tank side of the check valve.	W, D	Comply: See response to code section 3421.

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3429	Where a gravity tank is located on a tower in the yard, the gate valve on the tank side of the check valve should be of O.S.&Y. type; the other should be either an O.S.&Y. valve or an indicator post valve. Where a gravity tank is located on a building both gate valves should be of the O.S.&Y. type; and all fittings inside the building, except thedrain tee and heater connections, shall be under the control of a gate valve.	W	Not Applicable: There are no systems of this type installed in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3430	In a city connection serving as one source of supply the city valve in the connection may serve as one of the required gate valves. An O.S.&Y. valve or an indicator post valve should be installed on the system side of the check valve.	W	Not Applicable: The connections discussed in this requirement are not provided in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3431	A connection from public water system should not extend into or through a building unless such connection is under the control of an outside indicator post or O.S.&Y. gate valve or under the control of an inside O.S.&Y. gate valve located near outside wall of the building.	W	Not Applicable: The connection discussed in this requirement are not provided in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3432	When a pump, located in a combustible pump house or exposed to danger from fire or falling walls, or a tank, discharges into a yard main fed by another supply, either the check valve in the connection should be located in a pit or the gate should be of the indicator post type, located a safe distance outside of buildings.	W	Not Applicable: The fire pumps are installed in noncombustible buildings. Ref: Walkdown Checklist No. 1 - 3.
3433	Check valves on tank or pump connections when located underground may be placed inside of buildings and at a safe distance from the tank riser or pump, except in cases where the building is entirely of one fire area, when it is ordinarily considered satisfactory to locate the check valve overhead in the lowest level.	W	Not Applicable: The conditions described in this requirement are not found for protection of safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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3434	All gate valves controlling water supplies for sprinklers shall be located where readily accessible and when necessary, permanent ladders, clamped treads on risers, chains and wheels, or other accepted means should be provided.	W, D	Comply: See response to code section 3421.
3440	Sectional Valves in Underground Fire Mains		Title
3441	Large yard systems shall have sectional controlling valves at appropriate points, in order to permit sectionalizing the system in the event of a break, or for the making of repairs or extensions. (See Standard for Outside Protection, NFPA No. 24.)	D	Comply: Sectional controlling valves are provided for isolation. Ref: Drawing No. 4 & 43.
3450	Floor Control Valves		Title
3451	Floor control valves may be required in special cases where area or height, or number of tenants is excessive, both in manufacturing and mercantile buildings, or where contents are more than ordinarily susceptible to damage. Floor valves should be located where they are readily accessible.	W	Not Applicable: There are no systems of this type installed for protection of safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3460	Indicator Posts For Gate Valves		Title
3461	Outside control should be provided wherever possible.	D	Comply: Control outside of the area being protected is provided. Ref: Drawing No. 4 & 43.
3462	Where sprinklers are supplied from a yard main, an approved outside indicator post gate valve should be placed in the connecting pipe at a safe distance from the building.	D	Not Applicable: Systems are not fed directly from an underground yard main, but from an internal header system. Ref: Drawing No. 4 & 43.
3463.	Indicator post valves should be located not less than 40 feet from buildings; but where necessary to place a valve close to a building, it should be located at a blank part of the wall.	W	Not Applicable: The conditions described in this code section do not exist in these areas. See sections 3462 & 3441. Ref: Walkdown Checklist No. 1 - 3.

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3464	When a building has no basement, and outside post indicator control cannot be furnished, short post indicator may be installed in a horizontal position in riser with handwheel projecting outside of wall.	W	Not Applicable: The conditions described in this code section do not exist in these areas. Ref: Walkdown Checklist No. 1 - 3.
3470	Pits for Underground Valves		Title
3471	Pits for underground valves, except those located at the base of a tank riser, are described in the Standard for Outside Protection (NFPA No. 24). For pits protecting valves located at the base of a tank riser, refer to the Standard for Water Tanks for Private Fire Protection (NFPA No. 22).		Information Only
3480	Securing of Valves		Title
3481	All gate valves in supply pipes to automatic sprinklers, whether or not of indicator or post pattern, should be sealed open in a satisfactory manner.	W	Comply: All gate valves are locked in position with a plastic seal. Ref: Walkdown Checklist No. 1 - 3.
3490	Identification of Valves		Title
3491	All control, drain, test and alarm valves shall be provided with identification signs of the standard design adopted by the automatic sprinkler industry, or their equivalent. Such identification signs shall be of the design illustrated in Fig. 3491.	W, D	Comply: Plastic identification signs are provided on each valve. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 4 Section 9.0.
3500	Hangers		Title
3510	General		Title
3511	Sprinkler piping should be substantially supported from the building structure which should be designed to support the added load of the water-filled pipe plus 250 pounds applied at the point of hanging. In all cases, sprinkler piping should be	D	Comply: Walkdown verification for these areas was not possible due to the limiting accessibility of the systems. A document review shows that the hangers are adequate. Ref: Technical Data No. 4 Section 1:08.1; Drawing No. 1 - 3.

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	supported independently of the ceiling sheathing. In cases where sprinkler protection is installed below duct-work, piping should be substantially supported from the building structure or from the steel angles supporting the duct-work provided the angles are of adequate size and shape to support the combined weight of the duct-work and water-filled sprinkler branch line piping. (As a minimum, angle iron must conform to Table 3516.)		
3512	Hangers shall be of a type approved for use with the pipe or tube involved. Sprinkler piping should be supported by round wrought-iron U-type or approved adjustable hangers.	W, D	Comply: See response to code section 3511.
3513	Approved C-type hangers are acceptable for use on steel beams when provided with a strap as shown by "L" in Fig. 3510 or when cup-pointed set screws with locknuts are provided for hangers by the manufacturer. Strap or locknut may be omitted in situations where there is no material vibration of structural members provided C-type hanger is specifically approved for use without such strap or locknut. Straps shall be not less than 1/8 by 1 inch in section.	W, D	Comply: See response to code section 3511.
3514	If hangers or parts of hangers are made of flat iron or steel, the thickness of the metal must be at least 3/16 inch, unless protected by a suitable corrosion-resistant material and the strength of the hangers must, in any case, be comparable to that of other approved types.	D	Not Applicable: See response to code section 3511.
3515	Under metal decking branch line hangers may be attached by drilling or punching vertical members and using through bolts. The distance from the bottom of the bolt hole to the bottom of the vertical member shall be not less than 3/8 inch.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.

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3516	For trapeze hangers, the minimum size of steel angle or pipe span between purlins or joists shall be as shown in Table 3516, all angles to be used with longer leg vertical. The angles shown are selected for economy and availability. Any other sizes or shapes giving equal or greater section modulus will be acceptable. The trapeze bar shall be secured to prevent slippage.	W, D	Comply: For the high roof area, drawing shows that the hangers are adequate. Ref: Walkdown Checklist No. 1; Drawing No. 2.
		W	Not Applicable: There are no trapeze hangers used in the C.R. cable room or the drumming area. Ref: Walkdown Checklist No. 2 & 3.
3517	For the size of hanger rods, "U" hooks, drive and lag screws for support of steel angle or pipe of the trapeze bars, see Section 3540.	D	Comply: See response to code section 3511.
3518	Pipe rings hung from coach screw hooks should be avoided. They should never be used on branch lines. Hangers which permit wide lateral motion of the pipe, particularly on branch lines, are not acceptable. Toggle hangers should be used only for the support of branch lines and under ceilings of hollow tile or metal lath and plaster, in buildings of fire-resistive or noncombustible construction.	D	Comply: See response to code section 3511.
3520	Hangers in Concrete		Title
3521	In concrete construction, approved inserts set in the concrete may be installed for the support of hangers. The use of wood plugs is not permitted.	D	Comply: Walkdown verification for these areas was not possible. A document review shows that the hangers are adequate. Ref: Technical Data No. 4 Section 1:08.1; Drawing No. 1 - 3.
3522	Hangers should be installed without regard to the support of the sleeves where pipes are run through concrete beams. Such sleeves should not normally be used for the support of pipes.	W	Not Applicable: Walkdowns verified that there is no piping through concrete beams. Ref: Walkdown Checklist No. 1 - 3.

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3523	Expansion shields for supporting pipes under concrete construction should preferably be used in a horizontal position in the sides of beams, but in good, sound concrete having gravel or crushed stone aggregate, they may be used in the vertical position to support pipes 4 inches or less in diameter. In all cases, the suitability of the concrete should be definitely determined before using expansion shields. Where increaser couplings are used, they shall be attached immediately adjacent to the expansion shield.	D	Comply: See response to code section 3521.
3524	For the support of pipes 4 inches and larger, expansion shields if used in the vertical position should alternate with hangers connected directly to the structural members such as trusses and girders, or to the sides of concrete beams. In the absence of convenient structural members, pipes 4 inches and larger may be supported entirely be expansion shields in the vertical position, but spaced not over 10 feet apart.	D	Comply: See response to code section 3521.
3525	Expansion shields should not be used in ceilings of gypsum or similar soft material. In cinder concrete, expansion shields should likewise not be used except on branch lines and even then they should alternative with through bolts or hangers attached to beams.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3526	It is important in all cases, and especially so where expansion shields are used in the vertical position, that the holes be made of the proper size and be drilled with care to provide for a uniform contact with the shield over its entire circumference. Depth of the hole should in no case be less than specified for the type of shield used.	D	Comply: See response to code section 3521.

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JOB NO 0120-108-1375
CALC NO 0120-108-004

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3527	Holes for shields in the side of concrete beams should ordinarily be above the center line of the beam and always well above the bottom reinforcement.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3528	Where pipes are run through concrete beams, sleeves at least two sizes larger than the piping should be used.	W	Not Applicable: Walkdowns of the areas shown that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3529	Listed hangers may be attached to precast, pre-stressed concrete construction only when the building owner, or his architect or engineer, grants assurance that the building construction is adequate to support the water-filled pipe with suitable factor of safety.	D	Comply: See response to code section 3521.
3530	Powder Driven Studs and Welding Studs		Title
3531	Powder driven studs, welding studs, and the tools used for installing these devices shall be listed by a nationally recognized testing laboratory and installed within the limits of pipe size, installation position, and construction material into which they are installed, as expressed in individual listings or approvals.	D	Comply: Walkdown verification for these areas was not possible. A document review shows compliance with this code section. Ref: Technical Data No. 4; Drawing No. 1 - 3.
3532	Powder driven studs should not be used in steel less than 3/16 inch total thickness. The size of sprinkler pipe supported by powder driven studs in steel shall not exceed 5 inches.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3533	Powder driven studs should be used in concrete only where the authority having jurisdiction approves such use on the basis of a test of the acceptability of the studs made in the actual concrete on the job. The ability of the concrete to hold the studs varies widely	W, D	Comply: See response to code section 3531.

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	according to type of aggregate and quality of concrete, and it should be established in each case by testing to determine that the studs will hold a minimum load of 750 lbs. for 2-inch or smaller pipe and 1,000 lbs for 3- or 3-1/2-inch pipe, and will not work loose by jiggling the stud or by vibration. The size of sprinkler pipe supported by powder driven studs in concrete shall not exceed 3-1/2 inches.		
3534	Studs or other hanger parts should not be attached by welding to steel less than 3/16 inch in thickness.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3535	Where increaser couplings are used, they shall be attached directly to the powder driven stud or welding stud.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3540.	Ceiling Flanges, Rods and "U" Hooks		
3541	Ceiling Flanges. For pipe sizes up to 2 inches, ceiling flanges shall have at least two supporting screw holes; for sizes 2-1/2 inches to 8 inches, not less than three holes, preferably so located that no two holes are in the same line as the grain in the planking.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3542	Rods. The size of rods for hangers shall not be less than that given in the following table. Such sizes are nominal diameters associated with machined threads. For rolled threads the rod size shall be not less than the root diameter of the thread. Pipe Size — Diameter of Rod Up to 2" — 3/8" 2-1/2", 3", 3-1/2" — 1/2" 4", 5" — 5/8" 6" — 3/8" 8" — 7/8"	D	Comply: Walkdown verification for these areas was not possible. A document review shows compliance with this code section. Ref: Technical Data No. 4; Drawing No. 1 - 3.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3543	"U" Hooks. The size of the rod material of "U" hooks shall be not less than that given in the following table: Pipe Size — Hook Material Diameter Up to 2" — 3/16" 2-1/2", 3" — 3/8" 3-1/2", 4" — 1/16" 5" — 1/2" 6" — 1/2" 8" — 3/4"	W, D	Comply: See response to code section 3542.
3544	Screws. For ceiling flanges and "U" hooks screw dimensions shall be not less than those given in the following table: Pipe Size — 2 Screw Flanges Up to 2" — Wood Screw No. 18 x 1-1/2" Pipe Size — 3 Screw Flanges Up to 2"in. — Wood Screw No. 18 x 1-1/2" 2-1/2", 3", 3-1/2" — Lag Screw 1/8" x 2" 4", 5", 6" — Lag Screw 1/2" x 2" 8" — Lag Screw 3/8" x 2" Pipe Size — 4 Screw Flanges Up to 2" — Wood Screw No. 18 x 1-1/2" 2-1/2", 3", 3-1/2" — Lag Screw 1/8" x 1-1/2" 4", 5", 6" — Lag Screw 1/2" x 2" 8" — Lag Screw 3/8" x 2" Pipe Size — 4 Screw Flanges Up to 2" — Drive Screw No. 16 x 2" 2-1/2", 3", 3-1/2" — Lag Screw 1/8" x 2-1/2" 4", 5", 6" — Lag Screw 1/2" x 3" 8" — Lag Screw 3/8" x 3"	W	Not Applicable: See response to code section 3541.

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3545	The size bolt or lag (coach) screw used with eye rod on the side of a beam shall be not less than that indicated in the following table:	W, D	Comply: See response to code section 3542.

TABLE 3545

Size of Rod	Size of Bolt or Lag Screw	Length of Lag Screw Used with Wood Beams
3/8"	3/8"	2-1/2"
1/2"	1/2"	3"
5/8"	1/2"	3"
3/4"	1/2"	3"
7/8"	5/8"	3"

3546	Drive screws shall be used only in a horizontal position as in the side of a beam. Wood screws shall not be driven. Nails are not acceptable for fastening hangers.	W	Not Applicable: See response to code section 3541.
3547	Screws in the side of a timber or joist should be not less than 2-1/2 inches from the lower edge when supporting branch lines, and not less than 3 inches when supporting main lines. This shall not apply to 2-inch or thicker nailing strips resting on top of steel beams.	W	Not Applicable: See response to code section 3541.
3548	When the thickness of planking and thickness of flange does not permit the use of screws 2 inches long, screws 1-3/4 inches long may be permitted.	W	Not Applicable: See response to code section 3541.
3549	The minimum thickness of plank and the minimum width of lower face of beams or joists in which lag screw rods are used shall be as given in the following table:	W	Not Applicable: See response to code section 3541.

Diameter of Rod	Nominal Plank Thickness	Nominal Width of Beam Face
Up to 3/8"	3"	2"
1/2"	4"	2"
5/8"	4"	3"
3/4"	4"	4"

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	Lag screw rods should not be used for support of pipes larger than 6 inches. All holes for lag screw rods should be predrilled 1/8 inch less in diameter than the root diameter of the lag screw thread.		
3550	Maximum Distance Between Hangers		Title
3551	With steel or wrought iron pipe or cold drawn copper tube as specified in Paragraph 3003, the maximum distance between hangers shall not exceed 12 feet for 1 and 1-1/4 inch sizes nor 15 feet for sizes 1-1/2 inch and large except as provided for in Section 3570 of this Sprinkler Standard. See Figure 2551(a).	W, D	Comply: See response to code section 3542.
3560	Location of Hangers on Branch Lines		Title
	NOTE: This Section is applicable to the support of steel or wrought iron pipe as described in Paragraph 3002 and is also applicable to the support of copper tube conforming to Paragraph 3003, both subject to the additional restrictions contained in Section 3550.		Information Only
3561	On branch lines, there should ordinarily be at least one hanger for each length of pipe. Further specifications and modification of this rule are included in Paragraphs 3562-3587, inclusive.	D	Comply: Walkdown verification for these areas was not possible. A document review shows compliance with this code section. Ref: Technical Data No. 4; Drawing No. 1 - 3.
3562	The minimum distance between hangers and upright sprinklers should be in accordance with Table 3562.	W	Does Not Comply: Numerous hangers in the C.R. Cable Vault are too close to sprinkler heads. Ref: Walkdown Checklist No. 3.

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		D	Comply: For drumming area and high roof area, walkdown verification for these areas was not possible. A document review shows compliance with this code section. Ref: Technical Data No. 4; Drawing No. 1 - 3.
	TABLE 3562 Size of Hanger — Minimum Distance Between Sprinkler and Hanger 1/2" or less — 3" 1" or less but more than 1/2" — 6" More than 1" — 12"		
3563	If necessary, the unsupported length between the end sprinkler and the last hanger may be extended to 36 inches for 1 inch pipe, or 48 inches for 1-1/4 inch pipe. Where these limits are exceeded, the pipe should be extended beyond the end sprinkler for an additional hanger.	W, D	Not Applicable: Walkdown and Drawing reviews verified that the conditions described in this section do not exist. Ref: Walkdown Checklist No. 3; Drawing No. 1 - 3.
3564	Where one hanger for each length of pipe would require hangers closer than 6 feet apart, hangers may be spaced up to, but not exceeding 12 feet.	D	Comply: Walkdown verification for these areas was not possible. A document review shows compliance with this code section. Ref: Technical Data No. 4; Drawing No. 1 - 3.
3565	Start lengths less than 6 feet do not require a hanger, except on the end line of a side-feed system, or where an intermediate cross main hanger has been omitted.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3566	One inch arms not over 12 inches long for copper tube, nor 24 inches long for steel pipe from branch lines or cross main do not require hangers.	D	Comply: Walkdown verification for these areas was not possible. A document review shows compliance with this code section. Ref: Technical Data No. 4; Drawing No. 1 - 3.

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3567	In special cases it may be necessary to make provisions to take care of the thrust of branch lines in a steeply pitched roof especially where there is a long nipple between the cross main and the branch. This may be done by installing a clamp on the pipe just above the lower hanger.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3570	Location of Hangers on Cross Mains NOTE: This Section is applicable to the support of steel or wrought iron pipe as described in Paragraph 3002 and is also applicable to the support of copper tube conforming to Paragraph 3003, both subject to the additional restrictions contained in Section 3550.		Title Information Only
3571	On cross mains there should ordinarily be one hanger between each two branch lines. In cases where cross mains are supported from floor or roof framing members and intermediate hanging may require the use of trapeze hangers, intermediate hangers may be omitted as outlined in Paragraphs 3572-3575, inclusive.	D	Comply: Walkdown verification for these areas was not possible. A document review shows compliance with this code section. Ref: Technical Data No. 4; Drawing No. 1 - 3.
3572	In bays having two branch lines, the intermediate hanger may be omitted provided that a hanger attached to a purlin is installed on each branch line located as near to the cross main as the location of the purlin permits. Remaining branch line hangers should be installed in accordance with Section 3560.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3573	In bays having three side fed branch lines, one (only) intermediate hanger may be omitted provided that a hanger attached to a purlin is installed on each branch line located as near to the cross main as the location of the purlin permits. Remaining branch line hangers should be installed in accordance with Section 3560.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.

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3574	In bays having three center feed branch lines, both intermediate hangers may be omitted provided that a hanger attached to a purlin is installed on each branch line as near to the cross main as the locations of the purlins permit. Remaining branch line hangers should be installed in accordance with Section 3560.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3575	At the end of the cross main, intermediate trapeze hangers should be installed unless the cross main is extended to the next framing member with an ordinary hanger installed at this point, in which event, intermediate hangers may be omitted in accordance with Paragraphs 3572-3574, inclusive.	W, D	Comply: For high roof area. See response to code section 3571.
		W	Not Applicable: For drumming area and the C.R. Cable Vault, walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3580	Location of Hanger on Feed Mains		Title
	NOTE: This Section is applicable to the support of steel or wrought iron pipe as described in Paragraph 3002 and is also applicable to the support of copper tube conforming to Paragraph 3003, both subject to the additional restrictions contained in Section 3550.		Information Only
3581	On feed mains there should be at least one hanger for each 15 feet of pipe.	D	Comply: A document review shows compliance with this code section. Ref: Technical Data No. 4; Drawing No. 1 - 3.
3590	Support of Risers		Title
3591	Risers shall be adequately supported by attachments direct to the riser or by hangers located on the horizontal connections close to the riser.	D	Comply: A document review shows compliance with this code section. Ref: Technical Data No. 4; Drawing No. 1 - 3.

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3592	Where risers are supported at the ground and are without offsets additional support at every fourth floor above will ordinarily be ample. Where risers do not rise from the ground, direct support should be provided, preferably at every floor.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3593	In buildings of heavy construction and ten stories in height, no support is required above the fifth floor.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3594	In buildings of heavy construction and more than ten stories, supports are required at the ground (first) level, fifth and ninth levels, and every fourth story above.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3595	In buildings of light construction additional supports are required.	W	Not Applicable: Walkdowns of the areas show that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3596	Sprinkler and tank risers in vertical shafts should be supported equivalent to the above.	W	Not Applicable: Walkdowns of the areas shown that the conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
3597	Clamps supporting pipe by means of set screws shall not be used.	D	Comply: See response to code section 3591.
3600	Sprinklers		Title
3601	Standards and Old Style Sprinklers		Title
3602	During the years 1952 and 1953 sprinklers were redesigned which resulted in greatly improved water distribution. The redesign of the deflectors was the principal reason for the		Information Only

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	improvement. As a result of these changes, water is discharged in all directions below the plane of the deflector. The spray pattern is roughly that of a half sphere completely filled with water spray. Little or no water is discharged upward to wet the ceiling.		
3603	The distribution pattern for approved standard sprinklers is more uniform than from the old style sprinklers and, at a distance four feet below the deflector, covers a circular area of useful intensity of water discharge of a diameter of about sixteen feet when discharging at fifteen gallons per minute. The area covered is generally independent of the type of ceiling and tends to be larger at distances over four feet and smaller at distances less than four feet.		Information Only
3604	The 1955 issue of the Standard for the Installation of Sprinkler Systems was revised principally on the basis of improved water distribution by the redesigned sprinkler which up to that time was known as the spray type.		Information Only
3605	This redesigned sprinkler is known as the standard sprinkler.		Information Only
3606	The former so-called conventional or regular sprinkler is known as the old style sprinkler.		Information Only
3607	Standard sprinklers may be used to replace old style sprinklers without system changes except for installation under piers and wharves where construction features may require upward discharge to wet the underside of decks and structural members supporting the decks. In these cases, a sprinkler that projects water upward to wet the overhead		Information Only

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	shall be used. This can be accomplished by using the standard pendent sprinkler installed in an upright position or by the use of the old style sprinklers.		
3608	Old style sprinklers may be used to replace old style sprinklers.		Information Only
3609	Old style sprinklers shall not be used to replace standard sprinklers without a complete engineering review of the system which may result in major changes.	W	Not Applicable: There are no old style sprinklers on site. Ref: Walkdown Checklist No. 1 - 3.
3610	Types of Sprinklers		Title
3611	Sprinklers shall be of approved makes and types. Sprinklers shall not be altered in any respect, nor have any type of ornamentation or coatings applied after shipment from the place of manufacture.	W, D	Comply: Documents show that sprinklers are approved. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 1. Due to the congestion in the control room cable vault, this information was not readily obtainable from plant walkdowns. Due to the lack of accessibility to the sprinkler heads in this drumming area and the high roof area, this information was not readily obtainable from plant walkdowns.
3612	Automatic sprinklers with nominal 1/2-inch discharge orifice and of the ordinary degree temperature ratings will usually be required.	W, D	Comply: See response to code section 3611.
3613	The character of the discharge of sprinklers is such that it is necessary to use two distinct designs - one approved for the upright and the other for the pendent position. Sprinklers should be installed with the frame parallel to the branch line pipe to reduce to minimum the obstruction of the discharge pattern.		Information Only

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3614	The authority having jurisdiction shall be consulted in every case involving special use of sprinklers as contemplated by this section of the Standard. Sprinklers used for the special purposes and locations described in Paragraphs 3615 to 3634 inclusive shall be of types specifically approved for such use.		Information Only
3615	Open sprinklers may be used to protect special hazards, for protection against exposures, or in other special locations.		Information Only
3616	For small enclosures and other special locations or conditions not requiring as much water as is discharged by a nominal 1/2-inch orifice sprinkler, sprinklers having smaller discharge orifices may be used.		Information Only
3617	In situations involving special problems of water distribution, sprinklers having a discharge other than that which is characteristic of the ordinary types may be used. These will usually have special deflectors. Sprinklers having special discharge characteristics may be required where either a fine spray or directional discharge of water is needed, (e.g, directional discharge may be needed to properly protect substructures of piers and wharves due to the arrangement of structural supporting members. See NFPA No. 87, Standard for the Construction and Protection of Piers and Wharves.)		Information Only
3620	Corrosion-Resistant Sprinklers		Title
3621	Approved corrosion-resistant or special coated sprinklers shall be installed in locations where chemicals, moisture or other corrosive vapors exist sufficient to cause corrosion of such devices as in paper mills, packing houses, tanneries, alkali plants,	W	Not Applicable: The conditions described in these requirements 3620 thru 3623 do not exist in safety related areas. Therefore, these sections will not be verified.

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	organic fertilizer plants, foundries, forge shops, pickle and vinegar works, stables, storage battery rooms, electroplating rooms, galvanizing rooms, steam rooms of all descriptions, including most vapor dry kilns, salt storage rooms, locomotive sheds or houses, driveways, areas exposed to outside weather such as piers and wharves exposed to salt air, areas under sidewalks, around bleaching equipment in flour mills, all portions of cold storage buildings where a direct ammonia expansion system is used, portions of any plant where corrosive vapors prevail.		
3622	Special care shall be taken in the handling and installation of wax-coated or similar sprinklers to avoid damaging the coating.	W	Not Applicable: See response to code section 3621.
3623	Corrosion-resistant coatings shall not be applied to sprinklers by anyone other than the manufacturer of the sprinklers, except that in all cases any damage to the protective coating occurring at the time of installation shall be repaired at once using only the coating of the manufacturer of the sprinkler in approved manner so that none of the sprinkler will be exposed after the installation has been completed. Otherwise, corrosion will attack the exposed metal and will in time creep under the coating.	W	Not Applicable: See response to code section 3621.
3630	Sidewall Sprinklers		Title
3631	Sidewall sprinklers are special purpose sprinklers and the authority having jurisdiction should be consulted where sidewall sprinklers are to be used.		Information Only
3632	Where a standard sprinkler system can be installed without interfering with the decorative scheme, sidewall sprinklers should not be used.	W, D	Not Applicable: Walkdowns and drawings show no sidewall sprinklers. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 1 - 3.

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3633	Where, to preserve appearance, concealed sprinkler piping and standard sprinklers can be installed, sidewall sprinklers should not be used.	W	Not Applicable: See response to code section 3632.
3634	Unless specifically tested and listed for ordinary hazard occupancies, the use of sidewall sprinklers should be confined to light hazard occupancies as defined in Paragraph 1311.	W	Not Applicable: See response to code section 3632.
3640	Discharge Capacities		Title
3641	The following Table 3641 shows the nominal discharge capacities of approved sprinklers having a nominal 1/2-inch orifice at various pressures up to 100 psi.		Information Only
3642	The following Table 3642 shows the K factor, relative discharge and identification for sprinklers having different orifice sizes.		Information Only
3650	Temperature Ratings		Title
3651	The standard temperature ratings of automatic sprinklers are shown in Table 3651. Automatic sprinklers shall have their frame arms colored in accordance with the color code designated in Table 3651, with the following exceptions: (a) The color identification for coated sprinklers may be a dot on the top of the deflector, the color of the coated material or colored frame arms. (b) Color identification is not required for plated sprinklers, ceiling sprinklers or similar decorative types.	D	Comply: Drawings show that all sprinkler heads are color coded. Ref: Drawing No. 1 - 3. Due to the congestion in the control room cable vault, this information was not readily obtainable from plant walkdowns. Due to the lack of accessibility to the sprinkler heads in this drumming area and the high roof area, this information was not readily obtainable from plant walkdowns.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3652	Where higher temperature sprinklers are necessary to meet extraordinary conditions, special sprinklers as high as 600 are obtainable.		Information Only
3653	The use of sprinklers with temperature ratings higher than ordinary shall be in accordance with the maximum ceiling temperatures given in Table 3651, except as provided in Paragraph 3654.	D	Comply: Drawing for the C.R. Cable Vault shows that the sprinklers used are in accordance with the temperatures given in Table 3651. Ref: Technical Data No. 15; Drawing No. 1.
		D	Does Not Comply: Drawings for the drumming and high roof areas show that 250°F rated sprinklers are used rather than 175°F to 225°F called out in Table 3651. Ref: Technical Data No. 15; Drawing No. 2 & 3.
3654	Where an occupancy hazard normally may be expected to produce a fast-developing fire or rapid rate of heat release the use of sprinklers of Intermediate or High Temperature Rating, as a means of limiting the total number of sprinklers which might open in a fire, is recommended subject to the approval of the authority having jurisdiction (the use of High Temperature Rating Sprinklers should be limited to buildings with structural steel fully protected). Since the number of sprinklers which might be expected to open will be reduced where the water pressure effective in first operating sprinklers is at least 75 psi without the disadvantage of a potential increase in fire damage, this alternative should be given first consideration. For situations involving rack storage, refer to NFPA, No. 231C entitled Rack Storage of Materials.	W	Not Applicable: The conditions described in this requirement do not exist in safety related areas with sprinkler protection. Ref: Walkdown Checklist No. 1 & 3.

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	NOTE: Fire tests have shown that the number of sprinklers which might be expected to open, particularly under conditions where fast-developing fires may be expected, can be limited by the use of Intermediate or High Temperature Rating Sprinklers. this may be of advantage in reducing the number of sprinklers which would otherwise open outside the area directly involved in a fire and decrease the overall water demand. However, some increase in fire damage and fire temperature should be expected when Intermediate or High Temperature Rating Sprinklers are used.		
3655	Information regarding the highest temperature that may be encountered in any location in a particular installation should be obtained by use of a thermometer that will register the highest temperature encountered, which should be hung for several days in the questionable location with the plant in operation.		Information Only
3656	The following general practices should be observed when installing high temperature sprinklers, unless special rulings have been made based on temperature readings. (a) Sprinklers near unit heater. Where steam pressure is not more than 15 lbs, sprinklers in the Heater Zone should be High and sprinklers in the Danger Zone Intermediate Temperature Classification. (b) Sprinklers located within 12 inches to one side or 30 inches above an uncovered steam main, heating coil or radiator, should be Intermediate Temperature Classification.	W	Not Applicable: Walkdowns show that the following code conditions do not exist. See response to code section 3653. Ref: Walkdown Checklist No. 1 - 3.

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	(c) Sprinklers within 7 feet of a low pressure blow-off valve which discharges free in a large room, should be High Temperature Classification.		
	(d) Sprinklers under glass skylights exposed to the direct rays of the sun should be Intermediate Temperature Classification.		
	(e) Sprinklers in an unventilated concealed space under an uninsulated wood or metal roof, or in an unventilated attic, or in a building having an unventilated peak roof of thin boards or metal, should be Intermediate Temperature Classification.		
	(f) Sprinklers in unventilated show windows having high-powered electric lights near the ceiling should be Intermediate Temperature Classification.		
	(g) At intervals some occupancies employ high temperature fumigation processes requiring consideration in the selection of sprinkler temperature ratings.		
	(h) Where a locomotive enters a building, sprinklers should be located not nearer than 5 feet from the center line of the track.		
	(i) Consideration should be given to the selection of sprinklers protecting commercial-type cooking equipment and ventilation systems. Sprinklers with temperature classifications of Intermediate, High or Extra High usually will be required as determined by use of a temperature measuring device (see paragraph 4328).		

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	(j) Representative solder type sprinklers with temperature classification of Extra High (325-575°F) or greater which are exposed on a semi-continuous to continuous maximum allowable ambient temperature condition should be tested at 5-year intervals for operation by a recognized testing laboratory.		
3657	In case of change of occupancy involving temperature change, the sprinklers should be changed accordingly.		Information Only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3660	Stock of Extra Sprinklers		Title
3661	There shall be maintained on the premises a supply of extra sprinklers (never less than six) so that sprinklers that have been operated or been injured in any way may promptly be replaced. These sprinklers shall correspond as to types and temperature ratings with the sprinklers in the property. The sprinklers should be kept in a cabinet located where the temperature to which they are subjected will at no time exceed 100°F. Cabinets are furnished in standard sizes of 6 and 12 sprinkler capacities.	W	Comply: Walkdowns and inventory documents show an ample supply of extra sprinklers in the store room. Ref: Walkdown Checklist No. 1 & 2.
3662	A special sprinkler wrench should also be provided and kept in the cabinet, to be used in the removal and installation of sprinklers.	W	Comply: Grinnell sprinkler wrench in in tool room. Ref: Walkdown Checklist No. 1 & 2.
3663	The number of sprinklers carried for replacement purposes should be governed by: (a) Size of system. (b) Location of protected property to source of sprinkler supply. (c) Number of sprinklers likely to be opened by extraordinary conditions such as flash fire.		Information Only
3664	Ordinarily, under average conditions, the stock of emergency sprinklers should be as follows: For equipments not over 300 sprinklers — 6 sprinklers For equipments 300 to 1,000 sprinklers — 12 sprinklers For equipments above 1,000 sprinklers — 24 sprinklers Stock of emergency sprinklers should include all types and ratings installed.	W,D	Comply: See response to code section 3661.

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3665	For equipment aboard vessels or isolated locations, a greater number of sprinklers should be carried, to permit equipment to be put back into service promptly after a fire.	W	Not Applicable: These conditions do not exist for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3670	Guards and Shields		Title
3671	Sprinklers which are so located as to be subject to mechanical injury (in either the upright or the pendent position) shall be protected with approved guards.	W	Not Applicable: Areas in question are such that mechanical damage is unlikely due to lack of accessability, height of sprinklers or radiation concerns. Ref: Walkdown Checklist No. 1 - 3.
3672	Sprinklers under the gridiron of theaters should be provided with metal shields.	W	Not Applicable: There are no systems of this type installed for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3673	Baffles over automatic sprinklers under steel grating floors should not be less than 18 inches in least dimension. The deflector should be located not more than 4 inches below the baffle.	W	Not Applicable: The conditions described in this code section do not exist in these areas. Ref: Walkdown Checklist No. 1 - 3.
3680	Painting and Ornamental Finishes		Title
3681	When the sprinkler piping is given any kind of coating, such as whitewash or paint, care must be exercised to see that no portion of the automatic sprinklers is coated. When painting sprinkler piping or painting in areas near sprinklers, the sprinklers may be protected by covering with a paper bag which shall be removed immediately after the painting has been finished.	W	Open Item: Due to the congestion in the control room cable vault, this information was not readily obtainable from plant walkdowns. Due to the lack of accessibility to the sprinkler heads in this drumming area and the high roof area, this information was not readily obtainable from plant walkdowns. Ref: Walkdown Checklist No. 1 - 3.

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3682	Sprinkler frames may be factory painted or enameled for the purpose of identifying sprinklers of different temperature ratings in accordance with Paragraph 3651. Otherwise, sprinklers shall be not painted and any sprinklers which have been painted, except for factory applied coatings applied for identification of temperature ratings shall be replaced with new approved sprinklers. Paintings of sprinklers may retard the thermal response of the fusible element, may interfere with the free movement of parts and may render the sprinkler inoperative. Moreover, painting may invite the application of subsequent coatings, thus increasing the possibility of a malfunction of the sprinkler.	W	Open Item: Due to the congestion in the control room cable vault, this information was not readily obtainable from plant walkdowns. Due to the lack of accessibility to the sprinkler heads in this drumming area and the high roof area, this information was not readily obtainable from plant walkdowns. Ref: Walkdown Checklist No. 1 - 3.
3683	Ornamental finishes shall not be applied to sprinklers by anyone other than the manufacturer of the sprinklers and only sprinklers approved with such finishes shall be used.	W	Open Item: Due to the congestion in the control room cable vault, this information was not readily obtainable from plant walkdowns. Due to the lack of accessibility to the sprinkler heads in this drumming area and the high roof area, this information was not readily obtainable from plant walkdowns. Ref: Walkdown Checklist No. 1 - 3.
3690	Clear Space Below Sprinklers		Title
3691	Arrangements should be made to keep at least 18 inches clearance below sprinkler deflectors to reduce possible obstruction to the distribution of water. For high piled combustible stock increased clearance of 36 inches or more should be provided.	W W	Comply: No obstacles in the high roof area and the drumming area. Ref: Walkdown Checklist No. 1 & 2. Does Not Comply: There are numerous obstacles for sprinklers in the CR cable vault. Ref: Walkdown Checklist No. 3.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3710	Definition		Title
3711	A local alarm unit is an assembly of apparatus approved for the service and so constructed and installed that any flow of water from a sprinkler system equal to or greater than that from a single automatic sprinkler will result in an audible alarm signal on the premises.		Information Only
3720	Where Required		Title
3721	Water flow alarms shall be provided on all sprinkler installations except where permission of the authority having jurisdiction is obtained for their omission. Central station water flow alarm service is desirable but central station water flow alarm service does not necessarily waive the local alarm requirement. All systems should be equipped with either outdoor water motor or electric alarm gongs.	W,D	Comply: All systems are provided with water flow alarms. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 2.
3722	Under conditions where central station water flow alarm service is not available it may be advisable to connect electrical alarm units to public Fire Department headquarters or nearest Fire Department station or other suitable place where aid may be readily secured.	W	Not Applicable: These conditions are not present in safety related areas. A central station alarm is installed in the control room. Ref: Walkdown Checklist No. 1 - 3.
3730	Water Flow Detecting Devices		Title
3731	Alarm Check Valves. The alarm apparatus for a wet-pipe system shall consist of approved alarm check valve or other approved water flow detecting alarm device with the necessary attachments required to give an alarm.	W W	Comply: Alarm check valves and alarm devices are provided for annunciation of the CR cable vault system in the control room. Ref: Walkdown Checklist No. 3. Not Applicable: The high roof area and the drumming area have pre-action systems. Ref: Walkdown Checklist No. 1 & 2.

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3732	Dry-Pipe Valves. The alarm apparatus for a dry-pipe system shall consist of approved alarm attachments to the dry-pipe valve. When a dry- pipe valve is located on the system side of an alarm valve, the actuating device of the alarms for the dry-pipe valve may be connected to the alarms on the wet-pipe system.	W	Not Applicable: There are no dry-pipe systems for protection of safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3733	Pre-Action and Deluge Valves. The alarm apparatus for pre-action and deluge systems shall consist of approved electric alarm attachments, actuated by a thermostatic system independently of flow of water in the system. A mechanical alarm (water motor gong) may also be required.	W, D	Comply: A pressure switch is located in the system piping downstream of each valve for the drumming and high roof area systems. Water flow provides annunciation to the EF panel in the control room. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 2 Section 9.2.4.
3734	Paddle Type Detectors. Water flow indicators (paddle type) should not be installed in dry-pipe, pre-action or deluge systems as the surge of water when valve trips would seriously damage the device.	W, D	Comply: The drumming area and the high roof area are provided with Mercoid pressure switches. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 2.
		W	Not Applicable: The CR cable vault has a wet-pipe system. Ref: Walkdown Checklist No. 3.
3740	Attachments - General		Title
3741	An alarm unit shall include an approved mechanical alarm, horn or siren, or an approved weatherproof electric gong, bell, horn or siren on the outside of the building or approved electric gongs, bells, horns, or sirens inside the building, or a combination of such devices, as required by the authority having jurisdiction.	W	Comply: A general fire alarm system (motor driven horns) provides an alarm to all areas of the plant upon fire suppression system actuation. This alarm is distinctive from other alarms. Ref: Technical Data No. 19 Section 8.1.1.
3742	All alarm apparatus shall be so located and installed that all parts are readily accessible for inspection removal, and repair, and shall be substantially supported. Outdoor mechanical or electrically operated bells shall be of weatherproof and guarded type.	D	Comply: All alarm apparatus are adequately supported and accessible. Ref: Technical Data No. 11 (1967).

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3743	On each alarm check valve used under conditions of variable water pressure, a retarding device shall be installed. Suitable valves shall be provided in the connections to retarding chambers, to permit repair or removal without shutting off sprinklers; these valves shall be so arranged that they may be locked or sealed in the open position.	W	Comply: The CR cable vault system is equipped with a retard chamber and applicable valving. Ref: Walkdown Checklist No. 3.
		W	Not Applicable: The drumming and high roof areas have pre-action systems. Ref: Walkdown Checklist No. 1 & 2.
3744	Dry-pipe, pre-action and deluge valves shall be fitted with a test connection for electric alarm switch and/or water motor gong. This pipe connection shall be made on the water side of the system and provided with a control valve and drain for the alarm piping. A check valve shall be installed in the pipe connection to the intermediate chamber of the dry-pipe valve.	W	Comply: The high roof and drumming areas have alarms on the priming line supplied from the water side of the system with applicable valving and piping. Ref: Walkdown Checklist No. 1 & 2.
		W	Not Applicable: CR cable vault has a wet-pipe system. The discussion on dry-pipe valves in this requirement is not applicable. Ref: Walkdown Checklist No. 1 - 3.
3745	It is not advisable to test a water motor alarm in extremely cold weather and where they are used a properly valved pipe bypass from a compressed air supply may be provided for test purposes.		Information Only
3746	A control valve shall be installed in connection with pressure-type contactor and water-motor-operated alarm devices and such valves shall be of the type which will clearly indicate whether they are open or closed and be so constructed that they may be locked or sealed in the open position. The control valve for the retarding chamber on alarm check valves of wet-pipe systems will be accepted as complying with this paragraph.	W, D	Comply: All systems are provided with indicating valves. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 2.

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3750	Attachments - Mechanically Operated		Title
3751	Water-motor-operated devices shall be located as near the alarm valve, dry-pipe valve or other water flow detecting device as practicable in order to avoid long runs or many fittings in the pipe to the water-motor-operated device. The total length of the pipe should not exceed 75 feet nor shall the water-motor-operated device be located over 20 feet above the alarm device or dry-pipe valve. If absolutely necessary to exceed 75 feet, the pipe line to the water-motor-operated device shall be increased one or more sizes to compensate for loss of pressure due to hydraulic friction. For all types of sprinkler systems employing water-motor-operated alarms, an approved 3/4-inch strainer shall be installed at the alarm outlet of the water flow detecting device except that when a retarding chamber is used in connection with an alarm valve, the strainer shall be located at the outlet of the retarding chamber. Water-motor-operated devices shall be protected from the weather, and shall be properly aligned and so installed as not to get out of adjustment. All piping to these devices shall be galvanized or brass of a size not less than 3/4 inch and larger for long runs of piping or where pressures are low. Piping shall be arranged to drain properly through a brass bushed orifice not larger than 1/8 inch. Drains shall be conducted to a proper place. (See Sections 3240 and 3780.)	W	Not Applicable: These components are not provided for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3752	No single mechanical alarm device should be connected to more than three sprinkler systems and the systems controlled by the valves should be in the same fire area.	W	Not Applicable: Walkdowns showed that there are no mechanical alarms. All systems have electric alarms. Ref: Walkdown Checklist No. 1 - 3.

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3760	Attachments - Electrically Operated		Title
3761	(a) Electrically operated alarm attachments forming part of an auxiliary, central station, proprietary or remote station signaling system shall be installed in accordance with the following applicable NFPA standards. 1. Central Station Protective Signaling Systems (NFPA No. 71). 2. Auxiliary Protective Signaling Systems (No. 72B). 3. Remote Station Protective Signaling Systems (NFPA No. 72C). 4. Proprietary Protective Signaling Systems (NFPA No. 72D). (b) Electrically operated alarm attachments forming part of a local sprinkler water flow alarm system shall be installed in accordance with the local alarm system provisions of NFPA No. 72A and in accordance with the provisions of the following Paragraphs 3762, 3763 and 3764. These standards permit local electrical waterflow alarms to be of open circuit type.	D	Does Not Comply: See the Code Compliance Verification Checklist NFPA 72D (1967) Section 2032. Ref: Technical Data No. 11 (1967) Section 2032.
3762	Waterflow devices, controlling electric alarm circuits, should be provided with means for testing the electrical supply, circuits, connection and devices. An actual waterflow, through the use of a test connection, shall be the method employed for testing the operation of the sprinkler alarm unit as a whole.	W, D D	Comply: Test devices are provided for each system. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 4 & 5. Does Not Comply: See the Code Compliance Verification Checklist NFPA 72D (1967) Section 2034. (Ref: Technical Data No. 11 (1967) Section 2034.

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3763	No single electrical waterflow alarm sounding device should be connected to more than three sprinkler systems; these systems should be in the same fire area. Switches which will silence electric alarm sounding devices by interruption of electrical current are not desirable; however, if such means are provided, then the electrical alarm sounding device circuit shall be arranged so that when the sounding device is electrically silenced, that fact shall be indicated by means of a conspicuous light located in the vicinity. This light shall remain in operation during the entire period of the electrical circuit interruption.	W,D	Comply: A water flow device is provided for each system. See the Code Compliance Verification Checklist for NFPA 72D (1967) Section 2432 for compliance to isolation switches. Ref: Walkdown Checklist No. 1-3; Technical Data No. 11 (1967) Section 2432; Drawing No. 4 & 5.
3764	Outdoor electric alarm devices shall be of a type specifically approved for outdoor use, and the outdoor wiring shall be in approved conduit, properly protected from the entrance of water in addition to the requirements of Paragraph 3761.	W	Not Applicable: These components do not exist for safety related areas Ref: Walkdown Checklist No. 1 - 3.
3770	Identification Signs		Title
3771	It is desirable and often essential to provide approved identification signs for outside alarm devices. The sign should be located near the device in a conspicuous position and shall be worded as follows: "Sprinkler Fire Alarm - when bell rings call fire department or police."	W	Not Applicable: There are no outside alarm devices for the systems. Ref: Walkdown Checklist No. 1 - 3.
3780	Drains		Title
3781	Where vents are necessary for satisfactory electric alarm switch operation, such vents should be properly piped to a drain.	D	Comply: Where pressure switches are provided with a vent, they are connected to a drain. Ref: Drawing No. 4
3782	Drains from alarm devices shall be so arranged that there will be no danger of freezing, and so that there will be no overflowing at the alarm apparatus, at domestic connections or	W	Comply: The alarm devices drain into the buildings which are not subject to freezing. Ref: Walkdown Checklist No. 1 - 3.

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	elsewhere with the sprinkler drains wide open and under pressure.		
3783	Drain from retarding chamber and electric alarm switch should preferably discharge through an open cone and be run separate from main system drains to a safe and visible point of free discharge or to sewer or ground drain. Drain from water-motor-operated alarm device may run separately to sewer or ground drain or may be connected to drain from retarding chamber at a point between such sewer and a check valve on this drain, a union or plug being inserted in the drain from the alarm device to permit inspection.	W	Does Not Comply: Walkdowns show that the drain from the C.R. Cable Vault wet pipe system discharges to the floor which contains numerous unsealed penetrations. Ref: Walkdown Checklist No. 3.
		W	Not Applicable: The drumming and high roof areas are pre-action systems. Ref: Walkdown Checklist No. 1 & 2.
3784	Where drains are connected with a sewer, a proper trap shall be provided.	W	Not Applicable: This condition does not exist for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
3785	Where exposed to frost and where it is necessary to drain alarm valves outside the wall, an open discharge cone should be provided inside to break the pipe line so that cold will not be conducted directly into the retarding chamber. Cold air has been known to enter drain pipes from retarding chambers of alarm valves sufficiently to cause trouble by freezing in the alarm check valve. (See Section 3240.)	W	Not Applicable: This condition does not exist for safety related areas. Ref: Walkdown Checklist No. 1 - 3.
	CHAPTER 4. SPACING, LOCATION AND POSITION OF SPRINKLERS		Title
4000	General Information		Title
4010	Authority Having Jurisdiction		Title
4011	The authority having jurisdiction shall be consulted in every case as to location and spacing of sprinklers for the protection of buildings and contents.	D	Comply: The specifications require that the plans and final installation are subject to approval of the authority having jurisdiction. Ref: Technical Data No. 3 Section 1:04.1.

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STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
		D	Open Item: Documentation for the C.R. Cable Vault is not provided for review.
4020	Basic Fundamentals		Title
4021	The basic fundamentals for providing proper protection are namely: (1) Sprinklers should be installed throughout the premises, including basements, lofts and all of the locations herein specified. (2) Definite maximum protection area per sprinkler. (3) Minimum interference to discharge pattern by beans, bracing, girders, trusses, piping, lighting fixtures and air conditioning ducts. (4) Correct location of automatic sprinklers with respect to ceilings, or beams and wood joists to obtain suitable sensitivity.		Information Only
4022	The installation requirements are specific for the usual arrangement of structural members. There will be arrangements of structural members not specifically detailed by the requirements. By applying the basic fundamentals, layouts for such construction can vary from specific illustrations provided the maximums specified for the Spacing of Sprinklers (Section 4100) and Position of Sprinklers (Section 4200) are not exceeded.		Information Only
4030	Partial Installation		Title
4031	Installation of sprinklers throughout the premises is necessary for complete protection to life and property. However, in some cases partial sprinkler installations covering hazardous sections and other areas are specified in codes or standards or are required by authorities having jurisdiction, for limited protection to property or to provide opportunity for safe exit from the building.		Information Only: Partial sprinkler coverage is determined by the "authority having jurisdiction." The NRC has been provided with information (FHA, etc.) necessary to evaluate the adequacy of partial coverage.

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4032	Where such partial sprinkler installations are installed, the standards of this pamphlet should be used insofar as they are applicable. The authority having jurisdiction should be consulted in each case.	W,D	Not Applicable: The high roof area and the C.R. Cable Vault have full coverage. See reponse to code section 4031. Ref: Walkdown Checklist No. 1 - 3; Drawing No. 1 & 2.
		D	Open Item: Although the plans for the drumming area was to have been approved by N.E.P.I.A. as required by specifications, such documentation is not provided for review. Ref: Technical Data No. 3 Section 1:04.1
4033	Water supplies for partial systems should be adequate and designed with due consideration to the fact that in a partial system more sprinklers may be opened in a fire which originates in an unprotected area and spreads to the sprinklered area than would be the case in a complete protected building.	D	Comply: The partial system for the drumming area is tested on a regular basis to show the adequacy of the of the water supply. See response to code section 4032. Ref: Procedure No. 2 - 4.
4040	Definitions		This section only defines types of ceiling construction and has, therefore, been completely omitted.
4100	Spacing and Location of Sprinklers		Title
4110	Distance Between the Branch Lines and Between Sprinklers on the Branch Lines		Title
4111	For Light Hazard Occupancies the maximum allowable distance between branch lines and between sprinklers on the branch lines is 15 feet.	D	Not Applicable: All systems are extra hazard occupancy pipe schedule. Ref: Drawing No. 1, 2 & 3.
4112	For Ordinary Hazard Occupancies the maximum allowable distance between the branch lines and between sprinklers on the branch lines is 15 feet, except in buildings used for high piled storage (as	D	Not Applicable: See response to code section 4111.

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	defined in Paragraph 4045) the maximum allowable distance between the branch lines and between sprinklers on the branch lines is 12 feet. In bays 25 feet wide, however, a spacing of 12 feet, 6 inches between sprinkler lines may be permitted provided the allotted area of 100 square feet per sprinkler is not exceeded.		
4113	For Extra Hazard Occupancy, the maximum allowable distance between the branch lines and between sprinklers on the branch lines is 12 feet.	D	Comply: Drawings show adequate sprinkler spacing for all areas. Ref: Drawing No. 1, 2 & 3.
4114	Distance From Walls. The distance from the walls to the end sprinklers on the branch lines should not exceed one-half of the allowable distance between sprinklers on the branch lines. The distance from the walls to the end branch lines should not exceed one-half the allowable distance between the branch lines. For exception relating to small rooms, refer to Paragraph 4330.	D	Comply: See response to code section 4113.
4130	Protection Area Limitations		
4131	Light Hazard Occupancy. Under Smooth Ceiling Construction and under Beam and Girder Construction (as defined in Paragraphs 4041 and 4042) the protection area of per sprinkler shall not exceed 200 square feet. A protection area of 200 square feet per sprinkler may be permitted for sprinklers under a combustible suspended ceiling as described in Section 4305(a) provided that there is a full complement of sprinklers in the space immediately above such a ceiling, and the space is unfloored and unoccupied. Under open Wood Joist Construction (as defined in Paragraph 4044) the protection area sprinkler shall not exceed 130 square feet. For all other types of construction the protection area per sprinkler shall not exceed 168 square feet.	D	Not Applicable: See response to code section 4111.

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4132	Ordinary Hazard Occupancy. For all types of construction the protection area per sprinkler shall not exceed 130 square feet, except that in buildings used for high piled storage (as defined in Paragraph 4045) the protection area per sprinkler shall not exceed 100 square feet.	D	Not Applicable: See response to code section 4111.
4133	Extra Hazard Occupancy. The protection area per sprinkler shall not exceed 90 square feet for any type of building construction.	W, D	Does Not Comply: Drawings indicate dry pilot head spacing at 130 sq ft/ sprinkler, and specifications indicate sprinkler spacing at 100 sq ft/ sprinkler for the drumming and high roof areas. Ref: Walkdown Checklist No. 1 - 3; Technical Data No. 3 Section 1:11; Drawing No. 1 - 3.
4140	Location of Sprinklers and Branch Lines With Respect to Structural Members		Title
4141	Sprinklers may be located under beams, in bays, or combination of both, but the locations must meet the provisions outlined in general terms in Paragraph 4142.		Information Only
4142	In addition to meeting the limitations specified for protection area per sprinkler (Section 4130) and distance between lines and distance between sprinklers on lines (Section 4110) the sprinklers must be so located that there will be minimum interference to the discharge pattern by structural members such as beams, girders and trusses (Section 4150). Also, sprinklers must be located the proper distance below beams and ceilings as specified in Section 4200.		The referenced sections in this requirement will be verified.

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4143	The arrangement of branch lines depends upon such construction features as the distance between girders or trusses, columns of mushroom type reinforced concrete, and beams of standard mill construction. Each space or bay should usually be treated as a unit, installing the same number of branch lines uniformly in each space. Where single branch lines will suffice, they should be placed midway in each bay or space. The arrangement of branch lines also depends upon the structural members available and suitable for the attachment of hangers and upon the need for properly locating sprinkler deflectors in accordance with Sections 4150 and 4200.	D	Comply: For high roof and drumming areas, the drawings show that the arrangements of branch lines are adequate. Ref: Drawing No. 2 & 3.
		W	Does Not Comply: For the CR cable vault, walkdowns show that the arrangement of branch lines are not adequate. The lines are not placed midway in each bay or space. Some bays do not have sprinklers. Ref: Walkdown Checklist No. 3.
4144	Where there are two sets of joists under a roof or ceiling and there is no flooring over the lower set, sprinklers should be installed above and below the lower set of joists where there is a clearance of from 6 inches to 12 inches between the top of the lower joist and bottom of the upper joist. (See Fig. 4144.)	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
4145	The direction in which branch lines are usually run in the common types of ceiling construction and framing is shown in Table 4145.		Information Only
4150	Clearance Between Sprinklers and Structural Members		Title
4151	Trusses. Sprinklers should be at least 2 feet laterally from truss members (web or chord) more than 4 inches wide, and at least 1 foot laterally from truss members 4 inches or less in width. Where sprinkler lines run above or through trusses, the sprinklers may be located on center line of truss, provided chord members are not more than 8 inches wide, and the deflector is at least 6 inches above the chord member. However, when sprinklers are located laterally beside chord members, clearances between the chord members and the sprinkler deflectors should be in accordance with Paragraph 4156.	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.

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4152	Girders. Sprinklers should be at least 3 feet 9 inches from girders except that they may be located directly above girders with the top flange not more than 8 inches wide, in which case the deflectors should be at least 6 inches above the top of the girder.	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
4153	Where wood joists are framed into supporting girders, the girders may be disregarded in the spacing of the branch lines providing sprinkler deflectors are at such elevation that the girders offer no obstruction to the spray discharge pattern.	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
4154	Open Wet-Type Steel Beams (Castellated) When branch lines are run across and through openings of open web type steel beams, sprinklers may be spaced bay and beam provided: (a) the distance between sprinklers and between branch lines conforms to Section 4110, (b) sprinklers in the beam openings are located within one inch horizontally of the opening center line, (c) the branch line is located within one inch horizontally of the opening center line, and (d) sprinklers on alternate lines are staggered.	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
4155	Bar Joists. Sprinklers should be at least three inches laterally from web members of open bar joists which do not exceed 1/2 inch or 6 inches laterally from web members which do not exceed 1 inch. When the dimension of the web member exceeds 1 inch, see Paragraph 4151.	W	Not Applicable: This type of construction is not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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4156	Beams. It is essential that if deflectors of sprinklers in bays are above the bottom of the beam, they be at sufficient distances from the beams, as shown in Table 4156 and Fib. 4156 to avoid obstruction to the sprinkler discharge pattern.	D	Comply: Due to the lack of accessibility to the sprinkler heads in the drumming area and the high roof area, this information was verified by a drawing review. Ref: Drawing No. 2 & 3
		W	Does Not Comply: Walkdowns show that there is insufficient distance between the sprinkler deflectors and beams in the CR cable vault. Ref: Walkdown Checklist No. 3.
4157	Position of Deflectors. Deflectors of sprinklers should be parallel to ceilings, roofs, or the incline of stairs, but when installed in the peak of a pitched roof they shall be horizontal. Low pitched roofs having slopes not greater than 1 inch per foot may be considered as level in the application of this rule and sprinklers may be installed with deflectors horizontal.	W,D	Comply: Where accessible, walkdowns show that deflector positioning is adequate. A drawing review was used to verify that the deflector positioning is adequate. Ref: Walkdown Checklist No. 1-3; Drawing No. 1-3.
4200	Position of Sprinklers		Title
4210	General		Title
4211	Where branch lines run across the beams, the deflectors of sprinklers located in the bays should preferably be located above the bottom of the beam and in no case more than 4 inches below the bottom level of the beams.	D	Comply: See response to code section 4156.
		W	Does Not Comply: See response to code section 4156.

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4220	Smooth Ceiling Construction		Title
4221	Deflectors of sprinklers in bays should be located not less than 3 inches below ceilings, and not more than 10 inches below combustible ceilings or 12 inches below noncombustible ceilings.	D	Does Not Comply: The sprinkler nozzles for the C.R. Cable Vault, the drumming area and the high roof area are in excess of 12" from the ceiling. Ref: Drawing No. 1-3
4222	Deflectors of sprinklers under beams should be located 1 inch to 4 inches below beams, and not more than 14 inches below combustible ceilings or not more than 16 inches below noncombustible ceilings.	W	Not Applicable: Conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
4223	When sprinklers approved for pendent use are installed in the pendent position under smooth ceilings the deflectors should be not less than 2-1/2 inches form ceiling. Special approved type pendent sprinklers (flush type, ceiling type) may have deflectors nearer the ceiling.	W	Comply: See response to code section 4221.
4224	If panel construction, see Paragraph 4233.		Information Only
4230	Beam and Girder Construction		Title
4231	Deflectors of sprinklers in bays should be located not less than 3 inches below and not more than 16 inches below combustible or noncombustible roof or floor decks.	W	Does Not Comply: Several deflectors are too close to beams and the ceiling in the CR cable vault. Ref: Walkdown Checklist No. 3.
		W	Not Applicable: The construction described in this code section does not exist for the high roof and drumming area. Ref: Walkdown Checklist No. 1 & 2.

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4232	Deflectors of sprinklers under beams should be located not less than 1 inch and not more than 4 inches below beams and not more than 20 inches below combustible or noncombustible roof or floor decks.	W	Not Applicable: See response to code section 4222.
4233	Panel Construction.	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
	(a) Beam and girder construction by definition is limited to bays not over 7-1/2 feet wide. For the purposes of this Section, bays in panel construction may be wider if the panel does not exceed 300 square feet in area. Nailing strips not exceeding 2 inches nominal thickness on beams only will not prevent the use of the panel area credit.		
	(b) Deflectors of sprinklers in bays formed by beams framed into girders resulting in panels up to 300 square feet should be located not less than 3 inches below and not more than 18 inches below combustible or noncombustible roof or floor decks.		
	(c) Deflectors of sprinklers under beams framed into girders forming panels up to 300 square feet should be located 1 inch to 4 inches below beams and not more than 22 inches below combustible and noncombustible roof or floor decks.		
4240	Open Bar Joist Construction		Title
4241	Deflectors of sprinklers should be located not less than 3 inches below and not more than 10 inches below combustible or not more than 12 inches below noncombustible roof or floor decks.	W	Not Applicable: This type of construction is not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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4250	Open Wood Joist Construction		Title
4251	In open joist construction, with joists spaced 3 feet or less on centers, sprinklers should be located with deflectors 1 inch to not more than 6 inches below the bottom of the joists. If open joists are spaced more than 3 feet on centers, sprinklers should be located with deflectors placed in accordance with Sections 4220 or 4230.	W	Not Applicable: This type of construction is not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
4260	Location Under Sheathed or Suspended Ceiling Under Any Type of Construction		Title
4261	The position of sprinklers under sheathed or suspended ceilings with any type of construction should be the same as for smooth ceiling construction, Paragraphs 4221 and 4223.	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
4300	Locations or Conditions Involving Special Consideration		Title
4301	Combustible Form Board. Where roof and floor decks consist of poured gypsum or concrete on combustible form board supported on steel supports, the position of sprinklers shall be the same as for noncombustible construction.	W	Not Applicable: This type of construction is not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
4302	Metal Roof Decks. Where roof decks are metal with combustible vapor seal, the position of sprinklers shall be the same as for combustible construction.	W	Not Applicable: This type of construction is not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
4303	Special Occupancy Considerations.		Title
	(a) Subject to the approval of the authority having jurisdiction, sprinklers may be omitted in rooms or areas where sprinklers are considered undesirable because of the nature of the contents, or in rooms or areas of noncombustible construction with wholly noncombustible		Information Only: Partial sprinkler coverage is determined by the "Authority Having Jurisdiction." The NRC is responsible to review all submittals which evaluate adequacy of partial coverage.

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	contents and which are not exposed by other areas. Sprinklers should not be omitted from any room merely because it is damp or of fire-resistive construction.		
	(b) It is not advisable to install sprinklers where the application of water or flame and water to the contents may constitute a serious life or fire hazard, as in the manufacture or storage of quantities of aluminum powder, calcium carbide, calcium phosphide, metallic sodium and potassium, quick lime, magnesium powder, and sodium peroxide, The manufacture and storage of such materials should be confined to specially cut-off, unsprinklered rooms or buildings of fire-resistive construction.	W	Not Applicable: These conditions are not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
4304	Spaces Under Ground Floors. Sprinklers should be installed in all spaces below combustible ground floors, except that by special permission sprinklers may be omitted where all of the following conditions prevail:	W	Not Applicable: These conditions are not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
	(a) The space is not accessible for storage purposes or entrance of unauthorized persons and is protected against accumulation of wind-borne debris;		
	(b) The space contains no equipment such as steam pipes, electric wiring, shafting, or conveyors;		
	(c) The floor over the space is tight;		
	(d) No flammable liquids are used on the floor above.		

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4305	Blind Spaces		Title
	(a) Sprinklers should be installed in all blind spaces enclosed wholly or partly by combustible construction, as in walls, floors and ceilings, except as modified by Paragraph (b) below. In spaces formed by studs or joists, sprinklers should be provided where there is 6 inches or more clearance between the inside or near edges of the studs or joists which form the opposite sides of the space; the distance from the first sprinkler to the wall, however, need not be less than specified in Paragraph 4114. In bar joist construction, sprinklers should be installed wherever the total depth of the space exceeds 6 inches between roof or floor deck and ceiling; the spacing of sprinklers in that case may be on the basis of light hazard classification provided the space does not exceed 24 inches in depth.	W	Not Applicable: These conditions are not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
	(b) Permission may be given to omit sprinklers from combustible blind spaces where the following conditions prevail:		
	1. Where the ceiling is attached directly to the under side of the supporting beams of a combustible roof or floor deck or otherwise installed to make the installation of sprinklers impracticable.		
	2. Where concealed space is entirely filled with a noncombustible insulation. In solid joisted construction the insulation need fill only the space from the ceiling to the bottom edge of the joist of the roof or floor deck.		
	3. Where there are small concealed spaces over closets, bathrooms and the like.		

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4306	Spacing of Sprinklers Under Pitched Roofs		Title
	(a) Under pitched roofs having a pitch in excess of 1 foot in 3 and where branch lines are run parallel to the peak, one line of sprinklers should be located in the peak of the roof or a line of sprinklers should be located on each side down from the peak a distance not greater than one-half the distance between branch lines. Where branch lines are run up the slopes, the end sprinklers on branch lines on one slope should be located in the peak or end sprinklers on branch lines on both slopes should be located down from the peak a distance not greater than one-half the allowable distance between sprinklers on the branch lines. In any case the deflectors of the highest sprinklers should be not more than 3 feet vertically below the peak. (See 4306(d).)	W	Not Applicable: These conditions are not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
	(b) The spacing of sprinklers should be in accordance with Section 4100 of this Standard. The distances between sprinklers on branch lines should be measured on a line parallel with the roof.		
	(c) In sawtooth roofs the end sprinklers on the branch lines should usually be not over 3 feet from the peak of the sawtooth.		
	(d) Interference with the discharge pattern may result where sprinklers are located in peaks of a steeply pitched roof. To minimize this interference the distance from peak to deflectors may be increased over that specified in Paragraph 4306(a). It is desirable to maintain a horizontal clearance of not less than 2 feet. (See Figures 4306(a) and 4306(d).)		

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4307	Spacing of Sprinklers Under Curved Roof Buildings		Title
	(a) Where roofs are curved down to the floor line, the horizontal distance measured at the floor level from the side wall or roof construction to the nearest sprinklers shall not be greater than one-half the allowable distance between sprinklers in the same direction.	W	Not Applicable: These conditions are not present in safety related areas. Ref: Walkdown Checklist No. 1 - 3
	(b) Deflectors of sprinklers should be parallel with the curve of the roof or tilted slightly toward the peak of the roof. Deflectors of sprinklers should be located as described for beam and girder construction or for the closes comparable type of ceiling construction.		
	(c) Where extra hazard occupancy spacing of sprinklers is used under curved ceilings of other than fire-resistive construction, as in aircraft storage or servicing areas, the spacing as projected on the floor shall be not wider than required for extra hazard occupancies, but in no case shall the spacing on the roof or ceiling be wider than required for ordinary hazard occupancies.		
4308	Narrow Pockets. Girders, beams or trusses forming narrow pockets of combustible construction along walls when of a depth which will obstruct the spray discharge pattern may require additional sprinklers. See Table 4156 showing Maximum Allowable Distance Deflector Above Bottom of Beam.	W	Not Applicable: These conditions do not exist in safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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4309	Elevators and Stairs		Title
	(a) Vertical Shafts	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
	(1) Within vertical shafts having combustible sides, sprinklers shall be provided for each 200 square feet of combustible surface, in addition to sprinklers at tops of shafts. Such sprinklers should be installed at each floor when practicable, and always when shaft is trapped. In vertical shafts with noncombustible sides there should be at least one sprinkler near the bottom.		
	(2) Where practical, sprinklers shall be "staggered" at the alternate floor levels, particularly when only one sprinkler is installed at each floor level.		
	(3) Where vertical opening are not protected by standard enclosures, sprinklers should be so placed as to fully cover them. This necessitates placing sprinklers close to such openings at each floor level.		
	(b) Stairways should be sprinklered underneath whether risers are open or not.		
	(c) Noncombustible stair shafts ordinarily will require sprinklers only at the top and lower tiers except when serving two or more separate fire sections when sprinklers will also be required at each floor landing.		

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4310	Building Service Chutes. Building service chutes (linen, rubbish, etc.) shall be protected internally by automatic sprinklers. This will require a sprinkler at the top of the chute and, in addition, a sprinkler shall be installed within the chute at alternate floor levels in buildings over two stories in height. The room or area into which the chute discharges shall also be protected by automatic sprinklers. The installation of sprinklers at floor levels shall be so arranged as to protect the sprinklers from mechanical injury, from falling materials, and not cause obstruction within the chute. This can usually be accomplished by recessing the sprinkler in the wall of the chute and by providing a protective deflector canopy over the sprinkler. Sprinkler should be placed so that there will be minimum interference of the discharged therefrom. (See also Paragraph 4033.)	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
4311	Exterior Docks and Platforms (a) Sprinklers should be installed under awnings or roofs over outside loading platforms. (b) Sprinklers should be installed under exterior docks and platforms of combustible construction unless such space is closed off and protected against accumulation of wind-borne debris.	W	Not Applicable: These conditions do not exist in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
4312	Overhead Doors. Where overhead doors form an obstruction to water distribution from sprinklers above, additional sprinkler protection may be required. When piping can be attached to the door structural framing, locate and space sprinklers under the doors in	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.

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	accordance with the rules for Ordinary Hazard Occupancy. When piping cannot be attached to the door structural framing, space sprinklers not over 12 feet apart around the perimeter of the three accessible sides of the doors and at least 12 inches in from the edges of the doors. Deflectors should not be more than 10 inches below the doors in the open position. Sidewall sprinklers may be used when their distribution would be more effective than that from standard sprinklers. Where doors are substantially glass construction and when these doors, in an open position, will merely be over a traffic aisle, sprinkler protection is not necessarily required.		
4313	Decks. Sprinklers should be installed under decks and galleries unless they do not exceed 4 feet in width, with at least 6 inches clearance from the wall or partition and with arrangements to keep all stock a similar distance from the wall or partition. (See Section 1110.)	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
4314	Library Stack Rooms. Additional sprinklers may be required beneath catwalks in library stack rooms.	W	Not Applicable: These conditions do not exist in safety related areas. Ref: Walkdown Checklist No. 1 - 3.
4315	Tables (a) Sprinklers should be installed under cutting, pressing, sewing machine and other work tables over 4-feet wide. Sprinklers may be omitted under tables less than 5-1/2 feet but wider than 4 feet if the tables are of temporary or semi-permanent nature, as determined by the authority having jurisdiction, and tight vertical petitions of galvanized iron or other noncombustible material are provide not over 10 feet apart.	W	Not Applicable: These conditions do not exist in safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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	(b) Partitions should be full width of table, extend from underside of table to floor and from from edge to back edge of table; should be substantially fastened to the underside of table and to floor, and should be reinforced with angle or channel iron uprights.		
	(c) The outer edges of each partition should be smoothly finished (rounded if of metal) so as to prevent injury to employees.		
	(d) Special instructions should be obtained relative to the installation of "stops" under tables of unusual construction.		
4316	Obstructions. Timbers, uprights, hangers, piping, lighting fixtures, duct, etc., are likely to interfere with the proper distribution of water from sprinklers. Therefore, sprinklers should be so located or spaced that any interference is held to a minimum. The required clearance between such members and sprinklers is dependent upon the size of the obstruction to water distribution. The clearances should not be less than those specified between sprinklers and truss members in Paragraphs 4151 and 4155. (See also Paragraph 4156.)	W W	Does Not Comply: See response to code section 4231. Not Applicable: The construction described in this code section does not exist for the high roof and drumming area. Ref: Walkdown Checklist No. 1 & 2.
4317	Ducts. Sprinklers should be installed under ducts which are over 4-feet wide, and under ducts of less width if distribution from ceiling sprinklers is obstructed.	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.
4318	Stock Fixtures. Sprinklers should be installed in all stock fixtures which exceed 5 feet in width, also in those which are less than 5 feet but more than 2-1/2 feet in width unless bulkheaded with tight partitions. Sprinklers should be installed in any compartments which are larger than 5-feet deep, 8-feet long and 3-feet high.	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.

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4319	Lighting Fixtures (a) Lighting fixtures of the pendent- or surface-mounted type may offer obstruction to discharge from sprinklers unless specified clearances are provided. (b) Branch sprinkler lines should be run parallel to and between lines of fixtures and should be sufficient in number to provide proper floor and ceiling coverage. Pendent fixtures located below the level of the sprinkler deflectors and also surface mounted fixtures may necessitate additional branch lines.	W	Open Item: Due to the congestion in the control room cable vault, this information was not readily obtainable from plant walkdowns. Due to lack of accessibility to the sprinkler heads in this drumming area and the high roof area, this information was not readily obtainable from plant walkdowns. Ref: Walkdown Checklist No. 1 - 3.
4320	Generator and Transformer Rooms. Sprinkler protection should ordinarily be provided in generator and transformer rooms. Hoods or shields to protect generators, switchboards and other important electrical equipment shall be noncombustible and should be arranged to minimize interference with sprinkler protection. Where walls, floor and ceiling are of fire-resistive construction, sprinklers may be omitted.	W	Not Applicable: Conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
4321	Open Grid Ceilings. The installation of open grid egg crate, louver or honeycomb ceilings beneath sprinklers restricts the sidewise travel of the sprinkler discharge and may change the character of discharge. The following rules are applicable to open grid ceilings in which the openings are 1/4-inch or larger in least dimension, where the thickness or depth of the material does not exceed the least dimension of the openings and where such openings constitute at least 70 percent of the area of the ceiling material. Other types of open grid ceilings should not be installed beneath sprinklers unless they are listed by a	W	Not Applicable: The construction described in this code section does not exist. Ref: Walkdown Checklist No. 1 - 3.

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	CHAPTER 5. TYPES OF SYSTEMS		Title
5010	General		Title
5011	Systems described in this Section shall comply with all other portions of this Standard, except as modified in Chapter 5.		Information Only
5100	Wet-Pipe Systems		Title
5110	Definition		Title
5111	A system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water dis- charges immediately from sprinklers opened by a fire.		Information Only
5120	Devices for Test Purposes		Title
5121	Pressure Guages. Approved pressure guages conforming to Paragraph 2822 shall be installed in sprinkler risers, above and below each alarm check valve.	W	Comply: The pressure gages are installed above and below the alarm check valve. See response to code section 2822. Ref: Walkdown Checklist No. 3.
		W	Not Applicable: The high roof and drumming area systems are not wet-pipe systems. Ref: Walkdown Checklist No. 1 & 2.
5200	Dry-Pipe Systems		Title
5210	General		Title
5211	Definition. A system employing automatic sprinklers attached to a piping system containing air under pressure, the release of which as from the opening of sprinklers permits the water pressure to open a valve known as a "dry-pipe valve." The water then flows into the piping system and out the opened sprinklers.	W	Not Applicable: The code sections discussing dry-pipe values (5200-5286) will not be verified since there are no systems of this type protecting safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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	Differential dry-pipe valves utilize two seat rings, one to control entry of water and a second to seal air pressure in the sprinkler piping. Differential rations of water pressure to air pressure when this type of valve operates may be nominally 6 to 1. Mechanical dry-pipe valves were of the earliest design and achieved their differential through external lever and escapement mechanisms. Latched-clapper dry-pipe valves usually utilize a diaphragm sensor to release the single water-controlling clapper at a preselected air pressure. Low differential dry-pipe valves utilize a single clapper which is held shut by air pressure in excess of the water pressure. They are equipped with a pilot valves or split seat ring to provide the fire alarm feature upon operation. The water pressure to air pressure ratio at the time of tripping is usually between 1.0 and 1.2 to 1.		
5212	When Installed. A dry-pipe system should be installed only where a wet-pipe system is impracticable, as in rooms or buildings which cannot be properly heated. The use of an approved dry-pipe system is, however, far preferable to entirely shutting off the water supply during cold weather.	W	Not Applicable: See response to 5211.
5213	Small Systems. Where it is necessary to have but 25 percent or less of the total number of sprinklers in a building on a dry-pipe system, only such sprinklers should be thus piped; the remainder should be placed on a wet system. This may require small dry-pipe systems or pre-action systems for show windows, blind attics or other minor portions exposed to freezing. Such small systems may be supplied from the wet-pipe system and control valves	W	Not Applicable: See response to 5211.

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	shall be readily accessible. No sprinklers should be shut off in cold weather without the consent of the authority having jurisdiction, and in no case should the number of sprinklers so shut off exceed ten.		
5214	Dry Pendent Sprinklers. Sprinklers should be installed in the upright position. Sprinklers installed in the pendent position shall be of the approval dry pendent type.	W	Not Applicable: See response to 5211.
5220	Subdivision of Systems		Title
5221	Where two or more dry-pipe valves are used, systems should preferably be divided horizontally.	W	Not Applicable: See response to 5211.
5222	Where required by the authority having jurisdiction in buildings of large single area such as piers, storage sheds, foundaries, car shops, large attics, etc., substantial curtains preferably of noncombustible material extending down 24 inches or more below the ceiling shall be provided to separate sprinkler systems or subdivide areas.	W	Not Applicable: See response to 5211.
5230	Size of Systems		Title
5231	Sprinkler and Volume Limitations		
	(a) Not more than 600 sprinklers should be controlled by one dry-pipe valve.	W	Not Applicable: See response to 5211.
	(b) Except as provided in paragraph 5231(c), not more than 750-gallon system capacity should be controlled by one dry-pipe valve, unless check valves are installed in branches of the system as provided for in Paragraph 5232.		

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	(c) Where the piping volume exceeds 750 gallons, the system should deliver water to the inspector's test pipe in not more than 60 seconds unless otherwise specified by the authority having jurisdiction.		
5232	Check Valves in Dry Pipe Systems. Check valves may be installed in branches of the system to assist in more rapidly reducing the air pressure above the valve seat to the dry pipe valve trip point. Using such an arrangement, the capacity of no system branch should exceed 600 gallons. A hole 1/8-inch in diameter shall be drilled in the clapper of each check valve to permit equalization of air pressure among the various parts of the system. A drain valve, connected in a by-pass around each check valve shall be provided as a means for draining the system. Such check valves shall be located in the heated dry pipe valve enclosure to prevent the formation of ice in winter.	W	Not Applicable: See response to 5211.
5233	The capacities of the various sizes of pipes are for convenience in calculating the air capacity of a system.	W	Not Applicable: See response to 5211.
5234	Eight-Inch Systems. Where an 8-inch riser is employed in connection with a dry-pipe system, a 6-inch dry-pipe valve and a 6-inch gate valve between taper reducers may be used.	W	Not Applicable: See response to 5211.
5235	Dry Pipe System Serving Several Remote Unheated Areas. Where a single dry pipe valve is used to supply piping and sprinklers located in several small unheated areas which are remote from each other, the dry pipe valve and riser, subject to the approval of the	W	Not Applicable: See response to 5211.

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	authority having jurisdiction, may be sized according to the number of sprinklers in the largest area. A check valve with 1/8-inch hole in clapper should be installed in the supply piping to each area and shall b located in a heated area. Each area so checked shall have an auxiliary drain and a dry pipe type inspector's test connection. The compressed air supply should be of sufficient capacity to restore normal air pressure in the entire system within 30 minutes.		
5240	Quick-Opening Devices		Title
5241	When Required. Dry pipe valves controlling systems having capacity of more than 500 gallons shall be provided with an approved quick opening device.	W	Not Applicable: See response to 5211.
5242	Location of Quick-Opening Devices. The quick-opening device shall be located as close as possible to the dry-pipe valve. Protection of the restriction orifice and other operating parts of the quick-opening device against submergence necessitates that the connection to the riser shall be at a point above which water (priming water and back drainage) is not to be expected when the dry-pipe valve and quick-opening device are set, except where design features of particular quick-opening devices make these requirements unnecessary. Note: In the case of dry-pipe valves having relatively small priming chambers and in which the normal quantity of priming water fills, or nearly fills, the entire priming chamber, the object contemplated by this rule will be met by requiring connection of the quick-opening device at a point on the riser	W.	Not Applicable: See response to 5211.

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	above the dry-pipe valve, which will provide a capacity measure between the normal priming level of the air chamber and the connection of 1-1/2, 2 and 3 gallons for 4-, 5-, 6-inch risers, respectively. Making the connection 24 inches above the normal priming water level will ordinarily provide this capacity.		
5243	A soft disc globe or angle valve shall be installed in the connection between the dry-pipe sprinkler riser and the quick-opening device provided to accelerate operation of dry-pipe valve.	W	Not Applicable: See response to 5211.
5244	A globe or gate valve shall be installed in the connection between the quick-opening device and the intermediate chamber of the dry-pipe valve when necessary to prevent the escape of water if the dry-pipe valve should trip with the quick-opening device disconnected. A check valves may be used instead of a gate valve whenever it will serve the same purpose.	W	Not Applicable: See response to 5211.
5245	The piping between sprinkler system and accelerator, and from accelerator to intermediate chamber of dry pipe valve, should be galvanized, brass, or copper.	W	Not Applicable: See response to 5211.
5260	Location and Protection of Dry-Pipe Valve		Title
5251	The dry-pipe valve should be located in an accessible place and as near as practicable to the sprinkler system it controls. It should be properly protected against freezing and mechanical injury.	W	Not Applicable: See response to 5211.
5252	To protect supply pipe from frost, avoid low space under floor.	W	Not Applicable: See response to 5211.

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5253	Where exposed to cold, the dry-pipe valve should preferably be located in an approved valve room or enclosure and, where is not possible, in an underground pit acceptable to the authority having jurisdiction. Room should be of sufficient size to give at least 2-1/2 feet of free space at the sides and in front of, also above and below the dry-pipe valve or valves, and this room, if feasible, should not be built until the valve is in position.	W	Not Applicable: See response to 5211.
5254	Size of enclosures should be governed by the number and arrangement of dry-pipe valves, so as to give ready access to these devices.	W	Not Applicable: See response to 5211.
5255	Valve room should be electrically lighted and properly heated by electric heater (installation to comply with the National Electrical Code, NFPA No. 70), steam, hot water or hot air.	W	Not Applicable: See response to 5211.
5256	Latches for doors should be arranged to hold door tight to frame. Latches similar to those used on refrigerators are recommended.	W	Not Applicable: See response to 5211.
5257	The supply for the sprinkler protection in the dry-pipe valve enclosure shall be from the dry side of the system.	W	Not Applicable: See response to 5211.
5258	Sketches of Dry-Pipe Valve Enclosures. The enclosures are intended to serve as illustrations of those already in successful use, rather than as standards, from which to select or modify the design most suitable for local needs, in consideration of the varing climatic conditions.	W	Not Applicable: See response to 5211.

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5259	Protection against excessive accumulation of water above the clapper shall be provided for a low differential dry-pipe valve. This may be an automatic high water level signaling device or an automatic drain device.	W	Not Applicable: See response to 5211.
5260	Cold Storage Rooms		Title
5261	Careful installation and maintenance, and some special arrangements of piping and devices as outlined in this section are needed to avoid the formation of ice and frost inside piping in cold storage rooms which will be maintained at or below 32°F. Conditions are particularly favorable to condensation where pipes enter cold rooms from rooms having temperatures above freezing. Periodic examinations of piping are needed to detect these formations.	W	Not Applicable: See response to 5211.
5262	Fittings for this purpose should be provided at the following locations. (a) Wherever a cross main connects to a riser or feed size to give at least 2-1/2 feet of free space at the sides and in front of, also above and below the dry-pipe valve or valves, and this room, if feasible, should not be built until the valve is in position. (b) Wherever feed mains change direction. Facilities are needed for direct observation of every length of feed main within the refrigerated area. This may be accomplished by means of 2-inch capped nipples or blind flanges on fittings.	W	Not Applicable: See response to 5211.

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	(c) Wherever a riser or feed main passes through a wall or floor from a warm room to a cold room. This may be accomplished at floor penetrations by a tee with a blind flange in the cold room and at wall penetrations by a 24-inch flanged removable section in the warm room.		
5263	Whenever the opportunity offers, fittings such as specified above as well as flushing connections specified in Paragraph 3063, should be provided in existing systems.	W	Not Applicable: See response to 5211.
5264	Risers should be located in stair towers or other locations outside of refrigerated areas, where possible. This would reduce the probabilities of ice or frost formation within the riser (supply) pipe.	W	Not Applicable: See response to 5211.
5265	Cross mains should be connected to risers or feed mains with flanges. In general, flanged fittings should be installed at points which would allow easy dismantling of the system. Split ring or other easily removable types of hangers will facilitate the dismantling.	W	Not Applicable: See response to 5211.
5266	A low air-pressure alarm is desirable on sprinkler systems supplying freezer sections.	W	Not Applicable: See response to 5211.
5267	Piping in cold storage rooms should be installed with ample pitch, as outlined in Section 3210.	W	Not Applicable: See response to 5211.

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5268	The air supply for dry-pipe systems in cold storage plants should be taken from the freezers of lowest temperature or through a chemical dehydrator.	W	Not Applicable: See response to 5211.
5269	Compressed nitrogen gas in cylinders can be used in place of air in dry-pipe systems to eliminate introducing moisture. Cylinder pressure should be reduced to somewhat less than maximum allowable system pressure, and regulated by the usual cylinder regulator. Propylene glycol or other suitable material may be used as a substitute for priming water, to prevent evaporation of the priming fluid, and thus reduce ice formation within the system.	W	Not Applicable: See response to 5211.
5270	Air Pressure and Supply		Title
5271	Maintenance of Air Pressure. Air pressure shall be maintained on dry-pipe systems throughout the year.	W	Not Applicable: See response to 5211.
5272	Air Supply.. The compressed air supply shall be from a reliable source available at all times and having a capacity of restoring normal air pressure in the system within 30 minutes except for low differential dry-pipe systems where this time may be 60 minutes. The compressor should draw its air supply from a place where the air is dry and not too warm. Moisture may cause trouble from condensation in the system. The air compressor, when the only supply and nonautomatic, shall be driven independently of all plant shafting. Where low differential dry-pipe valves are used, the air supply shall be maintained automatically.	W	Not Applicable: See response to 5211.

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5273	Air Filling Connection. The connection pipe from the air compressor should not be less than 3/4 inch and enter the system above the priming water level of the dry-pipe valve. In this air line there shall be installed a check valve and on the supply side of this check valve a shutoff valve of renewable disc type.	W	Not Applicable: See response to 5211.
5274	Relief Valve. An approved relief valve shall be provided between compressor and controlling valve and set to relieve at a pressure five pounds in excess of maximum air pressure which should be carried in the system.	W	Not Applicable: See response to 5211.
5275	Shop Air Supply. Where the air supply is taken from a shop system having a normal pressure greater than that required for dry-pipe systems, the relief valve shall be installed between two control valves in the air line and a small air cock, which is normally left open, installed in fitting below relief valve.	W	Not Applicable: See response to 5211.
5276	Automatic Air Compressor. Where a dry-pipe system is supplied by an automatic air compressor or plant air system any device or apparatus used for automatic maintenance or air pressure shall be of a type specifically approved for such service and capable of maintaining the required air pressure on the dry-pipe system. More than one dry-pipe system should not be connected to a single automatic air maintenance device where the air supply piping to the systems is subdivided only by check valves. Otherwise when one dry-pipe valve operates leakage past check valves could water column other dry-pipe valves.	W	Not Applicable: See response to 5211.

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5277	Air Pressure to be Carried. Excess air pressure in dry-pipe systems in undesirable. The pressure to be carried will depend upon the normal tripping pressure of the dry-pipe valve. The instruction chart furnished with dry-pipe valves should be consulted to determine the air pressure to be carried. The maximum air pressure needed has been found in modt cases to be 15 to 20 lbs. in excess of the normal tripping pressure of the dry-pipe valve. The permitted rate of air leakage shall be as specified in excess pressure relieving device which is intended to automatically limit the air pressure.	W	Not Applicable: See response to 5211.
5280	Devices for Test and Maintenance Purposes		Title
5281	Pressure Gauges. Approved pressure gauges conforming to Paragraph 2822 shall be connected as specified in Paragraphs 5282-5286, inclusive.	W	Not Applicable: See response to 5211.
5282	On the water side and air side of dry-pipe valve.	W	Not Applicable: See response to 5211.
5283	At the air pump supplying the air receiver.	W	Not Applicable: See response to 5211.
5284	At the air receiver.	W	Not Applicable: See response to 5211.
5285	In each independent pipe from air supply to dry-pipe system.	W	Not Applicable: See response to 5211.
5286	At exhausters and accelerators.	W	Not Applicable: See response to 5211.
5300	Pre-Action and Deluge Systems		Title

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5310	Definitions		Title
5311	Pre-Action System. A system employing automatic sprinklers attached to a piping system containing air that may or may not be under pressure, with a supplemental heat responsive system of generally more sensitive characteristics than the automatic sprinklers themselves, installed in the same areas as the sprinklers; actuation of the heat responsive system, as from a fire, opens a valve which permits water to flow into the sprinkler piping system and to be discharged from any sprinklers which may be open.		Information Only: The requirements in the code sections 5300-5393 do not apply to the wet-pipe system in the control room cable vault.
5312	Deluge System. A system employing open sprinklers attached to a piping system connected to a water supply through a valve which is opened by the operation of a heat responsive system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.		Information Only
5320	Description. Pre-action and deluge systems are normally without water in the system piping and the water supply is controlled by an automatic valve operated by means of heat-responsive devices and provided with manual means for operation which are independent of the sprinklers. Systems may have equipment of the types described in Paragraphs 5321-5328, inclusive. (See Paragraphs 5352 and 5362).		Information Only
5321	Automatic sprinklers with both sprinkler piping and heat-responsive devices automatically supervised.		Information Only: The high roof area and drumming area utilizes the equipment described. Ref: Drawing No. 2 & 3.

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5322	Automatic sprinklers with sprinkler piping and heat-responsive devices not automatically supervised.		Information Only: This equipment is not utilized.
5323	Open sprinklers with only heat-responsive devices automatically supervised.		Information Only: This equipment is not utilized.
5324	Open sprinklers with heat-responsive devices not automatically supervised.		Information Only: This equipment is not utilized.
5325	Combination of open and automatic sprinklers with heat-responsive devices automatically supervised.		Information Only: This equipment is not utilized.
5326	Combination of open and automatic sprinklers with heat-responsive devices not automatically supervised.		Information Only: This equipment is not utilized.
5327	Open head systems operated by both heat-responsive devices of the rate of temperature rise and fixed temperature types in combination, in which case the heat-responsive devices should be automatically supervised.	W	Not Applicable: There are no open head systems installed in areas evaluated for this code. Ref: Walkdown Checklist No. 1 - 3.
5328	Outside sprinklers for protection against exposure fire; the heat-responsive devices should be automatically supervised if more than 20 sprinklers on the system.	W	Not Applicable: There are no "outside sprinklers" providing protection for safety related areas. Ref: Walkdown Checklist No. 1-3.
5330	General		Title
5331	Where required by the authority having jurisdiction, sprinkler systems shall be of the pre-action or deluge type.		Information Only
5332	Conditions of occupancy or special hazards may require quick application of large quantities of water and in such cases deluge systems are likely to be needed.		Information Only

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5333	Care should be exercised to select heat-responsive devices having an adjustment to assure proper operation and to guard against premature operation of the system from normally fluctuating temperatures.		Information Only
5334	In locations where temperatures, at ceilings, are likely to be high from sources of heat other than fire conditions, such as manufacturing processes, boiler rooms and dry kilns, it is necessary to give special consideration to the selection of heat-responsive devices operating normally at higher than ordinary temperatures and which are capable of withstanding the normal high temperatures for long periods of time.	W, D	Not Applicable: The construction described in this requirement does not exist. Ref: Walkdown Checklist No. 1 - 3. Technical Data No. 15.
5335	Where corrosive conditions exist that may affect the heat-responsive devices or systems consideration should be given to the use of types of materials or protective coatings designed to resist corrosion.	W	Not Applicable: The corrosive conditions do not exist at the plant. Ref: Walkdown Checklist No. 1 - 3.
5336	Stock of extra fusible elements of heat-responsive devices, not less than two of each temperature, shall be maintained on the premises for replacement purposes.	W	Comply: Walkdowns and inventory documents verified an ample supply in the supply room. Ref: Walkdown Checklist No. 1 - 3.
5337	When hydraulic release systems are used, it is possible to water column the deluge valve or deluge-valve actuator if the heat-actuated devices (fixed temperature or rate-of-rise) are located at extreme heights above the valve. Refer to the manufacturer for height limitations of a specific deluge valve or deluge valve actuator.	D	Not Applicable: Testing of systems show that the condition described in this requirement are of no concern. Ref: Procedure No. 1.

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5338	All new pre-action or deluge systems shall be tested hydrostatically as specified in Paragraph 1631. In testing deluge systems plugs shall be installed in fittings and replaced with open sprinklers after the test is completed, or automatic sprinklers should be installed and the links, etc., knocked out after test is completed.	D	Comply: See response to code section 1631.
		W	Not Applicable: The C. R. Cable Vault has a wet-pipe system. Ref: Walkdown Checklist No. 3.
5340	Location and Spacing of Heat Responsive Devices		Title
5341	Spacing of heat-responsive devices shall be in accordance with their listing by nationally recognized testing laboratories, unless conditions indicate the need for a closer spacing.	W,D	Does Not Comply: The pilot head spacing of 130 sq ft/sprinkler is not in accordance with the extra hazard occupancy spacing required by the code for the drumming and high roof areas. Ref: Walkdown Checklist 1 & 2. Drawing No. 2 & 3.
		W	Not Applicable: The C.R. Cable Vault has a wet-pipe system. Ref: Walkdown Checklist No. 3.
5342	Distance Between Devices and Walls		
	(a) Where ceilings are level, one-half the distance allowed between rows of heat-responsive devices.	D	Comply: A drawing review verified proper distance between walls and devices. Ref: Drawing No. 2 & 3.
	(b) With sloping ceilings, slope more than 1 1/2 inches per foot, lowest row of heat-responsive devices two-thirds the distance allowed between rows of heat-responsive devices. Distance may be measured horizontally for both level and sloping ceilings.	W	Not Applicable: The C.R. Cable Vault has a wet pipe system. Ref: Walkdown Checklist No. 3.
	(c) In areas requiring only a single row of heat-responsive devices the distance between the end device and the end wall shall be one-third the allowable distance between heat-responsive devices.		

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5343	Ceiling Heights. Where ceiling heights exceed 35 feet the heat-responsive devices should be so spaced that the area covered by each device will not exceed 75 percent of the area normally covered.	W,D	Does Not Comply: See response to code section 4133 for the high roof area.
		W	Not Applicable: Conditions described in this code section do not exist for the drumming area and the C.R. Cable Vault. Ref: Walkdown Checklist No. 2 & 3.
5344	Special Hazards. In occupancies involving unusual hazards where it is necessary to discharge water through open sprinklers on the fire instantaneously, special arrangement of heat-responsive devices should be made in accordance with recognized good practice for such hazards.	W	Not Applicable: There are no hazards of the type described in this code section. Ref: Walkdown Checklist No. 1 - 3.
5345	Two or More Systems. Where there are two or more systems in one area controlled by separate systems of heat-responsive devices, the heat-responsive devices on each system shall be spaced up to the dividing line between systems as to a wall or partition or draft stop.	W	Not Applicable: The sprinkler systems are independent of heat-responsive devices of other systems. Ref: Walkdown Checklist No. 1 - 3.
5346	Monitors. Flat or sloping surfaces between monitors do not require heat-responsive devices, except when their width is such that the distance between rows of heat-responsive devices in adjoining monitors or between wall and rows of heat-responsive devices in adjoining monitors exceeds the allowable distance, in which case install heat-responsive devices under the flat or sloping sections in accordance with the rules governing the shape of ceiling and type of construction.	W	Not Applicable: The conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 - 3.
5347	Decks Inside Buildings. Decks, not enclosed and not more than 10 feet in width, should not ordinarily require the installation of heat-responsive devices.	W	Not Applicable: The construction described in this requirement does not exist. Ref: Walkdown Checklist No. 1 - 3.

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5348	Stair Towers, Elevator Shafts and Other Enclosures. Where sprinklers are installed in stair towers, elevator shafts and other enclosures, heat responsive devices shall be installed in each such enclosure.	W	Not Applicable: The construction described in this requirement does not exit. Ref: Walkdown Checklist No. 1 - 3.
5350	Pre-Action Systems		Title
5351	Size of Systems. Not more than 1,000 closed sprinklers shall be controlled by any one pre-action valve.	W,D	Comply: Drawings show that the size of the system is well below the limit. Ref: Walkdown Checklist No. 1 - 3.; Drawing No. 2 & 3.
5352	Supervision. The sprinkler piping and heat-responsive devices shall be automatically supervised unless otherwise approved by the authority having jurisdiction.	W,D	Does Not Comply: Walkdowns show that the pre-action systems in the high roof and drumming area are not provided with supervisory air. There are no documents to show that NEPIA approved these systems. Ref: Walkdown Checklist No. 1 - 3.; Drawing No. 2 & 3.
		W	Not Applicable: The C.R. Cable Vault has a wet pipe system. Ref: Walkdown Checklist No. 3.
5353	Pipe Schedules. See Sections 3030, 3040, 3050 and Chapter 7.		Information Only: The code sections referenced in this requirement will be verified for the pre-action systems, as applicable.
5354	Pipe Sprinklers. Automatic sprinklers installed in the pendent position shall be of the approved dry pendent type only if installed in an area subject to freezing.	W	Not Applicable: Areas are not subject to freezing. Ref: Walkdown Checklist No. 1 - 3.
5360	Deluge Systems		Title
5361	The number of open head sprinklers controlled by any one deluge valve should be as follows: 1 1/2 in. valve — 5 sprinklers 2 in. valve — 10 sprinklers	W	Not Applicable: There are no deluge systems installed in areas of concern. Ref: Walkdown Checklist No. 1 - 3.

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	2 1/2 in. valve 27 sprinklers 3 in. valve 40 sprinklers 4 in. valve 75 sprinklers 6 in. valve 150 sprinklers		
5362	Supervision. The heat-responsive devices or systems shall be automatically supervised unless otherwise approved by the authority having jurisdiction.	W	Not Applicable: See response to code section 5361.
5370	Pipe Schedule for Deluge Systems		Title
5371	The following pipe schedule is given only as a guide for installations having no unusual features. The pipe schedule for deluge systems (1/2-inch orifice sprinklers or equivalent discharge) is as follows: 1 in. pipe 1 sprinkler 1 1/4 in. pipe 2 sprinkler 1 1/2 in. pipe 5 sprinkler 2 in. pipe 8 sprinkler 2 1/2 in. pipe 15 sprinkler 3 in. pipe 27 sprinkler 3 1/2 in. pipe 40 sprinkler 4 in. pipe 55 sprinkler 5 in. pipe 90 sprinkler 6 in. pipe 150 sprinkler	W	Not Applicable: There are no deluge systems. Ref: Walkdown Checklist No. 1 - 3.
5372	Deluge systems are usually applied to severe conditions of occupancy. In designing the piping system the water supply should be based on not less than an average discharge of 15 gallons per minute per sprinkler. Adjustment in pipe sizes to provide uniform sprinkler discharge should be based on a variation of plus or minus 15 percent from the assumed average discharge per sprinkler. Where practical to obtain the required degree of uniformity of discharge by sizing of piping this should be done rather than by using sprinklers having orifices smaller than 1/2 inch. See Chapter 7.	W	Not Applicable: See response to code section 5371.

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5373	Pipe sizes should be calculated in accordance with the standards for Hydraulically Designed Sprinkler Systems as given in Chapter 7.	W	Not Applicable: See response to code section 5371.
5374	Where change is made in pipe sizes this should not be effected by means of reducing flanges.	W	Not Applicable: See response to code section 5371.
5375	Where 8-inch piping is employed to reduce friction losses in a system operated by heat-responsive devices a 6-inch pre-action or deluge valve and 6-inch gate valve between taper reducers may be used.	W	Not Applicable: See response to code section 5371.
5380	Gate Valves		Title
5381	A gate valve shall be installed to control the water supply to each pre-action or deluge valve.	W, D	Comply: See response to code section 3421.
5382	In hazardous locations the gate valve and manual means for operation of pre-action or deluge valve shall be installed a safe distance away from the pre-action and deluge valve and where access to the control valves is not likely to be prevented under fire emergency conditions.	W	Not Applicable: Condition does not exist. Ref: Walkdown Checklist No. 1 - 3.
5383	In case of deluge systems the deluge valve shall be located as close as possible to the hazard protected, consistent with safety, preferably in an enclosure outside any fire or explosion hazard area.	W	Not Applicable: There are no deluge systems. Ref: Walkdown Checklist No. 1 - 3.
5390	Devices for Test Purposes and Testing Apparatus		Title
5391	When heat-responsive devices installed in circuits are located where not readily accessible, an additional heat-responsive device shall be provided on each circuit for test purposes at an accessible location and shall be connected to the circuit at a point which will assure a proper test of the circuit.	W	Not Applicable: The pilot lines for the pre-action systems are pneumatically supervised. Manual valve stations to release pilot air are available for this purpose. Electric heat detectors are not utilized for system actuation. Ref: Walkdown Checklist No. 1-3.

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5392	Suitable testing apparatus capable of producing the heat or impulse necessary to operate any normal heat-responsive device shall be furnished to the owner of the property with each installation. Where explosive vapors or materials are present, hot water, steam or other safe method of testing shall be used.	W	Not Applicable: See response to code section 5391.
5393	Pressure Gauges. Approved pressure gauges conforming to Paragraph 2822 shall be installed as follows:	W	Comply: The installed pressure gages meet these requirements. Ref: Walkdown Checklist No. 1 & 2.
	(a) Above and below pre-action valve and below deluge valve.	W	Does Not Comply: See response to code section 2822.
	(b) On air supply to pre-action and deluge valves.	W	Not Applicable: The CR cable vault is a wet-pipe system. Ref: Walkdown Checklist No. 3.
5400	Combined Dry-Pipe and Pre-Action Systems		Title
5410	General		Title
5411	Definition of a Combined Dry-Pipe and Pre-Action Sprinkler System. A system employing automatic sprinklers attached to a piping system containing air under pressure with a supplemental heat responsive system of generally more sensitive characteristics that the automatic sprinklers themselves, installed in the same areas as the sprinklers; operatings of the heat responsive system, as from a fire, actuates tripping devices which open dry-pipe valves simultaneously and without loss of air pressure in the system. Operation of the heat responsive system also opens approved air exhaust valves at the end of the feed main which facilitates the filling of the system with water which usually precedes the opening of sprinklers. The heat responsive system also serves as an automatic fire alarm system.	W	Not Applicable: Code sections discussing Combined Dry-Pipe and Pre-Action Systems (5400-5461) will not be verified since these types of systems are not installed for protection of safety related areas. Ref: Walkdown Checklist No. 1 - 3.

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5412	Where Installed. Combined dry-pipe and pre-action systems may be installed where wet-pipe systems are impractical. They are intended for use but not limited to structures where a number of dry pipe valves would be required if a dry-pipe system were installed.	W	Not Applicable: See response to 5411.
5413	Combined automatic dry-pipe and pre-action systems shall be so constructed that failure of the heat responsive system shall not prevent the system from properly functioning as a conventional automatic dry-pipe system.	W	Not Applicable: See response to 5411.
5414	Combined automatic dry-pipe and pre-action systems shall be so constructed that failure of the dry-pipe system of automatic sprinklers shall not prevent the heat responsive system from properly functioning as an automatic fire alarm system.	W	Not Applicable: See response to 5411.
5415	Provisions shall be made for the manual operation of the heat responsive system at locations requiring not more than 200 feet of travel.	W	Not Applicable: See response to 5411.
5416	Automatic sprinklers installed in the pendent position shall be of the approved dry pendent type.	W	Not Applicable: See response to 5411.
5420	Dry-Pipe Valves		Title
5421	Where the system consists of more than 600 sprinklers or has more than 275 sprinklers in any fire area, the entire system shall be controlled through two 6 inch fire area,	W	Not Applicable: See response to 5411.

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	the entire system shall be controlled through two 6-inch dry-pipe valves connected in parallel and shall feed into a common feed main. These valves shall be checked against each other. (See Fig. 5421).		
5422	Each dry-pipe valve shall be provided with an approved tripping device actuated by the heat responsive system. Dry-pipe valves shall be cross connected through a 1-inch pipe connection to permit simultaneous tripping of both dry pipe valves. This 1-inch pipe connection shall be equipped with a gate valve so that either dry-pipe valve can be shut off and worked on while the other remains in service.	W	Not Applicable: See response to 5411.
5423	The check valves between the dry-pipe valves and the common feed main shall be equipped with 1/2 inch bypasses so that a loss of air from leakage in the trimmings of a dry-pipe valve will not cause same to trip until the pressure in the feed main is reduced to the tripping point. A gate valve shall be installed in each of these bypasses so that either dry-pipe valve can be completely isolated from the main riser or feed main and from each other.	W	Not Applicable: See response to 5411.
5424	Each combined dry-pipe and pre-action shall be provided with approved quick opening devices at the dry pipe valves.	W	Not Applicable: See response to 5411.
5430	Air Exhaust Valves		Title
5431	One or more approved air exhaust valves of 2-inch or larger size controlled by operation of a heat responsive system shall be installed at the end of the common feed main. (See Fig. 5431). These air exhaust valves shall have soft	W	Not Applicable: See response to 5411.

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	meated globe or angle valves in their intakes, also approved strainers shall be installed between these globe valves and the air exhaust valves.		
5440	Sub-Division of System Using Check Valves		Title
5441	Where more than 275 sprinklers are required in a single fire area, the system shall be divided into sections of 275 sprinklers or less by means of check valves. If system is installed in more than one fire area or story, not more than 600 sprinklers shall be supplied through any one check valve. Each section shall have a 1 1/4-inch drain on the system side of each check valve supplemented by a drum drip.	W	Not Applicable: See response to 5411.
5442	Section drain lines and drum drips should be located in heated areas or inside of thermostatically controlled electrically heated cabinets of sufficient size to enclose drain valves and drum drips for each section. Drum drips should also be provided for all low points except that heated cabinets need not be required for 20 sprinklers or less. Air exhaust valves at end of feed main and associated check valves shall also be protected against freezing.	W	Not Applicable: See response to 5411.
5450	Time Limitation		Title
5451	The sprinkler system shall be so constructed and the number of sprinkler heads controlled shall be so limited that water shall reach the furthest sprinkler within a period of time not exceeding one minute for each 400 feet of common feed main from the time heat responsive system operates. Maximum time permitted not to exceed three minutes.	W	Not Applicable: See response to 5411.

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5460	Inspector's Test Connection		Title
5461	The end section shall have an inspector's test connection as required for day-pipe systems.	W	Not Applicable: See response to 5411.
5500	Anti-Freeze Solutions		Title
5510	Where Used		Title
5511	Anti-freeze solutions may be used for maintaining automatic sprinkler protection in small unheated areas which would otherwise be shut off and drained during freezing weather. Anti-freeze solutions are recommended only for systems not exceeding 20 sprinklers. The cost of refilling the system or even of replenishing small leaks makes it more advisable to use small dry valves where more than 20 sprinklers are to be supplied.	W	Not Applicable: There are no systems requiring anti-freeze solutions installed for protection of safety related areas. Therefore, codes sections 5500-5552 will not be verified. Ref: Walkdown Checklist No. 1 - 3.
5520	Recommended Anti-Freeze Solutions		Title
5521	Where sprinkler systems are supplied by public water connections the use of anti-freeze solutions other than water solutions of pure glycerine (C.P. or U.S.P. 96.5% Grade) or propylene glycol are undesirable from a public health standpoint. The use of anti-freeze solutions MUST be in conformity with any state or local health regulations which may apply. Suitable glycerine-water and propylene glycol-water mixtures are shown in Table 5521.	W	Not Applicable: There are no systems requiring anti-freeze solutions installed for protection of safety related areas. Therefore, codes sections 5500-5552 will not be verified. Ref: Walkdown Checklist No. 1 - 3.
5522	Beyond certain limits, increased proportions of antifreeze does not lower the freezing point of solution. (See Fig. 5522).	W	Not Applicable: See response to 5511.

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5523	If public water is not connected to sprinklers, the commercially available materials indicated in Table 5523 are suitable for use in anti-freeze solutions.	W	Not Applicable: See response to 5511.
5524	An anti-freeze solution should be prepared with a freezing point a few degrees below the expected minimum temperature for the locality. The specific gravity of the prepared solution should be checked by a hydrometer with suitable scale.	W	Not Applicable: See response to 5511.
5525	Glycerine, diethylene glycol, ethylene glycol and propylene glycol should never be used without mixing with water in proper proportions because these materials tend to thicken near 32°F.	W	Not Applicable: See response to 5511.
5530	Arrangement of Supply Piping and Valves		Title
5531	All anti-freeze solutions are heavier than water. At the point of contact (interface) the heavier liquid must be below the lighter liquid in order to prevent diffusion of water into the unheated areas. In most cases, this makes necessary the use of a 5-foot drop pipe or U-loop as illustrated in Fig. 5531. The preferred arrangement is to have the sprinklers below the interface between the water and the anti-freeze solution. If sprinklers are above the interface, a check valve with 1/2 inch hole in the clapper should be provided in the U-loop. A water control valve and two small solution test valves should be provided as illustrated in Fig. 5531. An acceptable arrangement of filling cup is also shown. To avoid leakage, the materials and workmanship must be excellent, the threads clean and sharp, and the joints tight. Use only metal-faced valves.	W	Not Applicable: See response to 5511.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
5540	Filling		Title
5541	With water supply valve closed and the system drained, fill the piping through the filling cup, using a suitable anti-freeze solution of the proper concentration. Vent the air at the end sprinklers. Back out all sprinklers slightly until the liquid appears so that the piping will be completely filled and all air expelled. If the filling cup is not above the highest sprinklers, the piping may be filled through valve B by means of a small pump or thorough a filling cup installed at the highest branch sprinkler line. If the last-named method is used, the drop pipe should be filled through the filling cup shown in diagram. Then tighten the sprinkler heads and open valve A until the 12-inch section of pipe above this valve is empty and the level of the anti-freeze solution in the drop pipe is at valve A. Close valve A. Close the filling connection valve and slowly open the supply valve wide.	W	Not Applicable: See response to 5511.
5550	Testing		Title
5551	Before freezing weather each year, the solution in the entire system should be emptied into convenient containers and brought to the proper specific gravity by adding concentrated liquid as needed. The resulting solution should be used to refill the system.	W	Not Applicable: See response to 5511.
5552	Tests should be made by drawing a sample of the solution from valve B two or three times during the freezing season, especially if it has been necessary to drain the building sprinkler system for repairs, changes, etc. A small hydrometer should be used so that a small sample will be	W	Not Applicable: See response to 5511.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	sufficient. When water appears at valve B or when the test sample indicates that the solution has become weakened, empty the entire system and recharge as previously described.		
5600	Limited Water Supply System		Title
5610	General		Title
5611	Definition of Limited Water Supply System. A system employing automatic sprinklers and conforming to this Standard but supplied by a pressure tank of limited capacity.	W	Not Applicable: The type of water supply described in this requirement is not provided for protection of safety related areas. Ref: Walkdown Checklist No. 1 - 3.
5612	Maintenance of Water Supply (See paragraph 2512).		Information Only

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 6. OUTSIDE SPRINKLERS FOR PROTECTION AGAINST EXPOSURE FIRES		Title: The type of system discussed in Chapter 6 of this edition of NFPA 13 is not provided for protection of safety related areas. Therefore, none of the requirements in this chapter apply and all have been deleted.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 7. HYDRAULICALLY DESIGNED SPRINKLER SYSTEMS		Title: All systems reviewed under this edition of NFPA 13 are extra hazard occupancy pipe schedule. Therefore, the requirements of Chapter 7 do not apply and all have been deleted.

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APPENDIX A

NFPA 13 1983 Edition

REFERENCES

Ref No.	Document Number	Title	Rev. No.	Date
		Walkdown Verification Checklists		
1	0120-108-004G	Impell Calculation, NFPA 13, 1983 Code Compliance Walkdown Verification Checklist (Wet Pipe Systems)	0	11/13/87
2	0120-108-004H	Impell Calculation, NFPA 13, 1983 Code Compliance Walkdown Verification Checklist (Pre-Action-Pilot Actuated Sprinkler Systems)	0	11/13/87
		Procedures		
1	PO-050-508	Fire Protection-Water Preoperational Test Procedure	0	07/03/74
2	12 MHP 4030.STP.020	Inspection of the Fire Protection System Deluge and Preaction Spray Headers in the Auxiliary Building	3	03/06/86
3	12 THP 4030.STP.223	Fire Protection Water System Test	6	09/11/87
4	12 OHP 4030.STP.120	Fire Protection System - Water and Carbon Dioxide	11	01/30/87
		Technical Data		
1		Letter From: R.J. Daley To: R.H. Jurgensen Instruction Book, "Grinnel and Star Fire Systems Equipment"		07/15/74
2	SD-DCC-FP101	System Description, Fire Protection System-Water	2	Draft
3		Specification for Fire Protection Systems of D.C. Cook Nuclear Plant	0	04/02/71

REFERENCES (Continued)

Ref No.	Document Number	Title	Rev. No.	Date
4	DCCPM104QCS	Piping Specification	4	11/09/72
5	DCCPM102QCS	Shop and Field Fabrication and Erection	4	05/24/73
6	RFC DC-01-2680	Appendix R Sprinkler System Modification Packet	0	09/17/85
7		Instruction Manual for Appendix "R" Sprinkler Additions - RFC's 01-2680 and 02-2695		
8	DCCFP109QCS	Fabrication and Installation of Appendix R Sprinkler Systems, Specification for RFC's DC-02-2695 and DC-01-2680 PSI (Power Systems Inc.)	0	02/10/84
9	RFC #02-2695 RFCDL REF #52	Hydraulic Calculations (Phoenix Contractors)		08/ /84
10	DCCFP108QCS	Design of App. R Sprinkler Specification for RFC's DC-02-2695 and DC-01-2680 Phoenix Contractors	2	02/10/84
11	0120-108-007	Impell Calculation, NFPA 72D Code Compliance Verification Checklist	0	
12	0120-108-008	Impell Calculation, NFPA 72E Code Compliance Verification Checklist	0	
13		Telecopy from Al Hall to D. Hoover		12/14/87
14		ANI's Recommendations for Carbon Filters		09/--/77
15	ROC from D. Kipley to B. Gerwe	Ambient Conditions of Plant		12/03/87

REFERENCES (Continued)

Ref No.	Document Number	Title	Rev. No.	Date
16		Hydraulic Calculation for "The Hydrogen Bulk Storage Tanks" (Grinnell)	1	12/18/71
17	RFC #12-2231 RFCDL REF #53	Hydraulic Calculations (Phoenix Contractors)		04/26/79
18	DCC-FP-103	Fire Protection Systems - Miscellaneous	3	08/26/87
		Licensing Documents		
1	DRP No. 74	Donald C. Cook, FHA Docket No. 50-316	1	01/30/87
		Drawings		
1	Hodgman DHG 127-1	Control Room Cable Vault Sprinkler Piping Planview	2	06/18/75
2	DHG 46-032-71M-18	High Roof Area Sprinkler Piping Planview (Grinnell)	5	03/03/72
3	DHG 46-032-71M-16	Drumming Area Sprinkler Piping Planview (Grinnell)	5	02/28/72
4	DHG 12-5152N-2	Flow Diagram Fire Protection - Water System Details - Yard Piping	2	07/01/87
5	DHG 12-5152L-2	Flow Diagram Fire Protection - Water System Details - Turbine Bldg.	2	02/25/87
6	DHG 12-5152A-1	Flow Diagram Fire Protection - Water Piping at Pumps	1	01/22/87

REFERENCES (Continued)

Ref No.	Document Number	Title	Rev. No.	Date
7	DWG HB-1181	Filter Unit Fire Hose Connection RFC-12-2463, 2465	A	08/20/81
8	DWG 46-032-71M-17	"Hydrogen Storage Tanks and Valve Header for High Roof, Drumming Area, and Outside Tanks" (Grinnell)	4	12/17/71
9	DWG DC 1 & 2-MFP-PHX-FILE-015000	DWG DC 1 & 2-MFP-PHX-FILE-015000 Contractor's Access Sprinkler Drawing from RFC-12-1437	2	12/07/81
10	DWG DC-2-MFP-RD22695-009-002 (AEPSC No.)	Elev. 633'-0 Aux. Bldg. East Piping Corridor (Phoenix DWG)	7	06/19/84
11	DWG DC-2-MFP-RD22695-010-002 (AEPSC No.)	Elev. 633'-0 Aux. Bldg. North Piping Corridor (Phoenix DWG)	8	06/19/84
12	DWG DC-2-MFP-RD22695-008-001 (AEPSC No.	Elev. 633'-0 Aux. Bldg. South Piping Corridor (Phoenix DWG)	8	06/11/84
13	DWG DC-2-MFP-RD22695-025-000 (AEPSC No.)	Inspectors Test Detail Elev. 633'-0 Aux. Bldg. N. Corridor (Phoenix DWG)	2	06/13/84
14	DWG DC-2-MFP-RD22695-017-001 (AEPSC No.)	Details & Sections Elev. 633'-0 Bldg N. Corridor (Phoenix DWG)	2	06/14/84
15	DWG DC-2-MFP-RD22695-007-001 (AEPSC No.)	Elev. 633'-0 Turbine Bldg. Supply Piping Details (Phoenix DWG)	2	06/04/84
16	DWG DC-2-MFP-RD22695-023-001 (AEPSC No.)	Elev. 620'-6 Aux. Bldg. HVAC Room Unit #1 (Phoenix DWG)	2	06/13/84
17	DWG DC-2-MFP-RD22695-022-002 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. - Fire Protection Piping	8	07/02/86
18	DWG DC-2-MFP-RD22695-022-001 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. - Fire Protection Piping (Phoenix DWG)	6	06/19/84
19	DWG DC-2-MFP-RD22695-024-001 (AEPSC No.)	RFC-02-2695 Elevation 609 Turbine Bldg. Riser Diagram (Phoenix DWG)	3	06/15/84

REFERENCES (Continued)

Ref No.	Document Number	Title	Rev. No.	Date
20	DWG DC-2-MFP-RD22695-020-001 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. Section Views (Phoenix DWG)	6	06/19/84
21	DWG DC-2-MFP-RD22695-006-002 (AEPSC No.)	Elev. 609'-0 Turbine Bldg. Supply Piping Details (Phoenix DWG)	4	06/05/84
22	DWG DC-1 & 2-MFP-RFC-RFC-2621-001-001 (AEPSC No.)	As-Built for Aux. Bldg. 587' & 609'	2	———
23	DWG DC-2-MFP-RD22695-021-002 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. East/West Piping Corridors (Phoenix DWG)	3	07/02/86
24	DWG DC-2-MFP-RD22695-019-001 (AEPSC No.)	Elev. 609'-0 Aux. Bldg. - CCW Fire Protection - Sidewall Sprinklers (Phoenix DWG)	7	06/19/84
25	DWG DC-2-MFP-RD22695-005-004 (AEPSC No.)	Units 1 & 2 Aux. Feed Pump Corridor Sprinkler System (Phoenix DWG)	6	06/13/84
26	DWG DC-2-MFP-RD22695-004-004 (AEPSC No.)	Unit 2 Emerg. DG Pump/Corridor Sprinkler System (Phoenix DWG)	6	06/13/84
27	DWG DC-2-MFP-RD22695-003-004 (AEPSC No.)	South Stair of Aux. Bldg. Elev. 587'-0 Sprinkler Water Curtain (Phoenix DWG)	4	05/14/84
28	DWG DC-2-MFP-RD22695-016-003 (AEPSC No.)	RFC-02-2695 Elev. 587'-Inspection Test Conn. (Phoenix DWG)	4	06/13/84
29	DWG DC-2-MFP-RD22695-002-004 (AEPSC No.)	North Stair of Aux. Bldg. Elev. 587'-0 Sprinkler Water Curtain (Phoenix DWG)	6	06/10/84
30	DWG DC-1 & 2-MFP-RFC-2621-002-001 (AEPSC No.)	As-Builts for Aux. Bldg. 587' & 609' (Phoenix DWG)	3	———
31	DWG DC-1 & 2-MFP-RFC-2621-003-001 (AEPSC No.)	As-Builts for Aux. Bldg. 587' & 609' (Phoenix DWG)	2	———

REFERENCES (Continued)

Ref No.	Document Number	Title	Rev. No.	Date
32	DHG DC-1 & 2-MFP-RFC-2621-004-001 (AEPSC No.)	As-Builts for Aux. Bldg. 587' & 609' (Phoenix DHG)	2	———
33	DHG DC-1 & 2-MFP-RFC-2621-005-001 (AEPSC No.)	As-Builts fo Aux. Bldg. 537' & 609' (Phoenix DHG)	4	06/01/84
34	DHG DC-2-MFP-RD22695-001-004 (AEPSC No.)	East Stair of Aux. Bldg. Elev. 573'-0 & 587'-0 Sprinkler Water Curtain (Phoenix DHG)	6	06/13/84
35	DHG 2-5152K-1	Flow Diagram, Fire Protection - Water System Details - Turbine Bldg. & Screen House	1	02/25/87
36	DHG 12-5152E-2	Flow Diagram, Fire Protection - Water Charcoal Filters	2	07/07/87
37	DHG 12-5401-7	Aux. Bldg. Fire Protection Piping to Charcoal Filters	6	01/22/86
38	DHG 12-5401A-6	Aux. Bldg. Fire Protection Piping to Charcoal Filters	5	01/10/78
39	DHG 1-5152J	Flow Diagram, Fire Protection - Water System Details - Turbine Bldg. & Screen House	0	10/06/86
40	DHG 46-032-71H-15	Grinnell Sprinkler Drawing for Unit 1 Auxiliary Feed Pump Room	0	09/24/71
41	DHG Phoenix T-591-H	Unit 1 Emergency DG Ramp	0	03/08/84
42	Hodgman DHG 121-15	Unit 2 AFW Pump Initial Installation DHG	1	05/01/75
43	DHG 12-5152D	Flow Diagram, Fire Protection Water Aux. and Containment Buildings	0	10/06/86

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The following plant areas were evaluated under the requirements of NFPA 13, 1983 edition:

System	Fire Areas	Fire Zones
• Wet pipe sprinklers - protecting Unit 2 Turbine Driven AFW Pump and AFW Pump corridor.	Q, S, T	17C, 17E, 17F
• Wet pipe sprinklers - protecting Unit 1 Emergency Diesel Generator Ramp and Corridor.	B	79
• Wet pipe sprinkler - protecting Unit 2 Emergency Diesel Generator Ramp and Corridor.	B	85
• Pre-action sprinklers - pilot actuated - protecting elevations 570' and 587'-0".	E, A, YY, and ZZ	1, 5, 6H, 6N, 6S, 62A, 62B, 62C, 63A, 63B, 63C, 64A, 64B, 65A, and 65B
• Pre-action sprinklers - pilot actuated - protecting elevation 609'-0".	HH	44N, 44S
• Pre-action sprinklers - pilot actuated - protecting elevation 633'-0".	C	51, 52
• Wet-pipe sprinklers - protecting Contractor's Access Control Bldg.	FF	105

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	Chapter 1 General Information		Title
1-1	Scope. This standard provides the minimum requirements for the design and installation of automatic sprinkler systems and of exposure protection sprinkler systems, including the character and adequacy of water supplies and the selection of sprinklers, piping, valves and all materials and accessories; but not including the installation of private fire service mains and their appurtenances, the installation of fire pumps, the construction and installation of gravity and pressure tanks and towers. NOTE: Consult other NFPA standards for additional requirements relating to water supplies.		Information Only
1-2	Purpose. The purpose of this standard is to provide a reasonable degree of protection for life and property from fire through installation requirements for sprinkler systems based upon sound engineering principles, test data, and field experience. The standard endeavors to continue the excellent record that has been established by standard sprinkler systems and meet the needs of changing technology. Nothing in this standard is intended to restrict new technologies or alternate arrangements, providing the level of safety prescribed by the standard is not lowered. NOTE: A sprinkler system is a specialized fire protection system and requires knowledge and experienced design and installation.		Information Only
1-3	Definitions		Information Only: This section of the code contains definitions only and has, therefore, been omitted in its entirety.

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1-4	Other Publications. A selected list of other publications related to the installation of sprinkler systems is published at the end of this standard.		Information Only
1-5	Maintenance		Title
1-5.1	A sprinkler system installed under this standard shall be properly maintained for efficient service. The owner is responsible for the condition of the sprinkler system and shall use due diligence in keeping the system in good operating condition.	W, D	Comply. Maintenance and testing procedures are provided to meet the requirements of this code section. Any deviations found during the walkdowns or document reviews will be addressed under the specific code sections. Ref: Walkdown Checklist No. 1 & 2. Procedure No. 2, 3 & 4.
1-5.2	The installing contractor shall provide the owner with:	D	Comply. The instruction manual contains NPFA 13A maintenance recommendations and procedures. Ref: Technical Data No. 7.
	(a) Instruction charts describing operation and proper maintenance of sprinkler devices.	D	The preoperational test procedure for the wet pipe sprinkler system specifies minimum NFPA 13A test recommendations. Ref: Procedure No. 1.
	(b) Publication entitled NFPA 13A, Care and Maintenance of Sprinkler Systems.	D	Open Item: Documentation for the contractor's access is unavailable for review.
1-6	Classification of Sprinkler Systems		Title
1-6.1	This standard covers automatic sprinkler systems of the types listed below, also systems of outside sprinklers for protection against exposure fires covered specifically in Chapter 6. Manually operated deluge systems, used for certain special hazard conditions,		Information Only

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	are not specifically covered in this standard but certain provisions of this standard will be found applicable. Wet-Pipe Systems (See Section 5-1.) Dry-Pipe Systems (See Section 5-2.) Pre-Action Systems (See Section 5-3.) Deluge Systems (See Section 5-3.) Combined Dry-Pipe and Pre-Action Systems (See Section 5-4). Sprinkler System - Special Types. Special purpose systems employing departures from the requirements of this standard, such as special water supplies and reduced pipe sizing, shall be installed in accordance with their listing.		
1-7	Classification of Occupancies	Title	
1-7.1	Occupancy classifications for this standard relate to sprinkler installations and their water supplies only. They are not intended to be a general classification of occupancy hazards.	Information Only	
1-7.2	Light Hazard Occupancies	Title	
1-7.2.1	Light Hazard. Occupancies or portions of other occupancies where the quantity and/or combustibility of contents is low and fires with relatively low rates of heat release are expected.	Information Only	
1-7.3	Ordinary Hazard Occupancies	Title	
1-7.3.1	Ordinary Hazard (Group 1). Occupancies or portions of other occupancies where combustibility is low, quantity of	Information Only	

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	combustibles is moderate, stock piles of combustibles do not exceed 8 ft (2.4 m) and fires with moderate rates of heat release are expected.		
1-7.3.2	Ordinary Hazard (Group 2). Occupancies or portions of other occupancies where quantity and combustibility of contents is moderate, stock piles do not exceed 12 ft (3.7 m) and fires with moderate rate of heat release are expected.		Information Only
1-7.3.3	Ordinary Hazard (Group 3). Occupancies or portions of other occupancies where quantity and/or combustibility of contents is high, and fires of high rate of heat release are expected.		Information Only
1-7.4	Extra Hazard Occupancies		Title
1-7.4.1	Extra Hazard occupancies or portions of other occupancies where quantity and combustibility of contents is very high, and flammable and combustible liquids, dust, lint or other materials are present introducing the probability of rapidly developing fires with high rates of heat release.		Information Only
1-7.4.2	Extra hazard occupancies involve a wide range of variables which may produce severe fires. The following shall be used to evaluate the severity of extra hazard occupancies: Extra Hazard (Group 1) include occupancies described in 1-7.4.1 with little or no flammable or combustible liquids. Extra Hazard (Group 2) include occupancies described in 1-7.4.1 with moderate to substantial amounts of flammable or combustible liquids or where shielding of combustibles is extensive.		Information Only

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1-8	Design and Installation		Title
1-8.1	Devices and Materials		Title
1-8.1.1	Only new sprinklers shall be employed in the installation of sprinkler systems.	W, D	Comply: Specifications or walkdowns identified that the sprinkler systems are new installations. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 10 Section 4.0.
1-8.1.2	When a sprinkler system is installed, only approved materials and devices shall be used.	W, D	Does Not Comply: See response to code sections 3-14.2.1 and 3-17.3.3.
1-8.1.3	Sprinkler systems shall be designed for a maximum working pressure of 175 psi (12.1 bars).	D	Comply: Specifications show that the system was designed for 175 psig at ambient temperature. Ref: Technical Data No. 10 Sheet 33 Of 41.
		D	Open Item: Documentation for the contractors access area is unavailable for review.
1-8.1.3.1	Interior system components subject to pressure shall be designed for a working pressure not less than 175 psi (12.1 bars).	D	Comply: See response to code section 1-8.1.3.
1-9	Working Plans		Title
1-9.1	Working plans shall be submitted for approval to the authority having jurisdiction before any equipment is installed or remodeled. Deviation from approved plans will require permission of the authority having jurisdiction.	D	Comply: Final layout drawings and hydraulic calculations were submitted to American Nuclear Insurers (ANI) for approval. Ref: Technical Data No. 3 Section 1.04-1 and No. 10 Section 6.3.
		D	Open Item: Documentation for the contractors access area is unavailable for review.

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1-9.2	Working plans shall be drawn to an indicated scale, on sheets of uniform size, with plan of each floor, made so that they can be easily duplicated, and shall show the following data. (a) Name of owner and occupant (b) Location, including street address (c) Point of compass (d) Ceiling construction (e) Full height cross section (f) Location of fire walls (g) Location of partitions (h) Occupancy of each area or room (i) Location and size of concealed spaces and closets. (See 4-4.3 to 4-4.17 inclusive, except 4-4.5 and 4-4.6.) (j) Any questionable small enclosures in which no sprinklers are to be installed (k) Size of city main in street, pressure and whether dead-end or circulating and, if dead-end, direction and distance to nearest circulating main, city main test results (see B-2-1). (l) Other sources of water supply, with pressure or elevation (m) Make, type and nominal orifice size of sprinklers (n) Temperature rating and location of high temperature sprinklers	D	Does Not Comply: All data is provided except for the hydraulic design data plate material descriptions or is not available for review for the following drawings: Ref: Drawing No. 10 - 34. • Grinnel drawing - Unit 1 AFW Pump Room system - 9/24/71. • Hodgman drawing - 121-15 - Unit 2 AFW Pump Room system Initial Installation. • Drawings DC-1 & 2 - HFP-RFC-2621-001 through 005.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	(o) Total area protected by each system on each floor		
	(p) Number of sprinklers on each riser per floor		
	(q) Make, type, model and size of dry-pipe valve		
	(r) Make, type, model and size of pre-action or deluge valve		
	(s) Kind and location of alarm bells		
	(t) Total number of sprinklers on each dry-pipe/pre-action system or deluge system		
	(u) Approximate capacity in gallons of each dry-pipe system		
	(v) Pipe type and schedule of wall thickness		
	(w) Nominal pipe size and cutting lengths of pipe (or center to center dimensions)		
	NOTE: Where typical branch lines prevail, it will be necessary to size only one line.		
	(x) Location and size of riser nipples		
	(y) Type of fittings and joints and location of all welds and bends		
	(z) Type and locations of hangers and sleeves		
	(aa) All control valves, check valves, drain pipes and test pipes		
	(bb) Size and location of hand hose, hose outlets and related equipment		

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	(cc) Underground pipe size, length, location, weight, material, point of connection to city main; the type of valves, meters and valve pits; and the depth that top of the pipe is laid below grade.		
	(dd) Provision for flushing (see 3-8.2)		
	(ee) When the equipment is to be installed as an addition to an existing system enough of the existing system shall be indicated on the plans to make all conditions clear		
	(ff) For hydraulically designed systems, the material to be included on the hydraulic data nameplate		
	(gg) Name and address of contractor.		
1-10	Approval of Sprinkler Systems		Title
1-10.1	The installer shall perform all required acceptance tests (see Section 1-11), complete the Contractor's Material and Test Certificate(s) (see Section 1-12), and forward the certificate(s) to the authority having jurisdiction prior to asking for approval of the installation.	D	Comply: See response to code section 1-9.1. Ref: Technical Data No. 8 Sections 3.0 & 4.0.
1-10.2	When the authority having jurisdiction desires to be present during the conduct of acceptance tests, the installer shall give advance notification of the time and date the testing will be performed.	D	Comply: The specifications require notification of 10 working days prior to testing of systems. Ref: Technical Data No. 10 Sections 7.4.3 & 7.4.4.
		D	Open Item: There is no documentation for the contractor's access area available for review.
1-11	Acceptance Tests		Title
1-11.1	Flushing of Underground Connections		Title
1-11.1.1	Underground mains and lead-in connections to system risers shall be flushed before	D	Open Item: Documentation could not be found which showed that lead in mains

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	connection is made to sprinkler piping in had been flushed. order to remove foreign materials which may have entered the underground piping during the course of the installation. For all systems, the flushing operation shall be continued until water is clear.		
1-11.1.2	Underground mains and lead-in connections shall be flushed at a flow rate not less than indicated in Table 1-11.1.2 or at the hydraulically calculated water demand rate of the system, whichever is greater. Exception No. 1: When the water supply will not produce the stipulated flow rate, connections to a hydraulically designed system may be flushed at the demand rate of the system, including hose streams if hose or hydrants or both are supplied from that connection. Exception No. 2: For pipe schedule systems, when the water supply will not produce the stipulated flow rate, the maximum flow rate available shall be used. Table 1-11.1.2 Pipe Size / Flow Rate / L/min. 4 in. 400 gpm 1514 5 in. 600 gpm 2271 6 in. 750 gpm 2839 8 in. 1000 gpm 3785 10 in. 1500 gpm 5678 12 in. 2000 gpm 7570	D	Open Item: See response to code section 1-11.1.1.
1-11.1.3	Provision shall be made for the disposal of water issuing from test outlets to avoid property damage.	D	Open Item: See response to code section 1-11.1.1.

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1-11.2	Hydrostatic Tests		Title
1-11.2.1	All new systems including yard piping shall be hydrostatically tested at not less than 200 psi (13.8 bars) pressure for 2 hours, or at 50 psi (3.4 bars) in excess of the maximum pressure, when the maximum pressure to be maintained in the system is in excess of 150 psi (10.3 bars). The test pressure shall be read from a gauge located at the low elevation point of the individual system or portion of the system being tested. Exception: At seasons of the year that will not permit testing with water an interim test may be conducted with air pressure of at least 40 psi (2.8 bars) allowed to stand for 24 hours. The standard hydrostatic test shall be conducted when weather permits.	D	Open Item: Design specifications called for all systems to be hydrostatically tested at not less than 235 psi for 2 hours, however, test certificates were not available for review. Ref: Technical Data No. 10 Section 7.4.
1-11.2.2	Permissible Leakage. The inside sprinkler piping shall be installed in such a manner that there will be no visible leakage when the system is subjected to the hydrostatic pressure test. Refer to NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances, for permissible leakage in underground piping. The amount of leakage shall be measured by pumping from a calibrated container.	W, D	Open Item: The specifications do not allow visible leakage during the hydrostatic tests, however test certificates were not available for review. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 10 Section 7.4.1.1b.
1-11.2.3	Fire Department Connection. Piping between the check valve in the fire department inlet pipe and the outside connection shall be tested the same as the balance of the system.	W	Not Applicable: The connection discussed in this requirement is not provided in systems for safety related areas. Ref: Walkdown Checklist No. 1 & 2.
1-11.2.4	Corrosive Chemicals. Brine or other corrosive chemicals shall not be used for testing systems.	D	Comply: Supply water from Lake Michigan was used for testing the systems. This water is free of the

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			pollutants described in this requirement. Ref: Procedure No. 1; Technical Data No. 2.
1-11.2.5	Test Blanks. Whenever a test blank is used it shall be of the self-indicating type. Test blanks shall have red painted lugs protruding beyond the flange in such a way as to clearly indicate their presence. The installer shall have all test blanks numbered so as to keep track of their use and assure their removal after the work is completed.	D	Open Item: See response to code section 1-11.1.1.
1-11.3.	Test of Dry-Pipe Systems		Title
1-11.3.1	Differential Dry-Pipe Valves. The clapper of a differential type dry-pipe valve shall be held off its seat during any test in excess of 50 psi (3.4 bars) to prevent damaging the valve.	W	Not Applicable: Dry-pipe systems are not provided for protection of safety related areas. Ref: Walkdown Checklist No. 1 & 2.
1-11.3.2	Air Test. In dry-pipe systems an air pressure of 40 psi (2.8 bars) shall be pumped up, allowed to stand 24 hours, and all leaks which allow a loss of pressure over 1 1/2 psi (0.1 bar) for the 24 hours shall be stopped.	D	Not Applicable: See response to code section 1-11.3.1. This criteria was, however, applied to the App. R systems upgrade as no other criteria was available. Ref: Technical Data No. 10.
1-11.3.3	Operating Test of Dry-Pipe Valve. A working test of the dry-pipe valve alone and with quick opening device, if installed, shall be made before acceptance by opening the inspector's test connection. Trip and water delivery times shall be recorded using the Contractor's Material and Test Certificate for Aboveground Piping.	D	Not Applicable: See response to code section 1-11.3.1.
1-11.4	Tests of Drainage Facilities. Tests of drainage facilities shall be made while the control valve is wide open. The main drain valve shall be opened and remain open until the system pressure stabilizes. (See 2-9.1.)	D	Comply: The pre-operational test procedure calls for main drain testing. Ref: Procedure No. 1.

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1-12	Contractor's Material and Test Certificates (Certificates and requirements appear on pages 9-12 of the code.)	D	Information Only. See response to code section 1-11.1.1 and 1-11.2.1.
1-13	Operation of Sprinkler System Control Valves by Contractors. When work on a sprinkler system requires that a contractor operate a valve controlling water supplies to a sprinkler system, the contractor shall inform the owner so that the owner may follow the normal valve supervision procedure.	D	Comply: The specifications require that the owner coordinate all testing. Ref: Technical Data No. 8 Section 7.3.5.
1-14	Units. Metric units of measurement in this standard are in accordance with the modernized meteric system known as the International System of Units (SI). Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection. These units are listed in Table 1-14 with conversion factors.		Information Only

Table 1-14

Name of Unit	Unit Symbol	Conversion Factor
liter	L	1 gal = 3.785L
liter per minute per square meter	$(L/min)/m^2$	1 gpm/ft^2 = 40.746 $(L/min)/m^2$
millimeter per minute	1 mm/min	1 gpm/ft^2 = 40.746 mm/min
cubic decimeter	dm^3	1 gal = 3.785 dm^3
pascal	Pa	1 psi = 6894.757 Pa
bar	bar	1 psi = 0.0689 bar
bar	bar	1 bar = 10^5 Pa

~~For additional conversions and information~~
see ASTM E380, Standard for Metric Practice.

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1-14.1	If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.		Information Only: The English units of measure will be used.
1-14.2	The conversion procedure for the SI units has been to multiply the quantity by the conversion factor and then round the result to the appropriate number of significant digits.		Information Only
	CHAPTER 2 WATER SUPPLIES		Title
2-1	General Provisions. Every automatic sprinkler system shall have at least one automatic water supply.	D	Comply: Water can be supplied by five separate fire pumps from Lake Michigan. Ref: Technical Data No. 2 Section 1.1.
2-2	Water Supply Requirements for Sprinkler Systems		Title
2-2.1	Water Supply Requirement Tables		Title
2-2.1.1	Water Supply Requirement Tables shall be used in determining the minimum water supply requirements for light, ordinary and extra hazard occupancies. Occupancy classification shall be determined from Section 1-7. (a) Table 2-2.1 (A) is used to determine the minimum volume of water and pressure normally required for a pipe schedule sprinkler system. THE TABLE IS TO BE USED ONLY WITH EXPERIENCED JUDGMENT. (b) Table 2-2.1(B) is used to determine the minimum volume of water and pressure normally required for a hydraulically designed sprinkler system.	D	Comply: The Contr. Access Control Building was sized for ordinary hazard pipe schedule. The D.C. Cook fire water supply system is more than adequate to meet minimum water supply requirements of Table 2-2.1.A for this system. Ref: Drawing No. 9; Technical Data No. 2.

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2-2.1.2	The following shall be used in applying Table 2-2.1(B):	D	Not Applicable: Code Section 2-2.1.2.1 through 2-2.1.2.12 will be verified to evaluate this requirement.
2-2.1.2.1	The water supply requirement for sprinklers only shall be calculated from the density curves in Table 2-2.1(B). System piping shall be calculated to satisfy a single point on the appropriate design curve. It is not necessary to meet all points on the selected curve.	D	Comply: The sprinkler system modifications being evaluated in the code review were designed with the following densities: • AFW Pump Corridor elev. 591'-0" (Zone 17C) - 0.30 GPM/sq. ft. over 3000 sq. ft. • Unit 2 Ener. Diesel Ramp/Corridor elev. 591'-0" (N.E. portion - Zone 85) - 0.30 GPM/sq. ft. over 3000 sq. ft. • North Stair - Aux. Bldg., elev. 587'-0" (Zone 6N to 44N) - 3.0 GPM per lineal foot of opening. • South Stair - Aux. Bldg., elev. 587'-0" (Zone 6S to 44S) - 3.0 GPM per lineal foot of opening. • East Stair - Aux. Bldg., elev. 573'-0" and 587'-0" (Zones 1, 5 and 44N) - 3.0 GPM per lineal foot of opening. • Aux. Bldg. elev. 587'-0" - 0.30 GPM/sq. ft. over 4000 sq. ft. • Aux. Bldg. elev. 609'-0" - 0.30 GPM/sq. ft. over 3000 sq. ft. or 4000 sq. ft. depending on which portion of the floor. • Aux. Bldg. elev. 633'-0" (Zone 51 & 52) - 0.30 GPM/sq. ft. over 3000 sq. ft. • Aux. Bldg. elev. 609'-0" - 0.30 GPM/sq. ft. over 3000 sq. ft.

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			These densities are far above those densities which would be called out by the NFPA density curves for ordinary hazards or extra hazardard group 1 areas, and were selected on the basis of ANI recommendations. Ref: Technical Data No. 9 & 17.
2-2.1.2:2	When inside hose stations are planned or are required by other standards, a water allowance of 50 gpm (198 L/min) for a one hose station installation [100 gpm (378 L/min) for a two or more station installation] shall be added to the sprinkler requirement at the point of connection to the system at the residual pressure required by the sprinkler system design.	W	Not Applicable: D.C. Cook is provided with a separate fire hose standpipe system. Ref: Walkdown Checklist No. 1 & 2.
2-2.1.2.3	Water supply demands for ceiling sprinklers and in rack sprinklers for rack storage systems shall be combined and hydraulically balanced at the common supply point.	W	Not Applicable: There are no in rack sprinkler providing protection in safety related areas. Ref: Walkdown Checklist No. 1 & 2.
2-2.1.2.4	Water allowance for outside hose shall be added to the sprinkler and inside hose requirement at the connection to the city water main, or at a yard hydrant, whichever is closer to the system riser.	D	Does Not Comply: Exterior hose demands were not shown added to the calculations for the pre-action systems or the wet-pipe systems. Ref: Technical Data No. 9 & 17.
2-2.1.2.5	The lower duration figure is ordinarily acceptable where remote station water flow alarm service or equivalent is provided.	D	Does Not Comply: See response to code section 2-2.1.2.4.
2-2.1.2.6	When pumps, gravity tanks or pressure tanks supply sprinklers only, requirements for inside and outside hose need not be considered in determining the size of such pumps and tanks.	W	Not Applicable: The condition described in this code requirement does not exist for the systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.

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2-2.1.2.7	The water supply requirement for sprinklers only shall be based upon the area of the sprinkler operation selected from Table 2-2.1(B) or upon the area of the largest room, at the discretion of the designer. Such a room shall be enclosed with construction having a fire resistance rating equal to the water supply duration indicated in Table 2-2.1(B) with minimum protection of openings as follows: (a) Light Hazard - automatic or self-closing doors. Exception: When openings are not protected, calculations shall include the sprinklers in the room plus two sprinklers in the communicating space nearest each such unprotected opening unless the communicating space has only one sprinkler, in which case calculations shall be extended to the operation of the sprinkler. (b) Ordinary and Extra Hazard - automatic or self-closing doors with appropriate fire resistance ratings for the enclosure.	D	Comply: Design areas were selected on the basis of ANI recommendations. (.3 GPM/sq. ft. for 3000 sq. ft.) Ref: Technical Data No. 9 & 17.
2-2.1.2.8	For areas of sprinkler operation less than 1500 sq ft (139 m^2) used for light and ordinary hazard occupancies, the density for 1500 sq ft (232 m^2) for extra hazard occupancies (Groups 1 and 2), the density for 2500 sq ft (232 m^2) shall be used.	D	Comply: See response to code section 2-2.1.2.7.
2-2.1.2.9	For dry-pipe systems, increase area of sprinkler operation by 30 percent without revising density.	W	Not Applicable: There are no dry-pipe systems providing protection of safety related areas. Ref: Walkdown Checklist No. 1 & 2.
2-2.1.2.10	For construction having unsprinklered combustible concealed spaces, as described in 4-4.4, the minimum area of sprinkler operation shall be 3000 sq ft (279 m^2).	W	Not Applicable: There are no combustible concealed spaces, as described in this requirement, in safety related areas. Ref: Walkdown Checklist No. 1 & 2.

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2-2.1.2.11	For hazard classifications other than those indicated see appropriate NFPA standards for design criteria.		Information Only
2-2.1.2.12	When high temperature sprinklers are used for extra hazard occupancies (Group 1 and 2) the area of sprinkler operation may be reduced by 25 percent without revising the density but not to less than 2000 sq ft (185.8 m^2).	D	Not Applicable: Zone 17E - AFW pump room was appropriately sized for sprinkler area operation. Ref: Drawing No. 40.
2-2.1.3	When other NFPA standards have developed sprinkler system design criteria, they shall take precedence.		Information Only
2-3	Connections to Water Works Systems		Title
2-3.1	Acceptability		Title
2-3.1.1	A connection to a reliable water works system shall be an acceptable water supply source. The volume and pressure of a public water supply shall be determined from water flow test data.	D	Not Applicable: The sprinkler systems at D.C. Cook are not connected to a water works system. Ref: Technical Data No. 2.
2-3.1.2	Meters. Meters are not recommended for use on sprinkler systems; however, where required by other authorities, they shall be of approved type.	W	Not Applicable: The components described in this requirement are not provided on systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.
2-3.2	Capacity. The connection and arrangement of underground supply piping shall be capable of supplying the volume as required in Table 2-2.1(A) or 2-2.1(B). Pipe size shall be at least as large as the system riser. (See NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.) Exception: Unlined cast or ductile iron shall not be less than 4 in. in size.	D	Comply: The underground supply piping is sufficiently sized to supply the needed water volume. Ref: Technical Data No. 2.

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2-4	Gravity Tanks		Title
2-4.1	Acceptability. An elevated tank sized in accordance with Table 2-2.1(A) or 2-2.1(B) shall be an acceptable water supply source. (See NFPA 22, Water Tanks for Private Fire Protection.)	W	Not Applicable: Gravity tanks, as discussed in this requirement, are not provided for protection of safety related areas. Ref: Walkdown Checklist No. 1 & 2.
2-4.2	Capacity and Elevation. The capacity and elevation of the tank and the arrangement of the underground supply piping shall provide the volume and pressure required by Table 2-2.1(A) or 2-2.1(B) designs.	W	Not Applicable: Gravity tanks, as discussed in this requirement, are not provided for protection of safety related areas. Ref: Walkdown Checklist No. 1 & 2.
2-5	Pumps		Title
2-5.1	Acceptability. A single automatically controlled fire pump sized in accordance with Table 2-2.1(A) or 2-2.1(B) supplied under positive head shall be an acceptable water supply source. (See NFPA 20, Installation of Centrifugal Fire Pumps.)	D	Comply: The sprinkler systems are supplied by five fire pumps. Ref: Technical Data No. 2 Section 1.2.
2-5.2	Supervision. When a single fire pump constitutes the sole sprinkler supply, it shall be provided with supervisory service from an approved central station, proprietary, remote station system or equivalent.	D	Not Applicable: See response to code section 2-5.1. Refer to the NFPA 72D Code Compliance Evaluation Section 3446 for fire pump supervision. Ref: Technical Data No. 11.
2-6	Pressure Tanks		Title
2-6.1	Acceptability		Title
2-6.1.1	A pressure tank sized in accordance with Table 2-2.1(A) or 2-2.1(B) is an acceptable water supply source. (See NFPA 22, Water Tanks for Private Fire Protection.)	W	Not Applicable. There are no pressure tanks, as described in Section 2-6, used for protection of safety related areas. Ref: Walkdown Checklist No. 1 & 2.

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2-6.1.2	Pressure tanks shall be provided with an approved means for automatically maintaining the required air pressure. When a pressure tank is the sole water supply there shall also be provided an approved trouble alarm to indicate low air pressure and low water level with the alarm supplied from an electrical branch circuit independent of the air compressor.	W	Not Applicable: See response to code section 2-6.1.1.
2-6.1.3	Pressure tanks shall not be used to supply other than sprinklers and hand hose attached to sprinkler piping.	W	Not Applicable: See response to code section 2-6.1.1.
2-6.2	Capacity		Title
2-6.2.1	The size of the pressure tank required shall be in accordance with Table 2-2.1(A) or 2-2.1(B) and shall include the extra capacity needed to fill dry-pipe systems when installed. Minimum requirements when pressure tanks are not the sole water supply source shall be as indicated in 2-6.2.2, 2-6.2.3, and 2-6.2.4.	W	Not Applicable: See response to code section 2-6.1.1.
2-6.2.2	Light Hazard Occupancy. Amount available water, not less than 2,000 gal (7570 L).	W	Not Applicable: See response to code section 2-6.1.1.
2-6.2.3	Ordinary Hazard Occupancy. Amount of available water, not less than 3,000 gal (11 355 L) for Groups 1 and 2. For Group 3, refer to authority having jurisdiction.	W	Not Applicable: See response to code section 2-6.1.1.
2-6.2.4	Extra Hazard and Woodworker Occupancies. Refer to authority having jurisdiction.	W	Not Applicable: See response to code section 2-6.1.1.
2-6.2.5	For high-rise buildings, see Chapter 8.	W	Not Applicable: See response to code section 2-6.1.1.
2-6.3	Water Level and Air Pressure. Unless otherwise approved by the authority having jurisdiction, the pressure of at least 75 psi (5.2 bars) by the gage shall be maintained. When the bottom	W	Not Applicable: See response to code section 2-6.1.1.

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	of the tank is located below the highest sprinklers served, the air pressure by the gage shall be at least 75 psi (5.2 bars) plus three times the pressure caused by the column of water in the sprinkler system above the tank bottom.		
2-7	Fire Department Connections		Title
2-7.1	A fire department connection shall be provided as described in this section.	W	Not Applicable: There are no fire department connections installed on systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.
	Exception: When permission of the authority having jurisdiction has been obtained for its omission.		Fire department connections would not aid the sprinkler systems. The pump/ piping network is adequately supplied to ensure sufficient pressure for site suppression systems. A double break of the main system would be required to disable all supply and is highly improbable.
2-7.2	Size. Pipe size shall be not less than 4 in. for fire engine connections and not less than 6 in. for fire boat connections, except that 3-in. pipe may be used to connect a single hose connection to a 3-in. or smaller riser.	W	Not Applicable: See response to code section 2-7.1.
2-7.3	Arrangement. (See 3-14.2.5 and 3-14.2.6)		Title.
2-7.3.1	The fire department connection shall be made on the system side of a check valve in the water supply piping.	W	Not Applicable: See response to code section 2-7.1.
2-7.3.2	On wet-pipe systems with a single riser the connection shall be made on the system side of approved indicating, check, and alarm valves to the riser, unless the system is supplied by a fire department pumper connection in the yard. (See 3-14.2.6)	W	Not Applicable: See response to code section 2-7.1.

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2-7.3.3	On dry-pipe systems with a single riser the connection shall be made between the approved indicating valve and the dry-pipe valve, unless the system is supplied by a fire department pumper connection in the yard.	W	Not Applicable: See response to code section 2-7.1.
2-7.3.4	On systems with two or more risers the connection shall be made on the system side of all shut-off valves controlling other water supplies, but on the supply side of the riser shut-off valves so that, with any one riser off, the connection will feed the remaining sprinklers, unless the sprinklers are supplied by a fire department pumper connection in the yard.	W	Not Applicable: See response to code section 2-7.1.
2-7.3.5	Fire department connections shall not be connected on the suction side of booster pumps.	W	Not Applicable: See response to code section 2-7.1.
2-7.3.6	Fire department connections to sprinkler systems shall be designated by a sign having raised letters at least 1 in. (25 mm) in size cast on plate or fitting reading for service designated: viz. — "AUTOSPKR.," "OPEN SPKR." or "AUTOSPKR. and STANDPIPE."	W	Not Applicable: See response to code section 2-7.1.
2-7.4	Valves		Title
2-7.4.1	An approved check valve shall be installed in each fire department connection, located as near as practicable to the point where it joins the system.	W	Not Applicable; See response to code section 2-7.1.
2-7.4.2	There shall be no shut-off valve in the fire department connection.	W	Not Applicable: See response to code section 2-7.1.
2-7.5	Drainage. The piping between the check valve and the outside hose coupling shall be equipped with an approved automatic drip.	W	Not Applicable: See response to code section 2-7.1.

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2-7.6	Hose Connections		Title
2-7.6.1	The fire department connection(s) shall be internal threaded swivel fitting(s) having the NH standard thread, at least one of which shall be 2.5-7.5 NH standard thread, as specified in NFPA 1963, Screw Threads and Gaskets for Fire Hose Connections. Exception: When local fire department connections do not conform to NFPA 1963, the authority having jurisdiction shall designate the connection to be used.	W	Not Applicable: See response to code section 2-7.1.
2-7.6.2	Hose connections shall be equipped with listed plugs or caps.	W	Not Applicable: See response to code section 2-7.1.
2-8	Arrangement of Water Supply Connections.		Title
2-8.1	Connection Between Underground and Aboveground Piping. The connection between the system piping and underground piping shall be made with a suitable transition piece and shall be properly strapped or fastened by approved devices. The transition piece shall be protected against possible damage from corrosive agents, solvent attack, or mechanical damage.	W	Comply: All piping feeding safety-related area systems in the Aux. building is part of the above ground internal distribution loop. Ref: Walkdown Checklist No. 1 & 2.
2-8.2	Connection Passing Through or Under Foundation Walls. When system piping pierces a foundation wall below grade or is located under the foundation wall, clearance shall be provided to prevent breakage of the piping due to building settlement.	W	Not Applicable: System piping does not penetrate or run under a foundation wall. Ref: Walkdown Checklist No. 1 & 2.

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2-9	Water Supply Test Pipes and Gages.		Title
2-9.1	Test Pipes. Test pipes, which may also be used as drain pipes, shall be provided at locations that will permit flow tests to be made to determine whether water supplies and connections are in order. Such test pipes shall be not less than the sizes specified in 3-11.2 and equipped with a shut-off valve. They shall be so installed that the valve may be opened wide for a sufficient time to assure a proper test without causing water damage. (See 3-11.2 and 3-11.4)	W,D	Comply: Test pipes are provided for all systems. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 9, 19, 25, 26, 40 and 41.
2-9.2	Gages		Title
2-9.2.1	A pressure gage shall be installed on the riser or feed main at or near each test pipe, with a connection not smaller than 1/4 in. This gage connection shall be equipped with a shut-off valve and with provision for draining.	W,D	Comply: Pressure gages are provided adjacent to risers which allow for testing. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 4, 35 and 39. Comply: Pressure gages are provided as verified by walkdowns and documents. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 19.
2-9.2.2	The required pressure gages shall be of approved type and shall have a maximum limit not less than twice the normal working pressure at the point where installed. They shall be installed to permit removal, and shall be located where they will not be subject to freezing.	W,D	Comply: Anatek gages have a 0-300 psi range. The rating for the jockey fire pump is 76 psi and maintains system pressure between 100 and 125 psi. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 2 & 7.

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	CHAPTER 3 SYSTEM COMPONENTS		Title
3-1	Piping		Title
3-1.1	Piping Specifications		Title
3-1.1.1	Pipe or tube used in sprinkler systems shall be of the materials in Table 3-1.1.1 or in accordance with 3-1.1.2 through 3-1.1.6. The chemical properties, physical properties and dimensions of the materials listed in Table 3-1.1.1 shall be at least equivalent to the standard cited in the table. Pipe and tube used in sprinkler systems shall be designed to withstand a working pressure of not less than 175 psi (12.1 bars).	D	Comply: Specifications and drawings show that the components used for each system is in accordance with this code section. Ref: Technical Data No. 8 Attachment 10.10; Drawing No. 9.
3-1.1.2	When welded and seamless steel pipe listed in Table 3-1.1.1 is used and joined by welding as referenced in 3-12.2 or by roll grooved pipe and couplings as referenced in 3-12.3, the minimum nominal wall thickness for pressures up to 300 psi (20.7 bars) shall be in accordance with Schedule 10 for sizes up to 5 in.; 0.134 in. (3.40 mm) for 6 in.; and 0.188 in. (4.78 mm) for 8- and 10-in. pipe; or as modified in 3-1.1.5 or as defined in 3-1.1.6.	D	Comply: See response to code section 3-1.1.1. Not Applicable: For the contractors access area, all fittings are screwed (black cast iron). Ref: Drawing No. 9.
3-1.1.3	When steel pipe listed in Table 3-1.1.1 is used and joined by threaded fittings referenced in 3-12.1 or by couplings used with pipe having cut grooves, the minimum wall thickness shall be in accordance with Schedule 30 (in sizes 8 in. and larger) or Schedule 40 (in sizes less than 8 in.) pipe for pressures up to 300 psi (20.7 bars).	D	Comply: See response to code section 3-1.1.1.
3-1.1.4	Copper tube as specified in the standards listed in Table 3-1.1.1, used in sprinkler systems, shall have a wall thickness of Type K, L or M.	W	Not Applicable: There are no components of this type installed in systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.

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3-1.1.5	Other types of pipe or tube may be used, but only those investigated and listed for this service by a testing and inspection agency laboratory.	D	Not Applicable: See response to code section 3-1.1.1.
3-1.1.6	Whenever the word pipe is used in this standard it shall be understood to also mean tube.		Information Only
3-1.1.7	Pipe Bending. Bending of steel pipe (Schedule 40) and copper tube (Type K & L) may be accomplished when bends are made in conformance with good installation practices and show no kinks, ripples, distortions, reduction in diameter, or any noticeable deviations from round. The minimum radius of a bend shall be 6 pipe diameters for pipe sizes 2 in. and smaller, and 5 pipe diameters for pipe sizes 2 1/2 in. and larger.	W	Not Applicable: Walkdowns show that there are no pipe bends. Ref: Walkdown Checklist No. 1 & 2.
3-2	Definitions. (See Figure A-3-2)		Information Only
	Risers. The vertical pipes in a sprinkler system.		
	System Riser. The aboveground supply pipe directly connected to the water supply.		
	Feed Mains. Mains supplying risers or cross mains.		
	Cross Mains. Pipes directly supplying the lines in which the sprinklers are placed.		
	Branch Lines. Lines of pipe, from the point of attachment to the cross main (or similar connection) to the end sprinkler, in which the sprinklers are directly placed.		

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3-3	Area Limitation		Title
3-3.1	The maximum floor area to be protected by sprinklers supplied on each system riser on any one floor shall be as follows: Light Hazard — 52,000 sq ft (4831 m^2) Ordinary Hazard — 52,000 sq ft (4831 m^2) Solid piled storage in excess of 15 ft (4.6 m) in height or palletized or rack storage in excess of 12 ft (3.7 m) in height — 40,000 sq ft (3716 m^2) Extra Hazard — 25,000 sq ft (2323 m^2). Exception: When single systems serve both solid piled storage in excess of 12 ft (3.7 m) or palletized or rack storage in excess of 12 ft (3.7 m) in height and ordinary hazard areas, storage area coverage shall not exceed 40,000 sq ft (3716 m^2) and total area coverage shall not exceed 52,000 sq ft (4831 m^2). See NFPA standards, NFPA 231, Indoor General Storage, and NFPA 231C, Rack Storage of Materials, for definitions of solid piled, palletized or rack storage.	W,D	Comply: The following are the maximum area of coverage for each system. AFW Pump Rooms 328 sq. ft. AFW Pump Rm Corr 219 sq. ft. D.G. Corridors 648 sq. ft. Contractors Access 972 sq. ft. (upstairs) 1,188 sq. ft. (downstairs) el 633 ft. 17,283 sq. ft. el 609 ft. 21,555 sq. ft. el 587 ft. 19,925 sq. ft. Ref: Drawing No. 9 - 41.
3-4	Pipe Schedules		Title
3-4.1	The pipe schedule sizing provisions shall not apply to hydraulically designed systems.		Information Only: The contractors access and Zone 17E, AFW Pump Room are pipe schedule systems; all other systems are hydraulically calculated. Thus, all responses from sections 3-4.1 thru 3-7.2 will only apply to these sprinkler systems. The hydraulically calculated systems are not subjected to these code sections.

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3-4.2	The number of automatic sprinklers on a given pipe size on one floor shall not exceed the number given in Sections 3-5, 3-6, or 3-7 for a given occupancy.		Information Only: This requirement verified by the referenced code sections.
3-4.3	Size of Risers. Each system riser shall be sized to supply all sprinklers on the riser on any one floor as determined by the standard schedules of pipe sizes in Sections 3-5, 3-6, or 3-7.		Information Only: This requirement verified by the referenced code sections.
3-4.4	Slatted Floors, Large Floor Openings, Mezzanines, and Large Platforms. Buildings having slatted floors, or large unprotected floor openings without approved stops, shall be treated as one area with reference to the pipes sizes, and the feed mains or risers shall be of the size required for the total number of sprinklers.	D	Comply: Feed mains to the contractor's access area are appropriately sized. Ref: Drawing No. 9.
3-5	Schedule for Light Hazard Occupancies.		Information Only
3-5.1	Branch lines shall not exceed 8 sprinklers on either side of a cross main. Exception: When occupancy is classified as light hazard and when more than 8 sprinklers on a branch line are necessary, lines may be increased to 9 sprinklers by making the two end lengths 1 in. and 1 1/4 in. respectively, and the sizes thereafter standard. Ten sprinklers may be placed on a branch line making the two end lengths 1 in. and 1 1/4 in., respectively, and feeding the tenth sprinkler by a 2 1/2 in. pipe.	W,D	Not Applicable: Contractors access control building was sized according to an ordinary hazard occupancy. Zone 17E was sized to extra hazard occupancy. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 9 & 40.

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3-5.2	Pipe sizes shall be in accordance with Table 3-5.2.	W, D	Not Applicable: See response to code section 3-5.1.

TABLE 3-5.2

Steel

1	in pipe.	2 sprinklers
1 1/4	in pipe.	3 sprinklers
1 1/4	in pipe.	5 sprinklers
2	in pipe. . . .	10 sprinklers
2 1/2	in pipe. . . .	30 sprinklers
3	in pipe. . . .	60 sprinklers
3 1/2	in pipe. . . .	100 sprinklers
4	in pipe.	See 3-3.1

Copper

1	in tube.	2 sprinklers
1 1/4	in tube.	3 sprinklers
1 1/2	in tube.	5 sprinklers
2	in tube. . . .	12 sprinklers
2 1/2	in tube. . . .	40 sprinklers
3	in tube. . . .	65 sprinklers
3 1/2	in tube. . . .	115 sprinklers
4	in tube.	See 3-3.1

Exception: Each area requiring more than 100 sprinklers and without subdividing partitions (not necessarily fire walls) shall be supplied by feed mains or risers sized for ordinary hazard occupancies.

3-5.3	When sprinklers are installed above and below a ceiling [see Figure 3-5.3(A) and Figure 3-5.3(B)] and such sprinklers are supplied from a common set of branch lines, such branch lines shall not exceed 8 sprinklers above and 8 sprinklers below the ceiling on either side of the cross main. Pipe sizing, up to and including 2 1/2-in., shall be as shown in Table 3-5.3.	W, D	Not Applicable: See response to code section 3-5.1.

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	TABLE 3-5.3 Number of Sprinklers Above and Below Steel 1 in. . . . . 2 sprinklers 1 1/4 in. . . . . 4 sprinklers 1 1/2 in. . . . . 7 sprinklers 2 in. . . . . 15 sprinklers 2 1/2 in. . . . . 50 sprinklers Copper 1 in. . . . . 2 sprinklers 1 1/4 in. . . . . 4 sprinklers 1 1/2 in. . . . . 7 sprinklers 2 in. . . . . 18 sprinklers 2 1/2 in. . . . . 65 sprinklers		
3-5.3.1.	When the total number of sprinklers above and below the ceiling exceeds 50, the pipe supplying more than 50 sprinklers shall be increased to 3 in., and sized thereafter according to the schedule shown in Table 3-5.2 for the number of sprinklers above or below the ceiling, whichever is larger.	W, D	Not Applicable: See response to code section 3-5.1.
3-6	Schedule for Ordinary Hazard Occupancies.		Title
3-6.1	Branch lines shall not exceed 8 sprinklers on either side of a cross main. Exception: When occupancy is classified as ordinary hazard and when more than 8 sprinklers on a branch line are necessary, lines may be increased to 9 sprinklers by making the two end lengths 1 in. and 1 1/4 in., respectively, and the sizes thereafter standard. Ten sprinklers may be placed on a branch line making the two end lengths 1 in. and 1 1/4 in. respectively, and feeding the tenth sprinkler by a 2 1/2 in. pipe.	W,D	Comply: Drawing and walkdowns show that there are no more than three sprinklers on either side of a cross main in the contractor's access area. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 9.

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3-6.2	Pipe sizes shall be in accordance with Table 3-6.2(a). Table 3-6.2(a) Steel 1 in pipe. . . . . 2 sprinklers 1 1/4 in pipe. . . . . 3 sprinklers 1 1/2 in pipe. . . . . 5 sprinklers 2 in pipe. . . . 10 sprinklers 2 1/2 in pipe. . . . 20 sprinklers 3 in pipe. . . . 40 sprinklers 3 1/2 in pipe. . . . 65 sprinklers 4 in pipe. . . . 100 sprinklers 5 in pipe. . . . 160 sprinklers 6 in pipe. . . . 275 sprinklers 8 in pipe. See Exception No. 1 and 3-3.1 Copper 1 in tube. . . . . 2 sprinklers 1 1/4 in tube. . . . . 3 sprinklers 1 1/2 in tube. . . . . 5 sprinklers 2 in tube. . . . 12 sprinklers 2 1/2 in tube. . . . 25 sprinklers 3 in tube. . . . 45 sprinklers 3 1/2 in tube. . . . 75 sprinklers 4 in tube. . . . 115 sprinklers 5 in tube. . . . 180 sprinklers 6 in tube. . . . 300 sprinklers 8 in tube. See Exception No. 1 and 3-3.1 Exception No. 1: For solid piled storage in excess of 12 ft (3.7 m) in height or palletized or racked storage in excess of 12 ft (3.7 m), the area served by any one 8-in. pipe or tube size shall not exceed 40,000 sq ft (3716 m^2). Where single systems serve both such storage and ordinary hazard areas, storage area coverage shall not exceed 40,000 sq ft (3716 m^2) and total area coverage shall not exceed 52,000 sq ft (4831 m^2).	W,D	Comply: Drawings show that all pipe sizes are in accordance with Table 3-6.2(a). Ref: Walkdown Checklist No. 1 & 2; Drawing No. 9.

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	Exception No. 2: When the distance between sprinklers on the branch line exceeds 12 ft (3.7 m), the number of sprinklers for a given pipe size shall be in accordance with Table 3-6.2(b). TABLE 3-6.2(b) Steel 2 1/2 in pipe. . . . 15 sprinklers 3 in pipe. . . . 30 sprinklers 3 1/2 in pipe. . . . 60 sprinklers Copper 2 1/2 in tube. . . . 20 sprinklers 3 in tube. . . . 35 sprinklers 3 1/2 in tube. . . . 65 sprinklers For other pipe and tube sizes, see Table 3-6.2(a).		
3-6.3	When sprinklers are installed above and below a ceiling and such sprinklers are supplied from a common set of branch lines, such branch lines shall not exceed 8 sprinklers above and 8 sprinklers below the ceiling on either side of the cross main. Pipe sizing up to and including 3 in. shall be as shown in Table 3-6.3. TABLE 3-6.3 Number of Sprinklers Above and Below Steel 1 in. . . . 2 sprinklers 1 1/4 in. . . . 4 sprinklers 1 1/2 in. . . . 7 sprinklers 2 in. . . . 15 sprinklers 2 1/2 in. . . . 30 sprinklers 3 in. . . . 60 sprinklers	W	Not Applicable: Walkdowns show that the sprinklers are not installed above and below a ceiling. Ref: Walkdown Checklist No. 1 & 2.

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	Copper 1 in. . . . . 2 sprinklers 1 1/4 in. . . . . 4 sprinklers 1 1/2 in. . . . . 7 sprinklers 2 in. . . . 18 sprinklers 2 1/2 in. . . . 40 sprinklers 3 in. . . . 65 sprinklers		
3-6.3.1	When the total number of sprinklers above and below the ceiling exceeds 60, the pipes supplying more than 60 sprinklers shall be increased to 3 1/2-in. and sized thereafter according to the schedule shown in Table 3-6.2(a) for the number of sprinklers above or below the ceiling, whichever is larger.	W	Not Applicable: See response to code section 3-6.3.
3-7	Schedule for Extra Hazard Occupancies		
3-7.1	Branch lines shall not exceed 6 sprinklers on either side of cross main. The number of sprinklers for a given pipe size shall be in accordance with Table 3-7.1. TABLE 3-7.1 Steel 1 in pipe. . . . . 1 sprinkler 1 1/4 in pipe. . . . . 2 sprinklers 1 1/2 in pipe. . . . . 5 sprinklers 2 in pipe. . . . . 8 sprinklers 2 1/2 in pipe. . . . .15 sprinklers 3 in pipe. . . . .27 sprinklers 3 1/2 in pipe. . . . .40 sprinklers 4 in pipe. . . . .55 sprinklers 5 in pipe. . . . .90 sprinklers 6 in pipe. . . . 150 sprinklers 8 in pipe. . . . See 3-3.1	D	Comply: Zone 17E, AFW pump room sprinklers do not exceed 6 on a branch and are appropriately sized. Ref: Drawing No. 40.

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	Copper 1 in tube. . . . . 1 sprinkler 1 1/4 in tube. . . . . 2 sprinklers 1 1/2 in tube. . . . . 5 sprinklers 2 in tube. . . . . 8 sprinklers 2 1/2 in tube. . . . 20 sprinklers 3 in tube. . . . 30 sprinklers 3 1/2 in tube. . . . 45 sprinklers 4 in tube. . . . 65 sprinklers 5 in tube. . . . 100 sprinklers 6 in tube. . . . 170 sprinklers 8 in tube. . . . . See 3-3.1		
3-7.2	Open sprinkler and deluge systems shall be hydraulically calculated according to applicable standards. Exception: Open sprinklers for exposure protection. See Chapter 6.	W	Not Applicable: Zone 17E, AFW pump room is protected with a wet pipe wet pipe system. Ref: Walkdown Checklist No. 1.
3-8	Special Provisions Applicable to Piping		Title
3-8.1	For sprinklers in storage racks see NFPA 231C, Standard for Rack Storage of Materials.		Information Only
3-8.2	Provisions for Flushing Systems. All sprinkler systems shall be arranged for flushing. Readily removable fittings shall be provided at the end of all cross mains. All cross mains shall terminate in 1 1/4 in. or larger pipe. All branch lines on gridded systems shall be arranged to facilitate flushing. (See NFPA 13A.)	D	Does Not Comply: Drawings show that the ends of cross mains have welded caps for the system protecting el 633'. Ref: Drawing No. 10 - 14.
		D	Comply: All other systems are provided with fittings at the ends of cross mains. Ref: Technical Data No. 8; Drawing No. 9, 17 - 41.
3-8.3	Stair Towers. Stairs, towers or other construction with incomplete floors, if piped on independent risers, shall be treated as one area with reference to pipe sizes.	W	Not Applicable: Conditions described in this code section do not exist at D.C. Cook as verified by walkdowns. Ref: Walkdown Checklist No. 1.

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3-8.4	Return Bends. When piping on wet systems is concealed, with sprinklers installed in pendent position below a ceiling, return bends shall be used when the water supply to the sprinkler system is from a raw water source, millpond, or from open top reservoirs. Return bends shall be connected to the tops of branch lines in order to avoid accumulation of sediment in the drop nipples. In new systems the return bend pipe and fittings shall be 1 in. in size. In revamping existing systems, where is is not necessary to retain sprinklers in the concealed space, 1/2-in. or 3/4-in. close nipples inserted in the existing sprinkler fittings may be used with 1-in. pipe and fittings for the other portions of the return bend. When water supply is potable, return bends are not required on wet systems. (See Figure 3-8.4.)	W, D	Comply: There are no concealed piping areas which have pendant heads installed below a ceiling. Ref: Walkdown Checklist No. 1 & 2.
3-8.5	Dry Pipe Underground. When necessary to place pipe which will be under air pressure underground, the pipe shall be protected against corrosion (see 3-10.2), or unprotected cast or ductile iron pipe may be used when joined with a gasketed joint listed for air service underground.	W	Not Applicable: There are no systems of this type installed for protection of safety related areas. Ref: Walkdown Checklist No. 1 & 2.
3-8.6	One and One-Half-Inch Hose Connections. One and one-half-inch (1 1/2 in.) hose used for fire purposes only may be connected to wet sprinkler systems only, subject to the following restrictions: (a) Hose stations supply pipes shall not be connected to any pipe smaller than 2 1/2 in.	D	Not Applicable: There are no hose connections tied to the sprinkler systems. Ref: Technical Data No. 8; Drawing No. 9 - 41.

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	Exception: For hydraulically designed loops and grids the minimum size pipe between the hose stations supply pipe and the source may be 2 in. (b) Pipe shall be minimum 1 in. for horizontal runs up to 20 ft. (6.1 m), minimum 1 1/4 in. for the entire run for runs between 20 and 80 ft (6.1 and 24.4m), and minimum 1 1/2 in. for the entire run for runs greater than 80 ft (24.4 m). (c) Piping shall be at least 1 in. for vertical runs. (d) When the pressure at any hose station outlet exceeds 100 psi (6.9 bars), an approved device shall be installed at the outlet to reduce the pressure at the outlet to 100 psi (6.9 bars).		
3-8.7	Hose Connections for Fire Department Use. In buildings of light or ordinary hazard occupancy, 2 1/2-in. hose valves for fire department use may be attached to wet-pipe sprinkler system risers subject to the following restrictions: (a) Sprinklers shall be under separate floor control valves. (b) The minimum size of the riser shall be 4 in. unless hydraulic calculations indicate smaller size riser will satisfy sprinkler and hose stream demand. (c) For completely sprinklered buildings, the water supply for sprinklers need not be added to standpipe demand as determined from NFPA 14, Standard for the Installation of Standpipe and Hose Systems.	D	Not Applicable: There are no hose connections to systems installed for protection of safety related areas. Ref: Technical Data No. 8; Drawing No. 9 - 41.

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	(d) For partially sprinklered buildings, the sprinkler demand, not including hose stream allowance, as indicated in Table. 2-2.1(B) shall be added to the requirements given in NFPA 14.		
	(e) Each combined sprinkler and standpipe riser shall be equipped with a riser control valve to permit isolating a riser without interrupting the supply to other risers from the same source of supply.		
	(f) For fire department connections serving standpipe and sprinkler refer to Section 2-7.		
3-9	System Test Pipes		Title
3-9.1	Wet Systems		Title
3-9.1.1	A test pipe not less than 1 in. in diameter terminating in a smooth bore corrosion resistant orifice giving a flow equivalent to one sprinkler shall be provided for each system. The test connection valve shall be readily accessible. The discharge shall be to the outside, to a drain connection capable of accepting full flow under system pressure or to another location where water damage will not result.	W, D	Open Item: The test connections for the contractors access and the AFW rooms are shown. However, the information regarding the orifice size is not provided. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 9, 25, 40 and 42.
		W	Not Applicable: The remaining systems are pre-action systems. Ref: Walkdown Checklist No. 1 & 2.
3-9.1.2	In multi-story buildings where waterflow alarm devices are provided at each riser on each floor or where more than one alarm device is provided in one sprinkler system, a test pipe shall be provided for testing each alarm device.	W	Not Applicable. Multiple alarm devices are not provided. Ref: Walkdown Checklist No. 1 & 2.

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3-9.2	Dry-Pipe Systems. A test pipe of not less than 1 in. in size terminating in a smooth or corrosion resistant orifice to provide a flow equivalent to one sprinkler of a type installed on the particular system shall be installed on the end of the most distant sprinkler pipe in the upper story and be equipped with a 1 in. shut-off valve and plug, a nipple and cap may be used.	W	Not Applicable: There are no dry-pipe systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.
3-10	Protection of Piping		Title
3-10.1	Protection of Piping Against Freezing		Title
3-10.1.1	When portions of systems subject to freezing and temperatures cannot be reliably maintained at or above 40°F (4°C) sprinklers shall be installed as a dry-pipe or pre-action system in such areas. Pre-action systems subject to freezing shall be provided with all drainage facilities required for dry-pipe systems. Exception: Small unheated areas may be protected by antifreeze systems. (See Section 5-5.)	W	Not Applicable: All portions of the system can be reliably maintained at 40°F or above, as verified by walkdowns. Ref: Walkdown Checklist No. 1 & 2.
3-10.1.2	When supply pipes, risers, system risers or feed mains pass through open areas, cold rooms, passageways or other areas exposed to freezing, the pipe shall be protected against freezing by insulating coverings, frost-proof casing or other reliable means capable of maintaining a minimum 40°F (4°C).	W	Not Applicable: See response to code section 3-10.1.1.
3-10.2	Protection of Piping Against Corrosion		Title
3-10.2.1	Where corrosive conditions exist, such as at bleacheries, dye-houses, metalplating processes, animal pens, certain chemical plants and at other locations, where corrosive fumes or moisture may be present,	W	Not Applicable: The sprinkler systems are not subject to a corrosive environment. In addition, all piping was painted for protection. Ref: Walkdown Checklist No. 1 & 2.

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	types of pipe tube, fittings and hangers, and protective coatings that resist corrosion shall be used.		
3-10.2.2	Steel pipe in overhead feed mains running from one building to another, where exposed to the weather, shall be galvanized, or otherwise protected against corrosion.	W	Not Applicable: There is no piping to systems protecting safety related areas which is installed as described in this code section. Ref: Walkdown Checklist No. 1 & 2.
3-10.2.3	When steel pipe is used underground as a connection from a system to sprinklers in a detached building, the pipe shall be protected against corrosion before being buried.	W	Not Applicable: See response to code section 3-10.2.2.
3-10.3	Protection of Piping Against Damage Where Subject to Earthquakes		Title
3-10.3.1	Sprinkler systems shall be protected to minimize or prevent pipe breakage where subject to earthquakes as follows: (a) Piping shall be made flexible were necessary. (b) Piping shall be tied to the structure for minimum relative movement, but allowing for expansion, and differential movement within and between structures.	D	Not Applicable: Although the sprinkler systems protecting safety related areas are seismically supported, the ISO Earthquake Zone Map indicates that this area has an extremely low potential for earthquakes and therefore the systems need not be designed to the criteria in this code section. Ref: Drawing No. 10 - 42.
3-10.3.2	Couplings. Listed flexible pipe couplings joining grooved end pipe shall be provided as flexure joints to allow individual sections of piping 3 1/2 in. or larger to move differentially with the individual sections of the building to which it is attached. Couplings shall be	D	Not Applicable: See response to code section 3-10.3.1.

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	arranged to coincide with structural separations within a building. They shall be installed: (a) Within 24 in. (610 mm) of the top and bottom of all risers. Exception No. 1: In risers less than 3 ft. (0.9 m) in length flexible couplings may be omitted. Exception No. 2: In risers 3 to 7 ft (0.9 to 2.1 m) in length, one flexible coupling is adequate. (b) At the ceiling of each intermediate floor in multi-story buildings. (c) At each side of concrete or masonry walls 2 to 3 ft. (0.6 to 0.9 m) from wall surface. (d) On one side of building expansion joints		
3-10.3.3	Fittings. Additional fittings and devices with flexible joints shall be installed where necessary. ..with flexible joints shall be installed where necessary.	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.3.1	Fittings with flexible joints shall be installed at the top of drops to hose lines regardless of piping size.	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.3.2	Drops to sprinklers in racks shall be equipped with swing joints assembled with flexible fittings between the rack and the overhead sprinkler system. Exception: Flexible fittings are not required in the swing joints on drops 3 in. or less in size.	D	Not Applicable: See response to code section 3-10.3.1.

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3-10.3.4	Clearance. Clearance shall be provided around all piping extending through walls, floors, platforms and foundations, including drains, fire department connections and other auxiliary piping. (a) Minimum clearance on all sides shall be not less than 1 in. (25 mm) for pipes 1 in. through 3 1/2 in. and 2 in. (51 mm) for pipe sized 4 in. and larger. Exception No. 1: When clearance is provided by a pipe sleeve, a nominal diameter 2 in. (50 mm) larger than the nominal diameter of the pipe is acceptable for pipe sizes 1 in. through 3 1/2 in. and the clearance provided by a pipe sleeve of nominal diameter 4 in. larger than the nominal diameter of the pipe is acceptable for pipe sizes 4 in. and larger. Exception No. 2: No clearance is necessary for piping passing through gypsum board or equally frangible construction, which is not required to have a fire resistance rating. (b) When required the clearance shall be filled with a flexible material such as mastic. Exception: When piping enters a building through a basement wall and ground water conditions make providing clearance a problem, the end of the pipe may be attached firmly to the wall, with provisions to allow flexing to take place outside the building. The pipe shall be connected to the riser with fittings with flexible joints.	D	Not Applicable. See response to code section 3-10.3.1.

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3-10.3.5	Sway Bracing of Piping Where Subject to Earthquakes.		Title
3-10.3.5.1	Feed and cross mains shall be braced with a two-way longitudinal sway brace.	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.5.2	Sway bracing shall be designed to withstand a force in tension or compression equivalent to not less than half the weight of water-filled piping.	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.5.3	Tops of risers shall be secured against drifting in any direction, utilizing a four-way sway brace.	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.5.4	When feed and cross mains are hung with single rods sway bracing shall be provided.	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.5.5	Bracing shall be attached directly to feed and cross mains.	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.5.6	A length of pipe shall not be fastened to sections which will move differently, such as a wall and a roof.	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.5.7	The last length of pipe at the end of a feed or cross main shall be provided with a lateral brace. Lateral braces may also act as longitudinal braces if they are within 24 in. (610 mm) of the center line of the piping braced longitudinally.	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.5.8	When additional flexible couplings are used in horizontal piping for purposes other than the requirements for earthquake protection (usually for ease of installation), a sway brace shall be provided within 24 in. (610 mm) of each such coupling.	D	Not Applicable: See response to code section 3-10.3.1.

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3-10.3.5.9	Where "U" hook hangers are used on branch lines, the pipe shall be secured to the end hanger by a wrap-around-type "U" hook. (See Figure A-3-15.1.)	D	Not Applicable: See response to code section 3-10.3.1.
3-10.3.5.10	U-type hangers used to support a system will satisfy most of the requirements for sway bracing except that, in general, the longitudinal brace in Figure A-3-10.3.5(b) shall also be required for 2 1/2 in. and larger diameter piping. U-type hangers used as lateral braces shall have legs bent out 10 degrees from the vertical.	D	Not Applicable: See response to code section 3-10.3.1.
3-11	Drainage		Title
3-11.1	Pitching of Piping for Drainage		Title
3-11.1.1	All sprinkler pipe and fittings shall be so installed that the system may be drained.	W, D	Comply: The entire piping system is sloped and contains provisions for drainage. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 8 Section 7.1.5.
3-11.1.2	On wet-pipe systems, sprinkler pipes may be installed level. Trapped piping shall be drained in accordance with 3-11.3.	W, D	Comply: See response to code section 3-11.1.1 and 3-11.2.1.
3-11.1.3	On dry-pipe systems, sprinkler pipe on branch lines shall be pitched at least 1/2 in. in 10 ft. (4 mm m) and the pipe of cross and feed mains shall be given a pitch of not less than 1/4 in. in 10 ft. (2 mm m). A pitch of 3/4 in. to 1 in. (19 mm to 25 mm) shall be provided for short branch lines and 1/2 in. in 10 ft. (4mm m) for cross and feed mains in refrigerated areas and in buildings of light construction where floor may settle under heavy loads.	W, D	Comply: See response to code section 3-11.1.1 and 3-11.2.1.

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3-11.2	System or Main Drain Connections and Drain Valves (See Figure 3-11.2.)		Title
3-11.2.1	Provisions shall be made to properly drain all parts of the system.	W	Comply: Walkdowns show that proper drains are provided for all parts of the system. Ref: Walkdown Checklist No. 1 & 2.
3-11.2.2	On all risers 4 in. or larger, 2-in. drain pipes and valves shall be provided.	W	Comply: All risers are provided with 2 inch drains as verified by walkdowns. Ref: Walkdown Checklist No. 1 & 2.
3-11.2.3	On risers 2 1/2 in. to 3 1/2 in. inclusive, drain pipes and valves not smaller than 1 1/4 in. shall be provided.	W	Not Applicable: All risers are 4 inches or larger. Ref: Walkdown Checklist No. 1 & 2.
3-11.2.4	On smaller risers, drain pipe and valves not smaller than 3/4 in. shall be provided.	W	Not Applicable: All risers are 4 inches or larger. Ref: Walkdown Checklist No. 1 & 2.
3-11.2.5	All interior sectional control valves shall be provided with an auxiliary drain valve so located as to drain that portion of the system controlled by the sectional valve. These drains shall discharge either outside or to a drain connection.	W	Comply: All systems are provided with auxiliary drain valves as verified by walkdowns. Ref: Walkdown Checklist No. 1 & 2.
3-11.2.6	The test valves required by 2-9.1 may be used as main drain valves.		Information Only
3-11.3	Auxiliary Drains		Title
3-11.3:1	Auxiliary drains shall be provided when a change in piping direction prevents drainage of sections of branch lines or mains through the main drain valve.	W	Comply: See response to code section 3-11.2.1. Ref: Walkdown Checklist No. 1 & 2.

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3-11.3.2	Auxiliary Drains for Wet-Pipe Systems		Title
3-11.3.2.1	When capacity of trapped sections of pipes is 5 gal (18.9 L) or less, the auxiliary drain shall consist of a nipple and cap or brass plug not less than 3/4 in. in size. Exception: Auxiliary drains are not required for piping to a single sprinkler.	W W	Comply: See response to code section 3-11.2.1. Not Applicable: The systems in the auxiliary building are pre-action systems. Ref: Walkdown Checklist No. 1 & 2.
3-11.3.2.2	When capacity of isolated trapped sections of pipe is more than 5 gal (18.9 L), the auxiliary drain shall consist of a valve not smaller than 3/4 in. size and plug, at least one of which shall be brass. In lieu of a plug, a nipple and cap may be used.	W	Comply: See response to code section 3-11.2.1 and 3-11.3.2.1.
3-11.3.2.3	Tie-in drains are not required on wet-pipe systems.		Information Only
3-11.3.3	Auxiliary Drains for Dry-Pipe Systems		Title
3-11.3.3.1	When capacity of trapped sections of pipe is 5 gal (18.9 L) or less, the auxiliary drain shall consist of a valve not smaller than 1/2 in. size and plug, at least one of which shall be brass. In lieu of a plug, a nipple and cap may be used. Exception: Auxiliary drains are not required for a drop nipple when installed in accordance with 5-2.2.	W	Not Applicable: There are no dry-pipe systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.
3-11.3.3.2	When capacity of isolated trapped sections of pipe is more than 5 gal (18.9 L), the auxiliary drain shall consist of two 1-in. valves, and one 2-in. by 12-in. (305-mm) condensate nipple or equivalent. (See Figure 3-11.3.3.3.)	W	Not Applicable: See response to code section 3-11.3.3.1.

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3-11.3.3.3	Tie-in drains shall be provided for multiple adjacent tapped branch lines and shall be a minimum of 1-in. in size.	W	Not Applicable: See response to code section 3-11.3.3.1.
3-11.3.3.4	The provisions of 3-11.3.3.1, 3-11.3.3.2 and 3-11.3.3.3 do not apply to pre-action systems in areas not subject to freezing and complying with 3-11.3.2.	W	Not Applicable: See response to code section 3-11.3.3.1.
3-11.3.4	Auxiliary Drains for Pre-Action Systems		Title
3-11.3.4.1	When trapped sections of pipe are in areas subject to freezing, auxiliary drains shall conform to 3-11.3.3.	W	Not Applicable: See response to code section 3-10.1.1.
3-11.3.4.2	When trapped sections of pipe are in areas not subject to freezing, auxiliary drains shall consist of a 1 in. valve and plug, at lease one of which shall be brass. In lieu of a plug, a nipple and cap may be used. Exception No. 1: Auxiliary drains are not required for piping to a single sprinkler. Exception No. 2: When the capacity of the trapped section of piping is 5 gal. (18.9 L) or less, auxiliary drains shall consist of a 3/4-in. valve and plug, at least one of which shall be brass. In lieu of a plug, a nipple and cap may be used.	W	Comply: See response to code section 3-11.2.1.
3-11.4	Discharge of Drain Valves		Title
3-11.4.1	Direct interconnections shall not be made between sewers and sprinkler drains of systems supplied by public water. The drain discharge shall be in conformity with any health or water department regulations.	D	Not Applicable: The plant drainage system is not tied to a public sewer system. Ref: Technical Data No. 2.
3-11.4.2	When drain pipes are buried underground, approved corrosive-resistant pipe shall be used.	W	Not Applicable: System drain pipes are not buried underground. Ref: Walkdown Checklist No. 1 & 2.

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3-11.4.3	Drain pipes shall not terminate in blind spaces under the building.	W	Not Applicable: Drain pipes do not terminate in blind spaces. Ref: Walkdown Checklist No. 1 & 2.
3-11.4.4	Drain pipes when exposed shall be fitted with a turned down elbow.	W	Not Applicable: Drain pipes are not exposed. Ref: Walkdown Checklist No. 1 & 2.
3-11.4.5	Drain pipes shall be arranged as not to expose any part of the sprinkler system to freezing conditions.	W	Not Applicable: Drain pipes are not subject to freezing. Ref: Walkdown Checklist No. 1 & 2.
3-12	Joining of Pipe and Fittings		Title
3-12.1	Threaded Pipe and Fittings		Title
3-12.1.1	Steel pipe with wall thicknesses less than Schedule 30 (in sizes 8 in. and larger) or Schedule 40 (in sizes less than 8 in.) shall not be joined by threaded fittings, unless a threaded assembly has been investigated for suitability in automatic sprinkler installations and listed for this service.	D	Comply: Piping used in systems protecting safety related areas is Schedule 40. Ref: Drawing No. 9 - 34.
3-12.1.2	All threaded fittings and pipe shall have threads cut to ANSI Standard B2.1, Pipe Threads (Except Dryseal). Care shall be taken that the pipe does not extend into the fitting sufficiently to reduce the waterway.	D	Open Item: No documentation was available to verify this code requirement.
3-12.1.3	Joint compound or tape shall be applied to the threads of the pipe and not in the fitting.	D	Open Item: No documentation was available to adequately verify this code requirement.
3.12.2	Welded Piping		Title
3-12.2.1	Welding methods which comply with all of the requirements of AWS D10.9, Standard for Building Service Piping, Level AR-3, are acceptable means of joining fire protection piping. (See Appendix D.)	D	Comply: Welding methods were specified as meeting ASME Section IX requirements which supercede the listed requirement. Ref: Technical Data No. 8 & 10.

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		D	Not Applicable: Pipe joining in the contractors access area was by threaded joint. Ref: Drawing No. 9.
3-12.2.2	Welding sections of sprinkler piping in place inside the building shall not be permitted. Sections of branch lines, cross mains or risers may be shop welded. Exception: Welding sections of sprinkler piping in place inside new buildings under construction may be permitted only when the construction is noncombustible and no combustible contents are present and when the welding process is performed in accordance with NFPA 51B, Standard for Fire Prevention in Use of Cutting and Welding Processes.	D	Comply: The piping and the shop and field fabrication and erection specifications require proper fabrication practices under ASME qualification procedures. Ref: Technical Data No. 1 & 2.
3-12.2.3	Welding procedures, welders and welding machine operators shall be qualified as required by 3-12.2.11.	D	Comply: Specifications required all welders to be qualified and use AEPSC approved welding procedures. Ref: Technical Data No. 8 & 10.
3-12.2.4	Welded fittings and welded formations manufactured, fabricated, or joined in conformance with a qualified welding procedure as set forth herein are an acceptable product under this standard, provided that materials and wall thickness are compatible with other sections of this standard.	D	Comply: Specifications required use of qualified welding procedures during fabrication. Ref: Technical Data No. 8 & 10.
3-12.2.5	No welding shall be performed if there is impingement of rain, snow, sleet or high wind on the weld area of the pipe product.	D	Comply: The piping and the shop and field fabrication and erection specifications require proper fabrication practices under ASME qualified procedures. Ref: Technical Data 1 & 2.

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3-12.2.6	When welded outlets are formed: (a) Holes in piping shall be cut to full inside diameter of fitting or shaped, contoured nipple. (b) Discs shall be retrieved. (c) Openings in piping shall be smooth. (d) All slag and other welding residue shall be removed. (e) Fittings or shaped, contoured nipples of any length shall not penetrate beyond the internal diameter of the piping.	D	Comply: The piping and the shop and field fabrication and erection specifications require proper fabrication practices under ASME qualified procedures. Ref: Technical Data 1 & 2.
3-12.2.7	When reducing a pipe size in the run of a main, cross main, or branch, a suitable reducing fitting designed for that purpose shall be used.	D	Comply: All reducing fittings are suitable where used. Ref: Technical Data No. 4 and No. 8 Attachment 10.10; Drawing No. 9.
3-12.2.8	Torch cutting and welding shall not be permitted as means of modifying or repairing sprinkler systems.	D	Comply: The piping and the shop and field fabrication and erection specifications require proper fabrication practices under ASME qualified procedures. Ref: Technical Data No. 1 & 2.
3-12.2.9	When welding is planned, contractor shall specify the section to be shop welded on drawings and the type of fittings or formations to be used.	D	Comply: The piping and the shop and field fabrication and erection specifications require proper fabrication practices under ASME qualified procedures. Ref: Technical Data No. 1 & 2.
3-12.2.10	Sections of shop welded piping shall be joined by means of flanged or flexible gasketed joints or other approved fittings. Exception: See 3-12.2.2.	D	Comply: Specifications called out the use of proper fittings for welded piping/joint connections. Ref: Technical Data No. 8 & 10.

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3-12.2.11	Qualifications		Title
3-12.2.11.1	A welding procedure shall be prepared and qualified before any welding is done. Qualification of the welding procedure to be used and the performance of welders and welding operators is required and shall comply with the requirements of American Welding Society Standard AWS D10.9, Level AR-3.	D	Comply: See response to code section 3-12.2.1 and 3-12.2.3.
3-12.2.11.2	Each contractor or fabricator shall be responsible for all welding installed by him. Each contractor or fabricator shall have an established written quality assurance procedure related to control of the requirements of 3-12.2.6, available to the authority having jurisdiction.	D	Comply: See response to code section 3-12.2.1 and 3-12.2.3.
3-12.2.11.3	Each contractor or fabricator shall be responsible for qualifying any welding procedure that he intends to have used by personnel of his organization.	D	Comply: See response to code sections 3-12.2.1 and 3-12.2.3.
3-12.2.11.4	Each contractor or fabricator shall be responsible for qualifying all of the welders and welding machine operators employed by him in compliance with the requirements of AWS D10.9, Level AR-3.	D	Comply: See response to code section 3-12.2.1 and 3-12.2.3.
3-12.2.12	Qualifications Records. The contractor or fabricator shall maintain certified records, which are available to the authority having jurisdiction of the procedures used and the welders or welding machine operators employed by him. Records shall show the date and the results of procedure and performance qualifications.	D	Comply: See response to code section 3-12.2.1 and 3-12.2.3.

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3-12.3	Groove Joining Methods		Title
3-12.3.1	Pipe joined with mechanical grooved couplings shall be joined by a listed combination of couplings, gaskets and grooves. When grooves are cut or rolled on the pipe they shall be dimensionally compatible with the coupling. Exception: Steel pipe with wall thicknesses less than Schedule 30 (in sizes 8 in. and larger) or Schedule 40 (in sizes less than 8 in.) shall not be joined by couplings used with pipe having cut grooves.	W, D	Not Applicable: There are no mechanical grooved couplings for these systems as verified by walkdowns and documents. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 8; Drawing No. 9 - 41.
3-12.3.2	Mechanical grooved couplings including gaskets used on dry-pipe systems shall be listed for dry-pipe service.	D	Not Applicable: See response to code section 3-12.3.1.
3-12.4	Brazed and Soldered Joints. Joints for the connection of copper tube shall be brazed. Exception No. 1: Solder joints may be permitted for wet-pipe systems in Light Hazard Occupancies where the temperature classification of the installed sprinklers is Ordinary or Intermediate. Exception No. 2: Solder joints may be permitted for wet-pipe systems in Ordinary Hazard-Group 1 Occupancies where the piping is concealed.	W, D	Not Applicable: There are no brazed or soldered joints for these systems as verified by walkdowns and documents. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 8; Drawing No. 9 - 41.
3-12.5	Other Types. Other types of joints shall be made or installed in accordance with the requirements of the listing for this service.	D	Not Applicable: Other types of joints are not used. Ref: Technical Data No. 8; Drawing No. 9 - 41.
3-12.6	End Treatment. After cutting, pipe ends shall have burrs and fins removed.	D	Comply: The piping and the shop and field fabrication and erection specifications require proper fabrication practices under ASME qualified procedures. Ref: Technical Data No. 1 & 2.

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3-12.6.1	When using listed fittings, the pipe and its end treatment shall be in accordance with the manufacturer's installation instruction and the listing.	D	Comply: The piping and the shop and field fabrication and erection specifications require proper fabrication practices under ASME qualified procedures. Ref: Technical Data No. 1 & 2.
3-13	Fittings		Title
3-13.1	Type of Fittings		Title
3-13.1.1	Fittings used in sprinkler systems shall be of the materials listed in Table 3-13.1.1 or in accordance with 3-13.1.2. The chemical properties, physical properties and dimensions of the materials listed in Table 3-13.1.1 shall be at least equivalent to the standard cited in the table. Fittings used in sprinkler systems shall be designed to withstand the working pressures involved, but not less than 175 psi (12.1 bars) cold water [125 psi (8.6 bars) saturated steam] pressure.	D	Comply: All fittings are fabricated of materials listed in Table 3-13.1.1. Ref: Technical Data No. 8 Section 10.10; Drawing No. 9.
3-13.1.2	Other types of fittings may be used, but only those investigated and listed for this service. Exception: Welded fittings or formations as permitted in 3-12.2.	D	Not Applicable: See response to code section 3-13.1.1.
3-13.1.2.1	When unique characteristics of a fitting, such as a tendency to rotate, require support in addition to that required in Section 3-15, restraint shall be provided in accordance with its listing.	W	Not Applicable: Walkdowns showed that fittings described in this code section are not used. Ref: Walkdown Checklist No. 1 & 2.
3-13.1.3	Fittings used in sprinkler systems shall be extra heavy pattern where pressures exceed 175 psi (12.1 bars). Exception No. 1: Standard weight pattern cast-iron fittings 2 in. size and smaller may be used where pressures do not exceed 300 psi (20.7 bars).	D	Not Applicable: System pressures should not exceed the diesel fire pump relief valve setting of 165 psi. Ref: Technical Data No. 7.

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	Exception No. 2: Standard weight pattern malleable iron fittings 6 in. size and smaller may be used where pressures do not exceed 300 psi (20.7 bars). Exception No. 3: Fittings may be used for system pressures up to the limits specified in listings by a testing laboratory.		
3-13.1.4	Where water pressures are 175 to 300 psi (12.1. to 20.7 bars), the ANSI standards permit the use of standard wall pipe and extra heavy valves. Until pressure ratings for valves are standardized, the manufacturers' ratings shall be observed.	D	Not Applicable: See response to code section 3-13.1.3.
3-13.1.5	When risers are 3 in. in size or larger, a flanged joint or mechanical coupling shall be used at the riser at each floor.	W, D	Comply: Flanged joints are used at all risers as verified by walkdowns and documents. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 19, 35, 39, 40 & 42.
3-13.2	Couplings and Unions. Screwed unions shall not be used on pipe larger than 2 in. Couplings and unions of other than screwed type shall be of types approved specifically for use in sprinkler systems. Unions, screwed or mechanical couplings, or flanges may be used to facilitate installation.	D	Comply: Screwed unions on systems protecting safety-related areas were not used on 2" or larger pipe and all fittings were made of the proper material. Ref: Drawing No. 10-34.
3-13.3	Reducers and Bushings. A one-piece reducing fitting shall be used wherever a change is made in the size of the pipe. Exception: Hexagonal or face bushings may be used in reducing the size of openings of fittings when standard fittings of the required size are not available.	W	Comply: All reducing fittings are one piece as verified by walkdowns. Ref: Walkdown Checklist No. 1 & 2.

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3-14	Valves		Title
3-14.1	Types of Valves to Be Used		Title
3-14.1.1	All valves on connections to water supplies and in supply pipes to sprinklers shall be listed indicating valves unless a non-indicating valve, such as an underground gate valve with approved roadway box complete with T-wrench, is accepted by the authority having jurisdiction. Such valves shall not close is less than 5 seconds when operated at maximum possible speed from the fully open position. This is to avoid damage to piping by water hammer. The following may not incorporate indicating devices as part of the valve, but the valve assembly described shall qualify as an indicating valve: (a) An underground gate valve of listed type equipped with a listed indicator post, (b) A listed water control valve assembly which is normally open and requires constant energy application to close and keep closed, (c) A listed water control valve assembly which has a reliable position indication connected to a remote supervisory station.	W, D	Comply: Systems are provided with listed indicating valves which control water supply. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 21.
3-14.1.2	Drain valves and test valves shall be of listed type of 175 psi (12.1 bars) cold water [125 psi (8.6 bars) saturated steam] pressure rating.	W, D	Comply: Drain and test valves are bronze rated at 200 W.O.G. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 10-34.

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3-14.1.3	Check valves shall be listed and shall be installed in a vertical or horizontal position in accordance with their listing.	W, D	Comply: Check valves for the Appendix R pre-action systems are Kennedy model 126A and are U.L. listed. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 21.
3-14.2	Valves Controlling Sprinkler Systems		Title
3-14.2.1	Each system shall be provided with a listed indicating valve so located as to control all sources of water supply except fire department connections.	W, D	Comply: Pre-action system valves for the remaining items were adequate. Does Not Comply: The isolation valves to the wet pipe systems in the following areas were Jamesbury butterfly valves which are not U.L. listed for the fire service. • AFW corridor and Units 1 and 2 AFW pump rooms. • Unit 1 and 2 D.G. corridors.
3-14.2.2	At least one listed indicating valve shall be installed in each source of water supply except fire department connections.	W, D	Comply: See response to code section 3-14.2.1. Does Not Comply: See response to code section 3-14.2.1.
3-14.2.3	Valves controlling sprinkler systems except underground gate valves with roadway boxes, shall be supervised open by one of the following methods: (a) Central station, proprietary or remote station alarm service, (b) Local alarm service which will cause the sounding of an audible signal at a constantly attended point, (c) Locking valves open,	W, D	Comply: Isolation valves for the wetpipe systems and the pre-action systems are provided with tamper switches. In addition, valves are also sealed open by plastic tag. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 2.

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	(d) Sealing of valves and approved weekly recorded inspection when valves are located within fenced enclosures under the control of the owner.		
3-14.2.4	When there is more than one source of water supply, a check valve shall be installed in each connection. Exception: When cushion tanks are used with automatic fire pumps, no check valve is required in the cushion tank connection.	W, D	Comply: Each fire pump discharge is provided with a check valve. Ref: Technical Data No. 2.
3-14.2.5	A check valve shall be installed in each water supply connection if there is a fire department connection on the system.	W	Not Applicable: There are no fire department connections on systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.
3-14.2.6	When a single wet-pipe sprinkler system is equipped with a fire department connection, the alarm valve is considered a check valve and an additional check valve shall not be required.	W	Not Applicable: There are no fire department connections on systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.
3-14.2.7	In a city connection serving as one source of supply, the city valve in the connection may serve as one of the required valves. A listed indicating valve or an indicator post valve shall be installed on the system side of the check valve. (See Figure A-3.14.2.5.) Exception: When a wet-pipe sprinkler system is equipped with an (alarm) check valve, a gate valve is not required on the system side of the (alarm) check valve.	D	Not Applicable: The plant utilizes a private water supply. Ref: Technical Data No. 2.
3-14.3	Identification of Valves. When there is more than one control valve, permanently marked identification signs indicating the portion of the system controlled by each valve shall be provided. Embossed plastic tape, pencil, ink, crayon,	W, D	Comply: Standard metal signs to identify control valves are provided per specification requirements and were verified by walkdowns and documents. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 10 Section 4.10.

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	crayon, etc., shall not be considered permanent markings. The sign shall be secured with noncorrosive wire, chain, or other means.		
3-15	Hangers		Title
3-15.1	General. Type of hangers and installation methods shall be in accordance with the requirements of Section 3-15.		With the exception of the Contractor's Access area, the suppression system piping for the systems evaluated under this edition is seismically supported and requires no further analysis. The pilot piping, with a few exceptions (the 587 ft. and 591 ft. elevations) is not seismically supported. The Contractor's Access suppression piping and the pilot for the systems evaluated are reviewed against the applicable requirements in 3-15 of this code. Ref: Drawings No. 9 – 42.
3-15.1.1	The components of hanger assemblies which directly attach to the pipe or to the building structure shall be listed. Exception No. 1: Mild steel hangers formed from rods need not be listed. Exception No. 2: Hangers and installation methods certified by a registered professional engineer for the following: (a) Designed to support five times the weight of the water-filled pipe plus 250 lb. (114 kg) at each point of piping support. (b) These points of support are enough to support the sprinkler system.	W, D	Comply: The hangers evaluated for the Contractor's Access were observed during walkdowns and compared to listed assemblies shown on other documents. The pilot hangers are also listed for this service. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 6 & 10; Drawings No. 9 – 42.

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	(c) Ferrous materials are used for hanger components. Detailed calculations shall be submitted, when required by the reviewing authority, showing stresses developed both in hangers and piping and safety factors allowed.		
3-15.1.2	Sprinkler piping or hangers shall not be used to support non-system components.	W	Comply: Walkdowns showed that sprinkler system piping and hangers are independent of other systems. Ref: Walkdown Checklist No. 1 & 2.
3-15.1.3	Sprinkler piping shall be substantially supported from the building structure which must support the added load of the water-filled pipe plus a minimum of 250 lb (114 kg) applied at the point of hanging.	W, D	Comply: This building structure is concrete. Sufficient detail was available to show installation. Ref: Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42; Technical Data 6 & 10.
3-15.1.4	Sprinkler piping shall be supported independently of the ceiling sheathing. Exception: Toggle hangers shall be used only for the support of pipe 1-1/2 in. or smaller in size under ceilings of hollow tile or metal lath and plaster.	W	Not Applicable: Conditions described in this code section (sheathing) do not exist. Ref: Walkdown Checklist No. 1 & 2.
3-15.1.5	When sprinkler piping is installed below ductwork, piping shall be substantially supported from the building structure or from the steel angles supporting the ductwork provided the angles conform to Table 3-15.1.6.	W	Comply: Walkdowns verified that sprinkler piping is not supported from the ductwork. Ref: Walkdown Checklist No. 1 & 2.
3-15.1.6	For trapeze hangers, the minimum size of steel angle or pipe span between purlins or joists shall be as shown in Table 3-15.1.6, all angles to be used with longer leg vertical. Any other sizes or shapes giving equal or greater section modulus will be acceptable. The trapeze member shall be secured to prevent slippage.	W, D	Not Applicable: The hangers described in this code section were not supporting the piping evaluated. Ref: Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42.

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3-15.1.7	The size of hanger rods and fasteners required to support the steel angle iron or pipe indicated in Table 3-15.1.6 shall comply with 3-15.4.	W, D	Not Applicable: This code requirement is for trapeze type hangers. See response to code section 3-15.1.6.
3-15.1.8	Eye rods and ring hangers shall be secured with necessary lock washers to prevent lateral motion at the point of support.	W, D	Comply: See response to code section 3-15.1.1.
3-15.1.9	Holes through concrete beams may also be considered as a substitute for hangers for the support of pipes.		Not Applicable: The piping evaluated was not supported in the fashion described in this code requirement. Ref: Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42.
3-15.1.10	Maximum Distance Between Hangers. With steel pipe or copper tube as specified in 3-1.1.1, the maximum distance between hangers shall not exceed 12 ft. (3.7 m) for 1 and 1-1/4 in. sizes nor 15 ft. (4.6 m) for sizes 1-1/2 in. and larger except as provided in 3-15.6. (See Figure A-3-15.1.10.)	W, D	Comply: The piping evaluated is provided with hangers/supports spaced in accordance with this code section. Ref: Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42.
3-15.1.11	When sprinkler piping is installed in storage racks as defined in NFPA 231C, piping shall be substantially supported from the storage rack structure or building in accordance with all applicable provisions of Section 3-15.	W	Not Applicable: There are no systems protecting storage racks installed for safety related areas. Ref: Walkdown Checklist No. 1 & 2.
3-15.2	Hangers in Concrete		Title
3-15.2.1	Listed inserts set in concrete may be installed for the support of hangers. Wood plugs shall not be used.	W, D	Comply: All inserts are set in reinforced concrete. The expansion shields have been tested and accepted by AEP as documented on AEP form CE-138F. Ref: Technical Data No 6 & 10; Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42.

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			Not Applicable: The Contractor's Access Area piping is supported by steel beams. Ref: Walkdown Checklist No. 1 & 2.
3-15.2.2	Listed expansion shields for supporting pipes under concrete construction may be used in a horizontal position in the sides of beams. In concrete having gravel or crushed stone aggregate, expansion shields may be used in the vertical position to support pipes 4 in. or less in diameter.	W, D	Not Applicable: The Contractor's Access Area piping is supported by steel beams. Ref: Walkdown Checklist No. 1 & 2. Comply: All inserts are set in reinforced concrete. The expansion shields have been tested and accepted by AEP as documented on AEP form CE-138F. Ref: Technical Data No. 6 & 10; Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42.
3-15.2.3	For the support of pipes 5 in. and larger, expansion shields if used in the vertical position shall alternate with hangers connected directly to the structural members such as trusses and girders, or to the sides of concrete beams. In the absence of convenient structural members, pipes 5 in. and larger may be supported entirely by expansion shields in the vertical position, but spaced not over 10 ft. (3 m) apart.	W	Not Applicable: The application described in this code section was not used to support system piping. Ref: Walkdown Checklist No. 1 & 2.
3-15.2.4	Expansion shields shall not be used in ceilings of gypsum or similar soft material. In cinder concrete, expansion shields shall not be used except on branch lines where they shall alternate with through bolts or hangers attached to beams.	W	Comply: All expansion shields were used in reinforced concrete. Ref: Walkdown Checklist No. 1 & 2.
3-15.2.5	When expansion shields are used in the vertical position, the holes shall be drilled to provide uniform contact with the shield over its entire circumference. Depth of the hole shall be not less than specified for the type of shield used.	D	Comply: The installation of expansion shields was done in accordance with AEP procedures. Ref: Technical Data No. 6.

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3-15.2.6	Holes for expansion shields in the side of concrete beams shall be above the center line of the beam or above the bottom reinforcement steel rods.	W	Not Applicable: The application described in this code section was not used to support system piping. Ref: Walkdown Checklist No. 1 & 2.
3-15.3	Power Driven Studs and Welding Studs		Title
3-15.3.1	Powder driven studs, welding studs, and the tools used for installing these devices shall be listed by a testing laboratory and installed within the limits of pipe size, installation position, and construction material into which they are installed as expressed in individual listings or approvals.	D	Open Item: The materials and tools used during the initial installation could not be verified.
3-15.3.2	The ability of concrete to hold the studs varies widely according to type of aggregate and quality of concrete, and it shall be established in each case by testing concrete on the job to determine that the studs will hold a minimum load of 750 lb. (341 kg) for 2 in. or smaller pipe, 1000 lb. (454 kg) for 2-1/2, 3, or 3-1/2 in. pipe, and 1200 lb. (545 kg) for 4 or 5 in. pipe.	W, D	Comply: See response to code section 3-15.2.2.
3-15.3.3	When increaser couplings are used, they shall be attached directly to the powder driven stud or welding stud.	W	Not Applicable: See response to code section 3-15.3.1.
3-15.3.4	Welded studs or other hanger parts shall not be attached by welding to steel less than US Standard, 12 gage.	W	Not Applicable: See response to code section 3-15.3.1.
3-15.4	Rods and "U" Hooks		Title
3-15.4.1	Hanger rod size shall be the same as that approved for use with the hanger assembly and the size of rods shall not be less than that given in Table 3-15.4.1. Exception: Rods of smaller diameter may be	W, D	Comply: The drawings show that the hangers for the pilot piping meet the minimal requirements of this code section. Ref: Drawing No. 18.

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	used when the hanger assembly has been tested and listed by a testing laboratory and installed within the limits of pipe size expressed in individual listings or approvals. For rolled threads, the rod size shall not be less than the root diameter of the thread.		Also, see response to code section 3-15.1.1.

TABLE 3-15.4.1

Pipe Size	Dia. of Rod In.	mm
Up to and including 4 in.	3/8	9.5
5, 6 and 8 in.	1/2	12.7
10 and 12 in.	3/8	15.9

3-15.4.2	"U" Hooks. The size of the rod material of "U" hooks shall be not less than that given in Table 3-15.4.2.	W, D	Comply: See response to code section 3-15.4.1.

TABLE 3-15.4.2

Pipe Size	Hook Material Diameter In.	mm
Up to 2 in.	5/16	7.9
2-1/2 in. to 6 in.	3/8	9.5
8 in.	1/2	12.7

3-15.4.3	The size of the rod material for eye rods shall not be less than specified in Table 3-15.4.3.	W, D	Comply: See response to code section 3-15.4.1.

TABLE 3-15.4.3

Pipe Size	Diameter of Rod With Bent Eye In.	mm	With Welded Eye In.	mm
Up to 4 in.	3/8	9.5	3/8	9.5
5-6 in.	1/2	12.7	1/2	12.7
8 in.	3/4	19.1	1/2	12.7

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3-15.4.4	Screws. For ceiling flanges and "U" hooks, screw dimensions shall be not less than those given in Table 3-15.4.4. Exception: When the thickness of planking and thickness of flange does not permit the use of screws 2 in. (51 mm) long, screws of 1-3/4 in. (44 mm) long may be permitted with hangers spaced not over 10 ft. (3 m) apart. When the thickness of beams or joists does not permit the use of screws 2-1/2 in. (64 mm) long, screws 2 in. (512 mm) long may be permitted with hangers spaced not over 10 ft. (3 m) apart.	W	Not Applicable: The screws described in this code section were not used to support system piping. Ref: Walkdown Checklist No. 1 & 2.

TABLE 3-15.4.4

Pipe Size	2 Screw Flanges
Up to 2"	Wood Screw No. 18 x 1-1/2 in.

Pipe Size	3 Screw Flanges
Up to 2"	Wood Screw No. 18 x 1-1/2 in.
2.5", 3", 3.5"	Lag Screw 3/8 in. x 2 in.
4", 5",.6"	Lag Screw 1/2 in. x 2 in.
8"	Lag Screw 5/8 in. x 2 in.

Pipe Size	4 Screw Flanges
Up to 2"	Wood Screw No. 18 x 1-1/2 in.
2.5", 3", 3.5"	Lag Screw 3/8 in. x 1-1/2 in.
4", 5", 6"	Lag Screw 1/2 in. x 2 in.
8"	Lag Screw 5/8 in. x 2 in.

Pipe Size	5 Screw Flanges
Up to 2"	Drive Screw No. 16 x 2 in.
2.5", 3", 3.5"	Lag Screw 3/8 in. x 2-1/2 in.
4", 5", 6"	Lag Screw 1/2 in. x 3 in.
8"	Lag Screw 5/8 in. x 3 in.

For SI Units: 1" = 25.4 mm

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3-15.4.5	The size bolt or lag (coach) screw used with an eye rod or flange on the side of the beam shall not be less than specified in Table 3-15.4.5. Exception: When the thickness of beams or joists does not permit the use of screws 2-1/2 in. (64 mm), screws 2 in. (51 mm) may be permitted with hangers spaced not over 10 ft. (3 m) apart.	W	Not Applicable: See response to code section 3-15.4.4.
3-15.4.6	Drive screws shall be used only in a horizontal position as in the side of a beam. Wood screws shall not be driven. Nails are not acceptable for fastening hangers.	W	Not Applicable: See response to code section 3-15.4.4.
3-15.4.7	Screws in the side of a timber or joist shall be not less than 2-1/2 in. (64 mm) from the lower edge when supporting branch lines, and not less than 3 in. (76 mm) when supporting main lines. This shall not apply to 2 in. (51 mm) or thicker nailing strips resting on top of steel beams.	W	Not Applicable: See response to code section 3-15.4.4.
3-15.4.8	The minimum thickness of plank and the minimum width of lower face of beams or joists in	W	Not Applicable: See response to code section 3-15.4.4.

TABLE 3-15.4.5

Size of Pipe	Size of Bolt or Lag Screw In.	mm	Length of Lag Screw Used with Wood Beams In.	mm
Up to & including 2"	3/8	9.5	2-1/2	64
2-1/2 to 6" (inclusive)	1/2	12.7	3	76
8"	5/8	15.9	3	76

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which lag screw rods are used shall be given in Table 3-15.4.8.

TABLE 3-15.4.8

Pipe Size	Nominal Plank Thickness In.	Nominal Plank Thickness mm	Nominal Width of Beam Face In.	Nominal Width of Beam Face mm
Up to 2 in.	3	76	2	51
2-1/2 in. to 3-1/2 in.	4	102	2	51
4 in and 5 in.	4	102	3	76
6 in.	4	102	4	102

Lag screw rods shall not be used for support of pipes larger than 6 in. All holes for lag screw rods shall be pre-drilled 1/8 in. (3.2 mm) less in diameter than the root diameter of the lag screw thread.

3-15.5	Location of Hangers on Branch Lines. This subsection applies to the support of steel pipe or copper tube as specified in 3-1.1.1, subject to the provisions of 3-15.1.10.		Information Only
3-15.5.1	On branch lines, there shall be not less than one hanger for each length of pipe. Exception: Hangers may be located as provided in 3-15.5.2 to 3-15.5.6 inclusive.	W, D	Comply: Hangers are provided for each length of pipe on branch lines. Ref: Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42.
3-15.5.2	The distance between the hanger and center line of upright sprinkler shall be no less than 3 in. (76 mm).	W, D	Comply: Hangers are provided within the tolerances described in this code requirement. Ref: Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42.
3-15.5.3	The unsupported length between the end sprinkler and the last hanger shall be not more than 36 in. (914 mm) for 1 in. pipe, or 48 in. (1219 mm) for 1-1/4 in. pipe. When	W, D	Comply: The lengths specified in this requirement are not exceeded. Ref: Walkdown Checlist No. 1; Drawings No. 9 - 42.

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	these limits are exceeded, the pipe shall be extended beyond the end sprinkler and supported by an additional hanger.		
3-15.5.4	When sprinklers are less than 6 ft. (1.8 m) apart, hangers may be spaced up to, but not exceeding, 12 ft. (3.7 m). (See Figure A-3-15.5.4.)	W, D	Not Applicable: Sprinklers are not spaced less than 6 ft. apart. Ref: Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42.
3-15.5.5	Starter lengths less than 6 ft. (1.8 m) do not require a hanger, except on the end line of a side-feed system, or where an intermediate cross main hanger has been omitted.	D	Comply: The requirements of this code section are applicable to the Contractor's Access. Hangers are spaced so that the requirements are met. Ref: Drawing No. 9.
3-15.5.6	Hangers are not required on 1 in. arms not over 12 in. (305 mm) long for copper tube, nor 24 in. (610 mm) long for steel pipe from branch lines or cross mains. (See 3-13.1.2.1.)	W, D	Comply: The limitations of this code section are not exceeded.
3-15.6	Location of Hangers on Cross Mains. This subsection applies to the support of steel pipe only as specified in 3-1.1.1, subject to the provisions of 3-15.1.10. Intermediate hangers shall not be omitted for copper tube.		Information Only
3-15.6.1	On cross mains, there shall be at least one hanger between each two branch lines. Exception No. 1: In bays having two branch lines, the intermediate hanger may be omitted provided that a hanger attached to a purlin is installed on each branch line located as near to the cross main as the location of the purlin permits. [See Figure A-3-15.6.1(A).] Remaining branch line hangers shall be installed in accordance with 3-15.5.	W, D	Comply: A minimum of one hanger is provided on the cross mains between each two branch lines. Ref: Walkdown Checklist No. 1 & 2. Drawings No. 9 - 42.

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	Exception No. 2: In bays having three or more branch lines, either side or center feed, one (only) intermediate hanger may be omitted provided that a hanger attached to a purlin is installed on each branch line located as near to the cross main as the location of the purlin permits. [See Figures A-3-15.6.1(B) and A-3-15.6.1(C).] Remaining branch line hangers shall be installed in accordance with 3-15.5.		
3-15.6.2	At the end of the cross main, intermediate trapeze hangers shall be installed unless the cross main is extended to the next framing member with an ordinary hanger installed at this point, in which event an intermediate hanger may be omitted in accordance with 3-15.6.1 , Exception Nos. 1 and 2.	W, D	Comply: The cross mains are not extended to a point where the requirements of this code section are exceeded. Ref: Walkdown Checklist No. 1 & 2; Drawings No. 9 - 42.
3-15.7	Support of Risers		Title
3-15.7.1	Risers shall be supported by attachments directly to the riser or by hangers located on the horizontal connections close to the riser.	W	Comply: Walkdowns show that all system risers are adequately supported. Ref: Walkdown Checklist No. 1 & 2.
3-15.7.2	In multi-story buildings, riser supports shall be provided at the lowest level, at each alternate level above and below offsets, and at the top of the riser. Supports above the lowest level shall also restrain the pipe to prevent movement by an upward thrust when flexible fittings are used. Where risers are supported from the ground, the ground support constitutes the first level of riser support. Where risers are offset or do not rise from the ground, the first ceiling level above the offset constitutes the first level of riser support.	W	Comply: See response to code section 3-15.7.1.

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3-15.7.3	Sprinkler and tank risers in vertical shafts, or in buildings with ceilings over 25 ft. (7.6 m) high, shall have at least one support for each riser pipe section.	W	Not Applicable: The contractor's access valve is located immediately outside the hazard. The area does not have the conditions described in this requirement. Ref: Walkdown Checklist 1 & 2.
3-15.7.4	Clamps supporting pipe by means of set screws shall not be used.	W, D	Comply: The type of hanger described in this code section does not provide support of the piping evaluated. Ref: Walkdown Checklist 1 & 2; Drawings No. 9 - 42.
3-16	Sprinklers		Title
3-16.1	Types of Sprinklers. Some of the commonly used sprinklers are as follows:		Information Only
	(a) Upright Sprinklers. Sprinklers designed to be installed in such a way that the water spray is direct upwards against the deflector.		Pendant and upright sprinklers were used in the systems reviewed. Ref: Drawings No. 9 - 42.
	(b) Pendent Sprinklers. Sprinklers designed to be installed in such a way that the water stream is directed downward against the sprinkler.		
	(c) Sidewall Sprinklers. Sprinklers having special deflectors which are designed to discharge most of the water away from the nearby wall in a pattern resembling one quarter of a sphere, with a small portion of the discharge directed at the wall behind the sprinkler.		Sidewall sprinklers were used in the Auxiliary Building preaction sprinkler systems reviewed. Ref: Drawings No. 9 - 42.
	(d) Extended Coverage Sidewall Sprinklers. Sprinklers with special extended, directional, discharge patterns.		
	(e) Open Sprinklers. Sprinklers from which the actuating elements have been removed.		

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	(f) Corrosion Resistant Sprinklers. Sprinklers with special coatings or platings to be used in an atmosphere which would corrode an uncoated sprinkler.		
	(g) Nozzles. Devices for use in applications requiring special discharge patterns, directional spray, fine spray, or other unusual discharge characteristics.		Closed head directional spray nozzles were used to protect the CCW pumps in the Auxiliary Building. Ref: Drawings No. 9 - 42.
	(h) Dry Pendent Sprinklers. Sprinklers for use in a pendent position in a dry-pipe system or a wet pipe system with the seal in a heated area.		
	(i) Dry Upright Sprinklers. Sprinklers which are designed to be installed in an upright position, on a wet-pipe system, to extend into an unheated area with a seal in a heated area.		
	(j) Ornamental Sprinklers. Sprinklers which have been painted or plated by the manufacturer.		
	(k) Flush Sprinklers. Sprinklers in which all or part of the body, including the shank thread, is mounted above the lower plane of the ceiling.		
	(l) Recessed Sprinklers. Sprinklers in which all or part of the body, other than the shank thread, is mounted within a recessed housing.		
	(m) Concealed Sprinklers. Recessed sprinklers with cover plates.		
	(n) Old Style Sprinklers. Sprinklers which direct only from 40 to 60 percent of the total water initially in a downward		

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	direction and which are designed to be installed with the deflector either upright or pendent.		
	(o) Residential Sprinklers. Sprinklers which have been specifically listed for use in residential occupancies.		
3-16.2	Use of Sprinklers		Title
3-16.2.1	Only listed sprinklers shall be used and shall be installed in accordance with their listing. Exception: When construction features or other special situations require unusual water distribution, listed sprinklers may be installed in other positions than anticipated by their listing to achieve specific results.	W, D	Comply: All sprinklers used were listed. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 10.
3-16.2.2	Sprinklers shall not be altered in any respect or have any type of ornamentation or coating applied after shipment from the place of manufacture.	W	Comply: Walkdowns show that the sprinklers had not been altered or coating applied. Ref: Walkdown Checklist No. 1 & 2.
3-16.2.3	Sprinklers shall not be used for system working pressures exceeding 175 psi (12.1 bars). Exception: Higher design pressures may be used when sprinklers are listed for those pressures.	W, D	Comply: Walkdowns and the system description show that the working pressures for all systems are between 100 - 150 psi. Ref: Technical Data No. 2; Walkdown Checklist No. 1 & 2.
3-16.2.4	Old style sprinklers shall not be used in a new installation. Exception No. 1: For installation under piers and wharves where construction features require an upward discharge to wet the underside of decks and structural members supporting the decks, a sprinkler that projects water upward to wet the overhead	D	Comply: Old-style sprinklers were not used in systems protecting safety-related areas. Ref: Technical Data No. 10.

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	shall be used. This can be accomplished by using standard pendent sprinklers installed in an upright position or by the use of old style sprinklers. See NFPA 87, Standard for the Construction and Protection of Piers and Wharves. Exception No. 2: Old style sprinkler shall be installed in fur storage vaults. See 4-4.17.3. Also see NFPA 81, Standard on Fur Storage and Fumigation and Cleaning. Exception No. 3: Listed old style sprinklers may be used when construction features or other special situations require unique water distribution.		
3-16.2.5	Sidewall sprinkles shall be installed only in light hazard occupancies. Exception: Sidewall sprinklers specifically listed for use in ordinary hazard occupancies.	W,D	Comply: Sidewall heads used were Viking C-4s which do not carry specific approval for ordinary hazard occupancies. See response to code section 4-5.1.1 for justification. Ref: Walkdown Checklist No. 1 & 2.
3-16.2.6	Extend coverage sidewall sprinklers shall be installed only in accordance with their listing.	W	Not Applicable: Extended coverage sidewall sprinklers are not used on systems protecting safety-related areas. Ref: Walkdown Checklist No. 1 & 2.
3-16.2.7	Open sprinklers may be used to protect special hazards, for protection against exposures, or in other special locations.		Information Only
3-16.2.8	When nonmetallic ceiling plates (escutcheons) are used they shall be listed.	W	Not Applicale: Escutcheon plates are not used in systems protecting safety-related areas. Ref: Walkdown Checklist No. 1 & 2.

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3-16.2.9	Residential sprinklers may be used in residential portions of any occupancy provided they are installed in conformance with their listing and the positioning requirements of NFPA 13D, Sprinkler Systems in One- and Two-Family Dwellings.	W	Not Applicable: There are no components of this type installed for protection of safety related areas. Ref: Walkdown Checklist No. 1 & 2.
3-16.3	Replacement of Sprinklers		Title
3-16.3.1	When sprinklers are replaced, the replacement sprinkler shall be of the same type, orifice, and temperature rating unless conditions require a different type sprinkler be installed. The replacement sprinkler shall then be of a type, orifice, and temperature rating to suit the new conditions.	W	Comply: Spare sprinklers are of the proper types and rating, plant work control procedures will ensure proper head replacement. Ref: Walkdown Checklist No. 1 & 2.
3-16.3.2	Old style sprinklers may be replaced with old style sprinklers, or with the appropriate pendent or upright sprinkler.	D	Comply: See response to code section 3-16.2.4.
3-16.3.3	Old style sprinklers shall not be used to replace pendent or upright sprinklers.	D	Comply: See response to code section 3-16.2.4.
3-16.3.4	Extreme care shall be exercised when replacing horizontal sidewall and extended coverage sidewall sprinklers to assure the correct replacement sprinkler is installed.	W	Comply: See response to code section 3-16.3.1.
3-16.3.5	Sprinklers which have been painted or coated, except by the manufacturer, shall be replaced and shall not be cleaned by use of chemicals, abrasives, or other means. (See 3-16.9.2)	W	Comply: Reference response to code section 3-16.2.2.
3-16.4	Corrosion-resistant, Wax Coated or Similar Sprinklers		Title
3-16.4.1	Listed corrosion-resistant or special coated sprinklers shall be installed in locations where chemicals, moisture or other corrosive vapors exist sufficient to cause corrosion of such devices as in paper mills, packing	W	Not Applicable: The plant areas being evaluated do not contain corrosive or hazardous atmospheres as verified by walkdown. Ref: Walkdown Checklist No. 1 & 2.

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	houses, tanneries, alkali plants, organic fertilizer plants, foundries, forge shops, fumigation, pickle and vinegar works, stables, storage battery rooms, electroplating rooms, galvanizing rooms, steam rooms of all descriptions, including moist vapor dry kilns, salt storage rooms, locomotive sheds or houses, driveways, areas exposed to outside weather such as piers and wharves exposed to salt air, areas under sidewalks, around bleaching equipment in flour mills, all portions of cold storage buildings where a direct ammonia expansion system is used, and portions of any plant where corrosive vapors prevail.		
3-16.4.2	Care shall be taken in the handling and installation of wax coated or similar sprinklers to avoid damaging the coating.	W	Not Applicable: See response to code section 3-16.4.1.
3-16.4.3	Corrosion-resistant coatings shall be applied only by the manufacturer of the sprinkler. Exception: Any damage to the protective coating occurring at the time of installation shall be repaired at once using only the coating of the manufacturer of the sprinkler in the approved manner so that none of the sprinkler will be exposed after installation has been completed.	W	Not Applicable: See response to code section 3-16.4.1.
3-16.5	Sprinkler Discharge Characteristics and Identification		Title
3-16.5.1	Table 3-16.5 shows the K factor, relative discharge and identification for sprinklers having different orifice sizes. Exception: Special listed sprinklers may have pipe threads different from those shown in Table 3-16.5		Information Only

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3-16.5.2	For light hazard occupancies not requiring as much water as is discharged by a nominal 1/2 in. (12.7 mm) orifice sprinkler, sprinklers having a smaller orifice may be used subject to the following restrictions: (a) Small orifice sprinklers shall not be used on dry-pipe, pre-action or combined dry-pipe and pre-action systems. Exception: Outside sprinklers for protection from exposure fires. See Chapter 6. (b) An approved strainer shall be provided in the riser or feed main which supplies sprinklers having orifices smaller than 3/8 in. (9.5 mm).		Information Only

Table 3-16.5 Sprinkler Discharge Characteristics Identification

Nominal Orifice Size (in.)[1]	Orifice Type	"K"[2] Factor	Percent of Nominal 1/2 in. Discharge	Thread Type	Pintle	Nominal Orifice Size Marked On Frame
1/4	Small	1.3-1.5	25	1/2 in. NPT	Yes	Yes
5/16	Small	1.8-2.0	33.3	1/2 in. NPT	Yes	Yes
3/8	Small	2.6-2.9	50	1/2 in. NPT	Yes	Yes
7/16	Small	4.0-4.4	75	1/2 in. NPT	Yes	Yes
1/2	Standard	5.3-5.8	100	1/2 in. NPT	No	No
17/32	Large	7.4-8.2	140	3/4 in. NPT or 1/2 in. NPT	No Yes	No Yes

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	[1]See A-3-16.5.2 [2]"K" factor is the constant in the formula Where Q = K multiplied by the square root of P Q = Flow in gpm P = Pressure in psi For SI Units: Qm = Km multiplied by the square root of Pm Where Qm = flow in L/min Pm = Pressure in bars Km = 14 K		
3-16.5.3	For locations or conditions requiring more water than is discharged by a nominal 1/2 in. (12.7 mm) orifice sprinkler, a sprinkler having a larger orifice may be used. Large orifice sprinklers having 1/2 in. national pipe thread shall not be installed in new sprinkler systems.	W, D	Not Applicable: All heads are standard 1/2-inch orifice as identified by specifications and walkdown. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 10; Drawing No. 10-34.
3-16.6	Temperature Ratings, Classifications and Color or Coding		Title
3-16.6.1	The standard temperature ratings of automatic sprinklers are shown in Table 3-16.6.1 Automatic sprinklers shall have their frame arms colored in accordance with the color code designated in Table 3-16.6.1 with the following exceptions: Exception No. 1: The color identification for coated sprinklers may be a dot on the top of the deflector, the color of the coating material or colored frame arms. Exception No. 2: Color identification is not required for plated sprinklers, flush, recessed and concealed sprinklers or similar decorative types.	W	Comply: Frame arms of sprinklers were verified as being the appropriate color in all areas that were accessible. Ref: Walkdown Checklist No. 1 & 2.

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Table 3-16.6.1 Sprinkler Discharge Characteristics Identification

Max Ceiling Temp. °F	Max Ceiling Temp. °C	Temperature Rating °F	Temperature Rating °C	Temperature Classification	Color Code	Glass Bulb Colors
100	38	135 to 170	57 to 77	Ordinary	Uncolored	Orange or Red
150	66	175 to 225	79 to 107	Intermediate	White	Yellow or Green
225	107	250 to 300	121 to 149	High	Blue	Blue
300	149	325 to 375	163 to 191	Extra High	Red	Purple
375	191	400 to 475	204 to 246	Very Extra High	Green	Black
475	246	500 to 575	260 to 302	Ultra High	Orange	Black
625	329	650	343	Ultra High	Orange	Black

3-16.6.2	Ordinary temperature rated sprinklers shall be used throughout buildings. Exception No. 1: Where maximum ceiling temperatures exceed 100°F (38°C), sprinklers with temperature ratings in accordance with the maximum ceiling temperatures of Table 3-16.6.1 shall be used. Exception No. 2: Intermediate and high temperature sprinklers may be used throughout ordinary and extra hazard occupancies. Where situations involve high piled or rack storage refer to NFPA 231, Standard on Indoor General Storage and NFPA 231C, Standard for Rack Storage of Materials. Exception No. 3: Sprinklers of intermediate and high temperature ratings shall be installed in specific locations as required by 3-16.6.3.	W, D	Comply: Sprinkler heads in all safety-related areas were of the intermediate or high temperature classification. This is in compliance with Exception No. 2 of this code section. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 8; Drawing No. 9-41.

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3-16.6.3	The following practices shall be observed when installing high temperature sprinklers, unless maximum expected temperatures are otherwise determined or unless high temperature sprinklers are used throughout. (a) Sprinklers near unit heaters. Where steam pressure is not more than 15 psi (1 bar), sprinklers in the heater zone shall be high and sprinklers in the danger zone intermediate temperature classification. (b) Sprinklers located within 12 in. (505 mm) to one side or 30 in. (762 mm) above an uncovered steam main, heating coil or radiator shall be intermediate temperature classification. (c) Sprinklers within 7 ft. (2.1 m) of a low pressure blow-off valve which discharges free in a large room shall be high temperature classification. (d) Sprinklers under glass or plastic skylights exposed to the direct rays of the sun shall be intermediate temperature classification. (e) Sprinklers in an unventilated concealed space under an uninsulated roof, or in an unventilated attic, shall be of intermediate temperature classification. (f) Sprinklers in unventilated show windows having high-powered electric lights near the ceiling shall be intermediate temperature classification. (g) Where a locomotive enters a building, sprinklers shall be located not nearer than 5 ft. (1.5 m) from the center line of the track.	W	Not Applicable: The installation applications of this code section are not found in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.

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	(h) For sprinklers protecting commercial-type cooking equipment and ventilation systems, temperature classifications of intermediate, high or extra high shall be provided as determined by use of a temperature measuring device (See 4-4.18.2)		
3-16.6.4	In case of change of occupancy involving temperature change, the sprinklers shall be changed accordingly.	W	Not Applicable: There has been no change of occupancy within plant safety-related areas. Ref: Walkdown Checklist No. 1 & 2.
3-16.7	Stock of Spare Sprinklers		Title
3-16.7.1	There shall be maintained on the premises a supply of spare sprinklers (never less than six) so that any sprinklers that have operated or been damaged in any way may promptly be replaced. These sprinklers shall correspond as to types and temperature ratings with the sprinklers in the property. The sprinklers shall be kept in a cabinet located where the temperature to which they are subjected will at no time exceed 100°F (38°C).	W	Comply: Adequate spare sprinkler stock and an installation wrench are available for all systems protecting safety-related areas. Ref: Walkdown Checklist No. 1 & 2.
3-16.7.2	A special sprinkler wrench shall also be provided and kept in the cabinet, to be used in the renoval and installation of sprinklers.	W	Comply: See response to code section 3.16.7.1.
3-16.7.3	The stock of spare sprinklers shall be as follows: For equipments not over 300 sprinklers, not less than 6 sprinklers For equipments 300 to 1,000 sprinklers, not less than 12 sprinklers	W	Comply: See response to code section 3-16.7.1.

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	For equipments above 1,000 sprinklers, not less than 24 sprinklers. Stock of spare sprinklers shall include all types and ratings installed.		
3-16.8	Guards and Shields. Sprinklers which are so located as to be subject to mechanical injury (in either the upright or the pendent position) shall be protected with approved guards.	W	Does Not Comply: Various heads at Elev. 587, 609, and 633 on drops below duct work are not provided with guards and may be susceptible to damage. Ref: Walkdown Checklist No. 1 & 2.
3-16.9	Painting and Ornamental Finishes		Title
3-16.9.1	When the sprinkler piping is given any kind of coating, such as whitewash or paint, care shall be exercised to see that no automatic sprinklers are coated.	W	Comply: See response to code section 3-16.2.2 and 3-16.3.1.
3-16.9.2	Sprinkler frames may be factory painted or enameled for the purpose of identifying sprinklers of different temperature ratings in accordance with 3-16.6.1 or as ornamental finish in accordance with 3-16.9.3. Otherwise, sprinklers shall not be painted and any sprinklers which have been painted, except for factory applied coatings, shall be replaced with new listed sprinklers.	W	Comply: See response to code section 3-16.2.2 and 3-16.3.1.
3-16.9.3	Ornamental finishes shall not be applied to sprinklers by anyone other than the sprinkler manufacturer and only sprinklers listed with such finishes shall be used.	W	Comply: See response to code section 3-16.2.2 and 3-16.3.1.
3-17	Sprinkler Alarms		Title
3-17.1	Definition. A local alarm unit is an assembly of apparatus approved for the service and so constructed and installed that any flow of water from a sprinkler system equal to or greater than that from a single automatic		Information Only

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	sprinkler of the smallest orifice size installed on the system will result in an audible alarm on the premises within 5 minutes after such flow beings. For remote sprinkler water flow alarm transmission see 3-17.6.1.		
3-17.2	Where Required. Local waterflow alarms shall be provided on all sprinkler systems having more than 20 sprinklers.	W, D	Comply: The wetpipe and pre-action sprinkler systems will annunciate to the Control Room upon actuation. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 2.
3-17.3	Water Flow Detecting Devices		Title
3-17.3.1	Alarm Check Valves. The alarm apparatus for a wet-pipe system shall consist of listed alarm check valve or other approved waterflow detecting alarm device with the necessary attachments required to give an alarm.	W	Does Not Comply: The Grinnell and Hodgman alarm check valves are listed devices; however, the mercoid pressure switches used to annunciate system actuation are not. Ref: Walkdown Checklist No. 1 & 2.
3-17.3.2	Dry-Pipe Valves. The alarm apparatus for a dry-pipe system shall consist of listed alarm attachments to the dry-pipe valve. When a dry-pipe valve is located on the system side of an alarm valve, the actuating device of the alarms for the dry-pipe valve may be connected to the alarms on the wet-pipe system.	W	Not Applicable. There are no dry-pipe systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.
3-17.3.3	Preaction and Deluge Valves. The alarm apparatus for preaction and deluge systems shall consist of listed alarm attachments, actuated by a detection system independent of flow of water in the system.	W	Does Not Comply: The Mercoid pressure switches used to annunciate waterflow are not listed for sprinkler service. Ref: Walkdown Checklist No. 1 & 2.
3-17.3.4	Waterflow alarm indicators (paddle type) shall not be installed in dry-pipe, preaction or deluge systems.	W	Not Applicable: There are no waterflow switches on the pre-action systems protecting safety-related areas. Ref: Walkdown Checklist No. 1 & 2.

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3-17.4	Attachments - General		Title
3-17.4.1	An alarm unit shall include a listed mechanical alarm, horn or siren, or an approved weatherproof electric gong, bell, horn or siren.	D	Comply: A general fire alarm system (motor driven horns) provides an alarm to all areas of the plant upon fire suppression system actuation. Ref: Technical Data No. 19 Section 8.1.1.
3-17.4.2	Outdoor mechanical or electrically operated bells shall be of weatherproof and guarded type.	W	Not Applicable. These devices are not installed for systems protecting safety related areas. Ref: Walkdown Checklist No. 1 & 2.
3-17.4.3	On each alarm check valve used under conditions of variable water pressure, a retarding device shall be installed. Valves shall be provided in the connections to retarding chambers, to permit repair or removal without shutting off sprinklers; these valves shall be so arranged that they may be locked or sealed in the open position.	D	Comply: Retard chambers are provided for the wet-pipe sprinklers protecting safety-related areas. Valves are provided in the connections to these devices which can be sealed open. Ref: Drawing No. 5, 35 & 39.
3-17.4.4	Dry-pipe, preaction and deluge valves shall be fitted with a test connection for electric alarm switch or water motor gong or both. This pipe connection shall be made on the water side of the system and provided with a control valve and drain for the alarm piping. A check valve shall be installed in the pipe connection to the intermediate chamber of the dry-pipe valve.	W, D	Comply: All of the pre-action valves for safety-related areas were provided with alarm test bypass lines which are appropriately piped as listed in this code section. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 5.
3-17.4.5	A control valve shall be installed in connection with pressure-type contactor or water-motor-operated alarm devices and such valves shall be of the type which will clearly indicate whether they are open or closed and be so constructed that they may be locked or sealed in the open position. The control valve for the retarding chamber on alarm check valves of wet-pipe systems may be accepted as complying with this paragraph.	W, D	Does Not Comply: The alarm test bypass line and alarm pressure switch isolation valves are globe type valves. These valves are not indicating valves. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 5, 35 & 39.

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3-17.5	Attachments - Mechanically Operated. For all types of sprinkler systems employing water-motor operated alarms, an approved 3/4-in. strainer shall be installed at the alarm outlet of the waterflow detecting device except that when a retarding chamber is used in connection with an alarm valve, the strainer shall be located at the outlet of the retarding chamber unless the retarding chamber is provided with an approved integral strainer in its outlet. Water-motor-operated devices shall be protected from the weather, and shall be properly aligned and so installed as not to get out of adjustment. All piping to these devices shall be galvanized or brass or other approved corrosion resistant material of a size not less than 3/4-in.	W	Not Applicable: Water-motor operated alarms are not provided. Ref: Walkdown Checklist No. 1 & 2.
3-17.6	Attachments - Electrically Operated		Title
3-17.6.1	Electrically operated alarm attachments forming part of an auxiliary, central station, proprietary or remote station signaling system shall be installed in accordance with the following applicable NFPA standards. (a) NFPA 71, Central Station Signaling Systems, (b) NFPA 72B, Auxiliary Protective Signaling Systems, (c) NFPA 72C, Remote Station Protective Signaling Systems, (d) NFPA 72D, Proprietary Protective Signaling Systems.	D	The NFPA 72D Code Compliance Evaluation will provide information to verify this requirement. Ref: Technical Data No. 11, Article 340.

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3-17.6.2	The circuits of electrical alarm attachments forming part of a local sprinkler water flow alarm system need not be supervised.		Information Only
	Exception: If the local sprinkler water flow alarm system is part of a required local fire alarm system it shall be installed in accordance with NFPA 72A, Standard for Local Protective Signaling Systems.	D	Reference NFPA 72D Code Compliance Evaluation. Ref: Technical Data No. 11, Article 340.
3-17.6.3	Waterflow detecting devices, including the associated alarm circuits, shall be tested by an actual waterflow through use of a test connection.	D	The NFPA 72D Code Compliance Evaluation will be used to verify this requirement. Ref: Technical Data No. 11, Section 3431.
3-17.6.4	Outdoor electric alarm devices shall be of a type specifically listed for outdoor use, and the outdoor wiring shall be in approved conduit, properly protected from the entrance of water in addition to the requirements of 3-17.6.1.	D	Comply: The intent of this code section is to ensure adequate alarm upon system actuation. This is accomplished by the plant-wide fire siren. Some parts of the system may be installed outdoors but the system is plant-wide and therefore adequate. Ref: Technical Data No. 11.
3-17.7	Drains. Drains from alarm devices shall be so arranged that there will be no danger of freezing, and so that there will be no overflowing at the alarm apparatus at domestic connections or elsewhere with the sprinkler drains wide open and under system pressure. (See 3-11.4.)	W	Comply: The systems protecting safety-related areas are drained to locations which are not subject to freezing or overflowing. Ref: Walkdown Checklist No. 1 & 2.

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	CHAPTER 4 SPACING, LOCATION AND POSITION OF SPRINKLERS		Title
4-1	General Information		Title
4-1.1	Basic Principles		Title
4-1.1.1	The basic principles for providing proper protection are namely: (1) Sprinklers installed throughout the premises, including basements, lofts and all of the locations herein specified. (2) Definite maximum protection area per sprinkler. (3) Minimum interference to discharge pattern by beams, bracing, girders, trusses, piping, lighting fixtures and air conditioning ducts. (4) Correct location of automatic sprinklers with respect to ceilings, or beams and wood joists to obtain suitable sensitivity.	W	Does Not Comply: Sprinklers were found obstructed in the following locations. Ref: Walkdown Checklist No. 1 & 2. 1) El. 587 • Zone 6N - North area near column lines WL-L and WL-4, four consecutive sprinklers are blocked by piping. 2) El. 609 • Zone 44N - Near column lines 16 and WL-L, sprinkler is obstructed by ductwork. Near column lines 15 and WL-L, sidewall sprinkler is blocked by fire main. 3) El. 633 • Sidewall sprinkler heat collection plates will interfere with discharge patterns. • At column lines WL-L and WL-5, a heat collection plate is distorted such that the sprinkler discharge pattern will be blocked. • At column lines WL-L and WL-8, sprinkler water discharge is obstructed by numerous conduit.

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			• At column lines WL-L.5 and WL-8.5, a temporary curtain is installed too close to a sprinkler head and will obstruct discharge. • Sidewall sprinkler heat collection plates will interfere with discharge patterns. 4. AFW Pump Room and Corridor • In corridor area an upright sprinkler is obstructed by piping. • In Zone 17E, AFW Pump Room, an upright sprinkler is obstructed by conduit. 5. Contractors Access Area • Sprinklers were not provided over the partial ceiling area in the NE corner of the lower elevation.
4-1.1.2	The installation requirements are specific for the normal arrangement of structural members. There will be arrangements of structural members not specifically detailed by the requirements. By applying the basic principles, layouts for such construction can vary from specific illustrations, provided the maximum specified for the Spacing of Sprinklers (Section 4-2) and Position of Sprinklers (Section 4-3) are not exceeded.		Information Only
4-1.1.3	Special sprinklers may be installed with larger protection areas or distances between sprinklers than are specified in Sections 4-2 and 4-5 when installed in accordance with their listings.	W	Not Applicable: There are no special sprinkler applications which have not been approved. Ref: Walkdown Checklist No. 1 & 2.

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Checklist D. C. Cook Units 1 & 2

JOB NO 0120-108-1375
CALC NO 0120-108-004

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1983
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4-1.1.4	Clearance between sprinklers and structural member shall comply with this standard unless tests are performed which show that deviations offer no obstruction to spray discharge.	W, D	Does Not Comply: Discharge testing has not been performed to show that deviations identified during the walkdowns offer no obstruction to spray discharge. The deviations are discussed under specific sections of this evaluation. Ref: Walkdown Checklist No. 1 & 2; Procedure No. 1.
4-1.1.5	Clearance between sprinklers and ceilings may exceed the maximum specified in Section 4-3 provided that, for the conditions of occupancy protected, tests or calculations show comparable sensitivity and performance of the sprinklers to those installed in conformance with Section 4-3.	D	Not Applicable: Testing of sprinkler response has not been performed. Ref: Procedure No. 1.
4-1.2	When partial sprinkler installations are installed, the requirements of this standard shall be used insofar as they are applicable. The authority having jurisdiction shall be consulted in each case.	W, D	Comply: Areas of sprinkler coverage are reviewed and approved by the NRC who act as the authority having jurisdiction. Ref: Walkdown Checklist No. 1 & 2; Licensing Document No. 1.
4-1.3	Definitions		Title
4-1.3.1	Smooth Ceiling Construction. The term smooth ceiling construction as used in this standard includes:		Information Only
	(a) Flat slab, pan-type reinforced concrete, concrete joist less than 3 ft. (0.9 m) on centers.		
	(b) Continuous smooth bays formed by wood, concrete or steel beams spaced more than 7 1/2 ft. (2.9 m) on centers - beams supported by columns, girders or trusses.		This type of construction describes conditions in areas except for Contractors Access Areas. Ref: Walkdown Checklist No. 1 & 2.
	(c) Smooth roof or floor decks supported directly on girders or trusses spaced more than 7 1/2 ft. (2.9 m) on centers.		

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	(d) Smooth monolithic ceilings of at least 3/4 in. (19 mm) of plaster on metal lath or a combination of materials of equivalent fire-resistive rating attached to the underside of wood or bar joists.		
	(e) Open web-type steel beams regardless of spacing.		
	(f) Smooth shell-type roofs, such as folded plates, hyperbolic paraboloids, saddles, domes and long barrel shells.		
	(g) In (b) through (f) above, the roof and floor decks may be noncombustible or combustible. Item (b) would include standard mill construction.		
	(h) Suspended ceilings of noncombustible construction.		
	(i) Suspended ceilings of combustible construction where there is a full complement of sprinklers in the space immediately above such a ceiling and the space is unfloored and unoccupied.		
	(j) Smooth monolithic ceilings with fire resistance less than that specified under item (d) attached to the underside of wood or bar joists.		
	(k) Combustible suspended ceilings arranged other than as specified under item (i).		
4-1.3.2	Beam and Girder Construction. The term beam and girder construction as used in this standard includes noncombustible and combustible roof or floor decks supported by wood beams of 4 in. (102 mm) or greater		Information Only: This type of construction describes conditions in the Contractor's Access Area. Ref: Walkdown Checklist No. 1.

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	nominal thickness or concrete or steel beams spaced 3 to 7 1/2 ft. (0.9 to 2.3 m) on centers and either supported on or framed into girders. [When supporting a wood plank deck, this includes semi-mill and panel construction and when supporting (with steel framing) gypsum plank, steel deck, concrete, tile, or similar material, would include much of the so-called noncombustible construction.]		
4-1.3.3	Bar Joist and Girder Construction. The term bar joist construction refers to construction employing joists consisting of steel truss-shaped members. This definition includes noncombustible and combustible roof and floor decks supported on bar joists.		Information Only
4-1.3.4	Panel Construction. The term panel construction as used in this standard includes ceiling panels formed by members capable of trapping heat to aid the operation of sprinklers and limited to a maximum of 300 sq. ft. (27.9 m^2) in area. Beams spaced more than 7 1/2 ft. (2.3 m) apart and framed into girders qualify for panel construction provided the 300 sq. ft. (27.9 m^2) area limitation is met.		Information Only
4-1.3.5	Standard Mill Construction. The term standard mill construction as used in this standard refers to heavy timber construction as defined in NFPA 220, Standard on Types of Building Construction.		Information Only
4-1.3.6	Semi-Mill Construction. The term semi-mill construction as used in this standard refers to a modified standard mill construction where greater column spacing is used and beams rest on girders.		Information Only

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4-1.3.7	Wood Joist Construction. The term wood joist construction refers to wood boards or planks on wooden beams spaced less than 3 ft. (0.9 m) on centers. Wooden beams less than 4 in. (102 mm) nominal thickness spaced more than 3 ft. (0.9 m) on centers are also considered as wood joist construction.		Information Only
4-1.3.8	High Piled Storage. High-piled storage is defined as solid piled storage in excess of 12 ft. (3.7 m) in height or palletized or rack storage in excess of 12 ft. (3.7 m) in height. See Appendix D for availability of information for sprinkler protection of high-piled storage.	W	Not Applicable: There are no sprinkler systems protecting high-piled storage applications in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.
4-2	Spacing and Location of Sprinklers (See also Sections 4-3 and 4-4.)		
4-2.1	Distance Between the Branch Lines and Between Sprinklers on the Branch Lines		
4-2.1.1	For light hazard occupancies, the distance between branch lines and between sprinklers on the branch lines shall not exceed 15 ft. (4.6 m).	D	Not Applicable: None of the systems protecting safety-related areas are classified as light hazard. Ref: Drawings No. 9 - 42.
4-2.1.2	For ordinary hazard occupancies, except high-piled stock, the distance between the branch lines and between sprinklers on branch lines shall not exceed 15 ft. (4.6 m). In buildings used for high-piled storage (as defined in 4-1.3.8); the distance between the branch lines and between sprinklers on the branch lines shall not exceed 12 ft. (3.7 m) except in bays 25 ft. (7.6 m) wide, a spacing of 12 ft. 6 in. (3.8 m) between branch lines is permitted.	W	Comply: The maximum spacing distance of 15 feet is not exceeded. There is no high-piled storage in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.

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4-2.1.3	For extra hazard occupancy, the distance between the branch lines and between sprinklers on the branch lines shall not exceed 12 ft. (3.7 m).	D	Comply: The maximum spacing distance is not exceeded in the Unit 1, TDAFW Pump Rooms and in the AFW pump corridor. Ref: Drawings No. 25, 40 & 42. Not Applicable: The remaining systems are not classified as extra hazard occupancies. Ref: Drawings No. 9 - 41.
4-2.1.4	Distance From Walls. The distance from the walls to the end sprinklers on the branch lines shall not exceed one-half of the allowable distance between sprinklers on the branch lines. The distance from the walls to the end branch lines shall not exceed one-half the allowable distance between the branch lines. For exceptions relating to small rooms, refer to 4-4.20.	W	Does Not Comply: The pilot head in the southeast corner of the eastern-most portion of Zone 44N (Col. WL-6.5 WL-N) appears to be too far from the east wall. Ref: Walkdown Checklist No. 2.
4-2.2	Protection Area Limitations		Title
4-2.2.1	Light Hazard Occupancy		Title
4-2.2.1.1	Under smooth ceiling construction and under beam and girder construction [as defined in 4-1.3.1 items (a) through (i), and 4-1.3.2], the protection area for sprinkler shall not exceed 200 sq. ft. (18.6 m^2). For hydraulically designed sprinkler systems, the protected area limit per sprinkler may be increased to 225 sq. ft. (20.9 m^2).	D	Not Applicable: None of the system's protecting safety-related areas are classified as light hazard occupancy. Ref: Drawings No. 9 - 42.
4-2.2.1.2	Under open wood joist construction (as defined in 4-1.3.7), the protection area per sprinkler shall not exceed 350 sq. ft. (12.1 m^2).		Not Applicable: See response to code section 4-2.2.1.1.

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4-2.2.1.3	For other types of construction the protection area per sprinkler shall not exceed 168 sq. ft. (15.6 m^2).		Not Applicable: See response to code section 4-2.2.1.1.
4-2.2.2	Ordinary Hazard Occupancy. For all types of construction the protection area per sprinkler shall not exceed 130 sq. ft. (12.1 m^2), except that in buildings used for high-piled storage (as defined in 4-1.3.8) the protection area per sprinkler shall not exceed 100 sq. ft. (9.3 m^2). Exception: Sprinkler spacing may exceed 100 sq. ft. (9.3 m^2), but shall not exceed 130 sq. ft. (12.1 m^2) in systems hydraulically designed in accordance with NFPA 231 and 231C for densities below 0.25 gpm per sq. ft. [(10.2 L/min)/m^2].	W, D	Comply: Sprinkler coverage for the portions of safety-related areas reviewed comply with the 130 sq. ft. maximum. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 10 - 34.
4-2.2.3	Extra Hazard Occupancy. The protection area per sprinkler shall not exceed 90 sq. ft. (8.4 m^2) for any type of building construction, except protection area per sprinkler shall not exceed 100 sq. ft. (9.3 m^2) where the system is hydraulically designed.	D	Comply: Sprinkler spacing in the Unit 1 and 2 TDAFW Pump room and in the AFW pump room corridor meets the spacing requirements. Ref: Drawings No. 25, 40 & 42.
4-2.3	Location of Sprinklers and Branch Lines with Respect to Structural Members		Title
4-2.3.1	Sprinklers may be located under beams, in bays, or combination of both, but the locations must meet the provisions outlined in 4-2.4 and Section 4-3.	W	Comply: Sprinklers are located adequately except for as identified below. Does Not Comply: See response to code sections 4-2.4.6 and 4-3. Ref: Walkdown Checklist No. 1 & 2.
4-2.3.2	Where there are two sets of joists under a roof or ceiling and there is no flooring over the lower set, sprinklers shall be installed above and below the lower set of joists where	W	Not Applicable: This type of construction is not found in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.

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	there is a clearance of from 6 in to 12 in. (152 mm to 305 mm) between the top of the lower joist and bottom of the upper joist. (See Figure 4-2.3.2.)		
4-2.4	Clearance Between Sprinklers and Structural Members		Title
4-2.4.1	Trusses. Sprinklers shall be at least 2 ft. (0.6 m) laterally from truss members (web or chord) more than 4 in. (102 mm) wide, and at least 1 ft. (0.3 m) laterally from truss members 4 in. (102 mm) or less in width. When sprinkler lines run above or through trusses, the sprinklers may be located on center line of truss, provided chord members are not more than 8 in. (203 mm) wide, and the deflector is at least 7 in. (152 mm) above the chord member. When sprinklers are located laterally beside chord members, clearances between the chord members and the sprinkler deflectors shall be in accordance with 4-2.4.6.	W	Not Applicable: This type of construction is not found in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.
4-2.4.2	Girders. When sprinkler lines are located perpendicular to and above girders, sprinklers shall be at least 3 ft. 9 in. (229 mm) from girders except that they may be located directly above girders with the top flange not more than 8 in. (203 mm) wide, in which case the deflectors shall be at least 6 in. (152 mm) above the top of the girder.	W	Not Applicable: See response to code section 4-2.4.1.
4-2.4.3	When sprinkler deflectors are in accordance with Table 4-2.4.6, the girders may be disregarded in the spacing of the branch lines.	W	Not Applicable: See response to code section 4-2.4.1.
4-2.4.4	Open Web-Type Steel Beams. (See Figure 4-2.4.4.) When branch lines are run across and through openings of open web-type steel beams, sprinklers may be spaced bay and beam provided:	W	Not Applicable: See response to code section 4-2.4.1.

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	(a) The distance between sprinklers and between branch lines conforms to 4-2.1, (b) Sprinklers in the beam openings are located within 1 in. (25 mm) horizontally of the opening center line, (c) The branch line is located within 1 in. (25 mm) horizontally of the opening center line, and (d) Sprinklers on alternate lines are staggered.		
4-2.4.5	Bar Joists. Sprinkler shall be at least 3 in. (76 mm) laterally from web members of open bar joists which do not exceed 1/2 in. (13 mm) or at least 6 in. (152 mm) laterally from web members which do not exceed 1 in. (25 mm). When the dimensions of the web member exceed 1 in. (25 mm), see 4-2.4.1.	W	Not Applicable: See response to code section 4-2.4.1.
4-2.4.6	Beams. Deflectors of sprinklers in bays shall be at sufficient distance from the beams, as shown in Table 4-2.4.6 and Figure 4-2.4.6 to avoid obstruction to the sprinkler discharge pattern. Otherwise the spacing of sprinklers on opposite sides of the beams shall be measured from the beam and the distance shall not exceed 1/2 of the allowable distance between sprinklers.	W	Comply: Sprinklers are located adequately except as identified below. Does Not Comply: Contractors Access Area - Sprinklers in the SW corner of the lower elev. are too close to the beam. Ref: Walkdown Checklist No. 1. El. 633 - Sprinklers at the N. end of zone 52 (Col. WL-L) are running too close to beam (parallel). A sprinkler is also too close to the beam at Col. line WL-K & WL-3.5. Ref: Walkdown Checklist No. 2.
4-2.4.7	Position of Deflectors. Deflectors of sprinklers shall be parallel to ceilings, roofs, or the incline of stairs, but when installed in the peak of a pitched roof they	W	Comply: Sprinkler deflectors were positioned correctly. Ref: Walkdown Checklist No. 1 & 2.

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shall be horizontal. Low-pitched roofs having slopes not greater than 1 in. per ft. (83 mm/m) may be considered as level in the application of this rule and sprinklers may be installed with deflectors horizontal.

TABLE 4-2.4.6
Position of Deflector when Located above Bottom of Beam

Distance from Sprinkler to Side of Beam	Maximum Allowable Distance Deflector above Bottom of Beam
Less than 1'	0"
1' to less than 2'	1"
2' to less than 2'6"	2"
2'6" to less than 3'	3"
3' to less than 3'6"	4"
3'6" to less than 4'	6"
4' to less than 4'6"	7"
4'6" to less than 5'	9"
5' to less than 5'6"	11"
5'6" to less than 6'	14"

For SI Units: 1" = 25.4 mm; 1' = 0.3048 m

4-2.5 Clear Space Below Sprinklers

4-2.5.1	A minimum of 18 in. (457 mm) clearance shall be maintained between top of storage and ceiling sprinkler deflectors. For in-rack sprinklers, the clear space shall be in accordance with NFPA 231C, Rack Storage of Materials.	W	Comply: The minimum required clear space is maintained. Ref: Walkdown Checklist No. 1 & 2.
4-2.5.2	The clearance from sprinklers to privacy curtains, free-standing partitions or room dividers shall be not less than the distances given in Table 4-2.5.2 as measured in Figure 4-2.5.2.	W	Comply: Clearances to free-standing partitions and dividers are adequate. Ref: Walkdown Checklist No. 1 & 2.

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TABLE 4-2.5.2
Minimum Horizontal and Vertical Distance for Pendent Sprinklers

Horizontal Distance	Minimum Vertical Distance Below Deflector
6 in.	3 in.
9 in.	4 in.
12 in.	6 in.
15 in.	8 in.
18 in.	9-1/2 in.
24 in.	12-1/2 in.
30 in.	15-1/2 in.
Greater than or equal to 36 in.	18 in.

For SI Units: 1 in. = 25.4 mm.

4-3 Position of Sprinklers

Title

4-3.1 Smooth Ceiling Construction. (As defined in 4-1.3.1.) Deflectors of sprinklers shall be located 1 in. to 10 in. (25 mm to 254 mm) below combustible ceilings or 1 in. to 12 in. (25 mm to 305 mm) below noncombustible ceilings. The operating elements of sprinklers shall be located below the ceiling.

W, D

Does not Comply: Sprinkler heads at elevations 570, 587, and 609 are greater than 12 inches below the ceiling. However, this system design was mandated by the NRC in their SER and is therefore acceptable for the type of protection being provided. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 10 - 34; Licensing Document No. 1.

Exception No. 1: Deflectors of sprinklers under beams shall be located 1 in. to 4 in. (25 mm to 102 mm) below beams, and not more than 14 in. (356 mm) below combustible ceilings or not more than 16 in. (406 mm) below noncombustible ceilings.

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	Exception No. 2: Special ceiling-type pendent sprinklers (concealed, recessed and flush types) may have the operating element above the ceiling and the deflector located nearer the ceiling when installed in accordance with their listing.		
4-3.2	Beam and Girder Construction (as defined in 4-1.3.2.)		
4-3.2.1	Deflectors of sprinklers in bays shall be located 1 in. to 16 in (25 mm to 406 mm) below combustible or noncombustible roof or floor decks.	W	Not Applicable: This construction type is not present in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.
4-3.2.2	Deflectors of sprinklers under beams shall be located 1 in to 4 in. (25 mm to 102 mm) below beams and not more than 20 in. (508 mm) below combustible or noncombustible roof or floor decks.	W	Not Applicable: See response to code section 4-3.2.1.
4-3.2.3	Deflectors of sprinklers under concrete tee construction with stems spaced less than 7-1/2 ft. (2.3 m) but more than 3 ft. (0.9 m) on centers shall, regardless of the depth of the tee, be located at or above a plane 1 in. (25 mm) below the level of the bottom of the stems of the tees and comply with Table 4-2.4.6.	W	Not Applicable: See response to code section 4-3.2.1.
4-3.3	Open Bar Joist Construction (as defined in 4-1.3.3). Deflectors of sprinklers shall be located 1 in to 10 in. (25 mm to 254 mm) below combustible or not more than 12 in. (305 mm) below noncombustible roof or floor decks.	W	Not Applicable: See response to code section 4-3.2.1.
4-3.4	Panel Construction (as defined in 4-1.3.4).		
4-3.4.1	Deflectors of sprinklers in bays formed by members, such as beams framed into girders, resulting in panels up to 300 sq. ft.	W	Not Applicable: See response to code section 4-3.2.1.

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	(27.9 m^2) shall be located 1 in. to 18 in. (25 mm to 457 mm) below combustible or noncombustible roof or floor decks.		
4-3.4.2	Deflectors of sprinklers under the members, such as under beams framed into girders, forming panels up to 300 sq. ft. (27.9 m^2) shall be located 1 in. to 4 in. (25 mm to 102 mm) below such members and not more than 22 in. (559 mm) below combustible or noncombustible roof or floor decks.	W	Not Applicable: See response to code section 4-3.2.1.
4-3.5	Open Wood Joist Construction (as defined in 4-1.3.7). In open joist construction with joists spaced 3 ft. (0.9 m) or less on centers, sprinklers shall be located with deflectors 1 in. to 6 in. (25 mm to 152 mm) below the bottom of the joists. If open joists are spaced more than 3 ft. (0.9 m) on centers, sprinklers shall be located with deflectors placed in accordance with 4-3.1 or 4-3.2.	W	Not Applicable: See response to code section 4-3.2.1.
4-3.6	Location Under Sheathed or Suspended Ceiling Under Any Type of Construction. The position of sprinklers under sheathed or suspended ceilings with any type of construction shall be the same as for smooth ceiling construction; see sec 4-3.1.	W	Not Applicable: See response to code section 4-3.2.1.
4-4	Locations or Conditions Involving Special Consideration.		Title
4-4.1	Combustible Form Board. When roof or floor decks consist of poured gypsum or concrete on combustible form board supported on steel supports, the position of sprinkler deflectors shall be the same as for noncombustible construction as stated in	W	Not Applicable: This type of construction is not provided in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.

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	Section 4-3. When combustible form board is located above suspended ceilings or in concealed spaces, sec 4-4.4.1.		
4-4.2	Metal Roof Decks. When roof decks are metal with combustible adhesives or vapor seal, the position of sprinklers shall be the same as for combustible construction.	W	Not Applicable: See response to code section 4-4.1.
4-4.3	Spaces Under Ground Floors. Sprinklers shall be installed in all spaces below combustible ground floors except that, by permission of the authority having jurisdiction, sprinklers may be omitted when all of the following conditions prevail: (a) The space is not accessible for storage purposes or entrance of unauthorized persons and is protected against accumulation of windborne debris; (b) The space contains no equipment such as steam pipes, electric wiring, shafting, or conveyors; (c) The floor over the space is tight; (d) No combustible or flammable liquids or materials that under fire conditions may convert into combustible or flammable liquids are processed, handled or stored on the floor above.	W	Not Applicable: Below grade elevations are being evaluated against all pertinent code requirements for the sprinkler installations. Ref: Walkdown Checklist No. 1 & 2.
4-4.4	Concealed Spaces		Title
4-4.4.1	Sprinklers shall be installed in all concealed spaces enclosed wholly or partly by exposed combustible construction, as in walls, floors and ceilings, except as modified by 4-4.4.2 and 4-4.4.3. In spaces formed by studs or joists, sprinklers shall be provided where there is 6 in. (152 mm) or more clearance	W	Not Applicable: This type of construction is not provided in safety related areas. Ref: Walkdown Checklist No. 1 & 2.

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	between the inside or near edges of the studs or joists which form the opposite sides of the space; the distance from the first sprinkler to the wall, however, need not be less than specified in 4-2.1.4. In partly or wholly combustible bar joist construction, sprinklers shall be installed wherever the total depth of the space exceeds 6 in. (152 mm) between roof or floor deck and ceiling; the spacing of sprinklers in that case may be on the basis of light hazard classification provided the space is not accessible for storage or other use.		
4-4.4.2	Sprinklers may be omitted from combustible concealed spaces when any of the following conditions prevail. (a) When the ceiling is attached directly to the underside of the supporting beams of a combustible roof or floor deck. (b) When concealed space is entirely filled with a noncombustible insulation. In solid joisted construction the insulation need fill only the space from the ceiling to the bottom edge of the joist of the roof or floor deck. (c) When there are small concealed spaces over rooms that do not exceed 50 sq ft (4.6 M^2) in area. (d) When the exposed surfaces have a flame spread rating less than 25 and the materials have been demonstrated not to propogate fire in the form in which they are installed in the space or when the BTU content of the facing and substrate of insulation material does not exceed 1000 BTU per sq ft (11 356 kJ/m^2).	W	Not Applicable: This type of construction is not provided in safety related areas. Ref: Walkdown Checklist No. 1 & 2.

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4-4.4.3	In concealed spaces having exposed combustible construction or containing exposed combustibles in localized areas, the combustibles shall be protected as follows: (a) If the exposed combustibles are in the vertical partitions or walls around all or a portion of the enclosure, a single row of sprinklers spaced not over 12 ft (3.7 m) apart nor more than 6 ft (1.8 m) from the inside of the partition may be installed to protect the surface. The first and last sprinklers in such a row shall not be over 5 ft (1.5 m) from the ends of the partitions. (b) If the exposed combustibles are in the horizontal plane, permission may be given to protect the area of the combustibles on a light hazard spacing and add a row of sprinklers not over 6 ft (1.8 m) outside the outline of the area and not over 12 ft (3.7 m) on center along the outline. When the outline returns to a wall or other obstruction, the last sprinkler shall not be over 6 ft (1.8 m) from wall or obstruction.	W	Not Applicable: This type of construction is not provided in safety related areas. Ref: Walkdown Checklist No. 1 & 2.
4-4.5	Spacing of Sprinklers Under Pitched Roofs		Title
4-4.5.1	Branch lines parallel to peaks of pitched roofs and sprinklers on lines perpendicular to peaks shall be spaced throughout the distance measured along the slope. This will place a row of sprinklers either in the peak or one-half the spacing down the slope from the peak.	W	Not Applicable: This type of construction is not provided in safety related areas. Ref: Walkdown Checklist No. 1 & 2.

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4-4.5.2	Under saw-toothed roofs, the row of sprinklers at the highest elevation shall be not more than 3 ft (0.9 m) down the slope from the peak.	W	Not Applicable: See response to code section 4-4.5.1. Ref: Walkdown Checklist No. 1 & 2.
4-4.5.3	In 4-4.5.1 or 4-4.5.2 sprinklers in or near the peak shall have deflectors not more than 3 ft (0.9 m) vertically down from the peak. (See Figure 4-4.5.3.)	W	Not Applicable: See response to code section 4-4.5.1. Ref: Walkdown Checklist No. 1 & 2.
4-4.5.4	In a steeply pitched roof, the distance from the peak to deflectors may be increased to maintain a horizontal clearance of not less than 2 ft (0.6 m). (see Figure 4-4.5.4.)	W	Not Applicable: See response to code section 4-4.5.1. Ref: Walkdown Checklist No. 1 & 2.
4-4.6	Spacing of Sprinklers Under Curved Roof Buildings		Title
4-4.6.1	When roofs are curved down to the floor line, the horizontal distance measured at the floor level from the side wall or roof construction to the nearest sprinklers shall not be greater than one-half the allowable distance between sprinklers in the same direction.	W	Not Applicable: This type of construction is not found in safety related. Ref: Walkdown Checklist No. 1 & 2.
4-4.6.2	Deflectors of sprinklers shall be parallel with the curve of the roof or tilted slightly toward the peak of the roof. Deflectors of sprinklers shall be located as described for beam and girder construction or for the closest comparable type of ceiling construction	W	Not Applicable: See response to code section 4-4.6.1.
4-4.6.3	When extra hazard occupancy spacing of sprinklers is used under curved ceilings of other than fire-resistive construction, as in aircraft storage or servicing areas, the spacing as projected on the floor shall be not wider than required for extra hazard occupancies, but in no case shall the spacing on the roof or ceiling be wider than required for ordinary hazard occupancies.	W	Not Applicable: See response to code section 4-4.6.1.

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4-4.7	Narrow Pocket. Girders, beams or trusses forming narrow pockets of combustible construction along walls when of a depth which will obstruct the spray discharge pattern may require additional sprinklers positioned in accordance with Table 4-2.4.6.	W	Not Applicable: This type of construction is not found in safety related areas. Ref: Walkdown Checklist No. 1 & 2.
4-4.8	Elevators, Stairs and Floor Openings		Title
4-4.8.1	Vertical Shafts		Title
4-4.8.1.1	One sprinkler shall be installed at the top of all shafts.	D	Does Not Comply: There is no sprinkler in the elevator shaft at El. 633'. Ref: Drawing No. 10.
4-4.8.1.2	When vertical shafts have combustible sides, one sprinkler shall be installed at each alternate floor level. When a shaft having combustible surfaces is trapped, an additional sprinkler shall be installed at the top of each trap section.	W	Not Applicable: Vertical shafts in safety-related areas are noncombustible construction. Ref: Walkdown Checklist No. 1 & 2.
4-4.8.1.3	When accessible shafts have noncombustible surfaces, one sprinkler shall be installed near the bottom.	W	Not Applicable: There are no accessible shafts in the areas being evaluated. Ref: Walkdown Checklist No. 1 & 2.
4-4.8.1.4	When vertical openings are not protected by standard enclosures, sprinklers shall be so places as to fully cover them. This necessitates placing sprinklers close to such openings at each floor level.	D	Comply: Stair coverage is adequately provided for the areas being reviewed by sprinklers closely spaced around the perimiter of stair openings. Ref: Drawing No. 10-34.
4-4.8.2	Stairways		Title
4-4.8.2.1	Stairways of combustible construction shall be sprinklered underneath whether risers are open or not.	W	Not Applicable: Stairways in safety-related areas are noncombustible construction. Ref: Walkdown Checklist No. 1 & 2.

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4-4.8.2.2	Stairways of noncombustible construction with combustible storage shall be sprinklered	W,D	Comply: Stairway area protection is provided. Ref: Walkdown Checklist No. 1 & 2; Drawing No. 10-34.
4-4.8.2.3	When moving stairways, large monumental staircases, or similar floor openings are unenclosed, the floor openings involved shall be protected by draft stops in combination with closely spaced sprinklers. The draft stops shall be located immediately adjacent to the opening, shall be at least 18 in. (457 m) deep and shall be of substantially noncombustible material which will stay in place before and during sprinkler operation. Sprinklers spaced more than 6 ft (1.8 m) apart, shall be placed 6 to 12 in. (152 mm to 305 mm) from the draft stop on the side away from the opening to form a water curtain. Sprinklers in this water curtain shall be hydraulically designed to provide a discharge of 3 gpm/min per lineal foot [(37 L/min)/m] of water curtain, with no sprinklers discharging less than 15 gpm (56.8 L/min). The number of sprinklers calculated in this water curtain shall be the number in the length corresponding to the length parallel to the branch lines in the design area determined by 7-4.3.1. These sprinklers shall be added to the design area when considering the hydraulic design. Nominal 1/2 in. (12.7 mm) orifice closed head systems using sprinklers of Ordinary Temperature Classification are adequate for this purpose. When sprinklers are closer than 6 ft (1.8 m), cross baffles shall be provided in accordance with 4-4.19. When sprinklers in the normal pattern are closer than 6 ft (1.8 m) from the water curtain, it may be preferable to locate the water curtain sprinklers in recessed baffle pockets. (See Figure A-4.8.2.3.)	W	Not Applicable: This type of opening is not found in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.

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	Exception: Large openings such as those found in shopping malls, open atrium buildings or similar structures where all adjoining levels and spaces are protected with automatic sprinklers in accordance with this standard.		
4-4.8.2.4	In noncombustible stair shafts, sprinklers shall be installed at the top and under the first landing above the lowest level. When the stair shaft serves two or more separate fire sections sprinklers shall also be installed at each floor landing.	W, D	Comply: See response to code section 4-4.8.2.2.
4-4.9	Building Service Chutes. Building service chutes (linen, rubbish, etc.) shall be protected internally by automatic sprinklers. This will require a sprinkler at the top of the chute and, in addition, a sprinkler shall be installed within the chute at alternate floor levels in buildings over two stories in height. The room or area into which the chute discharges shall be protected by automatic sprinklers.	W	Not Applicable: This type of service is not found in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.
4-4.10	Exterior Canopies, Docks, and Platform		Title
4-4.10.1	Sprinklers shall be installed under roofs or canopies over outside-loading platforms, docks, or other areas where combustibles are stored or handled.	W	Not Applicable: This construction is not found in safety related areas. Ref: Walkdown Checklist No. 1 & 2.
4-4.10.2	Sprinklers shall be installed under exterior combustible roofs or canopies exceeding 4 ft (1.2 m) in width. Exception: Sprinklers may be omitted where construction in noncombustible and areas under the canopies are not used for storage or handling.	W	Not Applicable: This construction is not found in safety related areas. Ref: Walkdown Checklist No. 1 & 2.

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4-4.10.3	Sprinklers shall be installed under exterior docks and platforms of combustible construction unless such space is closed off and protected against accumulation of debris.	W	Not Applicable: This construction is not found in safety related areas. Ref: Walkdown Checklist No. 1 & 2.
4-4.11	Decks. Sprinklers shall be installed under decks and galleries which are over 4 ft (1.2 m) wide. Slatting of decks, walkways or the use of open gratings as a substitute for such sprinklers is not acceptable.	W	Not Applicable: This construction is not found in safety related areas. Ref: Walkdown Checklist No. 1 & 2.
4-4.12	Library Stack Rooms. For single tier stacks where 18 in. (457 mm) clearance can be provided between sprinkler deflectors and top of stacks, sprinklers shall be located without regard to stacks. For multi-tier stacks and for single-tier stacks where 18 in. (457 mm) clearance is not available between sprinkler deflectors and tops of stacks, branch lines shall be located in alternate aisles or in each aisle, depending on the arrangement of vertical shelf dividers. When vertical shelf dividers are incomplete, branch lines should be located in alternate aisles. If there are ventilation openings through floors or walkways, the location of branch lines shall be staggered in a vertical plane. When vertical shelf dividers are complete, so that lateral spread of sprinkler discharge will be prevented, branch lines shall be located in each aisle. (See Figure 4-4.12.)	W	Not Applicable: This construction is not found in safety related areas. Ref: Walkdown Checklist No. 1 & 2.
4-4.13	Ducts. Sprinklers shall be installed beneath ducts over 4 ft (1.2 m) wide unless ceiling sprinklers can be spaced in accordance with Table 4-2.4.6.	W	Comply: Sprinklers are placed in accordance with this code requirement except as identified below. Does Not Comply: There are no sprinklers under a 6' duct at the N end of Zone 52 (El. 633' along Col. WL-L.5). Ref: Walkdown Checklist No. 1 & 2.

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4-4.14	Electrical Equipment. When sprinkler protection is provided in generator and transformer rooms, hoods or shields installed to protect important electrical equipment from water shall be noncombustible.	W	Not Applicable: There are no areas where generator/transformer installations being evaluated by this code. Water impact on vital electrical equipment is addressed in AEP responses to NRC Generic Letter 83-41. Ref: Walkdown Checklist No. 1 & 2.
4-4.15	Open Grid Ceilings. The following requirements are applicable to open grid ceilings in which the openings are 1/4 in. (6.4 mm) or larger in least dimension, when the thickness or depth of the material does not exceed the least dimension of the openings and when such openings constitute at least 70 percent of the area of the ceiling material. Other types of open grid ceilings shall not be installed beneath sprinklers unless they are listed by a testing laboratory and are installed in accordance with the instructions contained in each package of the ceiling material. Ceilings made of highly flammable material may spread fire faster than sprinklers can control. (a) In light hazard occupancies when spacing of sprinklers of either standard or old style is not wider than 10 by 10 ft (3 X 3 m), a minimum clearance of at least 18 in. (457 mm) shall be provided between the sprinkler deflectors and the upper surface of the open grid ceiling. When spacing is wider than 10 by 10 ft (3 X 3 m) but not wider than 10 by 12 ft (3 X 3.7 m), a clearance of at least 24 in. (610 mm) shall be provided from standard sprinklers and at least 36 in. (914 mm) from old style sprinklers. When spacing is wider than 10 by 12 ft (3 X 3.7 m), a clearance of at least 48 in. (1219 mm) shall be provided.	W	Not Applicable: This type of construction does not exist in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.

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	(b) In ordinary hazard occupancies, open grid ceilings may be installed beneath sprinklers only where such use is approved by the authority having jurisdiction, and shall be installed beneath standard sprinklers only. When sprinkler spacing is not wider than 10 by 10 ft (3 X 3 m), a minimum clearance of at least 24 in. (610 mm) shall be provided between the sprinkler deflectors and the upper surface of the open grid ceiling. When spacing is wider than 10 by 10 ft (3 X 3 m), a clearance of at least 36 in. (914 mm) shall be provided.		
4-4.16	Drop-out Ceilings		Title
4-4.16.1	Drop-out ceilings may be installed beneath sprinklers when ceilings are listed for that service and are installed in accordance with their listing. The authority having jurisdiction shall be consulted in all cases.	W	Not Applicable: This type of construction does not exist in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.
4-4.16.2	Drop-out ceilings shall not be considered ceilings within the context of this standard.	W	Not Applicable: See response to code section 4-4.16.1.
4-4.16.3	Piping installed above drop-out ceilings shall not be considered concealed piping. (See 3-12.4, Exception No. 2.)	W	Not Applicable: See response to code section 4-4.16.1.
4-4.16.4	Sprinklers shall not be installed beneath drop-out ceilings.	W	Not Applicable: See response to code section 4-4.16.1.
4-4.17	Fur Vaults	D	Not Applicable: The entire code section is omitted.
4-4.18	Commercial-type Cooking Equipment and Ventilation Systems	D	Not Applicable: The entire code section is omitted.

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4-4.19	Baffles. Baffles (except for in-rack sprinklers, see NFPA 231C, Standard on Rack Storage of Materials) shall be installed whenever sprinklers are less than 6 ft (1.8 m) apart to prevent the sprinkler first opening from wetting adjoining sprinklers, thus delaying their operation. Baffles shall be located midway between sprinklers and arranged to baffle the actuating elements. Baffles may be of sheet metal about 8 in. (203 mm) wide and 6 in. (152 mm) high. When placed on branch line piping, the top of baffles shall extend 2 to 3 in. (51 to 76 mm) above the deflectors. (See Figure A-3-15.5.4.)	W	Does Not Comply: Sprinkler heads underneath duct at columns, WL-K.5 and WL-4, elev. 633' are less than 12" apart with no baffles. Ref: Walkdown Checklist No. 2.
4-4.20	Small Rooms. Small room means a room with a smooth ceiling area not exceeding 800 sq ft (74.3 m^2) of light hazard occupancy classification.		Information Only
4-4.20.1	Within small rooms sprinklers may be located not over 9 ft (2.7 m) from any single wall; however, sprinkler spacing limitations of 4-2.1.1 and area limitations of 4-2.2.1.1 shall not be exceeded.	D	Not Applicable: Small room requirements are only allowable under light hazard occupancies. The sprinkler systems evaluated are ordinary and extra hazard occupancies. Ref: Drawings No. 9 - 42.
4-4.21	Theater Stages	W	Not Applicable: The type of hazard described in this code section is not found in safety related areas. Ref: Walkdown Checklist No. 1 & 2.
4-5	Sidewall Sprinklers. (See 3-16.2.4.)		
4-5.1	Distance Between Branch Lines and Sprinklers on Branch Lines.		Title
4-5.1.1	Distance Between Branch Lines. Rooms or bays having widths in excess of 15 ft up to 30 ft (4.6 m to 9.1 m) shall have sprinklers on two opposite walls or two opposite sides of	D	Not Applicable: Sidewall sprinkler protection in safety-related areas are used for special applications (Boric Acid Tanks) and are not

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	bays with spacing as required in Section 4-5 and sprinklers regularly staggered. Additional branch lines shall be provided in rooms over 30 ft (9.1 m) in width except where special sprinklers are used (see 4-1.1.3).		intended for area coverage. The use and spacing of sidewall sprinklers in this application was accepted by ANI. Ref: RFCDL # 50, RFC 02-2695.
4-5.1.2	Distance Between Sprinklers on Branch Lines. Sidewall sprinklers shall be located not more than 10 ft (3 m) apart on walls for ordinary hazard occupancies and not more than 14 ft (4.3 m) apart for light hazard occupancies.	D	Comply: See response to code section 4-5.1.1.
4-5.2.	Protection Area Limitations for Light Hazard Occupancy		Title
4-5.2.1	With noncombustible smooth ceiling the protection area per sprinkler shall not exceed 196 sq ft (18.2 m) with the distance between sprinklers on lines not in excess of 14 ft (4.3 m).	D	Not Applicable: There are no systems installed for light hazard occupancies. Ref: Drawings No. 9 - 42.
4-5.2.2	With combustible smooth ceiling sheathed with plasterboard, metal, or wood lath and plaster, the protection area per sprinkler shall not exceed 168 sq ft (15.6 m^2) with the distance between sprinklers on lines not in excess of 14 ft (4.3 m). When sheathing is combustible such as wood, fiberboard or other combustible material, the protection area per sprinkler shall not exceed 120 sq ft (11.1 m^2) with the distance between sprinklers on lines not in excess of 14 ft (4.3 m). Exception: Noncombustible smooth ceiling spacing is permitted beneath a noncombustible smooth ceiling attached directly to the underside of a combustible sprinklered concealed space.	D	Not Applicable: See response to code section 4-5.2.1.

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4-5.3	Protection Area Limitations for Ordinary Hazard Occupancy		Title
4-5.3.1	With noncombustible smooth ceiling the protection area allotted per sprinkler shall not exceed 100 sq ft (9.3 m^2) with the distance between sprinklers on lines not in excess of 10 ft (3 m).	D	Not Applicable: See response to code section 4-5.1.1.
4-5.3.2	With combustible smooth ceiling sheathed with plasterboard, metal, wood lath and plaster, wood fiberboard or other combustible material, the protection area shall not exceed 80 sq ft (7.4 m^2) per sprinkler with the distance between sprinklers on lines not in excess of 10 ft (3 m). Exception: Noncombustible ceiling spacing is permitted beneath a noncombustible smooth ceiling attached directly to the underside of a combustible sprinklered concealed space.	W	Not Applicable: This type of construction is not found in safety-related areas. Ref: Walkdown Checklist No. 1 & 2.
4-5.4	Position of Sidewall Sprinklers. Sprinkler deflectors shall be at a distance from walls and ceilings not more than 6 in. (152 mm) or less than 4 in. (102 mm), unless special construction arrangements make a different position advisable for prompt operation and effective distribution. Exception: Horizontal-type sidewall sprinklers may be positioned 6 to 12 in. (152 to 305 mm) below noncombustible ceilings when listed for these positions.	D	Not Applicable: See response to code section 4-5.1.1.

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	CHAPTER 5. TYPES OF SYSTEMS		Title
5-1	Wet-Pipe Systems		Title
5-1.1	Definition. A system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by a fire.		Information Only
5-1.2	Pressure Gages. Approved pressure gages conforming to 2-9.2.2 shall be installed in sprinkler risers, above and below each alarm check valve.	W	Comply: Gages are installed as required. Ref: Walkdown Checklist No. 1 & 2.
5-2	Dry-Pipe Systems		Title
5-2.1	Definition. A system employing automatic sprinklers attached to a piping containing air or nitrogen under pressure, the release of which as from the opening of a sprinkler permits the water pressure to open a valve known as a dry-pipe valve. The water flows into the piping system and out the opened sprinklers.		Information Only
5-2.2	Dry Pendent Sprinklers. Automatic sprinklers installed in the pendent position shall be of the approved dry pendent type if installed in an area subject to freezing. The use of standard pendent sprinklers installed on return bends is permitted when the sprinklers and the return bends are located in a heated area.	W	Not Applicable: There are no dry-pipe systems installed in areas subject to freezing. Ref: Walkdown Checklist No. 1 & 2.
5-2.3	Size of Systems		Title
5-2.3.1	Volume Limitations. Not more than 500-gal (1893-L) system capacity for gridded systems or not more than 750-gal (2839-L) system capacity for nongridded systems shall be controlled by one dry-pipe valve.	W	Not Applicable: See response to code section 5-2.2.

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	Exception No. 1: If check valves are installed in branches of the system to assist in more rapidly reducing the air pressure above the valve seat to the dry-pipe valve trip point, systems may exceed the above volume limitations, but no system branch shall have a capacity exceeding 400 gal (1514 L) for gridded systems nor 600 gal (2271 L) for nongridded systems, nor shall the total of a system branch plus common pipe exceed 500 gal (1893 L) for gridded systems nor 750 gal (2839 L) for nongridded systems. A hole 8 in. (3.2 mm) in diameter shall be drilled in the clapper of each check valve to permit equalization of air pressure among the various parts of the system. An approved indicating drain valve, connected by a bypass around each check valve, shall be provided as a means for draining the system. All check valves shall be located in heated enclosures to prevent the formation of ice. Check valves shall not be installed in any piping where they may interfere with the hydraulic characteristics of the system, such as in the branch lines or cross mains of a gridded system. Exception No. 2: Piping volume may exceed 500 gal (1893 L) for gridded systems or exceed 750 gal (2839 L) for nongridded systems if the system design is such that water is delivered to the inspector's test pipe in not more than 60 sec, starting at the normal air pressure on the system.		
5-2.4	Quick-Opening Devices		Title
5-2.4.1	When Required. Dry-pipe valves shall be provided with an approved quick-opening device where system capacity exceeds 350 gal (1325 L) for gridded systems or capacity exceeds 500 gal (1893 L) for nongridded systems.	W	Not applicable: See response to code section 5-2.2.

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5-2.4.2	The quick-opening device shall be located as close as practical to the dry-pipe valve. To protect the restriction orifice and other operating parts of the quick-opening device against submergence, the connection to the riser shall be above the point at which water (priming water and back drainage) is expected when the dry-pipe valve and quick-opening device are set, except where design features of the particular quick-opening device made these requirements unnecessary.	W	Not applicable: See response to code section 5-2.2.
5-2.4.3	A soft disc globe or angle valve shall be installed in the connection between the dry-pipe sprinkler riser and the quick-opening device provided to accelerate operation of dry-pipe valve.	W	Not applicable: See response to code section 5-2.2.
5-2.4.4	A check valve shall be installed between the quick-opening device and the intermediate chamber of the dry-pipe valve. If the quick-opening device requires pressure feedback from the intermediate chamber, a valve of the type which will clearly indicate whether it is opened or closed may be installed in place of that check valve. This valve shall be constructed so that is may be locked or sealed in the open position.	W	Not applicable: See response to code section 5-2.2.
5-2.4.5	An approved antiflooding device shall be installed in the connection between the dry-pipe sprinkler riser and the quick-opening device, unless the particular quick-opening device has built-in antiflooding design features.	W	Not Applicable: See response to code section 5-2.2.
5-2.5	Location and Protection of Dry-Pipe Valve		Title
5-2.5.1	The dry-pipe valve and supply pipe shall be protected against freeing and mechanical injury.	W	Not Applicable. See response to code section 5-2.2.

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5-2.5.2	Valve rooms shall be lighted and heated.	W	Not Applicable: See response to code section 5-2.2.
5-2.5.3	The supply for the sprinkler in the dry-pipe valve enclosure shall be from the dry side of the system.	W	Not Applicable: See response to code section 5-2.2.
5-2.5.4	Protection against accumulation of water above the clapper shall be provided for a low differential dry-pipe valve. This may be an automatic high water level signaling device or an automatic drain device.	W	Not Applicable: See response to code section 5-2.2.
5-2.6	Cold Storage Rooms		Title
5-2.6.1	Fittings for Inspection Purposes		Title
5-2.6.1.1	Fittings for inspection purposes shall be provided whenever a cross main connects to a riser or feed main. This may be accomplished by a blind flange on a fitting (tee or cross) in the by a blind flange on a fitting (tee or cross) in the riser or cross main or a flanged removable section 24 in. (610 mm) long in the feed main as shown in Figure 5-2.6.1(A). Such fittings in conjunction with the flushing connections specified in 3-8.2 would permit examination of the entire lengths of the cross mains. Branch lines may be examined by backing the pipe out of fittings.	W	Not Applicable: See response to code section 5-2.2.
5-2.6.1.2	Whenever feed mains change direction, facilities shall be provided for direct observation of every length of feed main within the refrigerated area. This may be accomplished by means of 2-in. capped nipples or blind flanges on fittings.	W	Not Applicable: See response to code section 5-2.2.
5-2.6.1.3	Fittings for inspection purposes shall be provided whenever a riser or feed main passes through a wall or floor from a warm room to a cold room. This may be accomplished at floor	W	Not Applicable: See response to code section 5-2.2.

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	penetrations by a tee with a blind flange in the cold room and at wall penetrations by a 24 in. (610 mm) flanged removable section in the warm room as shown in Figure 5-2.6.1(B).		
5-2.6.2	A local low air-pressure alarm shall be installed on sprinkler systems supplying freezer sections.	W	Not Applicable: See response to code section 5-2.2.
5-2.6.3	Piping in cold storage rooms shall be installed with pitch, as outlined in 3-11.1.3.	W	Not Applicable: See response to code section 5-2.2.
5-2.6.4	The air supply for dry-pipe systems in cold storage plants shall be taken from the freezers of lowest temperature or through a chemical dehydrator. Compressed nitrogen gas from cylinders may be used in place of air in dry-pipe systems to eliminate introducing moisture.	W	Not Applicable: See response to code section 5-2.2.
5-2.7	Air Pressure and Supply		Title
5-2.7.1	Maintenance of Air Pressure. Air or nitrogen pressure shall be maintained on dry-pipe systems throughout the year.	W	Not Applicable: See response to code section 5-2.2.
5-2.7.2	Air Supply. The compressed air supply shall be from a source available at all times and having a capacity capable of restoring normal air pressure in the system within 30 minutes, except for low differential dry-pipe systems where this time may be 60 minutes. Where low differential dry-pipe valves are used, the air supply shall be maintained automatically.	W	Not Applicable: See response to code section 5-2.2.
5-2.7.3	Air Filling Connection. The connection pipe from the air compressor shall not be less than 1/2 in. and shall enter the system above the priming water level of he dry-pipe valve. A check valve shall be installed in	W	Not Applicable: See response to code section 5-2.2.

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	this air line and a shutoff valve of renewable disc type shall be installed on the supply side of this check valve and shall remain closed unless filling the system.		
5-2.7.4	Relief Valve. An approved relief valve shall be provided between compressor and controlling valve set to relieve at a pressure 5 psi (0.3 bars) in excess of maximum air pressure which should be carried in the system.	W	Not Applicable: See response to code section 5-2.2.
5-2.7.5	Shop Air Supply. When the air supply is taken from a shop system having a normal pressure greater than that required for dry-pipe systems and an automatic air maintenance device is not used, the relief valve shall be installed between two control valves in the air line and a small air cock, which is normally left open, shall be installed in fitting below relief valve.	W	Not Applicable: See response to code section 5-2.2.
5-2.7.6	Automatic Air Compressor. When a dry-pipe system is supplied by an automatic air compressor or plant air system, any device or apparatus used for automatic maintenance of air pressure shall be of a type specifically approve for such service and capable of maintaining the required air pressure on the dry-pipe system. Automatic air supply to more than one dry-pipe system shall be connected to enable individual maintenance of air pressure in each system. A check valve or other positive back flow prevention device shall be installed in th air supply to each system to prevent air or water flow from one system to another.	W	Not Applicable: See response to code section 5-2.2.
5-2.7.7	Air Pressure to Be Carried. The air pressure to be carried shall be in accordance with the instruction sheet furnished with the dry-pipe	W	Not Applicable: See response to code section 5-2.2.

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	valve, when available, or 20 psi (1.4 bars) in excess of the calculated trip pressure of the dry-pipe valve, based on the highest normal water pressure of the system supply. The permitted rate of air leakage shall be as specified in 1-11.3.2.		
5-2.7.8	When used, nitrogen shall be introduced through a pressure regulator set to maintain system pressure in accordance with 5-2.7.7.	W	Not Applicable: See response to code section 5-2.2.
5-2.8	Pressure Gages. Approved pressure gages conforming to 2-9.2.2 shall be connected:	W	Not Applicable: See response to code section 5-2.2.
	(a) On the water side and air side of dry-pipe valve,		
	(b) At the air pump supplying the air receiver,		
	(c) At the air receiver,		
	(d) In each independent pipe from air supply to dry-pipe system, and		
	(e) At exhausters and accelerators.		
5-3	Pre-Action and Deluge Systems		Title
5-3.1	Definitions		Title
	Pre-Action System means a system employing automatic sprinklers attached to a piping system containing air that may or may not be under pressure, with a supplemental fire detection system installed in the same areas as the sprinklers; actuation of the fire detection system as from a fire opens a valve which permits water to flow into the sprinkler piping system and to be discharged from any sprinklers which may be open.		Information Only

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	Deluge System means a system employing open sprinklers attached to a piping system connected to a water supply through a valve which is opened by the operation of a fire detection system installed in the same areas as the sprinklers; when this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.		Information Only
5-3.2	Description. Pre-action and deluge systems are normally without water in the system piping and the water supply is controlled by an automatic valve operated by means of fire detection devices and provided with manual means for operations which are independent of the sprinklers. Systems may have equipment of the types described in (a) through (f) below. (See 5-3.5.2.) (a) Automatic sprinklers with both sprinkler piping and fire detection devices automatically supervised. (b) Automatic sprinkles with sprinkler piping and fire detection devices not automatically supervised. (c) Open sprinklers with only fire detection devices automatically supervised, (d) Open sprinklers with fire detection devices not automatically supervised, (e) Combination of open and automatic sprinklers with fire detection devices automatically supervised, (f) Combination of open and automatic sprinklers with fire detection devices not automatically supervised.		Information Only The pre-action sprinkler systems reviewed utilize supervised detection and sprinkler piping as described under item (a).

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5-3.3	General		Title
5-3.3.1	A supply of spare fusible elements for heat-responsive devices, not less than two of each temperature rating, shall be maintained on the premises for replacement purposes.	W	Comply. A walkdown showed that the stockroom carries an ample supply of spare fusible elements. Ref: Walkdown Checklist No. 1 & 2.
5-3.3.2	When hydraulic release systems are used, it is possible to water column the deluge valve or deluge-valve actuator if the heat-actuated devices (fixed temperature or rate-of-rise) are located at extreme heights above the valve. Refer to the manufacturer for height limitations of a specific deluge valve or deluge valve actuator.	W	Not Applicable: The pre-action systems use pneumatic release. Ref: Walkdown Checklist No. 2.
5-3.3.3	All new pre-action or deluge systems shall be tested hydrostatically as specified in 1-11.3.1. In testing deluge systems, plugs shall be installed in fittings and replaced with open sprinklers after the test is completed, or automatic sprinklers may be installed and he operating parts removed after test is completed.	D	Comply: All new pre-action systems were hydrostatically tested as required per specifications. Ref: Technical Data No. 10 Section 7.4.16.
		W	Not Applicable: The contractors access, AFW pump rooms, and the D.G. corridors are protected by wet pipe systems. Ref: Walkdown Checklist No. 1.
5-3.4	Location and Spacing of Fire Detection Devices. Spacing of fire detection devices other than automatic sprinklers shall be in accordance with their listing by testing laboratories or in accordance with manufacturer's specifications. When automatic sprinklers are used as detectors, the distance between detectors and the area per detector shall not exceed the maximum permitted for supression sprinklers as specified in 4-2.1 and 4-2.2; they shall be positioned in accordance with Section 4-3, but need not conform with the clearance requirements of 4-2.2. (See NFPA 72E, Standard for Automatic Fire Detectors.)	W, D	Comply: The pilot head detection system met spacing requirements of sections 4-2.1 and 4-2.2 and positioning requirements of section 4-3. Ref: Walkdown Checklist No. 1 & 2; Drawings No. 10 - 34.

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5-3.5	Pre-Action Systems		Title
5-3.5.1	All components of pneumatic, hydraulic or electrical pre-action systems shall be compatible.	W, D	Comply: Documents show that all components of the system are compatible for the pre-action systems in the auxiliary building. Ref: Walkdown Checklist No. 2; Technical Data No. 7; Drawing No. 10-14, 17-20, & 27-34.
		W	Not Applicable: The AFW pump room, D.G. corridors and contractors access are protected by wet pipe systems. Ref: Walkdown Checklist No. 1.
5-3.5.2	Size of Systems. Not more than 1,000 closed sprinklers shall be controlled by any one pre-action valve.	W, D	Comply: el 633' - 502 spklrs el 609' - 372 spklrs el 587' - 201 spklrs Ref: Walkdown Checklist No. 2; Drawing No. 10-12, 17, 18, 22-24 & 27-34.
		W	Not Applicable. See response to code section 5-3.5.1 for systems not applicable.
5-3.5.3	Supervision. Sprinkler piping and fire detection devices shall be automatically supervised when there are more than 20 sprinklers on the system.	W, D	Comply: Pre-action systems are supervised by air pressure. Ref: Walkdown Checklist No. 2; Technical Data No. 7 and No. 8 Section 2.6.6.
		W	Not Applicable. See response to code section 5-3.5.1 for not applicable systems.
5-3.5.4	Pipe Schedule. (See Sections 3-5, 3-6, 3-7 and Chapter 7.)		Information Only
5-3.5.5	Pendent Sprinklers. Automatic sprinklers on pre-action systems installed in the pendent	W	Not Applicable: See response to code section 3-10.1.1.

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	position shall be of the approved dry pendent type if installed in an area subject to freezing.		
5-3.6	Deluge Systems. The fire detection devices or systems shall be automatically supervised when there are more than 20 sprinklers on the system.	W	Not Applicable: There are no deluge systems in areas evaluated under this report. Ref: Walkdown Checklist No. 1 & 2.
5-3.7	Devices for Test Purposes and Testing Apparatus		Title
5-3.7.1	When fire detection devices installed in circuits are located where not readily accessible, an additional fire detection device shall be provided on each circuit for test purposes at an accessible location and shall be connected to the circuit at a point which will assure a proper test of the circuit.	W, D	Comply: For areas in the Auxiliary Building, credit is given for the energency release pull stations at the riser or in the hazard to simulate loss of pilot head pressure. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 7; Drawing No. 10 - 34. Not Applicable: See response to code section 5-3.5.1 for not applicable systems.
5-3.7.2	Testing apparatus capable of producing the heat or impulse necessary to operate any normal fire detection device shall be furnished to the owner of the property with each installation. Where explosive vapors or materials are present, hot water, steam or other methods of testing not involving an ignition source shall be used.	W, D	Comply: See response to code section 5-3.7.1.
5-3.7.3	Pressure Gages. Approved pressure gages conforming to 2-9.2.2 shall be installed as follows: (a) Above and below pre-action valve and below deluge valve. (b) On air supply to pre-action and deluge valves.	W W	Comply: Walkdowns show that pressure gauges were installed in the proper location. See response to code section 2-9.2.2. Ref: Walkdown Checklist No. 2. Not Applicable: See response to code section 5-3.5.1 for not applicable systems.

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5-4	Combined Dry-Pipe and Pre-Action Systems		Title
5-4.1	General	W	Not Applicable: The system described in requirements 5-4 - 5-4.6 is not found in safety related areas. Therefore, these sections will not be verified. Ref: Walkdown Checklist No. 1 & 2.
5-4.1.1	Definition		
	Combined Dry-Pipe and Pre-Action Sprinkler System. A system employing automatic sprinklers attached to a piping system containing air under pressure with a supplemental fire detection system installed in the same areas as the sprinklers; operation of the fire detection system, as from a fire, actuates tripping devices which open dry-pipe valves simultaneously and without loss of air pressure in the system. Operation of the fire detection system also opens approved air exhaust valves at the end of the feed main which facilitates the filling of the system with water which usually precedes the opening of sprinklers. The fire detection system also services as an automatic fire alarm system.	W	Not Applicable: See response to code section 5-4.1.
5-4.1.2	Combined automatic dry-pipe and pre-action systems shall be so constructed that failure of the fire detection system shall not prevent the system from functioning as a conventional automatic dry-pipe system.	W	Not Applicable: See response to 5-4.1.
5-4.1.3	Combined automatic dry-pipe and pre-action systems shall be so constructed that failure of dry-pipe system of automatic sprinklers shall not prevent the fire detection system from properly functioning as an automatic fire alarm system.	W	Not Applicable: See response to 5-4.1.
5-4.1.4	Provisions shall be made for the manual operation of the fire detection system at	W	Not Applicable: See response to 5-4.1.

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	locations requiring not more than 200 ft (61.0 m) of travel.		
5-4.1.5	Except as indicated in 5-2.2, automatic sprinklers installed in the pendent position shall be of the approved dry pendent type.	W	Not Applicable: See response to 5-4.1.
5-4.2	Dry-Pipe Valves in Combined Systems		Title
5-4.2.1	Where the system consists of more than 600 sprinklers or has more than 275 sprinklers in any fire area, the entire system shall be controlled through two 6-in. dry-pipe valves connected in parallel and shall feed into a common feed main. These valves shall be checked against each other. (See Figure 5-4.2.)	W	Not Applicable: See response to 5-4.1.
5-4.2.2	Each dry-pipe valve shall be provided with an approved tripping device actuated by the fire detection system. Dry-pipe valves shall be cross connected through a 1-in. pipe connection to permit simultaneous tripping of both dry-pipe valves. This 1-in. pipe connection shall be equipped with a gate valve so that either dry-pipe valve can be shut off and worked on while the other remains in service.	W	Not Applicable: See response to 5-4.1.
5-4.2.3	The check valves between the dry-pipe valves and the common feed main shall be equipped with 1/2-in. bypasses so that a loss of air from leakage in the trimmings of a dry-pipe valve will not cause same to trip until the pressure in the feed main is reduced to the tripping point. A gate valve shall be installed in each of these bypasses so that either dry-pipe valve can be completely isolated from the main riser or feed main and from the other.	W	Not Applicable: See response to 5-4.1.

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5-4.2.4	Each combined dry-pipe and pre-action system shall be provided with approved quick opening devices at the dry-pipe valves.	W	Not Applicable: See response to 5-4.1.
5-4.3	Air Exhaust Valves. One or more approved air exhaust valves of 2-in. or larger size controlled by operation of a fire detection system shall be installed at the end of the common feed main. (See Figure A-5-4.3). These air exhaust valves shall have soft seated globe or angle valves in their intakes; also, approved strainers shall be installed between these globe valves and the air exhaust valves.	W	Not Applicable: See response to 5-4.1.
5-4.4	Subdivision of System Using Check Valves		Title
5-4.4.1	Where more than 275 sprinklers are required in a single fire area, the system shall be divided into sections of 275 sprinklers or less by means of check valves. If system is installed in more than one fire area or story, not more than 600 sprinklers shall be supplied through any one check valve. Each section shall have a 1-1/4 in. drain on the system side of each check valve supplemented by a drum drip.	W	Not Applicable: See response to 5-4.1.
5-4.4.2	Section drain lines and drum drips shall be located in heated areas or inside of thermostatically controlled electrically heated cabinets of sufficient size to enclose drain valves and drum drips for each section. Drum drips shall also be provided for all low points except that heated cabinets need not be required for 20 sprinklers or less.	W	Not Applicable: See response to 5-4.1.
5-4.4.3	Air exhaust valves at end of feed main and associated check valves shall be protected against freezing.	W	Not Applicable: See response to 5-4.1.

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5-4.5	Time Limitation. The sprinkler system shall be so constructed and the number of sprinkler heads controlled shall be so limited that water shall reach the furthest sprinkler within a period of time not exceeding 1 minute for each 400 ft. (122 m) of common feed main from the time the heat-responsive system operates. Maximum time permitted not to exceed 3 minutes.	W	Not Applicable: See response to 5-4.1.
5-4.6	Inspector's Test Connection. The end section shall have an inspector's test connection as required for dry-pipe systems.	W	Not Applicable: See response to 5-4.1.
5-5	Antifreeze Systems		Title
5-5.1	Definition. Antifreeze system means a system employing automatic sprinklers attached to a piping system containing an antifreeze solution and connected to a water supply. The antifreeze solution, followed by water, discharges immediately from sprinklers opened by a fire.		Not Applicable: There are no systems with the components described in code section 5-5 - 5-5.6 in safety related areas. Therefore, these sections will not be verified. Ref: Walkdown Checklist No. 1 & 2.
5-5.2	Where Used. The use of antifreeze solutions SHALL be in conformity with any state or local health regulations.	W	Not Applicable: See response to 5-5.1.
5-5.3	Antifreeze Solutions		Title
5-5.3.1	When sprinkler systems are supplied by public water connections, the use of antifreeze solutions other than water solutions of pure glycerine (C.P. or U.S.P. 96.5 Percent Grade) or propylene glycol shall not be permitted. Suitable glycerine-water and propylene glycol-water mixtures are shown in Table 5-5.3.1.	W	Not Applicable: See response to 5-5.1.
5-5.3.2	If public water is not connected to sprinklers, the commercially available materials indicated in Table 5-5.3.2 are suitable for use in antifreeze solutions.	W	Not Applicable: See response to 5-5.1.

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5-5.3.3	An antifreeze solution shall be prepared with a freezing point below the expected minimum temperature for the locality. The specific gravity of the prepared solution shall be checked by a hydrometer with suitable scale.	W	Not Applicable: See response to 5-5.1.
5-5.4	Arrangement of Supply Piping and Valves. All permitted antifreeze solutions are heavier than water. At the point of contact (interface) the heavier liquid will be below the lighter liquid in order to prevent diffusion of water into the unheated areas. In most cases, this necessitates the use of a 5 ft. (1.5 m) drop pipe or U-loop as illustrated in Figure 5-5.4. The preferred arrangement is to have the sprinklers below the interface between the water and the antifreeze solution. If sprinklers are above the interface, a check valve with 1/32 in. (3.2 mm) hole in the clapper shall be provided in the U-loop. A water control valve and two small solution test valves shall be provided as illustrated in Figure 5-5.4. An acceptable arrangement of filling cup is also shown.	W	Not Applicable: See response to 5-5.1.
5-5.5	Testing. Before freezing weather each year, the solution in the entire system shall be emptied into convenient containers and brought to the proper specific gravity by adding concentrated liquid as needed. The resulting solution may be used to refill the system.	W	Not Applicable: See response to 5-5.1.
5-5.6	Small loading docks, covered platforms, ducts or similar small unheated areas may be protected by dry pendent sprinklers extending through the wall from wet sprinkler piping in an adjacent heated area, as shown in Figure 5-5.6.	W	Not Applicable: See response to 5-5.1.

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	Where possible, the dry pendent sprinkler shall extend down at a 45° angle. The width of the area to be protected shall not exceed 7-1/2 ft. (2.3 m). Sprinklers shall be spaced not over 12 ft. (3.7 m) apart.		
5-6	Automatic Sprinkler Systems with Nonfire Protection Connections		Title
5-6.1	Circulating Closed Loop Systems		Title
5-6.1.1	Definition. A circulating closed loop is one with nonfire protection connections to automatic sprinkler systems in a closed loop piping arrangement for the purpose of utilizing sprinkler piping to conduct water for heating or cooling. Water is not removed or used from the system, but only circulated through the piping system.	W	Not Applicable: There are no systems with non-fire protection connections (as described in 5-6 - 5-6.1.12) in safety related areas. Therefore, these sections will not be verified. Ref: Walkdown Checklist No. 1 & 2.
5-6.1.2	System Components		Title
5-6.1.2.1	Basic Principle. A circulating closed loop system is primarily a sprinkler system, and all provisions of this standard such as control valves, area limitation of a system, alarms, fire department connections, sprinkler spacing, etc. are to be satisfied. Exception: Items as specifically detailed within 5-6.1.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.2.2	Piping, fittings, valves and pipe hangers shall meet requirements specified in Chapter 3.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.2.3	A dielectric fitting shall be installed in junction where dissimilar piping materials are joined, e.g., copper to steel.	W	Not Applicable: See response to 5-6.1.1.

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	Exception: Dielectric fittings are not required in junction where sprinklers are connected to piping.		
5-6.1.2.4	It is not required that other auxiliary devices be listed for sprinkler service; however, these devices such as pumps, circulating pumps, heat exchangers, radiators, and luminaires shall be pressure rated at 175 or 300 psi (12.1 or 20.7 bars) (rupture pressure of 5 x rated water working pressure), to match required rating of sprinkler system components.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.2.5	Auxiliary devices shall incorporate materials of construction and be so constructed that they will maintain their physical integrity under fire conditions to avoid impairment to the fire protection system.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.2.6	Auxiliary devices where hung from the building structure shall be supported independently from the sprinkler portion of the system, following recognized engineering practices.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.3	Hydraulic Characteristics. Piping systems for attached heating and cooling equipment shall have auxiliary pumps or an arrangement made to return water to the piping system in order to assure the following: (a) Water for sprinklers shall not be required to pass through heating or cooling equipment. At least one direct path shall exist for water flow from the sprinkler water supply to every sprinkler. Pipe sizing in the direct path shall be in accordance with design requirements of this standard.	W	Not Applicable: See response to 5-6.1.1.

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	(b) No portions of the sprinkler piping shall have less than the sprinkler system design pressure regardless of the mode of operation of the attached heating or cooling equipment.		
	(c) No portion of the sprinkler piping shall have less than the sprinkler system design pressure regardless of the mode of operation of the attached heating or cooling equipment.		
	(d) Shut-off valves and a means of drainage shall be provided on piping to heating or cooling equipment at all points of connection to sprinkler piping and shall be installed in such a manner as to make possible repair or removal of any auxiliary component without impairing the serviceability and response to the sprinkler system. All auxiliary components including strainer shall be installed on the auxiliary equipment side of the shut-off valves.		
5.6.1.4	Water Temperature		Title
5-6.1.4.1	Maximum. In no case shall maximum water temperature flowing through the sprinkler portion of the system exceed 120°F (49°C). Protective control devices listed for this purpose shall be installed to shut down heating or cooling systems when temperature of water flowing through the sprinkler portion of the system exceeds 120°F (49°C). When water temperature exceeds 100°F (37.8°C), intermediate or higher temperature rated sprinklers shall be used.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.4.2	Minimum. Precaution shall be taken to ensure that temperatures below 40°F (4.4°C) will not be permitted.	W	Not Applicable: See response to 5-6.1.1.

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5-6.1.5	Obstruction to Discharge. Automatic sprinklers shall not be obstructed by auxiliary devices, piping, insulation, etc., from detecting fire or from proper distribution of water.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.6	Valve Supervision. Position of all valves controlling sprinkler system (post indicator, main gate, sectional control) shall be supervised open by one of the following methods: (a) Central station, proprietary, or remote station alarm service. (b) Local alarm service, which will cause the sounding of an audible signal at a constantly attended point.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.7	Signs. Caution signs shall be attached to all controlling sprinkler valves. The caution sign shall be worded as follows: "This valve controls fire protection equipment. Do not close until after fire has been extinguished. Use auxiliary valves when necessary to shut supply to auxiliary equipment. CAUTION: Automatic alarm will be sounded if this valve is closed."	W	Not Applicable: See response to 5-6.1.1.
5-6.1.8	Water Additives. Materials added to water shall not adversely affect the fire fighting properties of the water and shall be in conformity with any state or local health regulations. Due care and caution shall be given to the use of additives which may remove or suspend scale from older piping system. When additives are necessary for proper system operation, due care shall be taken to ensure additives are replenished after alarm testing or whenever water is removed from the system.	W	Not Applicable: See response to 5-6.1.1.

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5-6.1.9	Water Flow Detection. The supply of water from sprinkler piping through auxiliary devices, circulatory piping, and pumps shall not under any condition or operation, transient or static, cause false sprinkler water flow signals.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.9.1	Sprinkler water flow signal shall not be impaired when water is discharged through opened sprinkler or through Inspector's Test Connection while auxiliary equipment is in any mode of operation (on, off, transient, stable).	W	Not Applicable: See response to 5-6.1.1.
5-6.1.10	Working Plans. Working plans shall be prepared and submitted in accordance with Section 1-9. Special symbols shall be used and explained for auxiliary piping, pumps, heat exchangers, valves, strainers and the like, clearly distinguishing those devices and piping runs from those of the sprinkler system. Model number, type and manufacturer's name shall be identified for each piece of auxiliary equipment.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.11	Testing		Title
5-6.1.11.1	All sprinkler system and auxiliary system components shall be hydrostatically tested in accordance with 1-11.3.	W	Not Applicable: See response to 5-6.1.1.
5-6.1.11.2	Sprinkler system discharge tests shall be conducted using system test pipes described in 3-9.1. Pressure gages shall be installed at critical points and readings taken under various modes of auxiliary equipment operation. Water flow alarm signals shall be responsive to discharge of water through system test pipes while auxiliary equipment is in each of the possible modes of operation.	W	Not Applicable: See response to 5-6.1.1.

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5-6.1.12	Contractor's Material and Test Certificate. Additional information shall be appended to the Contractor's Material and Test Certificate described in Section 1-12 as follows: (a) Certification that all auxiliary devices, such as heat pumps, circulating pumps, heat exchangers, radiators and luminaires have a pressure rating of 175 or 300 psi (12.1 or 20.7 bars). (b) All components of sprinkler system and auxiliary system have been pressure tested as a composite system in accordance with 1-11.3, Hydrostatic Tests. (c) Water flow tests have been conducted and water flow alarms have operated while auxiliary equipment is in each of the possible modes of operation. (d) With auxiliary equipment tested in each possible mode of operation and with no flow from sprinklers or test connection, water flow alarm signals did not operate. (e) Excess temperature controls for shutting down the auxiliary system have been properly field tested.	W	Not Applicable: See response to 5-6.1.1.

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	CHAPTER 6. OUTSIDE SPRINKLERS FOR PROTECTION		Not Applicable: There are no systems for outside exposure protection for safety related areas. Therefore, Chapter 6 will not be verified and is omitted.

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	CHAPTER 7. HYDRAULICALLY DESIGNED SPRINKLER SYSTEMS	Title	Note: Zone 17E of the AFW pump room area, which was sized to an extra hazard pipe schedule, and the contractors access area which was sized to an ordinary hazard pipe schedule, will not be addressed in the remaining sections.
7-1	General	Title	
7-1.1	Definition	Title	
7-1.1.1	A hydraulically designed sprinkler system is one in which pipe sizes are selected on a pressure loss basis to provide a prescribed density [gal per min per sq ft $(L/min)/m^2$] distributed over a specified area. This permits the selection of pipe sizes in accordance with the characteristics of the water supply available. The stipulated design density and area of application will vary with occupancy hazard.	Information Only	
7-1.1.2	The design basis for such a system or addition to an existing system supersedes the rules in the sprinkler standard governing pipe schedules, except that all systems continue to be limited by area, and pipe sizes shall be no less than 1 in. nominal for ferrous piping and 3/4 in. nominal for copper tubing. The size of pipe, number of sprinklers per branch line, and number of branch lines per cross main are otherwise limited only by the available water supply. However, sprinkler spacing and all other rules covered in this and other applicable standards shall be observed.	Information Only	

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7-1.2	The installer shall properly identify a hydraulically designed automatic sprinkler system by a permanently attached placard indicating the location, and the basis of design (discharge density over designed area of discharge, including gallons per minute and residual pressure demand at base of riser). Such signs shall be placed at the controlling alarm valve, or dry-pipe valve, for the system containing the hydraulically designed layout.	W	Does Not Comply: Placards or signs indicating a hydraulically designed system are not provided as verified by walkdowns. Ref: Walkdown Checklist No. 1 & 2.
7-2	Information Required		Title
7-2.1	Basic Design Information. Basic design criteria for hydraulically designed sprinkler systems shall be obtained from this or other applicable standards. Where no standards exist, the authority having jurisdiction shall be consulted.	D	Comply: Specification requires that all hydraulic calculations be submitted to the owner and authority having jurisdiction for approval. Ref: Technical Data No. 10 Section 6.3.
7-2.2	Sprinkler System Requirements. The following information shall be included when applicable: (a) Area of water application . . . . . sq. ft. (b) Minimum rate of water application (density). . . gpm/sq. ft. (c) Area per sprinkler . . . . sq. ft. (d) Allowance for inside hose and outside hydrants . . . . gpm (e) Allowance for in-rack sprinklers . . . gpm	D	Comply: The specifications require that all information in this code section be included, when applicable. Ref: Technical Data No. 10 Section 7.1.

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7-2.3	Water Supply Information. The following information shall be included: water flow data with existing or proposed water supply, dead end or circulating: (a) Location and elevation of static and residual test gage with relation to the riser reference point (b) Flow location (c) Static pressure, psi (e) Flow, gpm (f) Date (g) Time (h) Test conducted by or information supplied by . . .	D	Comply: Specifications provided maximum hydraulic demand for support by plant fire protection water system. Ref: Technical Data No. 10 Section 7.1.
7-2.4	Information Required on the Drawings		Title
7-2.4.2	Hyrdaulic Reference Points. Reference points may be shown by a number and/or letter designation and shall correspond with comparable reference points shown on the hydraulic calculation sheets.	D	Comply: The information required by this code section appear on drawings. Ref: Technical Data No. 8; Drawing No. 10-34, 40 & 41.
7-2.4.3	Sprinklers. Description of sprinklers used.	D	Comply: Sprinkler types were listed on the drawings. Ref: Drawings No. 9 - 42.
7-2.4.4	System Design Criteria. The minimum rate of water application (density), the design area of water application in rack sprinkler demand, and the water required for hose streams both inside and outside shall be included.	D	Does Not Comply: The system design criteria does not appear on the drawings. Ref: Technical Data No. 8; Drawing 10-34, 40 & 41.

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7-2.4.5	Actual Calculated Requirements. The total quantity of water and the pressure required shall be noted at a common reference point for each system.	D	Comply: See response to code section 7-2.4.2.
7-2.4.6	Elevation Data. Relative elevations of sprinklers, junction points and supply or reference points shall be noted.	D	Comply: See response to code section 7-2.4.2.
7-3	Data Sheets and Abbreviations		Title
7-3.1	General. Hydraulic calculations shall be prepared on form sheets that include a summary sheet, detailed work sheets, and a graph sheet. (See copy of typical forms, Figures A-7-3.3 and A-7-3.4.)	D	Information Only: Responses to this code section are covered under code sections 7-3.2 thru 7-3.5.
7-3.2	Summary Sheet. The summary sheet shall contain the following information, when applicable: (a) Date (b) Location (c) Name of owner and occupant (d) Building number or other identification (e) Description of hazard (f) Name and address of contractor or designer (g) Name of approving agency (h) System design requirements 1. Design area of water application . . . . sq. ft.	D	Does Not Comply: All information required by this code section is included in the hydraulic calculations except the area per sprinkler data. Ref: Technical Data No. 3 & 9.

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	2. Minimum rate of water application (density) . . . gpm per sq. ft.		
	3. Area per sprinkler . . . sq. ft.		
	(i) Total water requirements as calculated including allowance for inside hose and outside hydrants		
	(j) Water supply information.		
7-3.3	Detailed Work Sheets. Detailed work sheets (for sample work sheet, refer to Figure A-7-3.3) or computer printout sheets shall contain the following information:	D	Comply: The information required by this code section is included in the hydraulic calculations. Ref: Technical Data No. 3 & 9.
	(a) Sheet number		
	(b) Sprinkler description and discharge constant (K)		
	(c) Hydraulic reference points		
	(d) Flow in gpm		
	(e) Pipe size		
	(f) Pipe lengths, center to center fittings		
	(g) Equivalent pipe lengths for fitting and devices		
	(h) Friction loss in psi per ft of pipe		
	(i) Total friction loss between reference points		
	(j) In rack sprinkler demand		

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	(k) Elevation head in psi between reference points		
	(l) Required pressure in psi at each reference point		
	(m) Velocity pressure and normal pressure if included in calculations		
	(n) Note to indicate starting points, reference to other sheets or to clarify data shown		
	(o) Sketch to accompany gridded system calculations to indicated flow quantities and directions for lines with sprinklers operating in the remote area. [See Figure A-7-3.3 (o).]		
7-3.4	Graph Sheet. Water supply curves and system requirements, plus hose and in rack sprinkler demand when applicable, shall be plotted on semi-logarithmic graph paper ($Q^{1.85}$) so as to present a graphic summary of the complete hydraulic calculation.	D	Does Not Comply: Graph sheets are not provided in any of the calculations. Ref: Technical Data No. 3 & 9.
7-3.5	Abbreviations and Symbols. The following standard abbreviations and symbols shall be used on the calculation form: Symbol or Abbreviation — Item P — Pressure in psi gpm — U.S. Gallons per minute q — Flow increment in gpm to be added at a specific location	D	Comply: Standard abbreviations and symbols were used for each calculation. Ref: Technical Data No. 3 & 9.

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	Q — Summation of flow in gpm at a specific location		
	P_t — Total pressure in psi at a point in a pipe		
	P_f — Pressure loss due to friction between points indicated in location column		
	P_e — Pressure due to elevation difference between indicated points. This can be a plus value or a minus value. Where minus, the (-) shall be used; where plus, no sign need be indicated.		
	P_v — Velocity pressure in psi at a point in a pipe		
	P_n — Normal pressure in psi at a point in a pipe		
	E — 90° Ell		
	EE — 45° Ell		
	Lt.E — Long Turn Elbow		
	Cr — Cross		
	T — Tee - flow turned 90 degrees		
	GV — Gate Valve		
	BV — Butterfly Valve		
	Del V — Deluge Valve		
	DPV — Dry-Pipe Valve		

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	ALV Alarm Valve		
	CV Swing Check Valve		
	WCV Butterfly (Wafer) Check Valve		
	St Strainer		
	psi Pounds per square inch		
	v Velocity of water in pipe in feet per second		
7-4	Calculation		Title
7-4.1	Formulas		Title
7-4.1.1	Friction Loss Formula. Pipe friction losses shall be determined on the basis of Hazen and Williams formula. $$P = \frac{4.52\ Q^{1.85}}{C^{1.85}\ d^{4.87}}$$ where p is the frictional resistance in pounds pressure per square inch per feet of pipe, Q is the gallons per minute flowing and d is the actual internal diameter of pipe in inches with C as the friction loss coefficient. For SI Units: $P_m = 6.05 \times \frac{Q_m^{1.85}}{C^{1.85}\ d_m^{4.87}} \times 10^5$ P_m is the functional resistance in bars per meter of pipe, Q_m is the flow in L/min and d_m is the actual internal diameter in mm with C as the function loss coefficient.	D	Comply: Correct formulas were used for the calculations. Ref: Technical Data No. 9.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results. (List results and reference details in calculations, sketches, etc., as required)
7-4.1.2	Velocity Pressure Formula. Velocity pressure shall be determined on the basis of the formula $P_v = 0.001\,123 \cdot Q^2/D^4$ P_v = velocity pressure psi. where: Q = flow in gpm D = the inside diameter in inches For SI units: 1 in. = 25.4 mm; 1 gal = 3.785 L; 1 psi = 0.0689 bars.	D	Not Applicable: System calculations did not include velocity pressure. (See code section 7-4.3.1.7) Ref: Technical Data No. 9.
7-4.1.3	Normal pressure P_n shall be determined on the basis of the formula $P_n = P_t - P_v$ where: P_t = total pressure in psi (bars) P_v = velocity pressure in psi (bars)	D	Comply: See response to code section 7-4.1.1 and 7-4.1.2.
7-4.1.4	Hydraulic Junction Points. For gridded systems only, pressures at hydraulic junction points shall balance within 0.5 psi (0.03 bars). The highest pressure at the junction point shall be carried into the calculations.	W, D	Not Applicable: There are no gridded systems evaluated in this report. Ref: Walkdown Checklist No. 1 & 2; Technical Data No. 9.
7-4.2	Equivalent Pipe Lengths of Valves and Fittings		Title
7-4.2.1	Table 7-4.2 shall be used to determine the equivalent length of pipe fittings and devices unless manufacturer's test data indicate other factors are appropriate. For saddle type fittings having friction loss greater than shown in Table 7-4.2, the increased friction loss shall be included in hydraulic calculations.	D	Comply: The proper values for fitting equivalent lengths were used. Ref: Technical Data No. 9.

REV	BY	DATE	CHECKED	DATE
0	KM	9/26/88	DWK	10/28/88

IMPELL CORPORATION

NFPA 13 - Code Compliance Verification
Checklist D. C. Cook Units 1 & 2

JOB NO 0120-108-1375
CALC NO 0120-108-004

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1983
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
7-4.2.2	Use Table 7-4.2 with Hazen and Williams C = 120 only. For other values of C, the values in Table 7-4.2 shall be multiplied by the factors indicated below:	D	Comply: See response to code section 7-4.2.1.
	Value of C: 100 / 120 / 130 / 140 / 150 Multiplying Factor: 0.713 / 1.00 / 1.16 / 1.33 / 1.51		
	(This is based upon the friction loss through the fitting being independent of the C factor available to the piping.)		
7-4.2.3	Specific friction loss values or equivalent pipe lengths for alarm valves, dry-pipe valves, deluge valves, strainers and other devices shall be made available to the authority having jurisidiction.	D	Comply: See response to code section 7-4.1.1.
7-4.3	Calculation Procedure		Title
7-4.3.1	For all systems the design area shall be the hydraulically most demanding "rectangular area" having a dimension parallel to the branch lines equal to 1.2 times the square root of the area of sprinkler operation corresponding to the density used. This may include sprinklers on both sides of the cross main. Any fractional sprinkler shall be carried to the next higher whole sprinkler. Exception No. 1: Where the design area under consideration consists of a corridor protected by one row of sprinklers, the maximum number of sprinklers that need be calculated is 5.	D	Comply: The correct calculation procedure was used for the calculations. Ref: Technical Data No. 9.

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1983
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	Exception No. 2: In systems having branch lines with an insufficient number of sprinklers to fulfill the 1.2 (insert radical sign). A requirement, the design area shall be extended to include sprinklers on adjacent branch lines supplied by the same cross main.		
7-4.3.1.1	For gridded systems, the designer shall verify that the hydraulically most demanding area is being used. A minimum of two additional sets of calculations shall be submitted to demonstrate peaking of demand area friction loss when compared to areas immediately adjacent on either side along the same branch lines. Exception: Computer programs which show the peaking of the demand area friction loss shall be acceptable based on a single set of calculations.	W, D	Not Applicable: See response to code code section 7-4.1.4.
7-4.3.1.2	System piping shall be hydraulically designed using design densities and areas of operation in accordance with Table 2-2-1 (B) as required for the occupancies involved. (a) The density shall be calculated on the basis of floor area. The area covered by any sprinkler for use in hydraulic design and calculations shall be determined as follows: 1. Along Branch Lines. Determine distance to next sprinkler (or to wall in case of end sprinkler on branch line) upstream and downstream. Choose larger of either twice the distance to the wall or instance to the next sprinkler. Call this "S."	D	Comply: See response to code section 2-2.1.2.1. The defined hazard areas used for the density determination is based on requirements specified by ANI in their "Basic Fire Protection for Nuclear Power Plants" Guidelines.

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0	KM	11/22/88	[illegible]	11/29/88

IMPELL CORPORATION

NFPA 13 - Code Compliance Verification
Checklist D. C. Cook Units 1 & 2

JOB NO 0120-108-1375
CALC NO 0120-108-004

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1983
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	2. Between Branch Lines. Determine perpendicular distance to branch lines (or to wall in case of the last branch line) on each side of branch on which the subject sprinkler is positioned. Choose the larger of (1) the larger distance to the next branch line, or (2) in the case of the last branch line, twice the distance to the wall. Call this "L." 3. Design Area for Sprinkler = S X L. Exception: This does not apply to small rooms. (See 4-4.20.) (b) When sprinklers are installed above and below a ceiling and such sprinklers are supplied from a common set of branch lines, the branch lines and supply shall be calculated to supply the largest area of operation either above or below. (c) When sprinklers are installed above and below temporary obstructions such as overhead doors and such sprinklers are supplied from a common set of branch lines, the branch lines and the supply shall be calculated to supply the sprinklers both above and below the temporary obstruction.		
7-4.3.1.3	Each sprinkler in the design area and the remainder of the hydraulically designed system shall discharge at a flow rate at least equal to the stipulated minimum water application rate (density). Begin calculations at the hydraulically most remote sprinkler. Discharge at each sprinkler shall be based on the calculated pressure at that sprinkler.	D	Comply: See response to code section 7-4.3.1 and 7-4.3.1.2.

REV	BY	DATE	CHECKED	DATE
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NFPA 13 - Code Compliance Verification
Checklist D. C. Cook Units 1 & 2

IMPELL CORPORATION

JOB NO 0120-108-1375
CALC NO 0120-108-004

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1983
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
7-4.3.1.4	Calculate pipe friction loss in accordance with the Hazen and Williams formula with "C" values from Table 7-4.3.1.4. (a) Include pipe, fittings, and devices such as valves, meters, and strainers and calculate elevation changes which affect the sprinkler discharge. (b) Calculate the loss for a tee or a cross where flow direction change occurs based on the equivalent pipe length of the piping segment in which the fitting is included. The tee at the top of a riser nipple shall be included in the branch line; the tee at the base of a riser nipple shall be included in the riser nipple; and the tee or cross at a cross main-feed main junction shall be included in the cross main. Do not include fitting loss for straight through flow in a tee or cross (c) Calculate the loss of reducing elbows based on the equivalent feet value of the smallest outlet. Use the equivalent feet value for the "standard elbow" on any abrupt ninety-degree turn, such as the screw-type pattern. Use the equivalent feet value for the "long turn elbow" on any sweeping ninety-degree turn, such as a flanged, welded or mechanical joint-elbow type. (See Table 7.4.2.) (d) Friction loss shall be excluded for the fitting directly connected to a sprinkler.	D	Comply: See response to code section 7-4.3.1.

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IMPELL CORPORATION

NFPA 13 - Code Compliance Verification
Checklist D. C. Cook Units 1 & 2

JOB NO 0120-108-1375
CALC NO 0120-108-004

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1983
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
7-4.3.1.5	Orifice plates or sprinklers of different orifice sizes shall not be used for balancing the system, except for special use such as exposure protection, small rooms or enclosure or directional discharge. (See 4-4.20 for definition of small rooms.)	W, D	Comply: All sprinklers have standard 1/2" orifices. Ref: Technical Data No. 9.
7-4.3.1.6	Sprinkler discharge in closets, washrooms, and similar small compartments requiring only one sprinkler may be omitted from hydraulic calculations within the area of application. [Sprinklers in these small compartments shall, however, be capable of discharging minimum densities in accordance with Table 2-2.1(B).] Exception: This requirement shall not apply when areas of application are selected in accordance with 2-2.1.2.7.	W	Not Applicable: Conditions described in this code section do not exist. Ref: Walkdown Checklist No. 1 & 2.
7-4.3.1.7	Velocity pressure P_v may or may not be included in the calculations at the discretion of the designer. If velocity pressures are used, they shall be used on both branch lines and cross mains where applicable.	D	Comply: Velocity pressure method was not used in the calculations. Ref: Technical Data No. 9.
7-4.3.2	Minimum operating pressure of any sprinkler shall be 7 psi (0.5 bar).	D	Comply: See response to code section 7-4.3.1.

REV 0 | BY KAJ | DATE 4/28/88 | CHECKED SWH | DATE 4/28/88

IMPELL CORPORATION

NFPA 13 - Code Compliance Verification
Checklist D. C. Cook Units 1 & 2

JOB NO 0120-108-1375
CALC NO 0120-108-004

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1983
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 8. HIGH-RISE BUILDINGS		Chapter Omitted - does not apply.

REV	BY	DATE	CHECKED	DATE
0	KAJ	4/26/89	[illegible]	4/28/89

IMPELL CORPORATION

NFPA 13 - Code Compliance Verification
Checklist D. C. Cook Units 1 & 2

JOB NO 0120-108-1375
CALC NO 0120-108-004

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CALCULATION/PROBLEM COVER SHEET

Calculation/Problem No: 0120-108-005

Title: NFPA 14 CODE COMPLIANCE VERIFICATION CHECKLIST

Client: AEP **Project:** CODE COMPLIANCE REVIEW

Job No: 0120-108

Design Input/References:

SEE SECTION 5.0

Assumptions: SEE SECTION 2.0, ALSO SEE PROJECT INSTRUCTION PI-FP-01, REVISION 1, CONDUCTING AND DOCUMENTING NFPA CODE COMPLIANCE REVIEWS. SEE IMPELL REPORT 09-0120-0123, CODE COMPLIANCE SUMMARY REPORT.

Method: SEE SECTION 3.0. ALSO SEE PROTECT INSTRUCTION PI-FP-01, REVISION 1.

Remarks: PAGES 7 AND 8 IDENTIFY THE ZONES EVALUATED UNDER THE REQUIREMENTS OF THE 1971 EDITION. PAGE A1 IDENTIFIES THE ZONES EVALUATED UNDER THE REQUIREMENTS OF THE 1978 EDITION. PAGE B1 IDENTIFIES THE ZONES EVALUATED UNDER THE REQUIREMENTS OF THE 1986 EDITION.

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	E Klemsorg	5/16/88

EDS 0008 9/8

APPENDIX A [PAGE A1 – A17]; APPENDIX B [PAGE B1 – B

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

The intent of the standpipe service at the plant was to provide Class II service for those stations which have a single 1-1/2 inch hose valve and Class III service at those stations which have both 2-1/2 inch and 1-1/2 inch hose valves.

3.0 METHODOLOGY

Reference Section 2.1.1 of Impell Project Instruction PI-FP-01, Revision 1.

All maintenance issues noted during the walkdown phase of the project have been identified in the CCVC's, but are not considered deviations due to the limited number.

Justifications for deviations and open items identified in the CCVC's are detailed in Impell Technical Report No. 09-0120-0123.

The basis for the review of the fire protection systems against a specific code edition was determined by reviewing the systems against the code edition in effect during the time of the original system installation. Systems that were installed under modifications that took place after the original installation would be reviewed under the code edition in effect during the period of the modification installation.

Code sections of subsequent editions that provided typical requirements of the initial code edition reviewed, were verified under the initial code edition requirements. Code sections of subsequent editions that provided significant code requirement changes from the initial code edition, were reviewed under the subsequent code edition.

The hose stations reviewed were based on the hose stations required for use in the fire zones within our scope of the evaluation. These hose stations are detailed in the Fire Hazards Analysis, Revision 1.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

5.0 REFERENCES

Ref. No.	Document Number	Title	Revision No./Date	
		Walkdown Verification Checklists		
1	0120-108-005A	Unit 1 - '71, Elev. 573'	0	12/22/87
2	0120-108-005B	Unit 1 - '71, Elev. 587'	0	12/22/87
3	0120-108-005C	Unit 1 - '71, Elev. 609'	0	12/22/87
4	0120-108-005D	Unit 1 - '71, Elev. 620'	0	12/22/87
5	0120-108-005E	Unit 1 - '71, Elev. 633'	0	12/22/87
6	0120-108-005F	Unit 2 - '71, Elev. 573'	0	12/22/87
7	0120-108-005G	Unit 2 - '71, Elev. 587'	0	12/22/87
8	0120-108-005H	Unit 2 - '71, Elev. 609'	0	12/22/87
9	0120-108-005J	Unit 2 - '71, Elev. 620'	0	12/22/87
10	0120-108-005K	Unit 2 - '71, Elev. 633'	0	12/22/87
11	0120-108-005L	Units 1 & 2 - '71, Elev. 573'	0	12/22/87
12	0120-108-005M	Units 1 & 2 - '71, Elev. 587'	0	12/22/87
13	0120-108-005N	Units 1 & 2 - '71, Elev. 609'	0	12/22/87
14	0120-108-005O	Units 1 & 2 - '71, Elev. 650'	0	12/22/87
15	0120-108-005P	Unit 1 - '78, Elev. 620'	0	12/22/87
16	0120-108-005Q	Units 1 & 2 - '78, Elev. 591'	0	12/22/87
17	0120-108-005R	Units 1 & 2 - '78, Elev. 650'	0	12/22/87
18	0120-108-005S	Unit 1 - '86, Elev. 591'	0	12/22/87
19	0120-108-005T	Unit 1 - '86, Elev. 625'	0	12/22/87
20	0120-108-005U	Unit 2 - '86, Elev. 591'	0	12/22/87
21	0120-108-005V	Unit 2 - '86, Elev. 625'	0	12/22/87

5.0 REFERENCES

Ref. No.	Document Number	Title	Revision No./Date
		Procedures	
1	12QHP 4030 STP.007	Monthly Visual Inspection of the Plant Fire Hose Standpipe Connections	1 02/21/86
2	12QHP 4030 STP.006	Visual Inspection and Re-Rack of Fire Hoses	0 11/06/85
3	12QHP 4030 STP.003	Standpipe Operability Test	0 07/18/85
		Technical Data	
1	DCCPM102QCS	Shop and Field Fabrication and Erection	4 05/24/83
2	DCCFP103QCS	Fire Detection/Suppression Equipment and Systems	0 09/10/79
3	DCCPM104QCS	Material Specification	4 11/09/72
4	DCCPV110QCS-F	Shop and Field Fabrication and Erection of Fire Protection Piping	0 10/16/85
5	SD-DCC-FP103	Fire Protection System Misc. System Description	3 08/16/87 Draft
6	RFC-DC-12-2740	Add Hose Stations Modification Packet	0 02/12/87
7	RFC-DC-12-2229	Add Water Hose Reels & Hose Station Modification Packet	0-3 03/27/87
8	RFC-DC-12-2621	Add Hose Stations Modification Packet	0&1 02/13/87
9	Catalog Page 25	Fire End Fog 1 1/2" Nozzles	-- --

5.0 REFERENCES

Ref. No.	Document Number	Title	Revision No./Date
10	Catalog Page 78	Fire End Hose Reels for 1 1/2" Hose	-- --
11	Catalog Page 23	1 1/2" Crocker Standard Fire Hose #44-APS	-- 1978
12	Catalog Page 26	Crocker Standard Angle Valves 1 1/2" & 2 1/2"	-- 1978
13	--	Phoenix Contractors Quality Assurance Program	0 01/10/77
14	F125-670	Jamesbury Valve Catalog	-- 06/70
15	ANSI B-31.1	Power Piping Code	-- 1980
16	Pages 17-53 and 17-54	Fire Protection Handbook	16th 1986 Edition
		Licensing Documents	
1	I&MED D.C. Cook Units 1 & 2	Response to Appendix A to BTP APCSB 9.5-1	0 01/31/77
2	Docket #50-315 & 316 DPR 58 & 74	Fire Hazard Analysis D.C. Cook Units 1 & 2	1 01/30/87
		Drawings	
1	12-5152D	Flow Diagram Fire Protection - Water	0 10/06/86
2	1-5152B	Flow Diagram Fire Protection - Water	2 08/25/87
3	1-5152C	Flow Diagram Fire Protection - Water	0 10/06/86
4	12-5266-2	Fire Facilities Plan Below the Basement	2 08/17/87

5.0 REFERENCES

Ref. No.	Document Number	Title	Revision No./Date
5	12-5267-3	Fire Facilities Basement Plan	3 08/17/87
6	12-5268-2	Fire Facilities Mezzanine Floor	2 08/17/87
7	12-5268A-2	Fire Facilities Cable Vault Plans	2 08/17/87
8	12-5269-2	Fire Facilities Turbine Building	2 08/17/87
9	12-5270-2	Fire Facilities Reactor Building	2 08/17/87
10	12-5152A-1	Flow Diagram Fire Protection - Water	1 12/87
11	12-5152-1	Flow Diagram Fire Protection - Water	1 02/20/87
12	Sheet 17	Phoenix Contractor As-Built Drawings for Hose Stations	0 10/09/79
13	Sheet 18	Phoenix Contractor As-Built Drawings for Hose Stations	0 10/09/79
14	Sheet 20	Phoenix Contractor As-Built Drawings for Hose Stations	0 16/17/80

NFPA 14 - 1971 EDITION

STANDPIPE & HOSE SYSTEMS

This review includes the following hose stations:

FIRE ZONE	HOSE STATION	ELEVATION	ORIGINAL INSTALLATION	MODIFICATION NO.	MODIFICATION DATE
2	2A	569' 6"	2/71	---	---
2	3	569' 6"	2/71	---	---
2	3A	569' 6"	2/71	---	---
1	1	573'	2/71	---	---
5	4	587'	2/71	---	---
5	5	587'	2/71	---	---
6N	37	587'	2/71	---	---
6S	6	587'	2/71	---	---
79	32	587'	2/71	---	---
85	7	587'	2/71	---	---
84	10	591'	2/71	---	---
22	214	591'	---	12-2740	11/85
85	12	591'	2/71	---	---
12	222	591'	---	12-2740	11/85
79	31	591'	2/71	---	---
22	215	591'	---	12-2740	11/85
114	33	591'	2/71	---	---
12	213	591'	---	12-2740	11/85
84	8	591'	2/71	---	---
25	217	596'	---	12-2621	11/85
114	36	591'	2/71	---	---
9	216	596'	---	12-2621	11/85
142	20	591'	2/71	---	---
8	202	596'	---	12-2229	10/79
142	23	591'	2/71	---	---
26	206	596'	---	12-2229	10/79
8	201	596'	---	12-2229	10/79
26	205	596'	---	12-2229	10/79
7	200	596'	---	12-2229	10/79
27	204	596'	---	12-2229	10/79
33A	203	612'	---	12-2229	10/79
33A	203A	612'	---	12-2229	10/79
33A	211	612'	---	12-2229	10/79
33A	211A	612'	---	12-2229	10/79
34A	207	612'	---	12-2229	10/79
34A	207A	612'	---	12-2229	10/79

NFPA 14 - 1971 EDITION

STANDPIPE & HOSE SYSTEMS
(Continued)

FIRE ZONE	HOSE STATION	ELEVATION	ORIGINAL INSTALLATION	MODIFICATION NO.	MODIFICATION DATE
34A	212	612'	---	12-2229	10/79
34A	212A	612'	---	12-2229	10/79
32	38	609'	2/71	---	---
32	39	609'	2/71	---	---
44N	40	609'	2/71	---	---
44N	62	609'	2/71	---	---
44N	62A	609'	2/71	---	---
44S	41	609'	2/71	---	---
44S	41A	609'	2/71	---	---
97	45	609'	2/71	---	---
97	45A	609'	2/71	---	---
90	58	609'	2/71	---	---
90	58A	609'	2/71	---	---
91	59	609'	2/71	---	---
91	60	609'	2/71	---	---
44N	208	620'	---	12-2229	10/79
55	218	625'	---	12-2621	11/85
55	219	625'	---	12-2621	11/85
60	220	625'	---	12-2621	11/85
60	221	625'	---	12-2621	11/85
52	82	633'	2/71	---	---
52	82A	633'	2/71	---	---
52	65	633'	2/71	---	---
52	65A	633'	2/71	---	---
51	64	633'	2/71	---	---
52	223	633'	2/71	---	---
57 & 58	81	633'	2/71	---	---
109	67	633'	2/71	---	---
108	69	633'	2/71	---	---
69	83	650'	2/71	---	---
69	209	650'	---	12-2229	10/79
69	209A	650'	---	12-2229	10/79
69	210	650'	---	12-2229	10/79
69	210A	650'	---	12-2229	10/79
69	84	650'	2/71	---	---

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 14-1971
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 1. GENERAL INFORMATION.		Title
11.	Efficiency.		Title
111.	Standpipe systems which are properly designed, equipped, and maintained are one of the best internal means for extinguishing fires in buildings and structures. Even in buildings equipped with automatic sprinkler systems, standpipes may be a necessary complement. The standpipe system furnishes a reliable means of obtaining effective fire streams in the shortest possible time in places, such as the upper stories of high buildings or in other structures where construction, size, or other features limit the use of hose streams from the exterior.		For Information Only.
12.	Class of Service.		Title
121.	Standpipe systems may be grouped into three general classes of service for the intended use in the extinguishment of fire.		For Information Only.
(a)	Class I: For use by fire departments and those trained in handling heavy fire streams (2 1/2 inch hose).		For Information Only.
(b)	Class II: For use primarily by the building occupants until the arrival of the fire department small hose.		For Information Only.

REV	BY	DATE	CHECKED	DATE
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IMPELL CORPORATION

NFPA 14-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

JOB NO 0120-108
CALC NO 0120-108-005

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 14-1971
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
(c)	Class III: For use by either fire departments and those trained in handling heavy hose streams or by the building occoupants.		For Information Only.
122.	Class I service shall be capable of furnishing the effective fire streams required during the more advanced stages of fire on the inside of buildings or for exposure fire protection.		For Information Only.
123.	Class II service shall afford a ready means for the control of incipient fires by the occupants of buildings during working hours, and by watchmen and those present during the nighttime and holidays.		For Information Only.
124.	Class III service shall be capable of furnishing the effective fire streams required during the more advanced stages of fire on the inside of buildings as well as providing a ready means for the control of fires by the occupants of the building.		For Information Only.
13.	Type of System.		Title
131.	Standpipe systems may be of the following types.		For Information Only.
(1)	Wet standpipe system having supply valve open and water pressure maintained at all times.		For Information Only.

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 14-1971
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
(2)	Standpipe system so arranged through the use of approved devices as to admit water to the system automatically by opening a hose valve.		For Information Only.
(3)	Standpipe system arranged to admit water to system through manual operation of approved remote control devices located at each hose station.		For Information Only.
(4)	Dry standpipe having no permanent water supply.		For Information Only.
14.	Combined Systems.		Title
141.	Where a standpipe system for fire department use is installed as part of an automatic sprinkler system, i.e., the sprinkler system risers are equipped with 2-1/2 inch hose outlets, the combined system shall comply with the combined requirements of this Standard and the Standard for the Installation of Sprinkler Systems, NFPA No. 13.	D	Not Applicable: Combined systems are not provided at this plant. Ref: Drawing No. 1, 2 & 3.
15.	Approved Devices.		Title
151.	All devices and materials used in standpipe systems shall be of approved type.	W,D	Comply: The hose reel nozzles, hose valves and hose are approved for use in hose station. Does Not Comply: Hose reels are not approved and the shut-off valve in the supply line from the turbine building is not approved for fire system use. Ref: Walkdown Checklist No. 1 thru 4; Technical Data No. 9, 10, 11, 12 & 14.

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JOB NO 0120-108
CALC NO 0120-108-005

CODE COMPLIANCE VERIFICATION CHECKLIST
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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
16.	Closets and Cabinets.		Title
161.	Closets and cabinets used to contain fire hose shall be of sufficient size to permit the installation of the necessary equipment at hose stations, and so designed as not to interfere with the prompt handling of the hose and equipment at time of fire. They shall be used for fire equipment only, and each should be provided with a conspicuous sign reading "FIRE HOSE".	W	Not Applicable: There are no hose cabinets provided in the areas surveyed. Ref: Walkdown Checklist No. 1, 2 & 3.
17.	Plans and Specification.		Title
171.	Plans showing the location, sizes and connections of the fixed portion of the standpipe system shall be furnished to the authority having jurisdiction. The plans shall be drawn to scale, and shall include the details necessary to indicate clearly all of the equipment and its arrangements. The plans shall be accompanied by specifications covering the character of the material and the features relating to the installation in detail.	D	Open Item: Data was not available to confirm compliance that drawings and specifications were submitted to the authority having jurisdiction.
18.	Experienced Workmen;		Title
181.	The installation of standpipe systems shall be entrusted to none but fully experienced workmen. They shall be installed by responsible parties equipped to do the work under the approved detailed plans and specifications.	D	Comply: Systems were installed by qualified and experienced contractors. Ref: Technical Data No. 2 & 13.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 2. SIZE AND ARRANGEMENT OF STANDPIPES.		Title
21.	Design Basis.		Title
211.	The size of standpipes in a given case is governed by the size and number of the fire streams likely to be needed simultaneously and by the distance of the outlets from the source of water supply.		For Information Only.
212.	In standpipe systems for Class I and Class III services, each standpipe shall be sized for a minimum flow of 500 gallons per minute. Where only one standpipe is required, its supply piping shall be sized for a minimum flow of 500 gallons per minute. Where more than one standpipe is required, all common supply piping shall be sized for a minimum flow of 500 gallons per minute for the first standpipe plus 250 gallons per minute for each additional standpipe, the total not to exceed 2500 gallons per minute.	W,D	Open Item: Hydraulic calculations will be required to verify this condition.
(a)	Standpipes not exceeding 100 feet in height shall be at least 4 inches in size.		Comply: The original hose system installation provided 4" risers for (2) or more hose stations and 3" for (1) hose station. a. Does Not Comply: Drawing 12-5152D shows all standpipe risers are not 4" in diameter. All Standpipe risers are less than 100 ft. in height. b. Not Applicable: Standpipes are less than 100 ft. in height. c. Not Applicable: Standpipes do not exceed 100 ft. in height. Ref: Drawing No. 1; Technical Data No. 6, 7, & 8; Walkdown Checklist No. 1 thru 14.
(b)	Standpipes in excess of 100 feet in height shall be at least 6 inches in size.		
(c)	Standpipes shall be limited to 275 feet of height, and building in excesss of 275 feet of height shall be zoned accordingly.		

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D	DGL	7/14/88	MRC	7/15/88

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
213.	Where 2-1/2 inch hose outlets are provided on combined automatic sprinkler and standpipe risers, the minimum size of riser shall be 6 inches.	D	Not Applicable: Combined systems are not provided at this plant. Ref: Technical Data No. 5.
214.	Where pumps supplying two or more zones are located at the same level, each zone shall have separate and direct supply piping not less than 8 inches in size. Zones with two or more standpipes shall have at least two direct supply pipes at least 8 inches in size.	D	Not Applicable: Only one zone at this plant. Ref: Drawing No. 1.
215.	Where supply for each zone is pumped from the next lower zone, and the standpipe or standpipes in the lower zone are used to supply the higher zone, such risers shall comply with the provisions for supply lines in 214. At least two lines shall be provided between zones; one of these lines shall be arranged so that supply can be automatically delivered from the lower to the higher zone.	D	Not Applicable: Only one zone at this plant. Ref: Drawing No. 1.
216.	An approved means of maintaining a pressure on all zones of standpipe systems shall be provided.	D	Does Not Comply: Standpipe piping installed in the Auxiliary Building under this edition year has been arranged to eliminate the pressure condition from the piping during non-emergency times. Ref: Technical Data No. 5.
217.	In standpipe systems for Class II service each standpipe shall be sized for a minimum flow of 100 gallons per minute (379 l/min). Where one or more standpipes are required, all common supply piping shall be sized for a minimum flow of 100 gallons per minute (379 l/min).	W,D	Open Item: Hydraulic calculations will be required to verify this condition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
(a)	Standpipes not exceeding 50 feet in height shall be at least 2 inches in size.		a: Comply: Drawing 12-5152D shows Class II standpipes not exceeding 50 ft. high are minimum 2" in diameter.
(b)	Standpipes in excess of 50 feet in height shall be at least 2 1/2 inches in size.		b: Comply: Drawing 12-5152D shows Class II standpipes exceeding 50 ft. in height are minimum 2-1/2" in diameter. Ref: Drawing No. 1; Walkdown Checklist No. 1 thru 14.

CODE COMPLIANCE VERIFICATION CHECKLIST
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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 3. NUMBER AND LOCATION OF STANDPIPE AND HOSE CONNECTIONS.		Title
31.	Factors Governing.		Title
311.	The number and arrangement of standpipe equipment necessary for proper protection is governed by the local conditions such as occupancy, character and construction of building, exterior exposures and accessibility. The authority having jurisdiction should be consulted as to special requirements.		For Information Only.
32.	Number of Standpipes		Title
321.	The number of hose stations for Class I and Class III services in each building and in each section of a building divided by fire walls shall be such that all portions of each story of the building are within 30 feet of a nozzle attached to not more than 100 feet of hose. Equipment should be so arranged as to permit directing the discharge from the nozzle into all portions of important enclosures such as closets and like enclosures.	W,D	Comply: Hose stations are typically provided with primarily 50', 75' or 100' hose lengths. These hose stations will provide proper protection for those areas. Does Not Comply: Several areas are unable to be reached with 100 ft. of hose and 30 ft. throw of water. Ref: Walkdown Checklist No. 1 thru 14; Drawing No. 4 thru 9.
322.	The number of hose stations for Class II service in each building and each section of a building divided by fire walls shall be such that all portions of each story of the building are within 20 feet of a nozzle when attached to not more than 75 feet of hose. Equipment should be so arranged as to permit directing the	W,D	Comply: Hose stations are typically provided with 50' or 75' hose lengths. These hose stations will provide proper protection for those areas. Does Not Comply: Placement of hose stations is such that all areas of building cannot be reached with 75 ft. of hose and 20 ft. nozzle throw.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	discharge from the nozzle into all portions of important enclosures such as closets and like enclosures. NOTE: The standpipes supplying the 2-1/2 inch hose streams may also be used to supply the small hose streams. When the area of the building is large, separate standpipes or branches for the small hose streams may be necessary. Small hose streams may sometimes be supplied from an automatic sprinkler system. (See Standard for the Installation of Sprinkler Systems, NFPA No. 13.)		Ref: Walkdown Checklist No. 1 thru 14; Drawing No. 4 thru 9.
33.	Location of Standpipes.		Title
331.	Where buildings are within 60 feet of exposing buildings, standpipes for large streams should be located so as to afford protection against exterior exposures as well as to the interior of the buildings.	W,D	Comply: The Auxiliary Building, auxiliary feed water and essential service water rooms and the control rooms are located within interconnected buildings of the plant. Any exterior exposure to these areas, buildings or containments are provided by the yard hydrant system as well as the Class II and III hose stations provided throughout the plant. Ref: Drawing No. 1, 2, 3 & 11.
332.	Standpipes shall be so located that they are protected against mechanical and fire damage.	W	Comply: Standpipes are located adjacent to walls and stairways where they are protected from harm. Ref: Walkdown Checklist No. 1 thru 14.
333.	Dry standpipes shall not be concealed in building walls or built into pilasters.	W	Not Applicable: There are no dry standpipes in the area of our review. Ref: Drawing No. 4 thru 9.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
334.	In buildings divided by numerous partitions, standpipes shall be so located that the streams can be brought to bear in any room.	W,D	Comply: Reference Code Sections 321 and 322, this edition. Does Not Comply: Reference Code Sections 321 and 322, this edition.
335.	In buildings having large areas the standpipes may be located at interior columns.	W	Comply: The intent of the code is being met by the placement of hose stations near isles. Ref: Walkdown Checklist No. 1 thru 4.
34.	Hose Connections.		Title
341.	Standpipes for Class I service shall be provided with 2-1/2 inch hose connections on each floor.	D	Not Applicable: Class I hose stations are not provided in the area reviewed. Ref: Drawing No. 1, 2 & 3.
342.	Standpipes for Class II service shall be provided with 1-1/2 inch hose connections on each floor.	W	Comply: Each standpipe outlet location is provided with a 1-1/2 inch hose connection. Ref: Walkdown Checklist No. 1 thru 14.
343.	Standpipes for Class III service shall be both a 2-1/2 inch and 1-1/2 inch hose connection on each floor. The hose connections may be through one 2-1/2 inch hose valve and an easily removable 2-1/2 inch by 1-1/2 inch adapter.	W	Comply: Where provided, Class III standpipe outlets do have one 1-1/2 inch and one 2-1/2 inch hose connections. Ref: Walkdown Checklist No. 1 thru 14.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 4. HOSE OUTLETS		Title
41.	Location of Hose.		Title
411.	Hose outlets shall be within easy reach of a person standing on the floor and in no case shall be over six feet from the floor. Hose stations shall be located conspicuously within the immediate area and where not likely to be obstructed. NOTE: Hose may be located at one side of the standpipe and supplied by short lateral connections to the standpipe where necessary to avoid obstructions.	W,D	Comply: Hose outlets are located in conspicuous locations and are not over 6'-0" above finished floor. Ref: Walkdown Checklist No. 1 thru 14; Drawing No. 4 thru 9.
412.	Hose outlets for Class I service should be located in a stairway enclosure, and for Class II service in the corridor or space adjacent to the stairway enclosure and connected through the wall to the standpipe. For Class III service, the outlets for large hose shall be located in a stairway enclosure, and for small hose located in the corridor or space adjacent to the stairway enclosure. NOTE: The above arrangement make it possible to use small hose streams promptly in case the stairway is filled with people escaping at the time of fire.	D	Not Applicable: Enclosures are not provided for stairways in the areas surveyed. Ref: Drawing No. 4 thru 9.
413.	Valves of approved type should be provided at the main riser for controlling branch lines to hose station outlets so that in the event that the branch is broken during the fire, the fire department may shut off this branch, conserving the water for their use.	W,D	Comply: Sectionalizing valves are provided for the RCT tunnel systems Unit 1 and 2. Does Not Comply: Valves not are provided for sectionalizing branches to hose outlets for the Auxiliary Building system. Ref: Drawing No. 1.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
42.	Hose.	Title	
421.	Each hose outlet provided for the use of building occupants (Class II and III services) shall be equipped with not more than 75 feet and preferably not more then 50 feet of approved small fire hose attached and ready for use. NOTE: Long lengths of hose should be avoided as they are difficult to handle likely to kink and interfere with the effectiveness of the streams and cause loss of time when it is most valuable. For information on the selection of hose, see Care of Fire Hose, NFPA No. 198.	W,D	Comply: Class II and III hose stations were typically provided with 50' or 75' hose lengths. Does Not Comply: Many hose connections have 100 ft. or more hose installed. Where the hose exceeds 100', it is provided on a second hose reel and is not hooked up to the hose system. Ref: Drawing No. 4 thru 9, Walkdown Checklist No. 1 thru 14.
43.	Hose Racks.		Title
431.	Each station provided with small hose shall be equipped with an approved rack securely fastened in position. NOTE: With hose racks of the "semi-automatic" or "one-man" type, the hose valve should first be opened wide. The nozzle should then be grasped firmly and the hose lines drawn toward the fire. The water is automatically restored as the last few feed of hose are pulled from the rack.	W,D	Comply: The hose reels are securely fastened in position. Each hose station provided with hose, is provided with 1 1/2" hose. The hose reel furnished under recent modifications are UL listed. Does Not Comply: Hose reels are not approved by a nationally recognized testing laboratory. Ref: Walkdown Checklist No. 1 thru 14; Technical Data No. 6, 7, 8 & 10; Drawing No. 4 thru 9.
432.	Each rack for small hose should be provided with a sign reading "Fire Hose for Use by Occupants of Building". Signs shall be securely fastened in position.	W	Does Not Comply: Signs at each hose station read, "For Trained Personnel Only". Signs are securely fastened. Ref: Walkdown Checklist No. 1 thru 4.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
44.	Hose Valves.		Title
441.	An approved hose valve shall be provided at each outlet for attachment of hose.	W,D	Comply: Approved hose valves are provided. Ref: Technical Data No. 12; Walkdown Checklist No. 1 thru 14.
442.	Where the static pressure at any standpipe outlet for small hose exceeds 100 pounds per square inch, an approved device shall be installed at the outlet to reduce the pressure so that the nozzle pressure will be approximately 80 pounds per square inch. NOTE: Pressure reducers are not required on standpipe outlets for 2-1/2 inch hose because it is assumed 2-1/2 inch hose will be attached only when the pesons likely to use it are trained in handling large streams.	W,D	Does Not Comply: Static pressures at small hose outlets do exceed 100 psi. Pressure reducers are not provided. Ref: Drawing No. 10; Walkdown Checklist No. 1 thru 14.
443.	Each hose valve on a wet system should be provided with a suitable open or automatic drip connection so installed that any slight leakage past the valve seat will be carried off and prevented from entering the fire hose.	W,D	Does Not Comply: Open or automatic drip connections are not provided at the hose valves. Ref: Drawing No. 1, 2 & 3; Walkdown Checklist No. 1 thru 14; Technical Data 12.
444.	The hose connection at each hose valve should have threads conforming to those used by the public fire department. National (American) Standard Fire Hose Coupling Screw Threads shall be used whenever they will fit existing equipment. NOTE: See Standard for Screw Threads and Gaskets for Fire Hose Couplings, NFPA No. 194.	W,D	Comply: Hose connections do have national standard threads. Ref: Walkdown Checklist No. 1 thru 14; Technical Data No. 12.

REV 0 | BY Rew | DATE 8/14/88 | CHECKED [illegible] | DATE 8/15/88

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
45.	Nozzles.		Title
451.	Nozzles shall be of an approved type. Size of nozzles for small hose shall be not larger than 1-1/2 inch.	W,D	Comply: 1-1/2 inch nozzles are provided for 1 1/2 inch small hose. Ref: Walkdown Checklist No. 1 thru 14; Technical Data No. 9 & 11.
452.	Shutoff nozzles shall be provided when required by the authority having jurisdiction. NOTE: Combination nozzles which give a spray or a solid stream are advantagous in certain locations where the use of a solid stream may contribute to the spread of fire by scattering the burning material or where the existance of flammable liquids makes the use of spray stream desirable.	W,D	Comply: Nozzles are all fog, no straight stream. Ref: Walkdown Checklist No. 1 thru 14; Technical Data No. 9.
46.	Dry Standpipe Identification.		Title
461.	Each hose outlet on dry standpipes shall be provided with a conspicuous, durable and permanently legible sign reading "Dry Standpipe for Fire Department Use Only."	W	Not Applicable: Dry standpipes are not provided in the area reviewed. Ref: Walkdown Checklist No. 1 thru 14.

REV 0 | BY DRK | DATE 5/14/82 | CHECKED QC | DATE 5/15/82

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 5. WATER SUPPLIES.		Title
51.	Factors Governing.		Title
511.	The water supply requirements for standpipe systems are dependent upon the size and number of fire streams likely to be needed at any fire, and the length of time such streams will have to be used. Both of these factors are largely influenced by the conditions at the building or plant to be equipped and it is necessary that the probable number of standard streams for the protection of both interior and exterior of the building be carefully ascertained before the water supply is decided upon. The selection of water supplies for each installation shall be determined in cooperation with the authority having jurisdiction.	D	Open Item: Water supply is Lake Michigan. Cook has five (5) fire pumps and hydraulic calculations are required to verify these conditions.
52.	Character of Water Supplies.		Title
521.	Standpipe systems, other than dry standpipes, shall have an approved water supply. A single source of supply may be acceptable where it is capable of automatically supplying all of the fire streams required for the full protection of the property for the required period. In some cases, more than a single water supply may be necessary.	D	Comply: Water supply is from five (5) independent fire pumps. Ref: Drawing No. 1, 2, 3 & 10.
522.	Acceptable water supplies may be:		Title
(1)	Public waterworks system where pressure and discharge capacity are adequate.		For Information Only.

REV 0 | BY Pete | DATE 3/14/88 | CHECKED JDC | DATE 3/14/88

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(2)	Automatic fire pumps.		For Information Only.
(3)	Manually controlled fire pumps in combination with pressure tanks.		For Information Only.
(4)	Pressure tanks.		For Information Only.
(5)	Gravity tanks.		For Information Only.
(6)	Manually controlled fire pumps operated by remote control devices at each hose station. [See Section 131 (3).] NOTE: See Standard for Water Tanks for Private Fire Protection, NFPA No. 22 and Standard for the Installation of Centrifugal Fire Pumps, NFPA No. 30.		For Information Only.
523.	At least one water supply shall be automatic and capable of supplying the streams first operated until the secondary sources can be brought into action.	W,D	Comply: Each fire pump is automatic. Ref: Walkdown Checklist No. 1 thru 14; Technical Data No. 5.
524.	Supply for Class I and Class III services should be capable of furnishing the number of streams required for full protection for long periods.	D	Open Item: Hydraulic calculations are required to verify this condition.
525.	Where the system will supply sprinklers in addition to standpipes, the water supply requirements of both shall be considered. NOTE: See also Standard for the Installation of Sprinkler Systems, NFPA No. 13.	D	Open Item: Hydraulic calculations are required to verify this condition.

REV 2 | BY DCC | DATE 5/14/82 | CHECKED QAC | DATE 5/15/82

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526.	Where connections are made from public waterworks systems it may be necessary to guard against possible contamination of the public supply. The requirements of the public health authority shall be deterined and followed.	D	Not Applicable: This situation is not present. Ref: Drawing No. 11.
53.	Minimum Supply for Class I Service.		Title
531.	The minimum supply for Class I service shall be sufficient to provide 500 gallons per minute for a period of at least thirty (30) minutes. Where more than one standpipe is required by Chapter 3, the minimum supply shall be 500 gallons per minute for the first standpipe and 250 gallons per minute for each additional standpipe, the toal supply not to exceed 2500 gallons per minute for a period of at least thirty (30) minutes. The supply shall be sufficient to maintain a residual pressure of 65 pounds per square inch at the topmost outlet of each standpipe with 500 gallons per minute flowing from the topmost outlet of the most remote standpipe and 250 gallons per minute flowing from the topmost outlet of each of the other standpipes up to a maximum of 2500 gallons per minute flowing. The supply shall be sufficient to maintain a residual pressure of 65 pounds per square inch at the topmost outlet of each standpipe (including the roof outlet) with 500 gallons per minute flowing.	D Verify that the requirements for this section are met for Class III service. Ref: Code Section 551. Not applicable for Class I service, not provided at this plant.	Open Item: Hydraulic calculations are required to verify this condition.

REV D | BY DGL | DATE 9/14/82 | CHECKED [illegible] | DATE 9/15/82

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54.	Minimum Supply for Class II Service.		Title
541.	The minimum supply of Class II service shall be sufficient to provide 100 gallons per minute for a period of at least thirty (30) minutes. The supply shall be sufficient to maintain a residual pressure of 65 pounds per square inch at the topmost outlet of each standpipe (including the roof outlet) with 100 gallons per minute flowing.	D	Open Item: Hydraulic calculations are required to verify this condition.
55.	Minimum Supply for Class III Service.		Title
551.	The minimum supply for Class III service shall be the same as for Class I service.	D	Open Item: See response for 531.
56.	Fire Department Connections.	D	Title. Not Applicable: This situation not present at the plant within the protected area. All of Section 56 deleted. Ref: Drawing No. 1.

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	CHAPTER 6. PIPING VALVES AND FITTINGS		Title
61.	Connections to Systems.		Title
611.	Connections from gravity tanks (on buildings) and pressure tanks (on top floor or roof) shall be made to the top of the standpipe system except where the tanks are used as a supply to standpipes in several buildings or sections of a building, in which cases they shall be made at the base of the standpipes. Such connections to standpipes for Class I and III services shall be at least 4 inches; for Class II service at least 2-1/2 inches.	D	Not Applicable: Tanks for fire protection water are not provided at this plant. Ref: Drawing No. 11.
612.	Where a gravity tank and a pressure tank are connected to a common riser, approved means shall be provided to prevent residual air pressure in the pressure tank (after water has been drained off from it) from holding the gravity tank check valve closed, a condition known as "air lock" may be conveniently prevented in new equipment by connecting the gravity tank and pressure tank discharge pipes together 45 feet (13.7 m) or more below the bottom of the gravity tank and placing the gravity tank check valve at the level of this connection. NOTE: See Standard for Water Tanks for Private Fire Protection, NFPA 22.	D	Not Applicable: Tanks for fire protection water are not provided at this plant. Ref: Drawing No. 11.
613.	Connections from fire pumps and sources outside the building shall be large enough to deliver the full required water demand without excessive friction loss.	D	Not Applicable: Fire pumps are located within the building at elevation 571'. Ref: Drawing No. 10.

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614.	Where two or more standpipes are installed in the same building or section of a building, they shall be interconnected at the bottom. Where standpipes in a single building are supplied by tanks they shall also be interconnected at the top; in such cases, check valves may be installed at the base of each riser to prevent circulation.	W,D	Comply: Standpipes interconnected at Elevation 587. Ref: Drawing No. 1, 2 & 3; Walkdown Checklist No. 1 thru 14.
62.	Gate and Check Valves.		Title
621.	Connections to each water supply, except to fire department connections, shall be provided with an approved gate and check valve located close to the supply, as at tank, pump and in connection from water-works system. Where the water supply feeds the standpipes in more than one building or section of a building, the check valves shall be placed in a safe position in the underground connections, where not exposed to danger from fire or falling buildings.	W,D	Comply: Approved indicating valves and check valves are installed at the discharge connections of each of the five fire pumps. Ref: Walkdown Checklist No. 1 thru 14; Drawing No. 10.
622.	Sufficient stop valves or check valves should be provided to permit cutting off a standpipe riser without interrupting the supply to other risers from the same source of supply.	W,D	Does Not Comply: Individual risers do not have stop or check valves to permit one riser from being cut off without interrupting supply to other risers. Ref: Drawing No. 1, 2 & 3; Walkdown Checklist 1 thru 14.
623.	Connections to public works systems should, where feasible, be controlled by indicator post gate valves of an approved type located not less than 40 feet from the building protected; or if this cannot be done, placed where they will be readily	D	Not Applicable: This situation not present in the areas reviewed. Ref: Drawing No. 10.

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	accessible in case of fire and not subject to injury. Where indicator post valves cannot be readily used, as in a city street, underground gate valves should conform to the above as far as possible and their locations and directions to open shall be plainly marked on the buildings. All indicator post valves shall be plainly marked to indicate the service they control.		
624.	Where the standpipes are supplied from a yard main or header in another building, the connection shall be provided with an approved outside indicator post gate valve at a safe distance from the building or an approved indicator valve at the header.	W,D	Comply: The standpipe system is properly connected to the water supply. Does Not Comply: Valve in header from turbine building not approved for fire service. Ref: Walkdown Checklist No. 1 thru 14; Drawing No. 1, 2 & 3.
625.	Gate and check valves shall be of the approved extra heavy flanged pattern where the pressures are in excess of 175 pounds per square inch, or where the pressures are likely to be in excess of this amount. NOTE: The use of standard weight valves should ordinarily be confined to the upper stories of very high buildings and to equipments where the highest available pressures are less than 175 pounds per square inch.	W,D	Not Applicable: Water pressure regulated to not exceed 165 psi. Ref: Drawing No. 10; Technical Data No. 17.
63.	Piping.		Title
631.	Pipe and tube used in standpipe systems should be of the materials listed in Table 631. The chemical properties, physical properties and dimensions of the	D	Comply: ASTM A-106, Grade B exceeds the specification of Table 631. Ref: Technical Data No. 15.

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	materials listed in Table 631 should conform at least to the standards cited in the Table. Pipe and tube used in standpipe systems should be designed to withstand a working pressure of not less than 175 psi.		
632.	Other types of pipe or tube may be used, but only those investigated and listed for this service by a nationally-recognized testing and inspection agency and acceptable to the authority having jurisdiction.	D	Comply: ASTM A-106, Grade B, seamless pipe exceeds the requirements of Table 631. Ref: Technical Data No. 15.
633.	Brazed joints for the connection of pipe or tube and fittings may be used. The fire hazard of the process shall be suitably safeguarded.		For Information Only.
64.	Fittings.		Title
641.	The fittings in the standpipe and connections should be of the extra heavy pattern where the pressures are in excess of 175 pounds per square inch or where the pressures are likely to be in excess of this amount.	D	Not Applicable: Water pressures regulated and will not exceed 165 psi. Ref: Drawing No. 10; Technical Data No. 17.
642.	Fittings should be of flanged pattern for sizes in excess of 6 inches. All piping shall be installed by means of screw or flanged fittings or other approved means. Welding of joints may be allowed. Permission for this work shall be obtained from the authority having jurisdiction. Welding should perferably be done in the shop and welding fittings used. Welding fittings should comply with ANSI Standard B16.9-1964, ANSI Standard B16.25-1964 and ASTM Designation A234-65."	D	Comply: Piping is welded and welding fittings are specified to comply with ASTM A234 by Specification DCCPM104QCS, Rev. 4, dated 11/9/72. Ref: Technical Data No. 3.

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643.	Approved expansion joints or flexible couplings should be provided where necessary.	D		Not Applicable: Expansion joints not necessary. Ref: Walkdown Checklist No. 1 thru 14.
65.	Pipe Hangers.			Title
651.	The pipe hangers shall be of approved type, so arranged that they will sustain the loads and retain the piping securely in position. They shall be used in sufficient number to prevent vibration in the piping when the standpipe is in use.	W,D	Verify for non-seismically qualified systems identified by AEPSE only.	Comply: All non-seismically qualified systems reviewed were properly supported except as indicated below. Does Not Comply: Header piping on Elevation 587 has insufficient restraints. Ref: Walkdown Checklist No. 1 thru 14.
66.	Drains.			Title
661.	The system shall be provided with a system of drain pipes large enough to carry off the water from the open drain while they are discharging under pressure.	W		Comply: Drain pipes are provided on standpipe systems. Ref: Walkdown Checklist No. 1 thru 14.
662.	The drains should be so arranged as to be free from the possibility of causing water damage and not exposed to freezing. If practicable, the drain should be so arranged that the discharge will be visible from the point of operation of the drain valve.	W		Comply: Although drains discharge directly onto the floor in the vicinity of the drain connection, there is no equipment or products in these areas susceptible to water damage. Some drains are also fitted with hose connections to permit installation of hose to direct the discharge to a safe location. Ref: Walkdown Checklist No. 1 thru 14.
67.	Pressure Gages.			Title
671.	An approved 3-1/2 inch dial spring pressure gage shall be connected with each discharge pipe from fire pump and public waterworks, at the pressure tank, at the air pump supplying pressure tank and at the top of each standpipe. Gages	W,D		Comply: Dial gages are provided at the fire pumps and at stations 218 and 220. Does Not Comply: Gages are installed at the fire pumps. Gages are not installed at the top of each standpipe with the exception of hose stations #218 and #220.

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	shall be located in a suitable place where water will not freeze. Each gage will be controlled by a valve having arrangement for draining. NOTE: Where several standpipes are interconnected at the top, a single gage properly located may be substituted for the gages at the top of each standpipe. Additional pressure gages at the base of the standpipes may be desirable in some equipments, particularly in large plants and high buildings.		Ref: Walkdown Checklist No. 1 thru 14; Drawing No. 1.
68.	Water Flow Alarms.		Title
681.	Water flow alarms should be provided on all standpipe risers, where required by the authority having jurisdiction.	D	Comply: Waterflow alarms are provided for the Unit 1 and 2 RCT tunnel hose systems. Does Not Comply: Waterflow alarms are required by Section II.E.3.a of Appendix A to BTP. APCSB 9.5-1. Waterflow alarms are not provided on the non-pressurized standpipes which are controlled by valves ZMO-10 and ZMO-20. Ref: Licensing Document No. 1; Drawing No. 1, 2 & 3.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 7. TESTS AND MAINTENANCE.		Title
71.	Tests.		Title
711.	All new systems including yard piping shall be tested hydrostatically at no less than 200 pounds per square inch pressure for two hours, or at 50 pounds per square inch in excess of the normal pressure when the normal pressure is in excess of 150 pounds per square inch. NOTE: Where standpipe connections are built in the walls or partitions the above tests should be made before they are covered in or permanently concealed.	D	Open Item: Information on original acceptance tests for piping is not available.
712.	The amount of leakage in underground piping shall be measured at the specified test pressure by pumping from a calibrated container.	D	Open Item: See response to 711.
713.	a) New pipe laid with gasketed joints should, if the workmanship is satisfactory, have no leakage at the joints. Unsatisfactory amounts of leakage usually result from twisted, pinched, or cut gaskets. However, some leakage might result from small amounts of grit or small imperfections. The amount of leakage at the joints should not exceed 2 quarts per hour per 100 joints irrespective of pipe diameter. The leakage should be distributed over all joints. If such leakage occurs at a few joints the installation should be considered unsatisfactory and necessary repairs made.	D	Open Item: See response to 711.

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	b) New pipe laid with caulked lead or lead-substitute joints, should, if the workmanship is satisfactory, have little or no leakage at the joints. Any joint having leakage or more than a "slight drip" or "weeping" should be repaired. Leakage should not exceed 1 oz. (liquid measure) per hour per inch of pipe diameter per joint. The leakage should be distributed over all joints. If such leakage occurs almost entirely at a few joints, the installation should be considered unsatisfactory and necessary repairs made.		
714.	Piping between the fire department connection and the check valve in the inlet pipe shall be tested the same as the balance of the system.	D	Not Applicable: Fire department connections are not provided at this plant within the protected area. Ref: Drawing No. 1.
715.	In a standpipe system any piping which normally remains dry shall be pressure-tested at intervals of not less than 5 years.	D	Not Applicable: All standpipes in areas surveyed are wet pipe systems. Ref: Technical Data No. 5.
716.	Before restoring to service and before water is turned into it, a standpipe system which has been out of service a number of years shall be tested with air at a pressure not exceeding 25 pounds per square inch (1.7 bars) to determine its tightness. NOTE: This test is suggested to avoid water damage in buildings in the event that pipes have become broken off or disconnected.	W	Not Applicable: All standpipes in areas surveyed are continuously in service. Ref: Walkdown Checklist No. 1 thru 14.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
72.	Periodic Inspection.		Title
721.	Systematic periodic inspection of all portions of the standpipe system is essential, and personnel to whom this duty is entrusted shall be held strictly responsible for its condition.	D	Comply: Inspections of all facets of standpipe systems are performed in intervals not exceeding 30 days per Procedure 12 QHP 4030 STP.007, 2/21/86. Ref: Procedure No. 1.
722.	The tanks shall be kept properly filled, and where pressure tanks are employed, a pressure of at least 75 pounds per square inch shall be maintained at all times. Special attention shall be given to the condition of the tanks during freezing weather. NOTE: For further details, see NFPA 22, Standard for Water Tanks for Private Fire Protection.	D	Not Applicable: Tanks for fire protection water are not provided. Ref: Drawing No. 11.
723.	The valves in the main connection to the automatic sources of water supply shall be open at all times. The hose valves shall be frequently examined to see that they are tight. NOTE: Leakage at the hose valves may be detected by inspection of the drips at the valves, and care should be taken to see that these are not clogged with dirt or sediment.	D	Comply: All sectionalizing valves are open except as indicated below. Does Not Comply: ZMO valves in connections to Auxiliary Building are normally closed. The valves do have motor operators that will drive the valves open upon a signal from a push button at each hose station. Hose valves are inspected for tightness during monthly visual inspection of fire hose stations per Procedure 12 QHP 4030 STP.007, 2/21/86. Ref: Procedure No. 1; Drawing No. 1, 2 & 3.
724.	Inspections shall be made frequently to assure that the hose is in proper position on the racks, and that all of the equip-	D	Comply: All inspections perform the proper verification to confirm operability as required.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	ment is in place and in good condition. The hose should be removed and re-racked at intervals at least annually and new gaskets installed in the couplings, both at the hose valves and at the nozzles. Where couplings are polished, care should be taken to see that polish used does not touch fabric of hose. NOTE: For further details, see Care of Fire Hose, NFPA No. 198.		Does Not Comply: Inspections are made monthly to verify hose is in proper position on racks. Hose is removed and re-racked at 18 month intervals. Ref: Procedure No. 2.
725.	When a standpipe system or any portion thereof is out of service for any reason, notice shall be given to the local fire department and a sign shall be posted on each fire department connection indicating what portion of the system is out of service.	D	Comply: Plant fire brigade considered to be local fire department. No work is done to plant systems without first notifying shift supervisor in the control room. Ref: Procedure No. 3.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	CHAPTER 8. BUILDINGS UNDER CONSTRUCTION.		Not Applicable: The requirements of this section are no longer applicable. Compliance with this section during construction of the plant is no longer a concern.

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APPENDIX A

NFPA 14 - 1978 EDITION

STANDPIPE & HOSE SYSTEMS

This review includes the following hose stations:

FIRE ZONE	HOSE STATION	ELEVATION	ORIGINAL INSTALLATION	MODIFICATION NO.	MODIFICATION DATE
7	200	596'	---	12-2229	10/79
8	201	596'	---	12-2229	10/79
8	202	596'	---	12-2229	10/79
33A	203	612'	---	12-2229	10/79
33A	203A	612'	---	12-2229	10/79
33A	211	612'	---	12-2229	10/79
33A	211A	612'	---	12-2229	10/79
27	204	596'	---	12-2229	10/79
26	205	596'	---	12-2229	10/79
26	206	596'	---	12-2229	10/79
34A	207	612'	---	12-2229	10/79
34A	207A	612'	---	12-2229	10/79
34A	212	612'	---	12-2229	10/79
34A	212A	612'	---	12-2229	10/79
44N	208	620'	---	12-2229	6/80
69	209	650'	---	12-2229	6/80
69	209A	650'	---	12-2229	6/80
69	210	650'	---	12-2229	6/80
69	210A	650'	---	12-2229	6/80

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
1-1	Scope. This standard covers the minimum requirements for the installation of standpipe and hose systems for buildings and structures.		For Information Only.
1-2	Purpose. The purpose of this standard is to provide a reasonable degree of protection for life and property from fire through installation requirements for standpipe systems based upon sound engineering principles, test data and field experience.		For Information Only.
1-3	Definition of a Standpipe System. A standpipe system is an arrangement of piping, valves, hose outlets and allied equipment installed in a building or structure with outlets located in such a manner that water can be discharged in streams or spray patterns through hose and nozzles, attached to such hose outlets, for the purpose of extinguishing a fire and so protecting a building or structure and its contents in addition to protecting the occupants. This is accomplished by connections to water supply systems or by pumps, tanks and other equipment necessary to provide an adequate supply of water to the hose outlets.		For Information Only.
1-5	Units. Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI). Two units (litre and bar), outside of but recognized by SI, are commonly used in international fire protection. These units are listed in Table 1-5 with conversion factors.		For Information Only.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
1-5.1	If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.		For Information Only.
*1-6.1.2	Class II: For use primarily by the building occupants until the arrival of the fire department (1-1/2 inch hose).		For Information Only.
1-6.1.3	Class III: For use by either fire departments and those trained in handling heavy hose streams (2-1/2 inch hose) or by the building occupants (1-1/2 inch hose).		For Information Only.
1-6.4.	Class III service shall be capable of furnishing Class I as well as Class II service.		For Information Only.
1-6.5	Standpipe and hose systems not required by the authority having jurisdiction and not meeting the requirements of this standard shall be marked "FOR FIRE BRIGADE USE ONLY."	W,D	Not Applicable: Standpipe and hose stations are required by Appendix A to BTP APCSB 9.5-1, the authority having jurisdiction. All hose stations not meeting the requirements of this standard are marked with, signs indicating "for use by trained personnel only". Ref: Licensing Document No. 1; Walkdown Checklist No. 15 thru 17.
1-8	Combined Systems		Title Not Applicable: This entire Section 1-8 refers to combined systems and as such all sections are "Not Applicable". Ref: Technical Data No. 5.

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1-8.1.	A combined system is one where the water piping serves both 2 1/2-inch outlets for fire department use and outlets for automatic sprinklers. Such combined systems shall comply with the requirements of NFPA 13, Standard for Installation of Sprinkler Systems (see Appendix B), in regard to the automatic sprinkler portions of the system, and with NFPA 14 in regard to sizing of vertical risers and water supplies. When the building is completely sprinklered, the risers may be sized by hydraulic calculations.	D	Not Applicable: Combined systems are not provided in the area of our review.
1-8.2.	The water supply for a combined system shall comply with the requirements given in Section 5-3 or 5-5. When the building is completely sprinklered, the water supplies shall comply with 1-8.3. When the building is provided with partial sprinkler protection, the water supplies shall comply with 1-8.4.	D	Not Applicable: Combined systems are not provided in the area of our review.
*1-8.3.	For a completely sprinklered building, the water supply required in Section 5-3 or 5-5 may also serve the sprinkler system. Sprinkler demand need not be added. Exception: Where the sprinkler system demand, including hose stream allowance as determined in NFPA 13, Standard for the Installation of Sprinkler Systems (see Appendix B), exceeds the supply required in Section 5-3 or 5-5, the larger of the two values shall be provided. The water supply required for a combined	D	Not Applicable: Combined systems are not provided in the area of our review.

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	system in a light hazard occupancy building (completely sprinklered) need not exceed 1500 gpm unless required by the authority having jurisdiction.		
1-8.4.	For a building equipped with partial automatic sprinkler protection, the sprinkler system demand, not including hose stream allowance, shall be added to the requirements given in Secion 5-3 or 5-5. Exception: The authority having jurisdiction may modify this requirement based on local conditions.	D	Not Applicable: Combined systems are not provided in the area of our review.
1-8.5	In combined systems, when the building is completely sprinklered, 1-1/2 inch hose for use by the building occupants (Class II service) may be omitted, subject to the approval of the authority having jurisdiction, provided that each standpipe outlet location is equipped with a 2-1/2 inch hose valve, a 2-1/2 inch by 1-1/2 inch reducer, and a cap with attachment chain.	D	Not Applicable: Combined systems are not provided in the area of our review.
1-8.6.	Each connection from a combined riser to the sprinkler system shall have an individual control valve of the same size as the connection.	D	Not Applicable: Combined systems are not provided in the area of our review.
1-10.	Closets and Cabinets		Title
1-10.1.	Closets and cabinets used to contain fire hose shall be of sufficient size to permit the installation of the necessary equipment at hose stations, and so designed as not to interfere	W	Not Applicable: Hose stations in areas surveyed are not placed in closets or cabinets. Ref: Walkdown Checklist No. 15 thru 17.

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	with the prompt use of the hose valves, the hose, and other equipment at the time of fire. Within the cabinet, the hose valves shall be located such that there is at least 1 inch between any part of the cabinet and the handle of the valve when the valve is in any position from fully open to fully closed. The cabinet shall be used for fire equipment only and each shall be conspicuously identified.		
1-10.2.	Where a "break glass" type protective cover for a latching device is provided, the maximum area of the glass panel shall not exceed 25 sqaure inches. The device provided to break the glass panel shall be securely attached in the immediate area of the "break glass" panel and shall be so arranged that the device cannot be used to break other glass panels in the cabinet door.	W	Not Applicable: Hose cabinets are not provided in areas surveyed. Ref: Walkdown Checklist No. 15 thru. 17.
1-11.2.	In combined systems when the building is completely sprinklered, and risers are sized by hydraulic calculations, a complete set of all calculations shall be submitted when requested by the authority having jurisdiction.	D	Not Applicable: Combined systems are not provided in the areas reviewed. Ref: Technical Data No. 5.
1-11.3.	A complete set of "as-built" drawings and calculations shall be furnished by the installation company, when requested by the authority having jurisdiction, at the time of completion of the systems.	D	Comply: "As-Built" drawings were furnished by Phoenix Contractors, the installing contractor. Open Item: Calculations were not available to review. Ref: Drawing No. 12, 13 & 14.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
1-12	Experienced Workmen. The installation of standpipe systems shall be entrusted to none but fully experienced workmen. They shall be installed by responsible parties equipped to do the work under the approved detailed plans and specifications.		Editorial Changes: Addressed under Code Section 181, 1971 Edition.
2-1.3	Standpipe zone heights exceeding 275 feet (83.9 m) may be permitted when a listed pressure regulating device, which controls nozzle pressure under both flow and no flow conditions, is installed at each outlet and	W,D	Not Applicable: Systems do not exceed 275 feet in height. Ref: Drawing No. 1; Walkdown Checklist No. 15 thru 17.
2-1.3.1	the maximum zone height is not more than 400 feet (122 m);		For Information Only.
2-1.3.2	the pressure regulating device is arranged to regulate pressure at the hose valve outlet to a pressure not exceeding 100 psi (6.9 bars);		For Information Only.
2-1.3.3	the pressure on the inlet side of the pressure regulating device does not exceed working pressure rating of the device;		For Information Only.
2-1.3.4	all other pipes fittings, and devices, on the system are rated for not less than the maximum system pressure.		For Information Only.
2-1.4	The minimum size of risers for combined systems shall be six inches, except when the building is completely sprinklered, the risers may be hydraulically calculated (see 1-8.1) in accordance with Chapter 7 of NFPA 13, Standard for the Installation of Sprinkler Systems (see Appendix B).	D	Not Applicable: Combined systems are not provided in the areas reviewed. Ref: Technical Data No. 5.

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NFPA 14-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

IMPELL CORPORATION

JOB NO 0120-108
CALC NO 0120-108-005

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 14-1978
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2-1.5	Each zone requiring pumps shall be provided with a separate pump but this shall not preclude the use of pumps arranged in series.	D	Comply: Only one zone at this plant. See response to Section 214 of the 1971 Code Compliance Verification Checklist. Ref: Drawing No. 1.
2-1.8	For systems with two or more zones in which portions of a second and higher zones cannot be supplied with residual pressure of 65 psi (4.5 bars) by fire department pumpers through a fire department connection, another auxiliary means of supply shall be provided. This may be in the form of high level water storage with additional pumping equipment or other means acceptable to the authority having jurisdiction.	D	Not Applicable: Only one zone in the areas reviewed. Ref: Drawing No. 1. Comply: Hose stations are typically provided with 50', 75' or 100' hose lengths. These hose stations will provide protection for those areas.
*3-2.2.	The number of hose stations for Class II service in each building and each section of a building divided by fire walls shall be such that all portions of each story of the building are within 30 feet (9.2 m) of a nozzle when attached to not more than 100 feet (30.5 m) of hose.	W,D	Does Not Comply: Several areas are unable to be reached with a throw of 30 ft. beyond a 100 ft. length of hose. Ref: Walkdown Checklist No. 15 thru 17; Drawing No. 4 thru 9.
3-4.	Hose Connections.		Title
*3-4.1	Standpipes for Class I service shall be provided with 2-1/2 inch hose connections on each floor. At least one 2-1/2 inch roof outlet shall be provided on structures having combustible roofs, or where there are structures on the roof of combustible construction or housing combustible contents, or where needed for exposure protection. When required by the authority having jurisdiction, an approved duplex gated roof outlet shall be provided for testing and maintenance.	W,D	Not Applicable: Class I service is not provided in the area of our review. Ref: Walkdown Checklist No. 15 thru 17; Drawing No. 4 thru 9.

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CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 14-1978
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
3-4.3.	Standpipes for Class III service shall be provided with both a 2 1/2-inch and 1 1/2-inch hose connection on each floor. The hose connections may be through one 2 1/2-inch hose valve and an easily removable 2 1/2-inch by 1 1/2-inch adapter. At least one 2 1/2-inch roof outlet shall be provided on structures having combustible roofs or where there are structures on the roof of combustible construction or housing combustible contents, or where needed for exposure protection. When required by the authority having jurisdiction, an approved duplex gated roof outlet shall be provided for testing and maintenance.	W,D	Comply: Service at plant is intended to be either Class II or Class III depending upon whether the hose station has a 1-1/2 inch hose valve only or both a 1-1/2 inch and 2-1/2 inch hose valve. Roofs are not combustible and do not have combustible structures attached to them. Ref: Walkdown Checklist No. 15 thru 17; Drawing No. 4 thru 9.
4-1.2	Valves of approved indicating type shall be provided at the main riser for controlling branch lines for Class II service supplying more than one hose station so that in the event that the branch is broken during the fire, the fire department may shut off this branch, conserving the water for their use.	W,D	Does Not Comply: Valves are not provided at the main risers for control of branch lines supplying more than one Class II hose station. Ref: Walkdown Checklist No. 15 thru 17; Drawing No. 1.
4-2.	Hose.		Title
4-2.1.	Each hose outlet provided for use of building occupants (Class II and III services) shall be equipped with not more than 100 feet of approved lined, 1 1/2-inch fire hose attached and ready for use. [See NFPA 196, Standard for Fire Hose (see Appendix B).] Exception: Unlined hose may be used on existing standpipe installations made prior to June 1976.	W,D	Comply: The fire hose is approved for hose station use. Does Not Comply: Several hose stations found with more than 100 ft. of hose. Where the hose exceeds 100, it is provided on a second hose reel and is not hooked to the hose system. Ref: Walkdown Checklist No. 15 thru 17; Drawing No. 4 thru 9; Technical Data No. 11.

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JOB NO 0120-108
CALC NO 0120-108-006

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 14-1978
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-3.	Hose Racks.		Title
*4-3.1.	Each station provided with 1 1/2-inch hose shall be equpped with a listed rack or other approved storage facility.	W,D	Comply: The hose reels installed under the hose system modifications were approved for use in fire hose service. Does Not Comply: Hose reels are not listed by nationally recognized testing laboratory. Ref: Walkdown Checklist No. 15 thru 17; Technical Data No. 5 & 7.
4-3.2.	Each rack for 1 1/2-inch hose shall be provided with a label affixed to include "Fire Hose for Use by Occupants" and operating instructions.	W	Does Not Comply: All hose stations at plant have labels stating, "Warning, for trained personnel only." Ref: Walkdown Checklist No. 15 thru 17.
*4-4.2.	Where the pressure at any standpipe outlet exceeds 100 pounds per square inch, an approved device shall be installed at the outlet to reduce the pressure with required flow at the outlet to 100 pounds per square inch. For Class I and Class III systems the approved device shall not be capable of being adjusted to provide pressures higher than 100 psi if available, unless specified by the fire department. If a pressure greater than 150 psi is available, an appropriate warning sign shall be provided.	W	Comply: Pressures may exceed 150 psi. Signs are provided warning that trained personnel only should operate. Ref: Walkdown Checklist No. 15 thru 17.
4.4.4.	Hose outlet threads shall conform to the American National Fire Hose Connection Screw Thread, as specified in NFPA 194, Screw Threads and Gaskets for Fire Hose Connections (see Appendix B). Exception No. 1: Where local hose coupling threads do not conform to the American National Fire Hose	W,D	Comply: Hose outlet threads do conform to NFPA 194. Ref: Walkdown Checklist No. 15 thru 17; Technical Data No. 12.

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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	Connection Thread, the authority having jurisdiction shall designate the threads to be used. Exception No. 2: Where local hose couplings are of a type without threads, the authority having jurisdiction shall designate the type of couplings to be used.		
4-5.	Nozzles for 1 1/2-inch Hose		Title
4-5.1.	Nozzles shall be listed and approved.	W,D	Comply: Nozzles are approved spray type II. Ref: Walkdown Checklist No. 15 thru 17; Technical Data No. 9.
*4-5.2	Shutoff nozzles shall not be provided when the pressure at the hose valves exceeds 200 pounds per square inch (13.8 bars) unless a listed pressure regulating device which regulates pressure under both flow and no flow conditions is installed.	W,D	Not Applicable: Pressures do not exceed 200 psi. Ref: Drawing No. 10; Technical Data No. 17.
5-3.	Minimum Supply for Class I Service.		Title
*5-3.1.	The minimum supply for Class I service shall be sufficient to provide 500 gallons per minute for a period of at least thirty (30) minutes. Where more than one standpipe is required by Chapter 3, the minimum supply shall be 500 gallons per minute for the first standpipe and 250 gallons per minute for each additional standpipe, the total supply not to exceed 2500 gallons per minute for a period of at least thirty (30) minutes.		Editorial Changes: Addressed under Code Section 531, 1971 Edition. Open Item: See response to Section 531, 1971 Edition.

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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	The supply shall be sufficient to maintain a residual pressure of 65 pounds per square inch at the topmost outlet of each standpipe with 500 gallons per minute flowing from the topmost outlet of the most remote standpipe and 250 gallons per minute flowing from the topmost outlet of each of the other standpipes up to a maximum of 2500 gallons per minute flowing.		
5.3.2.	The minimum water supply at the hydraulically most remote hose connection shall be sufficient to provide a residual pressure of 65 pounds per square inch at the outlet with 500 gallons per minute flowing from the outlet.	W,D	Open Item: See response to Section 531, 1971 Edition.
5-4.2	The minimum water supply at the hydraulically most remote hose connection shall be sufficient to provide a residual pressure of 65 pounds per square inch (4.5 bars) at the outlet with 100 gallons per minute (379 l/min) flowing from the outlet.	W,D	Open Item: See response to Section 531, 1971 Edition.
5-5.2.	The minimum supply for the hydraulically most remote hose connection on Class III service shall be the same as for Class I service.	W,D	Open Item: See response to Section 531, 1971 Edition.
5-6.8.	Hose coupling threads shall conform to the American National Fire Hose Connection Screw Thread, as specified in NFPA 194, Screw Threads and Gaskets for Fire Hose Connections (see Appendix B). Exception No. 1: Where local hose coupling threads do not conform to the American National Fire Hose	D	Not Applicable: This section refers to fire department connections which have not been provided in the areas reviewed. Ref: Drawing No. 1, 2 & 3.

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D.C. COOK Units 1 and 2

JOB NO 0120-108
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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	Connection Thread, the authority having jurisdiction shall designate the threads to be used. Exception No. 2: Where local hose couplings are of a type without threads, the authority having jurisdiction shall designate the type of coupling to be used.		
5-6.9.	a) Hose connections shall be on the street side of buildings and shall be located and arranged so that hose lines can be readily and conveniently attached to the inlets without interference from any nearby objects including buildings, fences, posts, or other fire department connections. b) Hose connections shall be designated by a sign having raised letters at least one inch in size cast on a plate or fitting reading "STANDPIPE." If automatic sprinklers are also supplied by the hose connection, the sign or combination of signs shall indicate both designated services, e.g., "STANDPIPE AND AUTOSPKR," or "AUTOSPKR and STANDPIPE." c) Where a hose connection serves only a portion of a building, an appropriate and durable sign shall be attached indicating the portions of the building served.	D	Not Applicable: See response to Section 5-6.8, this edition.
6-1.1.	Connections from gravity tanks (on buildings) and pressure tanks (on top floor or roof) shall be made to the top of the standpipe system. The size of such connections shall not be smaller than the standpipes which they serve.	D	Not Applicable: This equipment has not been installed in the areas reviewed. Ref: Drawing No. 1, 2, 3 & 11.

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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	Exception: Where the tanks are used as a supply to standpipes in several buildings, or sections of a building, the connections shall be made at the base of the standpipes.		
*6-1.3.	Connections from fire pumps and sources outside the building shall be large enough to deliver the full required water demand without excessive friction loss.	D	Not Applicable: Fire pumps are located inside the plant at elevation 571'. Ref: Drawing 12-5152-1.
6-1.4.	Where two or more standpipes are installed in the same building or section of a building, they shall be interconnected at the bottom. Where standpipes in a single building are supplied by tanks they shall also be interconnected at the top; in such cases, check valves may be installed at the base of each riser to prevent circulation.	W,D	Comply: The Auxiliary Building hose risers are connected to the hose station supply main at elevation 587'. The Unit 1 & 2 RCT tunnel risers are connected to individual supply mains at elevation 587'.
6-4	Fittings.		Title
6-4.1	Type of Fittings.		Title
6-4.1.1	Fittings used in standpipe systems shall be of the materials listed in Table 6-4.1.1 or in accordance with 6-4.1.2. The chemical properties, physical properties and dimensions of materials listed in Table 6-4.1.1 shall be at least equivalent to the standards cited in the table. Fittings used in standpipe systems shall be designed to withstand the system working pressures, but not less than 175 psi (12.1 bars) cold water [125 psi (8.6 bars)] saturated steam pressure. (See Appendix B.)	D	Comply: The specifications for the ASTM A-106 pipe the exceed the requirements for Table 6-4.1.1. Ref: Technical Data No. 15.

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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
6-4.1.2	Other types of fittings may be used, but only those investigated and listed for this service by a recognized testing and inspection agency laboratory and acceptable to the authority having jurisdiction.	D	Comply: Reference code sections 6-4.1.1, this edition.
6-4.1.3	Fittings used in standpipe systems shall be extra heavy pattern where pressures exceed 175 psi(12.1 bars). Exception No. 1: Standard weight pattern cast iron fittings 2 inch size and smaller may be used where pressures do not exceed 300 psi (20.7 bars). Exception No. 2: Standard weight pattern malleable iron fittings 6 inch size and smaller may be used where pressures do not exceed 300 psi (20.7 bars). Exception No. 3: Fittings may be used for system pressures up to the limits specified in listings by a nationally recognized testing laboratory.	D	Not Applicable: Pressures do not exceed 165 psi. Ref: Drawing No. 10; Technical Data No. 10.
6-4.1.4	Where water pressures are 175 to 300 psi (12.1 to 20.7 bars) the ANSI standards permit the use of standard wall pipe and extra heavy valves. Until pressure ratings for valves are standardized, the manufacturer's ratings shall be observed.	D	Not Applicable. Pressures do not exceed 165 psi. Ref: Drawing No. 10; Technical Data No. 10.
6-4.2	All piping shall be installed by means of threaded or flanged fittings, flexible couplings or other approved means. Welding of joints may be allowed. Permission for this work shall be obtained from the authority having jurisdiction.	D	Comply: Welding was performed on site in accordance with the requirements. Ref: Technical Data No. 1.

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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	Welding shall be done in the shop and welding fittings used. Welding fittings shall comply with ANSI B16.9, ANSI B16.25 and ASTM A234 (see Appendix B). Exception: Welding may be done on the premises with the approval of the authority having jurisdiction.		
6-4.2.1	Certification of Welders and Brazers Welders or brazers shall be certified by contractor as being qualified for welding and/or brazing in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators. (See Appendix B).	D	Comply: Section 2.2.2 of Specification DCCPM102QCS, requires certificates of qualification for welders. Ref: Technical Data No. 1.
6-4.3	Approved expansion joints or flexible couplings shall be provided where necessary.		Addressed under Code Section 643, 1971 Edition.
*7-1.1.	All new systems including yard piping shall be tested hydrostatically at no less than 200 pounds per square inch pressure for two hours, or at 50 pounds per square inch in excess of the normal pressure when the normal pressure is in excess of 150 pounds per square inch. The inside standpipe piping shall show no leakage. Refer to NFPA 24 for permissible leakage in underground piping. (See Appendix B.)	D	Comply: Specification DCCPM102QCS, Section 3.4.3 requires hydrostatic testing at 1-1/2 times design pressure. From specification DCCPM104QCS design pressure is 150 psig. One and one-half times 150 psig equals 225 psig. Actual maximum pressure is 165 psi, plus 50 psig, equals 215 psig. Specification DCCPM102QCS is more conservative than the code. Ref: Technical Data No. 1.
7-1.2.1.	Piping between the fire department connection and the check valve in the inlet pipe shall be flushed with a sufficient volume of water so as to	D	Not appliable: Fire department connections are not installed within the area reviewed. Ref: Drawing No. 1, 2, 3 & 10.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	remove all construction debris and trash which may have accumulated in this pipe prior to the completion of the system and prior to the installation of the fire department connection.		
7-1.3.	In a standpipe system any piping which normally remains dry shall be hydrostatically tested at 50 psi above the normal pressure at intervals of not less than five years.	D	Not Applicable: Standpipe systems which normally remain dry are not installed in the areas reviewed. Ref: Drawing No. 4 thru 9.
*7-1.4	Before restoring to service and before water is turned into it, a standpipe system which has been out of service a number of years shall be tested with air at a pressure not exceeding 25 pounds per square inch (1.7 bars) to determine its tightness. The standpipe system shall also be hydrostatically tested at 50 psi (3.4 bars) above the normal pressure.	W	Not Applicable: All standpipes are in service. Ref: Walkdown Checklist No. 15 thru 17.
	CHAPTER 8 BUILDINGS UNDER CONSTRUCTION		Title. Not Applicable: The plant has been operating since the mid-1970's.

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APPENDIX B

NFPA 14 - 1986 EDITION

STANDPIPE & HOSE SYSTEMS

This review includes the following hose stations:

FIRE ZONE	HOSE STATION	ELEVATION	ORIGINAL INSTALLATION	MODIFICATION NO.	MODIFICATION DATE
55	218	625'	---	12-2621	11/85
55	219	625'	---	12-2621	11/85
9	216	596'	---	12-2621	11/85
12	222	591'	---	12-2740	11/85
12	213	591'	---	12-2740	11/85
22	214	591'	---	12-2740	11/85
22	215	591'	---	12-2740	11/85
25	217	596'	---	12-2621	11/85
60	220	625'	---	12-2621	11/85
60	221	625'	---	12-2621	11/85

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
1-6.2.*	CLASS II: For use primarily by the building occupants until the arrival of the fire department (1-1/2 in. hose). EXCEPTION: A MINIMUM 1 IN. HOSE MAY BE USED FOR CLASS II SERVICE IN LIGHT HAZARD OCCUPANCIES WHEN INVESTIGATED AND LISTED FOR THIS SERVICE AND WHEN APPROVED BY THE AUTHORITY HAVING JURISDICTION.	W	Does Not Comply: All hose stations marked for trained personnel only. Ref: Walkdown Checklist No. 18 thru 21.
1-7.1.2.	Dry standpipe system so arranged through the use of approved devices as to admit water to the system automatically by opening a hose valve.		Editorial Changes: Addressed under Code Section 131(2), 1971 Edition.
1-7.1.3.	Dry standpipe system arranged to admit water to the system through manual operation of approved remote control devices located at each hose station.		Editorial Changes: Addressed under Code Section 131(3), 1971 Edition.
1-9.2.	When a "break glass" type protective cover for a latching device is provided, the device provided to break the glass panel shall be securely attached in the immediate area of the "break glass" panel and shall be so arranged that the device cannot be used to break other glass panels in the cabinet door.	W	Not Applicable: Hose cabinets are not provided in the areas surveyed. Ref: Walkdown Checklist No. 18 thru 21.
1-10.2	In combined systems when the building is protected throughout by an approved automatic sprinkler system, and risers are sized by hydraulic calculations, a complete set of all calculations shall be submitted when requested by the authority having jurisdiction.		Editorial Changes: Adressed under Code Section 1-11.2, 1978 Edition.

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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
2-1.3.	CLASS II. In standpipe systems for Class II service each standpipe shall be sized for a minimum flow of 100 gpm (379 L/min). Where one or more standpipes are rrquired, all common supply piping shall be sized for a minimum flow of 100 gpm (379 L/min).	D	Open Item: Hydraulic calculations are required to verify these conditions.
2-1.4.	Standpipes shall be limited to 275 ft. (83.9m) in height and buildings in excess of 275 ft. (83.9m) in height shall be zoned accordingly. EXCEPTION: STANDPIPE ZONE HEIGHTS UP TO 400 FT. (122 M) ARE PERMITTED WHEN ALL PIPE, FITTINGS AND DEVICES ARE RATED FOR NOT LESS THAN THE MAXIMUM SYSTEM PRESSURE AND WHEN THE PROVISIONS OF SECTION 4-7 ARE FOLLOWED.	W,D	Comply: Standpipes are less than 275 ft. in height. Ref: Drawing No. 1, 2 & 3.
2-1.5.*	The minimum size of riser(s) for combined systems shall be 6 in. except when the building is completely sprinklered, the riser(s) may be hydraulically calculated (see Section 6-1).		Editorial Changes: Addressed under Code Section 2-1.4, 1978 Edition.
2-1.9.	For systems with two or more zones in which portions of the second and higher zones cannot be supplied with residual pressure of 65 psi (4.5 bars) by Fire Department Pumpers through a fire department connection, another auxiliary means of supply shall be provided. This may be in the form of high level water storage with additional pumping equipment or other means acceptable to the authority having jurisdiction. (See Figure A-2-1C.)		Editorial Changes: Addressed under Code Section 2-1.8, 1978 Edition.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-1.3.	Hose valve(s) shall have external threads having the NH standard thread, for the valve size specified, as specified in NFPA 1963. Screw Threads and Gaskets for Fire Hose Connections. EXCEPTION: WHERE LOCAL FIRE DEPARTMENT CONNECTIONS DO NOT CONFORM TO NFPA 1963, THE AUTHORITY HAVING JURISDICTION SHALL DESIGNATE THE CONNECTION TO BE USED.	D	Comply: P.O. 02075-821-5X for RFC-DC-12-2740, shows 1-1/2" & 2-1/2" hose valves with male outlets and NH threads. Ref: Technical Data No. 6.
4-4.3.	HOSE, HOSE RACKS, AND NOZZLES.		Title
4-4.3.1.*	Each hose connection provided for use by building occupants (Class II and Class III services) shall be equipped with not more than 100 ft. (30.5 m) of listed 1-1/2 in. lines, collapsible or noncollapsible fire hose attached and ready for use. EXCEPTION NO. 1: UNLINED HOSE MAY BE USED ON EXISTING STANDPIPE INSTALLATIONS MADE PRIOR TO JUNE, 1976. EXCEPTION NO. 2: WHEN HOSE LESS THAN 1-1/2 IN. IS USED FOR CLASS II SERVICE, LISTED NONCOLLAPSIBLE HOSE SHALL BE USED.	W,D	Comply: Class II and III hose stations were typically provided with 50 or 75 hose lenghts. Does Not Comply: Some hose stations found to have more than 100 feet of hose attached. Hose stations are not provided for use by building occupants. Where the hose lengths exceeded 100' it is provided on a second hose reel and is not hooked up to the hose system. Ref: Drawing No. 4 thru 9; Walkdown Checklist No. 18 thru 21.
4-4.3.2*	Each station provided with 1-1/2 in. hose shall be equipped with a listed rack or other approved storage facility. EXCEPTION: EACH STATION PROVIDED WITH HOSE LESS THAN 1-1/2 IN. SHALL BE EQUIPPED WITH A LISTED CONTINUOUS FLOW REEL.	D	Comply: The hose reels installed under modifications are approved for use in hose systems. Ref: Technical Data 6, 7 & 8.

NFPA 14-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

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CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 14-1986
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
4-4.3.3.	Each rack or storage facility for 1-1/2 in. or smaller hose shall be provided with a label affixed to include "Fire Hose for Use by Occupants" and operating instructions.		Editorial Changes: Addressed under Code Section 4-3.2, 1978 Edition.
4-7.	PRESSURE LIMITATIONS.		Title
4-7.1*	Where flowing pressures at any hose valve outlet exceed 100 psi (6.9 bars), an approved device shall be installed at the outlet to reduce the pressure with required flow at the outlet to 100 psi (6.9 bars). For Class I and Class III systems the approved device shall not be capable of being adjusted to provide pressures higher than 100 psi (6.9 bars) if available, unless specified by the fire department.	W,D	Does Not Comply: Flowing pressures can exceed 100 psi. Pressure reducers are not provided. Ref: Drawing No. 10; Walkdown Checklist No. 18 thru 21; Technical Data No. 17.
4-7.2.	Where system pressure at any hose valve outlet exceed 150 psi (10.3 bars), an appropriate warning sign shall be provided at each such outlet unless a pressure regulating device is provided.	W,D	Comply: Appropriate warning signs are provided. Ref: Walkdown Checklist No. 18 thru 21; Drawing No. 10; Technical Data No. 17.
4-7.3.	Where system pressure exceed 175 psi (12.1 bars), a listed pressure regulating device which regulates pressure under flow and no-flow conditions shall be installed at the hose valve outlet. The pressure on the inlet side of the pressure regulating device shall not exceed the rated working pressure of the device. The pressure regulating device shall be so arranged to regulate pressure at the hose valve outlet to a pressure not exceeding 100 psi (6.9 bars).	D	Not Applicable: System pressures are regulated to not exceed 165 psi. Ref: Drawing No. 10; Technical Data No. 17.

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2	RELL	7/14/88	[illegible]	8/15/88

NFPA 14-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

IMPELL CORPORATION

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CALC NO 0120-108-005

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 14-1986
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
5-2-2*	Acceptable water supplies may be: (a) Public waterworks system where pressure and discharge capacity are adequate. (b) Automatic fire pumps. (c) Manually controlled fire pumps in combination with pressure tanks. (d) Pressure tanks. (e) Gravity tanks. (f) Manually controlled fire pumps operated by remote control devices at each hose station (see 1-7.1.3).		Editorial Changes: Addressed Under Section 522, 1971 Edition.
6-1	A combined system is one where the water piping serves both 2-1/2 in. outlets for fire department use and outlets for automatic sprinklers. Such combined systems shall comply with the requirements of NFPA 13, Standard for the Installation of Sprinkler Systems, in regard to the automatic sprinkler portions of the system, and with this standard in regard to number and sizing of vertical risers and water supplies. When the building is protected throughout by an approved automatic sprinkler system, the risers may be sized by hydraulic calculations (See 2-1.5).		Editorial Changes: Addressed Under Section 1-8.2, 1978 Edition.
6-3*	For a building protected throughout by an approved automatic sprinkler system, the water supply required in Section 5-3 or 5-5 may also serve the sprinkler system. Sprinkler demand need not be added.	D	Editorial Changes: Addressed under Section 1-8.3, 1978 Edition.

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IMPELL CORPORATION

NFPA 14-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

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CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 14-1986
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
	EXCEPTION: WHERE THE SPRINKLER SYSTEM DEMAND, INCLUDING HOSE STREAM ALLOWANCE AS DETERMINED IN NFPA 13, STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS, EXCEEDS THE SUPPLY REQUIRED IN SECTION 5-3 OR 5-5, THE LARGER OF THE TWO VALUES SHALL BE PROVIDED. THE WATER SUPPLY REQUIRED FOR A COMBINED SYSTEM IN A BUILDING PROTECTED THROUGHOUT BY AN APPROVED AUTOMATIC SPRINKLER SYSTEM NEED NOT EXCEED 1500 GPM (5678 L/MIN) IN A LIGHT HAZARD OCCUPANCY BUILDING AND 2000 GPM (7570 L/MIN) IN AN ORDINARY HAZARD BUILDING UNLESS REQUIRED BY THE AUTHORITY HAVING JURISDICTION.		
6-4	For a combined system in a building equipped with partial automatic sprinkler protection the water supply requirements of Section 5-3 or 5-5 shall be increased by an amount equal to the hydraulically calculated sprinkler demand or by 150 gpm (568 L/min) for light hazard occupancies or by 500 gpm (1893 L/min) for ordinary hazard occupancies. EXCEPTION NO. 1: WHERE THE HYDRAULICALLY CALCULATED SPRINKLER DEMAND IS LESS THAN 150 GPM (IN LIGHT HAZARD OCCUPANCIES) OR 500 GPM (IN ORDINARY HAZARD OCCUPANCIES) THE HYDRAULICALLY CALCULATED SPRINKLER DEMAND MAY BE ADDED TO THE WATER SUPPLY REQUIREMENTS OF SECTION 5-3 OR 5-5. EXCEPTION NO. 2: THE AUTHORITY HAVING JURISDICITON MAY MODIFY THIS REQUIREMENT BASED ON LOCAL CONDITIONS.	D	Editorial Changes: Addressed under Section 1-8.4, 1978 Edition.

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IMPELL CORPORATION

NFPA 14-CODE COMPLIANCE VERIFICATION CHECKLIST
D.C. COOK Units 1 and 2

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Code Section	0 = Document Search	Summary of [illegible] (List results, and reference details in code sections, Sketches, etc. as required)
[illegible]	[illegible]	Editorial Changes; Addressed under Code Section [illegible], 1971 Edition.
Where a [illegible] tank and [illegible] connected to a common [illegible] means shall be provided [illegible] [illegible]	[illegible]	Editorial Changes; Addressed under Code Section 612, 1971 Edition.
[illegible]	[illegible]	Editorial Changes; Addressed under Code Section 524, 1971 Edition.

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 14-1986
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
6-5	In combined systems, when the building is protected throughout by an approved automatic sprinkler system, 1-1/2 in. hose for use by the building occupants (Class II service) may be omitted, subject to the approval of the authority having jurisdiction, provided that each standpipe outlet location is equipped with a 2-1/2 in. hose valve, a 2-1/2 in. by 1-1/2 in. reducer, and a cap with attachment chain.		Editorial Changes: Addressed under Section 1-8.5, 1978 Edition.
7-1.2*	Where a gravity tank and a pressure tank are connected to a common riser, approved means shall be provided to prevent residual air pressure in the pressure tank (after water has been drained off from it) from holding the gravity tank check valve closed, a condition known as "air lock". Under normal conditions, "air lock" may be conveniently prevented in new equipment by connecting the gravity tank and pressure tank discharge pipes together 45 ft (13.7 m) or more below the bottom of the gravity tank and placing the gravity tank check valve at the level of this connection.		Editorial Changes: Addressed under Code Section 612, 1971 Edition.
7-2.4*	Where the standpipes are supplied from a yard main or header in another building, the connection shall be provided with an approved indicating type valve located outside at a safe distance from the building or at the header.		Editorial Changes: Addressed under Code Section 624, 1971 Edition.

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0	DEW	5/14/88	DWK	5/15/88

Code Section		Method of Verification: W = Walkdown, D = Document Search	Summary of Results (List results and references, details of calculations, Sketches, etc., as required)
[illegible]-2.[illegible]	Valves shall be rated for wo[illegible] pressure not less than the [illegible] pressure to be developed at [illegible] point in the system under any cond[illegible] including th[illegible] pressure measu[illegible] permanently installed fire [illegible] operating at shut-off.	D	[illegible] Specification DC[illegible] Fire detection/suppression equipment and system requires all val[illegible] etc. to [illegible] listed or [illegible] approved. Valves meeting these requirements are rated at 175 psi minimum. Maximum pressure experienced in the fire protection systems at this plant is 165 psi. Ref: Technical Data No. 2.
8-1.1	All new systems including [illegible] shall be tested hydrostatically at not less than 200 lb psi (13.8 [illegible]) pressure for 2 hr or at 50 psi (3.5 [illegible]) in excess of normal pressure wh[illegible] normal pressure is in excess [illegible] (10.3 bars). They hydrostat[illegible] pressure shall be measured [illegible] elevation point of the individ[illegible] system or zone being tested. Inside standpipe piping shal[illegible] no leakage.	D	Comply: Specification DCCPV1100US, Section 5.2 requires hydrostatic tests at 225 psi for 2 hours with no visible leakage allowed. Ref: Technical Data No. 4.
8-1.2A	A flow test shall be conduct[illegible] the hydraulically most remote [illegible] to [illegible] the requirements of [illegible] are met.	D	Does Not Comply: Specification DCCPV1160US, Shop and Field Fabrication and Erection of Fire Protection Piping, does not require this test to be performed. Ref: Technical Data No. 4.
[illegible]	[illegible] tanks shall be kept prop[illegible] filled, and where pressure tanks are employed a pressure of at least 75 psi [illegible] shall be maintained at all times. Special attention shall be given to the condition of the tanks during freezing weather.	D	Not Applicable: Tanks for fire protection water are not provided. Ref: Drawing No. 11.

CODE COMPLIANCE VERIFICATION CHECKLIST
CODE NFPA 14-1986
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results, and reference details in calculations, Sketches, etc., as required)
7-2.5*	Valves shall be rated for working pressures not less than the maximum pressure to be developed at that point in the system under any condition including the pressure measured when a permanently installed fire pump is operating at shut-off.	W,D	Comply: Specification DCCPM103QCS, fire detection/suppression equipment and systems requires all valves, etc. to be UL listed or FM approved. Valves meeting these requirements are rated at 175 psi minimum, maximum pressure experienced in the fire protection systems at this plant is 165 psi. Ref: Technical Data No. 2.
8-1.1*	All new systems including yard piping shall be tested hydrostatically at not less than 200 lb psi (13.8 bars) pressure for 2 hr. or at 50 psi (3.5 bars) in excess of normal pressure when the normal pressure is in excess of 150 psi (10.3 bars). They hydrostatic test pressure shall be measured at the low elevation point of the individual system or zone being tested. The inside standpipe piping shall show no leakage.	D	Comply: Specification DCCPV110QCS, Section 5.2 requires hydrostatic tests at 235 psi for 2 hours with no visible leakage allowed. Ref: Technical Data No. 4.
8-1.2*	A flow test shall be conducted at the hydraulically most remote outlet to assure the requirements of 5-3.2 are met.	D	Does Not Comply: Specification DCCPV110QCS, Shop and Field Fabrication and erection of Fire Protection Piping, does not require this test to be performed. Ref: Technical Data No. 4.
8-2.2*	The tanks shall be kept properly filled, and where pressure tanks are employed, a pressure of at least 75 psi (5.2 bars) shall be maintained at all times. Special attention shall be given to the condition of the tanks during freezing weather.	D	Not Applicable: Tanks for fire protection water are not provided. Ref: Drawing No. 11.

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D.C. COOK Units 1 and 2

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EXTENDED
NFPA CODE COMPLIANCE EVALUATION
FOR THE
DONALD C. COOK NUCLEAR PLANT

PREPARED FOR:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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ABB IMPELL JOB NO. 0120-164

ABB IMPELL REPORT NO. 09-0120-0381

REVISION 1

JANUARY, 1991

IMPELL CORPORATION

REPORT APPROVAL COVER SHEET

CLIENT: American Electric Power Service Corporation

PROJECT: Cook Nuclear Extended NFPA Code Compliance

JOB NUMBER(S): 0120-164

REPORT TITLE: Extended NFPA Code Compliance Evaluation for D.C. Cook Plant

REPORT NUMBER: 09-0120-0381

REVISION RECORD

REV.	PREPARED	REVIEWED	APPROVED	DATE
0	David E. Kijek	S J Chiugo	M E Bartlett	12/14/90
1	David E. Kijek	S J Chiugo	M E Bartlett	1/14/91

Effective 06/88

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REVISION	PAGE	DESCRIPTION OF REVISION
A	--	Issue for Comment
0	--	Original Issue
1	--	Revised for Clarification

1.0 EXECUTIVE SUMMARY

1.1 Project Overview

This report documents the methodology, assumptions and results for the NFPA code compliance evaluation of the fire protection system in the areas listed below for the D.C. Cook Nuclear Plant.

"LIST OF PLANT FIRE AREAS REQUIRING VERIFICATION"

Fire Area	Fire Area Identification	Fire Zones Which Make Up the Fire Area	NFPA Code(s)
B	Unit 1 & 2 Turbine Building	79, 80, 84, 85, 90, 91 96, 97 * SEE NOTE 3	10, 13, 14 & 72D
B	Unit 1 & 2 Turbine Building	129, 130 *.SEE NOTE 1	10 & 14
AAA CCC	Unit 1 & 2 Containment Charcoal Filter Unit & Reactor Coolant Pump Suppression/Detection Systems, Unit 1 & 2 Containment Cable Tray Detection Circuits.	66, 67, 68, 74, 75, 76, 101, 102, 103, 104 * SEE NOTE 4	10, 14, 15, 72D & 72E
---	Unit 1 & 2 Transformer and Turbine Wall Water Spray Systems	Yard	15, 72D & 72E
B	Unit 1 & 2 Diesel Fire Pump Room Sprinkler Systems.	28, 30 * SEE NOTE 2 & 4	10, 13, 14 & 72D

* NOTES

1. NFPA 10 & 14 will be verified for coverage between columns H-19, G-19, H-8 & G-8 only for Aux. Bldg. exposure protection.

2. Hose and extinguishers located in Fire Zone 142 will be used to verify adequate coverage of hazards within Fire Zones 28 & 30.

3. These fire zones will be verified for all portions of the fire zone within 40 feet of column line H, and auxiliary feed water pump rooms or safety related trays. The portions of the fire zones reviewed included the area bounded by column coordinates: Fire Zones #79-80 (Col. Lines H-23, H-14, G-26, G-18, GA-23, GA-26, E-18 and E-14); Fire Zones #84-85 (Col. Lines H-13, H-4, G-9, G-1, GA-4, GA-1, E-13 and E-9); Fire Zones #90-91 (Col. Lines

H-14, H-23, E-14, E-18, G-18, G-26 and GA-26); Fire Zones #96-97 (Col. Lines H-13, H-4, G-13, G-1, GA-4 and GA-1); Fire Zones #129 & 130 (Col. Lines H-8, H-19, G-8 and G-19). ⚠

4. Fire Zones #28 & 30 and fire areas AAA & CCC will have the entire area reviewed for compliance with the applicable NFPA Code.

1.2 Conclusions

The evaluation concluded that the fire protection systems for the extended areas reviewed of the Donald C. Cook Nuclear Plant are generally in compliance with the NFPA codes reviewed. The systems were evaluated against the code requirements for each NFPA code edition to determine compliance, noncompliance, and open items, as shown in Appendix A1 through A6 of this report. Noncompliance and open items identified for each code edition are identified in Sections 3.1 through 3.6 of this report. Deviations were reevaluated to determine whether each item could be deemed acceptable "as installed" based upon credited plant procedures or past practices at the plant. Deviations and open items which could not be justified are identified below, by specific code:

NFPA 10 - Portable Fire Extinguishers

1. Several areas have Class A combustibles without having extinguishers suitable for these Class A hazards within the 75' travel distance required by the code.

2. Many locations exceed the maximum travel distances from the area to an extinguisher.

3. The fire facilities drawings which identify the location of fire extinguishers do not depict the actual installed conditions.

4. Extinguishers were found to have their access obstructed or are installed in locations which are not properly marked.

5. Procedure 12-SHP 2270 FIRE.001 does not verify if the extinguisher is unobstructed, operating instructions are facing out or the fullness of each unit.

NFPA 13 - Installation of Sprinkler Systems

1. Fire Zones 79, 80, 90 and 91 had misaligned sprinklers for the cable tray systems.

2. Sectionalizing valve No. 1-FP-196 does not have a valve manual operator.

3. Hangers were missing on sprinkler piping in Fire Zones 80, 84, 91 and 96.

4. Improper installation of sprinklers were observed in Fire Zones 80, 96 and 97.

5. The areas system installed in Fire Zone 91 use 1/4" orifice nozzles which are less than the 1/2" orifice specified by NFPA 13.

6. Sprinklers for Fire Zones 79, 80, 84, 91 and 96 were painted.

7. Sprinklers were found to be missing in Fire Zones 79, 80, 84, 91, and 96.

8. Sprinklers were found to be obstructed in Fire Zones 91, 96 and 97.

9. Sprinklers are installed greater than 16 inches below the deck in Fire Zones 90, 91, 96 and 97.

NFPA 14 - Standpipe and Hose System

1. Hydraulic calculations should be performed to verify system water supply adequacy.

NFPA 15 - Water Spray Fixed Systems

1. Water supply graphs are not available for review to verify that the water supply is adequate for the system demands.

NFPA 72D - Proprietary Protective Signaling System

1. The Unit 1 and 2 RCP pump detector loop resistance value is not verified in current surveillance tests.

   (NOTE: This is a typical deficiency for NFPA 72E - Automatic Fire Detectors.)

Specific details, including the actual code sections, describing these deviations and open items are presented in Sections 3.1 through 3.6 of this report. These sections also provide the justifications presented for the deviations and open items.

2.0 INTRODUCTION

ABB Impell Corporation was contracted by American Electric Power Service Corporation, Indiana-Michigan Power Company, under Contract No. C-7275, to perform an extension of the previous NFPA code compliance evaluation, which was originally conducted by ABB Impell in May 1988. The fire protection systems included in this evaluation process are those systems installed in selected portions of the turbine building, containment, and yard areas at the D.C. Cook Nuclear Plant.

D.C. Cook in their January 31, 1977 Response to Appendix A to BTP APCSB 9.5-1 stated that: "All fire suppression systems have been designed and installed in accordance with the applicable NFPA Codes as follows: 12, 12A, 13, 14, 15 and 17." This document also states, in Section E, Fire Detection and Suppression, that: "Fire detection systems at the Cook Plant conform to the applicable portions of NFPA 72D except for the testing frequency specified in Paragraph 1232."

Although D.C. Cook did not commit to NFPA 10 and 72E, ABB Impell was requested by AEP to include these codes as part of the original review.

Subsequently, the NRC's April, 1990 Safety Evaluation Report stipulated that the D.C. Cook Nuclear Plant should comply with the above NFPA codes for additional areas of the plant. The NRC also indicated that the review should focus on the significant deficiencies previously identified under ABB Impell Report No. 09-0120-0123 dated May, 1988. Generally, these areas include those which contain safety related/safe shutdown components and/or cables or the potential exposure of those systems to a fire hazard in an adjacent fire zone. The "significant deficiencies" would be defined as those which would impact system effectiveness (i.e., nozzle spacing, obstructions, system materials installed, etc.), supervision (i.e., method of connection to Plant fire alarm system) and maintenance (i.e., surveillance performance and procedures.) For the purposes of this report and conservative approach, the deficiencies reviewed encompassed all the deficiencies noted in Impell Report No. 09-0120-0123.

2.1 Scope of Work

ABB Impell's scope of work was to determine the compliance, or noncompliance, of the fire protection systems installed in the selected areas to the specific NFPA code requirements (edition years identified by the AEPSC) which were in effect at the time the fire protection systems were designed and/or installed.

The areas of the plant, that were reviewed, included:

Those portions of the fire zone within 40 feet of column line H, and auxiliary feed water pump rooms or safety related trays. The portions of the fire zones reviewed included the area bounded by column coordinates: Fire Zones #79-80 (Col. Lines H-23, H-14, G-26, G-18, GA-23, GA-26, E-18 and E-14); Fire Zones #84-85 (Col. Lines H-13, H-4, G-9, G-1, GA-4, GA-1, E-13 and E-9); Fire Zones #90-91 (Col. Lines H-14, H-23, E-14, E-18, G-18, G-26, and GA-26); Fire Zones #96-97 (Col. Lines H-13, H-4, G-13, G-1, GA-4 and GA-1) Fire Zones 129 & 130 (Col. Lines H-8, H-19, G-8 and G-19). 

- Unit 1 & 2 Containment Charcoal Filter Unit and Reactor Coolant Pump Suppression/Detection Systems, Unit 1 & 2 Containment Cable Tray Detection Circuits and Extinguisher/Standpipe Hose reach throughout (Fire Zone 66-68, 74-76, 101 through 104)

- Unit 1 & 2 Transformer and Turbine Wall Water Spray Systems (Yard)

- Unit 1 & 2 Diesel Fire Pump Room Sprinkler Systems (Fire Zone 28 & 30)

The NFPA Codes used for the evaluation included:

10 - Portable Fire Extinguishers; 1984 Edition

13 - Installation of Sprinkler Systems; 1971 Edition

14 - Installation of Standpipe and Hose Systems; 1971 Edition

15 - Water Spray Fixed Systems; 1973 Edition

72D - Installation, Maintenance and Use of Proprietary Protection Signaling Systems; 1967 Edition

72E - Automatic Fire Detectors; 1974 Edition

The NFPA standards referenced in this report can be found in ABB Impell Report No. 09-0120-0123, Rev. 0, Appendix A.

2.2 Methodology

ABB Impell conducted the code compliance review in three phases. Phase I identified the fire areas/zones containing or exposing safety related/safe shutdown equipment and also selected the NFPA Code section to be included in the code compliance review based on the "significant deficiencies" previously identified in ABB Impell Report No. 09-0120-0123. Phase II consisted of the actual code verification effort. Phase III will consist of the performance of engineering evaluations required to justify deficiencies identified during the Phase II process.

The identification of the fire areas/zones in the Phase I task was accomplished by reviewing the D.C. Cook Plant's Fire Hazards Analysis which described the fire areas/zones containing or exposing safety-related/safe shutdown equipment. Each of the identified NFPA code deficiencies in ABB Impell Report No. 09-0120-0123 were reviewed to determine which sections were considered significant and could have functional impact upon the adequacy of fire protection features in other areas of the D.C. Cook Nuclear Plant. For the purposes of this report and conservative approach, the deficiencies reviewed encompassed all the deficiencies noted in Impell Report No. 09-0120-0123.

Each of the codes and their respective sections were developed into a matrix, entitled Code Compliance Verification Checklist (CCVC) and shown in Appendix A1 through A6 in this report. This matrix identifies each code section to be verified, the verification method to be used (walkdown, document search or both) and a summary of the results of the evaluation.

To facilitate the verification process, two additional matrices were developed, a Walkdown Verification Checklist (WVD) and a Document Verification Checklist (DVC).. These checklists list the applicable code sections; whether the installed systems did/did not comply or if the code sections were not applicable to the installed system; and comments for each noncomplying/not applicable section. The DVC had an additional column to identify the documents reviewed for verification of the specific code sections.

In Phase II, walkdowns were conducted to verify each of the code sections. The walkdowns were conducted by three teams of two engineers each. Each team was assigned two of the six codes to be verified. This effort was conducted at the D.C. Cook Plant during the period of July 23 through July 27, 1990. Upon completion of the walkdowns, the teams then completed the document search portion of the code verification effort.

Phase III of the work will involve the review of the deficiencies identified in Phase II and provide an engineering evaluation to justify the adequacy of the system arrangement for areas in which it was installed. These evaluations utilize the methodology from Generic Letter 86-10 and good engineering practices. Where reasonable justifications can not be provided for the deficiency being evaluated, ABB Impell will provide a recommendation for upgrading the system to provide compliance with the applicable code.

2.3 General Assumptions

This report utilized the following general assumptions shown below and the additional assumptions identified in Sections 3.1 through 3.6 of this report.

1. All drawings, procedures, design specifications and other documentation provided to ABB Impell for use on this project are the latest revision, most current, available.

2. Specifications and drawings were used to evaluate the piping, fittings and miscellaneous hardware used in the fire protection systems to confirm compliance with the requirements of the appropriate NFPA codes in effect at the time of installation.

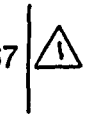
3. Workmanship and construction practices during installation of the systems complied with the code requirements in effect at the time.

4. It is assumed that all surveillance tests and procedures are properly implemented.

5. The review of certain systems within these structures shall be performed via documentation review only based on the following:

   - The Unit 1 containment (Fire Area AAA) will not be accessible due to the Plant being in operation.

   - The Unit 1 and 2 containment charcoal filter units due to ALARA concerns.

6. The new Alison control panels model number A888-M664/A recently installed for the Unit 1 main transformer and the Unit 2 start-up transformer, were reviewed for compliance with the requirements of NFPA 72D-1967 Edition. Although these panels were installed after 1986, the intent of the Code Section Requirements reviewed as part of this evaluation for the 1967 Edition, did not significantly change under the 1986 Edition. Therefore, to provide consistency, these panels were reviewed to the 1967 Edition. 

7. All fire zones within the turbine building identified in the Executive Summary and Section 2.1 of this report are based on reviewing those portions of the zone within 40 feet from column line H, the auxiliary feed water pump cubicles or safety related cable trays. The basis for this partial review assumes that a fire in the areas reviewed would be controlled, extinguished or limited in the extent of its damage by the area's suppression system. It is also assumed that for a fire originating outside the areas reviewed, the Fire Protection features provided in those areas are adequate for their intended function.

3.0 CODE COMPLIANCE EVALUATIONS

This section provides a detailed review of each specific NFPA code evaluated. This review includes: the scope of work for each evaluation, what assumptions were made, and a table listing the deviations/open items from the specific code sections and the recommendations/justifications for each deviation or open item.

3.1 NFPA 10 - Portable Fire Extinguishers

3.1.1 Scope of Evaluation

The evaluation of the portable fire extinguisher system was reviewed under the 1984 edition of the code. Although the system was installed under different edition years from 1970 to 1984, the difference in the edition requirements were minimal and the 1984 edition year was deemed to be more applicable to the installed system.

The following areas were evaluated under the requirements of NFPA 10, 1984 Edition:

- These fire zones will be verified for all portions of the fire zone within 40 feet of column line H, and auxiliary feed water pump rooms or safety related trays. The portions of the fire zones reviewed included the area bounded by column coordinates: Fire Zones #79-80 (Col. Lines H-23, H-14, G-26, G-18, GA-23, GA-26, E-18 and E-14); Fire Zones #84-85 (Col. Lines H-13, H-4, G-9, G-1, GA-4, GA-1, E-13 and E-9); Fire Zones #90-91 (Col. Lines H-14, H-23, E-14, E-18, G-18 to G-26 and GA-26); Fire Zones #96-97 (Col. Lines H-13, H-4, G-13, G-1, GA-4 and GA-1) Fire Zones 129 & 130 (Col. Lines H-8, H-19, G-8 and G-19). 1

- Unit 1 & 2 Containment Fire Areas AAA & CCC (Fire Zone 66-68, 74-76, 101 through 104)

- Unit 1 & 2 Diesel Fire Pump Room Sprinkler Systems (Fire Zone 28 & 30)

- Extinguishers located in Fire Zone 142 were used to verify adequate coverage of hazards within Fire Zones 28 & 30.

The evaluation of the portable fire extinguisher system verified the following features:

1. Proper types of fire extinguishers have been provided based upon the characteristics of the anticipated fires.

2. Fire extinguishers have been properly distributed throughout the plant.

3. Procedures for the Inspection, Maintenance and Recharging of fire extinguishers are satisfactory.

3.1.2 Assumptions

The following assumption has been made for the evaluation of NFPA 10.

1. Service activities performed on the fire extinguisher by all outside service companies are performed in accordance with the appropriate sections of the code.

3.1.3 Deviations and Recommendations/Justifications

Portable fire extinguishers at the plant are in compliance with NFPA 10 except as identified by the open items and deviations listed in Table 3.1-1. The table also provides recommendations and/or justifications for these items.

3.1.4 References

WALKDOWN VERIFICATION CHECKLISTS

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
1	0120-164-001A	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 79)	0	12/90
2	0120-164-001B	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 80)	0	12/90
3	0120-164-001C	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 84)	0	12/90
4	0120-164-001D	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 85)	0	12/90
5	0120-164-001E	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 28)	0	12/90

WALKDOWN VERIFICATION CHECKLISTS (Continued)

6	0120-164-001F	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 30)	0	12/90
7	0120-164-001G	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 90)	0	12/90
8	0120-164-001H	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 91)	0	12/90
9	0120-164-001I	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 96)	0	12/90
10	0120-164-001J	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 97)	0	12/90
11	0120-164-001K	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 129)	0	12/90
12	0120-164-001L	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 130)	0	12/90

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		PROCEDURES		
13	12SHP2270 FIRE.001	Portable Fire Extinguisher Inspection	1	06/03/88
		TECHNICAL DATA		
		Catalog **DRAWINGS**		
14	F-8486	Ansul Fire Protection	-	1984
15	12-5267-6	Fire Facilities Basement Plan El. 591'-0" & El. 587'-0" Units 1 & 2	6	01/29/90
16	12-5268-5	Fire Facilities Mezzanine Floor El. 609'-0" Units 1 & 2	5	01/29/90
17	12-5269-5	Fire Facilities Turbine Bldg. Main Floor El. 633'-0" Units 1 & 2	5	01/29/90
		LICENSING DOCUMENTS		
18	50-315 50-316	Safety Evaluation Document of IMPC D.C. Cook Plant Units 1 & 2	-	04/26/90

TABLE 3.1-1

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 10 - Portable Fire Extinguishers

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
1-6.2	Deviation a. Extinguishers are obstructed from direct access. These Include:	Recommendation: Relocate to an accessible location and revise facilities drawing accordingly.

Fire Zone	Exting. No.
79	FES 591T-78BC
	FES 591T-77CO_2
	FES 591T-79BC
80	FES 591T-72BC
	FES 591T-73CO_2
	FES 591T-66BC
84	FES 591T-96BC
	FES 591T-96CO_2
85	FES 591T-51BC
91	FES 609T-42CO_2
96	FES 633T-27BC

b. Extinguishers were not in their designated places or of the type of extinguisher designated.

Recommendation:
Relocate extinguisher or revise facilities drawing accordingly.

FZ#1/Exting No.	Deficiency
66/Unknown	Improper type indicated on dwg.
79/FES 591T-78BC	Wrong location on
FES 591T-77CO_2	on drawing.
80/FES 591T-68BC	Wrong type
FES 591T-66BC	Wrong location
84/FES 591T-61BC	Wrong type
91/FES 609T-50CO_2	Wrong location
129/FES 633T-27BC	Wrong location

TABLE 3.1-1 (Continued)

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 10 - Portable Fire Extinguishers

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
1-6.2 (Cont'd)	Extinguisher locations were not properly marked. They include: Fire Zone #/Exting. No. 80/FES 591T-75CO_2 96/FES 591T-35BC	Recommendation: The proper markings (i.e., painted location) should be provided.
3-1.2 & 3-2.1	Deviation: Class A rated extinguisher is not available within 75' travel distances for first aid use. These include Fire Zones 28, 30, 84, 85, 91, 96, 97, 129 & 130 and Fire Areas AAA & CCC (Unit 1 & 2 Containments).	Recommendation: Provide extinguisher within travel distance for fire zones 28, 30, 84, 85, 91, 96, 97, 129 & 130 accordingly. Justification: Based on the review of the SER for BTP APSCB 9.5-1, Appendix A, Table 1, the portable extinguishers provided within the containment structures (Fire Areas AAA & CCC) meet the requirements of the commitment made and are therefore, considered acceptable.
3-3.1 & 3-3.3	Deviation: Class B rated extinguisher is not available within 50' travel distances for the following: Fire Zones 96, 129 & 130 and Fire Areas AAA & CCC (Unit 1 & 2 Containments).	Recommendation: Provide extinguisher within travel distance for fire zones 96, 129 & 130 accordingly. Justification: Based on the review of SER for BTP APSCB 9.5-1 Appendix A, Table 1, the portable extinguishers provided within the containment structures meet (Fire Areas AAA & CCC) the requirement of the commitment made and are therefore, considered acceptable.

TABLE 3.1-1 (Continued)

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 10 - Portable Fire Extinguishers

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
4-3.2	Deviation: Procedure 12-SHP 2270 FIRE 001 does not contain surveillance criteria to verify that the extinguisher is unobstructed, the operating instructions are facing out, or that the unit is checked for inspection.	Recommendation: Revise procedure to ensure that extinguisher is accessible and unobstructed, the instructions are facing out, and fullness is verified by lifting the extinguisher.
4-3.4.2 & 4-4.3	Deviation: Extinguisher tanks do not indicate person providing service and when service was performed.	Justification: Plant procedure No. 12 SHP 2270 Fire.001 properly documents the personnel performing the service and when it was performed. Therefore, the intent of this code section is being met.

3.2 NFPA 13-1971 Sprinkler Systems

3.2.1 Scope of Evaluation

The sprinkler systems of D.C. Cook were originally designed under the jurisdiction of the 1971 Edition of NFPA 13. Over the course of time, modifications to the sprinkler systems were performed. The most recent modifications were completed under the jurisdiction of the 1983 Edition of NFPA-13. However, for the purpose of this evaluation, only the original (1971) Edition of NFPA 13 was utilized since no modifications after the initial design were performed on the systems being evaluated. The following systems were evaluated under the requirements of NFPA 13, 1971 Edition:

System	Fire Zone	Area
Wet Pipe	79, 80, 84, 85, 90, 91, 96, 97	The fire zones will be verified for all portions of the fire zone within 40 feet of column line H, and auxiliary feed water pump rooms or safety related trays. The portions of the fire zones reviewed included the area bounded by column coordinates: Fire Zones #79-80 (Col. Lines H-23, H-14, G-26, G-18, GA-23, GA-26, E-18 and E-14); Fire Zones #84-85 (Col. Lines H-13, H-4, G-9, G-1, GA-4, GA-1, E-13 and E-9); Fire Zones #90-91 (Col. Lines H-14, H-23, E-14, E-18, G-18, G-26 and GA-26); Fire Zones #96-97 (Col. Lines H-13, H-4, G-13, G-1, GA-4 and GA-1).
Wet Pipe	28, 30	Units 1 & 2 Diesel Fire Pump Room Sprinkler Systems

3.2.2 Assumptions

The following assumptions have been made for the evaluation of NFPA 13.

1. The above noted fire protection systems at the D.C. Cook Plant are not subject to earthquake support criteria as it pertains to NFPA codes.

3.2.3 Deviations and Recommendations/Justifications

The sprinkler systems evaluated are in compliance with NFPA 13 - 1971 except as identified by the open items and deviations in Table 3.2-1. The table also provides recommendations and/or justifications for these items.

3.2.4 References

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		WALKDOWN VERIFICATION CHECKLISTS		
1	0120-164-002A	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Turbine Bldg., Zone 79)	0	12/90
2	0120-164-002B	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Turbine Bldg., Zone 80)	0	12/90
3	0120-164-002C	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Turbine Bldg., Zone 90)	0	12/90
4	0120-164-002D	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Turbine Bldg., Zone 91)	0	12/90
5	0120-164-002A	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Cable Trays, Zone 79)	0	12/90
6	0120-164-002F	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Cable Trays, Zone 80)	0	12/90

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
7	0120-164-002G	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Cable Trays, Zone 90)	0	12/90
8	0120-164-002H	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Cable Trays, Zone 91)	0	12/90
9	0120-164-002I	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Area & Tray, Zone 84)	0	12/90
10	0120-164-002J	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Area & Tray, Zone 85)	0	12/90
11	0120-164-002K	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Area & Tray, Zone 96)	0	12/90
12	0120-164-002L	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Area & Tray, Zone 97)	0	12/90
13	0120-164-002M	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Diesel Fire Pump Rooms, Zones 28, 30)	0	12/90

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		PROCEDURES		
20	PO-050-508	Fire Protection - Water Preoperational Test Procedure	0	07/03/74
21	12-OHP-4030-STP-120VC	Fire Protection Yearly Valve Cycle and Lineup Verification	1	07/19/90
22	12-OHP-4030-STP-120VV	Fire Protection Valve Lineup Verification	0	11/17/88
23	12-OHP-4030-STP-120SF	Fire Protection Unobstructed Flow Test and Sprinkling Alarm Test	1	07/19/90
24	12-OHP-4030-STP-124	Fire Protection System Flush and Loop Flow Test	0	10/05/89
25	12-OHP-4030-STP-223	Fire Protection Water System Test	8	07/27/89
26	12-OHP-4030-STP-125NS	Non-Tech Spec Required Sprinkler Tests	1	10/12/89
		TECHNICAL DATA		
30	-	Letter From: R.J. Daley To: R.W. Jurgensen Instruction Book, "Grinnel and Star Fire Systems Equipment"	-	07/15/74
31	SD-DCC-FP101	System Description, Fire Protection System - Water	2	12/26/89
32	-	Specification for Fire Protection Systems of D.C. Cook Nuclear Plant	0	04/02/71
33	DCCPM104QCS	Piping Specification	4	11/09/72
34	DCCPM102QCS	Shop and Field Fabrication and Erection	4	05/24/73

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
35	ROC from D. Kipley to B. Gerwe	Ambient Temperature Conditions	-	08/06/90
36	0120-164-005	ABB Impell Calc., NFPA 72D, Code Compliance Verification Checklist	O	12/90
37	0120-164-006	ABB Impell Calc., NFPA 72E, Code Compliance Verification Checklist	O	12/90
38	-	Grinnel Hydraulic Calcs for Zone 79	-	02/18/72
39	-	Grinnel Hydraulic Calcs for Zone 80	-	03/13/72
40	-	Grinnel Hydraulic Calcs for Zone 90	-	03/30/72
41	-	Grinnel Hydraulic Calcs for Zone 91	-	03/30/72
42	-	Grinnel Hydraulic Calcs for Zone 79 Cable Trays	-	05/26/72
43	-	Grinnel Hydraulic Calcs for Zone 80 Cable Trays	-	07/05/72
44	-	Grinnel Hydraulic Calcs for Zone 90 Cable Trays	-	09/22/72
45	-	Grinnel Hydraulic Calcs for Zone 91 Cable Trays	-	11/09/72
46	-	Hodgeman Hydraulic Calcs for Zone 84	-	10/18/74
47	-	Hodgeman Hydraulic Calcs for Zone 85	-	12/27/72
48	-	Hodgeman Hydraulic Calcs for Zone 96	-	12/11/74

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
49	-	Hodgeman Hydraulic Calcs for Zone 97	-	05/19/75
50	ROC from D. Kipley to B. Gerwe	D.C. Cook Code Compliance Review	-	08/21/90
51	0120-164-007	ABB Impell Calc. Deviation Evaluation	0	12/90
		LICENSING DOCUMENTS		
60	Docket No. 50-315, 50-316	Safety Evaluation Document of Donald C. Cook Plant, Units 1 & 2	1	01/30/87
		DRAWINGS		
70	DWG 46-032-71M-20	Sprinkler Piping, Unit 1 Generator End Basement	2	12/18/71
71	DWG 46-032-71M-24	Sprinkler Piping, Unit 1 Turbine End Basement Zone 80	3	10/30/71
72	DWG 46-032-71M-29	Sprinkler Piping, Unit 1 Generator End, Mezz Floor Zone 90	0	12/10/71
73	DWG 46-032-71M-32	Sprinkler Piping, Unit 1 Turbine End Mezz Floor Zone 91	0	11/03/71
74	DWG 46-032-71M-22	Sprinkler Piping, Unit 1 Generator End Basement Cable Racks Zone 79	1	05/26/72
75	DWG 46-032-71M-26	Sprinkler Piping, Unit 1 Turbine End Basement Cable Racks Zone 80	0	05/26/72

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
76	DWG 46-032-71M-31	Sprinkler Piping, Unit 1 Generator End, Mezz Floor Cable Racks Zone 90	0	09/22/72
77	DWG 46-032-71M-35	Sprinkler Piping, Unit 1 Turbine End, Mezz Floor Cable Racks Zone 91	0	07/29/72
78	DWG 121-8	Sprinkler Piping, Unit 2 Turbine End, Mezz Floor Floor Zone 84	1	10/21/74
79	DWG 121-22	Sprinkler Piping, Unit 2 Turbine End Basement Cable Racks Zone 84	0	08/16/76
80	DWG 121-10	Sprinkler Piping, Unit 2 Generator End Basement Floor Zone 85	2	12/30/74
81	DWG 121-24	Sprinkler Piping, Unit 2 Generator End Basement Cable Trays Zone 85	0	09/23/76
82	DWG 121-12	Sprinkler Piping, Unit 2 Turbine End Mezz Floor Zone 96	1	11/27/74
83	DWG 121-31	Sprinkler Piping, Unit 2 Turbine End Mezz Floor Cable Racks, Zone 96	0	11/17/76
84	DWG 121-14	Sprinkler Piping, Unit 2 Generator End Mezz Floor Zone 97	1	05/19/75
85	DWG 121-28	Sprinkler Piping, Unit 2 General End Mezz Floor Cable Racks Zone 97	0	10/15/76
86	DWG 1-5152J-1	Flow Diagram, Unit 1 Details - Turbine Bldg. and Screen House	1	06/21/88

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
87	DWG 2-5152K-2	Flow Diagram, Unit 2 Details - Turbine Bldg. and Screen House	2	06/21/88
88	DWG 2-5152C-2	Flow Diagram, Unit 2 Turbine Bldg. and Screen House	2	08/04/88
89	DWG 1-5152B-1	Flow Diagram, Unit 1 Turbine Bldg. and Screen House	4	04/07/89
90	RDR-12-253	Sprinkler Piping Diesel Fire Pump Rooms	1	04/20/79

TABLE 3.2-1

DEVIATION AND RECOMMENDATIONS/JUSTIFICATION
NFPA 13 - Installation of Sprinkler Systems (1971)

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
1041	Deviation: a. Fire Zones 79, 80, 90 & 91 had misaligned sprinklers for the cable tray systems. b. Protective guards were missing for hatchway sprinklers in Fire Zone 80. c. Sectionalizing valve No. 1-FP-196 does not have a valve operator.	a. Recommendation: Realign sprinkler nozzles as originally designed. b. Justification: ABB Impell Calc. No. 0120-164-007, Section 4.1-1 verified that the protective guards for the sprinklers at the hatchway are not required. Recommendation: Provide valve operator for valve 1-FP-196.
1046	Open Item: The instructions charts or care maintenance pamphlets (NFPA 13A) provided for the Unit 2 sprinkler systems.	Justification: Although maintenance instructions are not provided, the surveillance not procedures currently being implemented meet the intent of this code section.
1141	Open Item: Documentation could not be found to verify if the flooring is watertight.	Justification: Based on ABB Impell Calc. No. 0120-164-007, Section 4.1-2 the location of the system headers and floor drain facilities were verified for not having an impact on the safety related components installed in the area of system headers.

DEVIATION AND RECOMMENDATIONS/JUSTIFICATION
NFPA 13 - Installation of Sprinkler Systems (1971)

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
1412	Open Item: No documents stating that all materials and devices installed for the sprinkler systems were new or considered satisfactory for reuse.	Justification: The materials and devices specified in the 1971 piping and installation specification are in accordance with the NFPA standard and are therefore acceptable. In addition, walkdowns of the systems performed in July, 1990, verified the system components were well maintained.
	Deviation: Jamesbury butterfly isolation valves for wet pipe systems are not approved for fire service use.	Justification: The Jamesbury butterfly valve, although not listed, is adequate for the intended service. Valve positions is indicated by an arrow on the valve body and is cast of the appropriate materials for the class of service.
1511 1631 1632 1700	Open Item: There are no documents stating that the installation and testing of the Unit 2 sprinkler systems have been completed.	Justification: The review of Procedure 2-PO-050-508 verified that preoperational testing was performed as required. In addition, surveillance procedures performed verify the operability of these systems.
1611	Open Item: There are no certificates of acceptance for all systems.	Justification: The review of procedure PO-050-508 verified that preoperational testing was performed and were found to be acceptable.
1620	Deviation: Installation specifications do not require lead-in connections to be flushed.	Justification: Test procedure (12 OHP 4030.STP.124) requires periodic flushing of all systems.

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
2822	Deviation: a. Non-approved gauges were provided for the sprinkler system riser in Fire Zone 96, 84, 85, 97, 28 & 30. b. Gauge by-pass lines at fire zone 28 alarm valve are not freeze protected. c. Fire Zones 28 & 30 gauges read 210 PSI on a 300 psi scale.	Justification: a. The intent of this code requirement is to establish gauge accuracy on systems subject to large fluctuations in pressure. The water system at D.C. Cook is not subject to large pressure surges and therefore the gauges are acceptable. b. The alarm valve for Fire Zone 28 is heat traced and has not experienced freezing problems. c. The intent of this code requirement is to establish gauge accuracy on systems subject to large fluctuations in pressure. The water system at D.C. Cook is not subject to large pressure surges and therefore the gauges are acceptable.
3091 3092 3093 3094 3095	Open Item: There are no documents to verify proper installation of piping fittings and joints.	Justification: See response to code sections 1511, 1631, 1632 & 1700.
3241 & 3783	The main drain facilities for the sprinkler system headers for Unit 1 are not piped to flushing header. The retard chamber drains for Unit 2 sprinkler systems drain to floor.	Justification: Based on ABB Impell Calc. No. 0120-164-007, Section 4.1.2, adequate precautions are utilized for facilitating drainage.
3562	Deviation: a. Hangers were missing on sprinkler piping in Fire Zones 80, 84, 91 & 96. Deviation: b. Hangers were obstructing sprinklers in Fire Zones 28, 79, 84, 96 & 97.	Recommendation: a. Install hangers in Fire Zones 80, 84, 91 & 96 as required by code and original design drawings. Justification: b. Based on ABB Impell Calc. No. 0120-164-007, Section 4.1.3 the hanger rods will not adversely impact the nozzle spray patterns.

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
3612	Deviation: a. The Cable Tray and Area Systems installed in Fire Zones 79, 80, 90 & 91 use 1/4" orifice nozzles which are less than the 1/2" orifices specified by the NFPA code.	Justification: a. Based on ABB Impell Calc. No. 0120-164-007, Section 4.1.4 the cable tray sprinklers were determined to be adequate protection for these areas. Recommendation: b. The (2) small orifice sprinklers installed in the area system for Fire Zone 91 should be replaced with 1/2" orifice sprinklers.
3653	Deviation: Unit 1 & 2 cable tray and Unit 1 Turbine Building area protection sprinkler systems use 250°F sprinklers which exceed the temperature requirements of the Code Table 3651.	Justification: Code Section 3654 allows using high temperature rated sprinklers for special hazards which are normally associated with the turbine building.
3681 3682 3683	Deviation: a.Sprinklers in Fire Zones 79, 80, 84, 91 & 96 were painted or covered.	Recommendation: All sprinklers which have been painted or covered should be replaced. Although sprinklers are painted or covered with a plastic bag, they are typically isolated to one or two sprinklers in an area. Since the painting is typically a light spraying, only the response time of the sprinkler is affected. Considering the overlap from adjacent sprinklers, this is not considered a significant problem.

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
4143	Deviation: a. Sprinklers where found to be missing in Fire Zones 79, 80, 90, 91, 84, 85, 96 & 97. b. Improper installation of sprinklers were provided for several Fire Zones 80, 91, 96 & 97.	Justification: a. Based on ABB Impell Calc. No. 0120-164-007, Section 4.1.5, several missing sprinklers were found to be justified based on the lack of combustible materials present and the control of a postulated fire by adjacent sprinklers. These Fire Zones include No. 80, 84, 85, 90 & 97. b. ABB Impell Calc. No. 0120-164-007, Section 4.1.5, verified the adequacy of the current type of sprinklers installed to protect the areas. The sprinklers are located in the hatchways in Fire Zones 80 & 91. Recommendation: a. Sprinklers missing in the following fire zones should be installed as required to provide protection. They include Fire Zones 79, 80, 84, 91 & 96. b. Replace improperly installed sprinklers in Fire Zones 80, 96 & 97.
4156 4316 4319	Deviation: Sprinklers were found to be obstructed in Fire Zones 79, 80, 90, 91, 84, 85, 96 & 97.	Justification: ABB Impell Calc. No. 0120-164-007, Section 4.1.6 verified that the sprinkler obstructions do not adversely affect the ability of the sprinklers to provide adequate protection. This justification includes sprinkler obstructions detailed in the calculation for Fire Zones 79, 80, 84, 85, 90, 91, 96 & 97. Recommendation: Sprinklers should be installed to provide adequate protection under obstructions in Fire Zones 91, 96 & 97.

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
4211 4231	Deviation: Sprinklers are installed greater than 12 inches below the deck in Fire Zones 90, 91, 96 & 97.	Justification: ABB Impell Calc. No. 0120-164-007, Section 4.1.7 verified that sprinklers located less than 16" below the deck will not have an adverse affect on the operation of the sprinkler system or its ability to provide adequate coverage for the underside of the deck. This is based on the combustibles present and adjacent sprinklers providing adequate protection. This includes Fire Zone No. 97. Recommendation: Deflectors should be located within 16 inches of the deck for sprinklers located in Fire Zone 90, 91, 96 & 97.

3.3 NFPA 14 - Installation of Standpipe and Hose Systems

3.3.1 Scope of Evaluation

The standpipe and hose systems were reviewed under the edition that was in effect at the time the original system was specified on April 2, 1971.

The following areas were evaluated under the requirements of NFPA 14, 1971 Edition:

- These fire zones will be verified for all portions of the fire zone within 40 feet of column line H, and auxiliary feed water pump rooms or safety related trays. The portions of the fire zones reviewed included the area bounded by column coordinates: Fire Zones #79-80 (Col. Lines H-23, H-14, G-26, G-18, GA-23, GA-26, E-18 and E-14); Fire Zones #84-85 (Col. Lines H-13, H-4, G-9, G-1, GA-4, GA-1, E-13 and E-9); Fire Zones #90-91 (Col. Lines H-14, H-23, E-14, E-18, G-18, G-26 and GA-26); Fire Zones #96-97 (Col. Lines H-13, H-4, G-13, G-1, GA-4 and GA-1) Fire Zones 129 & 130 (Col. Lines H-8, H-19, G-8 and G-19). 1

- Unit 1 & 2 Containment Fire Areas AAA & CCC (Fire Zone 66-68, 74-76, 101 through 104)

- Unit 1 & 2 Diesel Fire Pump Room Sprinkler Systems (Fire Zone 28 & 30)

- Hose Stations located in Fire Zone 142 were used to verify adequate coverage of hazards within Fire Zone 28 & 30.

3.3.2 Assumptions

The following assumption has been made for the evaluation of NFPA 14.

1. The intent of the standpipe service at the plant was to provide Class II service for those stations which have a single 1-1/2 inch hose valve and Class III service at those stations which have both 2-1/2 inch and 1-1/2 inch hose valves.

3.3.3 Deviations and Recommendations/Justifications

The standpipe and hose systems at the plant are in compliance with NFPA 14 except as identified by the open items and deviations in Table 3.3-1. The table also provides recommendations and/or justifications for these items.

3.3.4 References

WALKDOWN VERIFICATION CHECKLISTS

1	0120-164-003A	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 79)	0	12/90
2	0120-164-003B	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 80)	0	12/90
3	0120-164-003C	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 84)	0	12/90
4	0120-164-003D	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 85)	0	12/90
5	0120-164-003E	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 28)	0	12/90
6	0120-164-003F	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 30)	0	12/90
7	0120-164-003G	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 90)	0	12/90
8	0120-164-003H	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 91)	0	12/90
9	0120-164-003I	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 96)	0	12/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
10	0120-164-003J	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 97)	0	12/90
11	0120-164-003K	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 129)	0	12/90
12	0120-164-003L	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone 130)	0	12/90
		PROCEDURES		
13	12-SHP2270 FIRE.004	Tests and Inspections of the Plant Fire Hose Standpipe Stations	0	2/12/88
14	12-OHP4030.STP.120VV	Fire Protection Valve Lineup Verification	0	4/14/88
14A	12-OHP4030.STP.124	Fire Protection System Flush and Loop Flow Test	0	9/10/87
		TECHNICAL DATA		
15	09-0120-0123	Impell Report	0	5/88
15A	0120-164-007	ABB Impell Calc. for Deviation Evaluations	0	12/90
16	SD-DCC-FP101	Fire Protection System-Water (Pg. 12)	2	12/26/89
17	Catalog (Page 25 + 78)	Fire End	-	-
18	P125-670	Jamesbury Catalog	-	6/70
19	Catalog-T (Ref 57)	Elkhart	-	-
20	NFPA 14	NFPA 14: 4-2.2	-	1987
21		ROC Kipley to Russell	-	8/7/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		DRAWINGS		
22	0120-164	ROC Kipley to Basset	-	8/7/90
23	1-5152B-5	Flow Diagram Fire Protection Fire Protection - Water Turbine Bldg & Screen House Unit 1	5	4/7/89
24	2-5152C-2	Flow Diagram Fire Protection Fire Protection - Water Turbine Bldg & Screen House Unit 2	2	8/4/88
25	2-5152A-3	Flow Diagram Fire Protection Fire Protection - Water Piping at Pumps Units 1 & 2	3	3/23/88
26	12-5267-6	Fire Facilities Basement Plan El. 591'-0" and 587'-0" Units 1 & 2	6	1/29/90
27	12-5268-5	Fire Facilities Mezzanine Floor El. 609'-0" Units 1 & 2	5	1/29/90
28	12-5269-5	Fire Facilities Turbine Bldg. Main Floor El. 633'-0" Units 1 & 2	5	1/29/90
29	1-FP-4	Turbine Room Fire Protection Piping Isometric	8	7/23/87
30	1-FP-5	Turbine Room Fire Protection Piping Isometric	3	8/31/71
31	1-FP-12	Turbine Room Fire Protection Piping Isometric	7	1/16/89
32	1-FP-13	Turbine Room Fire Protection Piping Isometric	6	4/20/73
33	1-FP-27	Turbine Room Fire Protection Piping Isometric	4	4/20/73
34	1-FP-28	Turbine Room Fire Protection Piping Isometric	3	8/31/71

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
35	1-FP-29	Turbine Room Fire Protection Piping Isometric	5	3/11/87
36	1-FP-30	Turbine Room Fire Protection Piping Isometric	6	7/27/87
37	2-FP-37	Turbine Room Fire Protection Piping Isometric	5	3/23/87
38	2-FP-38	Turbine Room Fire Protection Piping Isometric	7	3/23/87
39	2-FP-39	Turbine Room Fire Protection Piping Isometric	6	2/1/88
40	2-FP-40	Turbine Room Fire Protection Piping Isometric	10	3/23/87
41	2-FP-41	Turbine Room Fire Protection Piping Isometric	7	4/10/85
42	2-FP-42	Turbine Room Fire Protection Piping Isometric	5	1/30/78
43	2-FP-60, sht. 1 of 2	Turbine Room Fire Protection Piping Isometric	6	5/22/85
44	2-FP-60, sht. 2 of 2	Turbine Room Fire Protection Piping Isometric	1	2/1/72
45	2-FP-78	Turbine Room Fire Protection Piping Isometric	4	1/20/88
46	2-FP-86, sht. 1 of 2	Turbine Room Fire Protection Piping Isometric	5	1/30/88
47	2-FP-86, sht. 2 of 2	Turbine Room Fire Protection Piping Isometric	2	2/20/73
48	2-FP-90	Turbine Room Fire Protection Piping Isometric	0	6/28/72
49	1-FP-119	Turbine Room Fire Protection Piping Isometric	1	1/4/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		LICENSING DOCUMENTS		
50	50-315 50-316	Safety Evaluation Report for BTP.APCSB 9.5-1, Appendix A	-	07/31/79
51	50-315 50-316	10CFR50, Appendix R Safety Evaluation Document of IMPC D.C. Cook Plant, Units 1 & 2	-	04/26/90

TABLE 3.3-1

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 14 - Standpipe and Hose System

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
171	Open Item: Plan and specification Documentation was not available to confirm that the authority having jurisdiction reviewed them for approval.	Justification: Although these documents could not be verified for approval, AEP (A/E) has plans and specifications for these systems in their files. These diagrams and specs are controlled documents and are maintained by AEP.
212, 212a, 511, 524, 525, 531 & 671	Open Item: Hydraulic calcs. will be required in order to determine compliance.	Recommendation: AEP to provide further evaluation in conjunction with new water supply and pumping facilities to determine compliance.
432, 442	Deviation: Pressure reducers are not provided at hose stations and signs are not installed at hose stations to warn personnel of high pressures.	Justification: The hose stations are for use by the fire brigade only. The fire brigade is trained in the use of high pressure hose.
622, 413	Deviation: Isolation valves are not provided for the Turbine Building hose systems risers and supplies.	Justification: The review of drawings 1-5152B & 2-5152C verified that adequate isolation valves were provided for a majority of the of the hose risers without adversely impacting the operation of sprinklers protecting safety related components. Also reference ABB Impell Calc., 0120-164-007, Section 4.2.1 for the justification for the lack of isolation valves for specific hose risers in Fire Zones 80, 84 & 142.

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 14 - Standpipe and Hose System

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
651	Open Item: Drawings were not available to verify compliance with the requirements for providing proper system piping supports.	Justification: Based on the review of the turbine room fire protection drawings (Ref. 29 through 49), the seismic class III support system provided verifies that the requirements for this section are being met. Also based on discussions with AEPSC staff, pipe support failures have not been a significant issue.
681	Deviation: Water flow alarms are not provided at base of risers.	Justification: This code section is a recommendation to preclude the use of hose stations by building occupants without the notification of others as to the fire location. Since the hose stations are for the fire brigade's use only, waterflow signaling will not provide a significant increase in the level of fire protection.

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 14 - Standpipe and Hose System

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
724	Deviation: New gaskets are not installed during annual testing.	Justification: Fire hoses are inspected monthly for verification of equipment present and identification of any damage. If damage is noted, the hose is replaced. At 18 month intervals, all hoses are removed; inspected for damage and degradation of gaskets; corrections made, if necessary, and reracked. This dual checking of hoses at one and 18 month frequencies satisfies the intent of this code to identify and correct damaged equipment.
321	Deviation: Hose reach for all portions of Unit 1 & 2 of containments are not achieved with maximum hose length of 100 feet.	Justification: Based on the review of AEP Calc. No. DCC-FP010-HS16-F & DCC-FP02-HS32-F, adequate protection would be provided by the hose stations located outside the containment access portals when using hose lengths in excess of 100 feet.

3.4 NFPA 15-1973 Water Spray Systems

3.4.1 Scope of Evaluation

The water spray systems evaluated for the D.C. Cook Nuclear Plant are limited to the following:

The following systems were evaluated under the requirements of NFPA 15, 1973 Edition:

- Unit 1 & 2 Containment Charcoal Filter Unit and Reactor Coolant Pump Suppression Systems, (Fire Zone 66-68, 74-76,)

- Unit 1 & 2 Transformer and Turbine Wall Water Spray Systems (Yard)

3.4.2 Assumptions

The following assumptions have been made for the evaluation of NFPA 15.

1. Due to ALARA (high radiation) concerns, the charcoal filter units were inaccessible during the walkdowns. Therefore, the water spray nozzle arrangements within the filtration units are assumed similar to the previous walkdown sketch as documented in the AEPSC evaluation document of June 17, 1988 for all units.

2. The above noted fire protection systems at the D.C. Cook Plant are not subject to earthquake support criteria as it pertains to NFPA codes.

3. The water spray systems were installed per April 2, 1971 specifications.

4. It is assumed that the spray system arrangement for the charcoal filter units are typical with the exception of the number of charcoal filter beds.

3.4.3 Deviations and Recommendations/Justifications

The water spray systems are in compliance with NFPA 15 with the exception of the open items and deficiencies identified in Table 3.6-1. The table also provides recommendations and/or justifications for these items.

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
	3.4.4 References			
		WALKDOWN VERIFICATION CHECKLISTS		
1	0120-164-004A	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Start-Up XFRM 101 AB)	0	12/90
2	0120-164-004B	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Start-Up XFRM 101 CD)	0	12/90
3	0120-164-004C	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Aux XFRM 1 CD)	0	12/90
4	0120-164-004D	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Aux XFRM 1 AB)	0	12/90
5	0120-164-004E	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (345KV Main XFRM)	0	12/90
6	0120-164-004F	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Unit 1 Exposure Prot)	0	12/90
7	0120-164-004G	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Aux XFRM 2 AB)	0	12/90
8	0120-164-004H	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Aux XFRM 2 CD)	0	12/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
9	0120-164-004I	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Unit 2 Main XFRM's 01,02,03)	0	12/90
10	0120-164-004J	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Start-Up XFRM's 201 AB, 201 CD)	0	12/90
11	0120-164-004K	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Unit 2 Exposure Prot)	0	12/90
12	0120-164-004L	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Charcoal Filter Units)	0	12/90
13	0120-164-004M	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (RCP Pump Systems)	0	12/90
		PROCEDURES		
20	P0-050-508	Fire Protection - Water Preoperational Test Procedure	0	07/03/74
21	12-0HP-4030-STP120VC	Fire Protection Yearly Valve Cycle and Lineup Verification	1	07/19/90
22	12-0HP-4030-STP120VV	Fire Protection Valve Lineup Verification	0	11/17/88
23	12-0HP-4030-STP120SF	Fire Protection Unobstructed Flow Test and Sprinkling Alarm Test	1	07/19/90
24	12-0HP-4030-STP.124	Fire Protection System Flush and Loop Flow Test	0	10/05/89
25	12-0HP-4030-STP.223	Fire Protection Water System Test	8	07/27/89
26	12-0HP-4030-STP.125NS	Non-Tech Spec Required Sprinkler Tests	1	10/12/89

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
27	1-0HP-4030-STP.123	Transformer Water Spray Test	2	07/25/88
28	2-0HP-4030-STP.123	Transformer Water Spray Test	2	12/29/88
29	1-0HP-4030-STP.125CV	Unit 1 Yearly Charcoal Filter Valve Cycle	0	09/21/89
30	2-0HP-4030-STP.125CV	Unit 2 Yearly Charcoal Filter Valve Cycle	0	05/19/88
31	12-0HP-4030-STP.125CF	Inside Containment Charcoal Filter F.P. Valve Cycling	0	02/23/89
32	1-MPH-4030-STP.032	Inspection of Preaction Spray Headers Inside Unit 1 Containment	1	03/13/86
33	2-MPH-4030-STP.032	Inspection of Preaction Spray Headers Inside Unit 2 Containment	1	02/27/86
34	12THP-4030-STP.239	RCP Fire Det. and Water System Test	7	07/06/90
35	120HP-4030-STP.120PS	RCP F.P. Strainer Blowdown and Isolation Valve Cycling	2	01/09/89
		TECHNICAL DATA		
40	-	Letter From: R.J. Daley To: R.W. Jurgensen Instruction Book, "Grinneland Star Fire Systems Equipment"	-	07/15/74
41	SD-DCC-FP101	System Description, Fire Protection System - Water	2	12/26/89
42	-	Specification for Fire Protection Systems of D.C. Cook Nuclear Plant	0	04/02/71
43	DCCPM104ECS	Shop and Field Fabrication and Erection	4	05/24/73
45	ROC from D. Kipley to B. Gerwe	Ambient Temperature Conditions		08/06/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
46	0120-164-005	ABB Impell Calc. NFPA 72D, Code Compliance Verification Checklist	0	12/90
47	0120-164-006	ABB Impell Calc. NFPA 72E, Code Compliance Verification Checklist	0	12/90
48	-	Grinnel Hydraulic Calcs. for Unit 1 Main XFRM	0	01/06/72
49	-	Grinnel Hydraulic Calcs. for Unit 1 Start-Up XFRM	0	09/20/71
50	-	Grinnel Hydraulic Calcs. for Unit 1 Aux XFRM	0	09/20/71
51	-	Grinnel Hydraulic Calcs. for Unit 1 Spare Main XFRM	1	07/31/72
52	-	Hodgeman Hydraulic Calcs. for Unit 1 Spare Main XFRM	0	09/15/76
53	-	Hodgeman Hydraulic Calcs. for Unit 1 Exposure Prot	0	02/12/76
54	-	Hodgeman Hydraulic Calcs. for Start-Up XFRMs 201 AB & 201 CD	0	11/08/74
55	-	Hodgeman Hydraulic Calcs. for Unit 2 Main XFRMs 01, 02, 03	0	07/08/74
56	-	Hodgeman Hydraulic Calcs. for Unit 2 Exposure Protection	0	06/02/76
57	DCCFP01HS02-F	AEPSC Hydraulic Calc. for Unit 1 HVAC Equip Vestibule	0	02/24/88
58	DCCFP02HS25-F	AEPSC Hydraulic Calc. for Unit 2 HVAC Equip	0	02/24/88
59	-	Grinnel and Hodgeman Sprinkler Head Spec Sheets	-	-

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
60	-	Phoenix Hydraulic Calcs. & FC 12-2231 (RCP & Diesel Pump Room)	0	04/26/79
61	RFCDC-12-2231	Phoenix Contractors Hydraulic Calcs. (RCP & Diesel F.P Rooms)	0	03/27/87
62	-	AEPSC Evaluation Document	0	06/17/88
63	0120-164-007	ABB Impell Calc. Deviation Evaluation	0	12/90
		LICENSING DOCUMENTS		
70	DRP No. 74	Donald C. Cook, FHA Docket No. 50-316	4	01/31/87
		DRAWINGS		
80	Dwg. 46-032-71M-11	Plot Plan and Header Details, Unit 1 Trans.	4	09/30-71
81	Dwg. 121-25	Unit 1 Main XFRM Bottom Ring	0	09/15/76
82	Dwg. 121-26	Unit 1 Main XFRM Top Ring	0	09/15/76
83	Dwg. 46-032-71M-7	Unit 1 Start-Up XFRM 101 AB & 101 CD	3	09/23/71
84	Dwg. 46-032-71M-8	Unit 1 Aux XFRM 1 AB & 1 CD	2	09/24/71
85	Dwg. 46-032-71M-10	Unit 1 345 KV Main XFRM	2	01/12/72
86	Dwg. 121-18 121-17	Unit No. 1 Exposure Protection	0	02/12/76
87	Dwg. 46-032-71M-43	Unit 2 Aux XFRMs	0	12/15/72
88	Dwg. 121-15	Unit No. 2 Aux XFRMs	-	-
89	Dwg. 121-6	Unit No. 2 Start-Up Transformers 201 AB, 201 CD	1	11/08/74

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
90	Dwg. 121-2	Unit 2 Plot Plan and Header Details	5	06/13/74
91	Dwg. 46-032-71M-42	Unit 2 Plot Plan and Header Details	0	12/15/72
92	Dwg. 121-3	Unit 2 Main XFRMs 01, 02, 03	2	06/14/74
93	Dwg. 46-032-71M-44	Unit 2 Main XFRMs 01, 02, 03	0	12/14/72
94	Dwg. 121-19 & 121-20	Unit No. 2 Exposure Protection	1	05/12/76
95	RFC No. 12-2231	RCP Spray Piping Plans (Phoenix sheets 3, 4, 5, 14, 15 & 16)	0	09/17/79
96	Dwg. 12-5152-4	Flow Diagram Fire Prot - Water Yard Piping Unit 1 & 2	4	07/25/89
97	Dwg. 1-5152B-5	Flow Diagram Fire Prot - Water Turb. Bldg. and Screen House Unit 1	5	04/07/89
98	Dwg. 2-5152C-2	Flow Diagram Fire Prot - Water Turb. Bldg. and Screen House Unit 2	2	08/04/88
99	Dwg. 12-5152D-7	Flow Diagram Fire Prot - Water Aux & Containment Unit 1 and 2	0	12/04/89
100	Dwg. 12-5152E-3	Flow Diagram Fire Prot - Water Charcoal Filters Units 1 and 2	3	01/08/90
101	Dwg. 1-5152J-1	Flow Diagram Fire Prot - Water Details - Turbine Bldg. and Screen House Unit 1	1	06/21/88
102	Dwg. 1-5152K-1	Flow Diagram Fire Prot - Water Details - Turbine Bldg. and Screen House Unit 2	2	06/21/88

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
103	Dwg. 12-5152L-7	Flow Diagram Fire Prot - Water Sys. Details Turb. Bldg. and Service Bldg. Unit 1 & 2	7	01/08/90
104	Dwg. 12-5152M-4	Flow Diagram Fire Prot - Water Details - RCP's Units 1 & 2	4	09/29/89
105	Dwg. 12-5152N-3	Flow Diagram Fire Prot - Water Sys. Details - Yard Piping & Aux Bldg. Units 1 & 2	3	09/18/89

TABLE 3.4-1

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 15 - Water Spray Fixed Systems

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
1061	Open Item: Document verifying the certifications of all water spray systems involved is not provided.	Justification: It is assumed that all materials and devices installed for the water spray systems are in accordance with standard installation practices under the guidance of the 1971 piping and installation specifications. The review of pre-operational test procedure PO-050-508 has also verified that the systems were properly tested by AEPSC and were found to be satisfactory prior to start-up.
2012	Open Item: a. Documents not available for verifying that materials were new at the time of procurement. b. Unit 1 & 2 spray system isolation valves are not approved for application. c. Unit 1 & 2 charcoal filter unit automatic valves are not approved for the application.	Justification: a. See response to code section 1061. b. The Jamesbury butterfly valve, Unit 1 & 2 charcoal filter unit although not listed, is adequate for the intended service. Valve position is indicated by an arrow on the valve body and is rated for the class of service. c. ABB Impell Calc. No. 0120-164-007, Section 4.3.1 verified the valves used for the filter unit spray systems are adequate for use in these systems.

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
2031 4072	Deviation: Inadequate spray protection is provided for the following: a. Unit 1 exposure protection does not consider (4) unprotected openings. b. Unit 2 main transformer nozzle obstructions. c. Unit 1 RCP #3 nozzle obstruction.	Justification: a. ABB Impell Calc. No.0120-164-007, Section 4.3.2 verified that the one opening in the turbine building wall and the three openings in the service building wall are provided adequate protection based on spacial separation, fire rated construction and/or transformer water spray system. b. The review of Hodgeman Calc. No. 121-1 & 121-2 verified that the original design included a significantly higher spray density for the transformer (0.7GPM/FT^2) than is required by NFPA 15-1987, Section 4-4.3.4 (0.25 GPM/FT^2). This increased density compensates for any minor obstructions encountered due to the physical restraints of the installation. c. The review of AEPSC Drawings No. 2-5695 & 2-5699, Phoenix Dwg. No. 14 & 15 and Grinnell nozzle data for EA-1, has verified that the (1) Nozzle obstructed by a 24" x 81" HVAC duct is being supported by overlapping spray from adjacent nozzles.
2082	Deviation: Non-approved solenoid valve for charcoal filter unit spray systems.	Justification: Based on ABB Impell Report No. 09-0120-0123, NFPA 72D Section 2032, the solenoid valves are considered acceptable.
2111	Deviation: Strainers are not provided for the Unit 1 & 2 transformer and exposure protection spray systems.	Justification: Based on ABB Impell Calc. No. 0120-164-007, Section 4.3.3, strainers are not considered to be necessary.

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 15 - Water Spray Fixed Systems

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
4081	Deviation: 3/8" pipe installed within the charcoal filter units is less than the 1" pipe required by the code.	Justification: Based on the review of the evaluation performed in AEP Evaluation Document dated 6/17/88, this piping arrangement is acceptable.
4082	Deviation: Test gauge connections are not provided for the Unit 2 RCP pumps, charcoal filter units, main transformers, startup transformers, and exposure protection spray systems.	Justification: The intent of this code is to verify design pressures during initial system tests. Hydraulic calcs verify the ability of the system to supply adequate pressure at the most remote nozzle, and system flow tests are performed every 18 months via plant procedures.
4121	Deviation: System gauges are not provided for the Unit 1 & 2 charcoal filter units and non-approved gauges are used in the Unit 2 transformer and exposure protection systems.	Justification: Based on ABB Impell Calc. No. 0120-164-007, Section 4.3.4, the system gauges provided are considered acceptable for surveillance and testing purposes and the provision of gauges for the filter units is not considered significant fire protection enhancement.
5011 5021 5031	Open Item: Documentation verifying the certification of all water spray systems involved is not provided.	Justification: See response to Code Section 1061.
5023	Open Item: There are no test results for the discharge pressure at the most remote nozzle of each system.	Justification: See response to Code Section 4082.

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 15 - Water Spray Fixed Systems

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
7000	Open Item: Design documents are not available for the Unit 1 & 2 charcoal filter units.	Justification: Although original design documents are not available, AEPSC has prepared system piping/support configuration sketches and hydraulic calcs to verify the adequacy of the water spray systems installed within the charcoal filter units.
7010	Open Item: Water supply graphs are not available for review to verify that the water supply is adequate for the systems reviewed.	Recommendation: AEPSC to evaluate water supply adequacy during future fire pump modification.
8051	Open Item: The activation of the Unit 1 & 2 detectors for the spray systems within the required time frame of 40 seconds could not be verified for compliance during testing.	Justification: Based on ABB Impell Calc. No. 0120-164-007, Section 4.3.5, the detection systems response time is considered adequate.

3.5 NFPA 72D - Proprietary Signaling Systems

3.5.1 Scope of Evaluation

The evaluation of the proprietary signaling system was based on the edition that was in effect at the time the system was specified on April 2, 1971. The edition that was applicable was 1967. The portions of the systems addressed under the 1967 edition, are as follows:

REVIEW INCLUDES THE FOLLOWING SYSTEMS:	INITIAL SYSTEM INSTALLATION DATE
Alison Controls detection panels which include:	
a. Charcoal Filter Units:	2/72
° 1 & 2-HV-CFT-1 (Detection Only)*	
° 1 & 2-HV-CFT-2 (Detection Only)*	
b. Reactor Coolant Pumps	4/79
° Units 1 & 2 RCP Pump #1-4 (Detection Only)*	
c. Containment Alarm System Unit 1 & 2 (Detection Only)*	6/71
d. Transformers	
° Unit 1 Main	9/86
° Unit 2 Main, Phases 1-3	2/72
° Transformer 1AB & 2AB	2/72
° Transformer 1CD & 2CD	2/72
° Transformer 101AB	2/72
° Transformer 101CD & 201CD	2/72
° Transformer 201AB	9/86
e. Unit 1 & 2 Turbine Building Wall Spray Systems.	7/72
The "EF" annunciator panel signaling line circuits only for the associated detection and sprinkler waterflow/supervisory systems were reviewed in items a through e above.	2/72
The waterflow and manual alarm and supervisory devices for suppression systems installed in Fire Zones 28, 30, 79, 80, 84, 85, 90, 91, 96 & 97, yard transformers and Turbine Bldg. walls. *	2/72

*NOTE: The control panels, waterflow, manual alarm and supervisory devices for suppression systems were previously reviewed for compliance in ABB Impell Report No. 09-0120-0123.

Certain scope limitations are identified in the report which are not verified due to their non-applicability. The limitations are as follows:

a. The proprietary signaling system has not been designed to perform Manual Fire Signaling Services as outlined in NFPA 72D, Article 310. This is based on code section 3010 which states that the signaling services may be applied individually or in any combination of different types of systems. Since manual stations have not been provided throughout the areas reviewed, only those areas where manual stations have been provided for the suppression system actuation have been reviewed. The intent of the suppression system manual station devices installed was not to provide a manual fire alarm signaling service. Therefore, code section 3113 which details the distribution requirements for providing a manual fire alarm signaling service are not applicable. However, code sections 3321 and 3421 requires that supplemental manual fire station be provided for detection systems and that they be located where designated by the authority having jurisdiction. These devices have been provided as required.

b. The intent in the design of proprietary signaling system at D.C. Cook was to be a "Class B" (two wire) system in accordance with the requirements of code section 4011. Therefore, the requirements of code sections 4012, and 4080 which address "Class A" systems are not applicable.

3.5.2 Assumptions

The following assumption has been made for the evaluation of NFPA 72D.

1. For the purpose of this report, it is assumed that under most conditions the authority having jurisdiction was the architect/engineer (A/E) for the plant who is American Electric Power Service Corporation (AEPSC) unless otherwise indicated.

2. AEPSC will ensure that any modifications required for compliance with the Factory Mutual approval criteria will be performed for the A888-M664/A panels installed.

3. The new Alison control panels model number A888-M664/A recently installed for the Unit 1 transformer and the Unit 2 start-up transformer, were reviewed for compliance with the requirements of NFPA 72D-1967 edition. Although these panels were installed after 1986, the intent of the code section requirements reviewed as part of this evaluation for the 1967 Edition, did not significantly change under the 1986 Edition. Therefore, to provide consistency, these panels were reviewed to the 1967 Edition.

3.5.3 Deviations and Recommendations/Justifications

The plant proprietary signaling system is in compliance with NFPA 72D except as identified by the open items and deviations in Table 3.5-1. The table also provides recommendations and/or justifications for these items.

3.5.4 References

		WALKDOWN VERIFICATION CHECKLISTS		
1	0120-164-005A	Fire Zone 79 - Unit 1	0	12/90
2	0120-164-005B	Fire Zone 80 - Unit 1	0	12/90
3	0120-164-005C	Fire Zone 84 - Unit 2	0	12/90
4	0120-164-005D	Fire Zone 85 - Unit 2	0	12/90
5	0120-164-005E	Fire Zone 90 - Unit 1	0	12/90
6	0120-164-005F	Fire Zone 97 - Unit 2	0	12/90
7	0120-164-005G	Yard - Unit 1	0	12/90
8	0120-164-005H	Yard - Unit 2	0	12/90
9	0120-164-005I	Fire Zone 28 - Unit 1	0	12/90
10	0120-164-005J	Fire Zone 30 - Unit 2	0	12/90
		TECHNICAL DATA		
11	0120-108-007.1	NFPA 72D Document Verification Checklist	0	5/11/88
12	09-0120-0123	ABB Impell Code Compliance Compliance Report	0	5/88
13	-	AEP NFPA Code Justification Evaluations	-	6/17/88
14	-	Alison Controls Inc. Manual for A888-M664/A	-	9/15/86
15	-	Record of Conversation Between D. Kipley and B. Gerwe	-	7/27/90
16	PM 683	Plant Modification Project for the Installation of ACI A888-M664/A Panels	1	01/07/87

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
16A	--	ABB Impell Memo No.M-007 on Alarm Circuit Supervision	-	7/6/90
		PROCEDURES		
17	1-0HP-4030-STP-123	Transformer Water Spray Test	2	07/25/88
18	2-0HP-4030-STP-123	Transformer Water Spray Test	2	12/29/88
19	PMI-2270	Fire Protection Program	16	02/09/87
20	12-0HP-4030-STP-125NS	Non-Tech Spec. Required Sprinkler Tests	1	10/12/89
21	12-THP-6030-IMP-142	Fire Det. & CO_2 System Surv. Testing (6 Mo.)	10	07/16/87
22	12-THP-4030-STP-239	RCP Fire Det. & Water System Test	7	07/06/90
23	12-0HP-4030-STP-125CF	Inside Containment Charcoal Filter Fire Prot. Valve Cycle	0	02/23/89
24	12-THP-4030-STP.223	Fire Protection Water System Test	8	07/27/89
25	1-MPH-4030-STP-032	Inspection of the Fire Prot. System Preaction Spray Headers in Unit 1 Containment Bldg.	1	03/13/86
26	2-MPH-4030-STP-032	Inspection of the Fire Prot. System Preaction Spray Headers in Unit 2 Containment Bldg.	1	02/22/86
27	12-0HP-4030-STP-120VC	Fire Prot. Yearly Valve Cycle and Lineup Verification	1	07/19/90
28	1-IHP-6030-IMP-190	Thermistor String Fire Det. System Operability and Calibration	3	04/05/90
29	2-IHP-6030-IMP-290	Thermistor String Fire Det. System Operability and Calibration	2	07/19/90
30	1-THP-6030-IMP-151	Containment Cable Tray Fire Det. System	4	07/19/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
31	2-THP-6030-IMP-251	Containment Cable Tray Fire Det. System	5	01/25/90
32	12-0HP-4030-STP-120VV	Fire Prot. Valve Lineup Verification	0	11/17/88
33	1-0HP-4024-101-001-100	Annun #1: Plant Fire System	2	03/10/86
34	2-0HP-4024-201-001-100	Annun #1: Plant Fire System	2	12/30/86
35	1-0HP-4024-102-001-050	Annun #2: Misc. Area Fire System	3	01/22/87
36	2-0HP-4024-202-001-050	Annun #2: Misc. Area Fire System	1	11/06/86
		LICENSING DOCUMENTS		
37	Docket No. 50-315 50-316	Safety Evaluation Document of IMPC D.C. Cook Plant, Units 1 & 2	-	04/26/90
37A	50-315 50-316	Safety Evaluation Report for BTP.APCSB 9.5-1, Appendix A	-	07/31/79
		DRAWINGS		
38	1-95907	Fire Prot. Transformer & Sprinkler Fire Systems Turb. & Aux. Bldgs.	16	04/01/87
39	2-95907	Fire Prot. Transformer & Sprinkler Fire Systems Turb. & Aux. Bldgs.	13	10/86
40	12-5152E	Flow Diagram Fire Prot. Water	3	01/03/90
41	12-5152J	Flow Diagram Fire Prot. Water	1	06/21/88
42	12-5152K	Flow Diagram Fire Prot. Water	2	06/21/88
43	12-5152L	Flow Diagram Fire Prot. Water	7	01/09/90
44	12-5152M	Flow Diagram Fire Prot. Water	4	09/29/89

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
45	12-5152N	Flow Diagram Fire Prot. Water	3	09/13/89
46	1-98972	Fire Prot. Water Systems Elementary Diagram	9	11/05/86
47	2-98972	Fire Prot. Water Systems Elementary Diagram	9	10/24/86
48	12-5152A	Flow Diagram Fire Prot. Water	3	03/23/88
49	12-5152B	Flow Diagram Fire Prot. Water	5	04/07/89
50	12-5152C	Flow Diagram Fire Prot. Water	2	08/04/88
51	12-5152D	Flow Diagram Fire Prot. Water	7	12/04/89
52	1-98612	Plant Fire System Annun. Elementary Diagram	12	07/01/86
53	2-98612	Plant Fire System Annun. Elementary Diagram	16	08/14/87
54	1-98613	Misc. Fire Area System & Vent Elementary Diagram	19	10/30/87
55	2-98613	Misc. Fire Area System & Vent Elementary Diagram	17	10/30/87
56	1-98969	FP Systems Annun. Elementary Diagram	7	06/08/87
57	1-12060	DC Aux. One-Line 250V DC Bus..	2	02/26/87
58	2-12060	DC Aux. One-Line 250V DC Bus	0	10/06/86

TABLE 3.5-1

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 72D - Proprietary Protective Signaling System

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
2032, 2212, & 3111	Deviation: a. The ACI A888-M664/A panel is not approved for the application. b. The pushbutton manual stations for transformer and exposure protection systems are not approved for the application. c. Automatic control valves for charcoal filter units are not approved for the application.	Justification: a. The ACI A888-M664/A panel is currently undergoing Factory Mutual's review. It is assumed that any deviations/non compliances found during FM's review will be adequately addressed and resolved by AEP. Alison Control Inc. has committed to AEP for any necessary modifications. b. Although these devices are not approved and do not latch into an alarm condition. The new Alison Control panels (A888-M664/A) will monitor these devices via properly supervised circuits as installed under PM Nos. 683, 1045 and MM-083, and will provide adequate verification of their operation by latching into an alarm condition at the panel and initiating all auxiliary functions. c. Based on the radiation conditions under which the valves are exposed due to their location being within containment, the installation of the system in accordance with the 1971 installation specification, and the operability verification of the valves under Procedure No. 12-OHP-4030-STP-125CF, these valves are considered acceptable.
2033	Open Item: Data was not available for the acceptance testing of ACI A909 panels and the sprinkler alarm devices.	Justification: The NRC regulatory requirements dictate that surveillance tests be performed to confirm the operability of the signaling system. The performance of these surveillances during the required frequencies incorporate the test

TABLE 3.5-1

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 72D - Proprietary Protective Signaling System

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
		requirements of NFPA 72D the manufacturer's recommendations. Pre-operational test documentation is also available to verify that the systems were tested for their operability prior to the turnover to AEPSC. Therefore, this condition is acceptable.
2034 4052	Deviation: Charcoal filter unit spray systems are not verified by flowing water during testing.	Justification: Although a water flow device is not provided for the CFT Unit spray systems, a detection system has been. The detection system is required to activate prior to the operation of the automatic valve therefore, the detection system provides the annunciation to the control room to alert the operators of a fire condition. Recommendation: The intent of this code section is to verify the operability of the system piping and alarm signaling devices as a whole. Air flow testing is performed on all filter systems in procedure 12 THP 4030 STP.223 except the CFT filter units. This testing should be incorporated into the procedure for the Unit 1 and 2 CFT Units. accordingly to verify the piping system.
2047	Deviation: Valve tamper switches are not verified operable during testing for all wet type transformer and exposure protection systems.	Justification: Procedure 12 OHP 4030.STP.120VV verifies monthly the position of the sprinkler system riser control valves which satisfies the intent of the valve tamper switches.
2251 2331 2341	Open Item: Data was not available to determine power supply compliance with the requirements.	Justification: Based on the review of the data collected under AEPSC Evaluation dated 6/17/88 for panel No. A909 and the compliance with FM approval criteria for the A888-

TABLE 3.5-1

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 72D - Proprietary Protective Signaling System

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
		M664/A panels the requirements for these code sections are satisfied.
2411 2422 3424 4011	Deviation: a. ACI A909 panels supervise all functions with the exception of the manual station and release circuits which do not verify the circuits for open or ground fault conditions. b. All sprinkler supervisory and alarm devices are not supervised for open circuit conditions from the "EF" panel.	Justification: The NRC regulatory requirements dictate that surveillance tests be performed to confirm the operability of the signaling system. The performance of these surveillances during 18 month frequencies incorporate the test requirements of NFPA 72D and manufacturers recommendations and provide an equivalency for this requirement. In addition, procedure 1-OHP 4030.001.001 requires the control room operators to visually examine the annunciator panels once per shift to verify their status.
2631 3423 4041	Deviation: a. RCP pump & charcoal filter unit panel alarm & trouble signals are transmitted as a non-distinct signal to "EF" panel. b. Containment detection does not provide distinctive alarm location.	Justification: The "EF" annunciators indicate a sprinkler system "abnormal" condition. The annunciator response procedures (1&2 OHP 4030.100 & 200 Series) indicate the potential problems and direct the operators to take the appropriate corrective action.
3112	Deviation: The pushbutton manual stations were mounted 4' or 4'-3" AFF, which is lower than the 4'-6" AFF requirement.	Justification: The mounting location of the manual stations does not deviate drastically from the minimum 4-1/2 ft mounting height required or mounted such that the device cannot be properly operated. In addition, NFPA 72D, 1979 Edition lower the minimum criteria to 3-1/2 ft. Therefore, this condition is acceptable.

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
3431	Deviation: Waterflow devices are not provided for hose station risers, transformer, exposure protection and charcoal filter spray systems.	Justification: The charcoal filter unit risers are provided with individual alarm annunciation to the "EF" panels via the ACI A924 panels. Temperature monitoring within the filter units is also furnished and will provide a high temperature signal in the control room which would be redundant to the fire alarm signal from the ACI A924 panel. Upon the actuation of the suppression system, a timing cycle will time down to deactivate the system, thus limiting the amount of water being discharged into the associated filter unit. The transformer and exposure protection spray system risers are provided with individual alarm annunciation to the "EF" panels via the ACI A909 & A888-M664/A panels. In addition to the detection system operation, the fire pumps will operate simultaneously thus providing additional confirmation on the "EF" panel of a fire for this area. Therefore, waterflow signaling does not provide significant increase in the level of fire protection features. For justification of the hose station risers refer to the discussion on Section 681, NFPA 14, 1971 Edition.
3441 3442 3443	Deviation: a. The "EF" annunciator panel does not provide a restoration signal. b. The RCP low air signal is transmitted to "EF" panel as non-distinctive signal.	Justification: The "EF" annunciators indicate a sprinkler system "abnormal" condition. The annunciator response procedures (1&2 OHP 4024.100 & .200 series) indicate the potential problems and directs the operators to take the appropriate corrective actions. In addition, AEP has committed to providing a "reflash" capability on the annunciator panel.
	Open Item: Transmission of tamper off-normal signal could not be verified.	Justification: See response to Code Section 2047.

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
3542	Deviation: The RCP pump detector loop resistance value is not verified.	Recommendation: Incorporate RCP pump detection loop resistance testing into the plant procedures.
3543	Deviation: The fire detection panels are not inspected monthly as required.	Justification: The systems controls are verified for operability typically semi-annually. Since the D.C. Cook plant specifically indicated that the testing frequencies required by NFPA 72D will not be met in their response to Appendix A to BTP/APSCB 9.5-1, this monthly surveillance is not required.
4091	Deviation: a. The "EF" panel signaling line circuits are not supervised for open circuit fault conditions. b. ACI A909 manual station and release circuits are not supervised for open and ground fault conditions.	Justification: See response to Code Sections 2411, 2422, 3424 & 4011.
4101 4111	Deviation: Supervisory or trouble reports are not generated.	Justification: Based on the review of the AEPSC response to Appendix A to BTP/APCSB 9.5-1 Section II.B.1 and clarification statements in the NRC 53 Questions (Questions 16 and 48), AEP clearly does not commit to providing a printer and is therefore not required. Also reference the response to Code Section 3423.

3.6 NFPA 72E - Automatic Fire Detectors

3.6.1 Scope of Evaluation

The evaluation of the installation and maintenance of the automatic fire detectors was based on the edition that was in effect at the time alarm system was specified on April 2, 1971. Since NFPA 72E was not adopted until 1974, this edition was used as the basis for the initial installation of the devices. The following systems/areas were reviewed under the requirements of NFPA 72E, 1974 Edition:

- Unit 1 & 2 Containment Charcoal Filter Unit and Reactor Coolant Pump Detection Systems, Unit 1 & 2 Containment Cable Tray Detection Circuits (Fire Zone 66-68, 74-76, 101 through 104)

- Unit 1 & 2 Transformer and Turbine Wall Water Spray Systems (Yard)

3.6.2 Assumptions

The following assumptions have been made for the evaluation of NFPA 72E.

1. Due to ALARA (high radiation) concerns, the charcoal filter units were inaccessible during the walkdowns. Therefore, the detection arrangements within the filtration units are assumed similar to the previous walkdown sketch as documented in the AEPSC evaluation document of June 17, 1988 for all units.

2. It is assumed that the detection arrangement for the charcoal filter units are typical with exception of change in the number of charcoal filter beds.

3.6.3 Deviations and Recommendations/Justifications

The plant fire alarm system is in compliance with NFPA 72E with the exception of the open items and deviations identified in Table 3.6-1. The table also provides recommendations/justifications for these items.

3.6.4 References

WALKDOWN VERIFICATION CHECKLISTS

1	0120-164-006A	XFRM 101AB	0	12/90
2	0120-164-006B	Start Up XFRM 101CD	0	12/90
3	0120-164-006C	Aux. XFRM 1CD	0	12/90
4	0120-164-006D	Aux. XFRM 1AB	0	12/90
5	0120-164-006E	345KV Main XFRM	0	12/90
6	0120-164-006F	Unit 2 Aux. XFRM 2AB	0	12/90
7	0120-164-006G	Unit 2 Aux. XFRM 2CD	0	12/90
8	0120-164-006H	Unit 2 Main XFRM	0	12/90
9	0120-164-006I	Unit 2 Start Up XFRMS	0	12/90
10	0120-164-006J	Charcoal Filter Units	0	12/90
11	0120-164-006K	RCP Pumps	0	12/90

TECHNICAL DATA

12	0120-164-005	NFPA 72D Code Compliance Verification Checklist	0	12/90
13	09-0120-0123	ABB Impell Code Compliance Report	0	05/88
14	-	AEP Evaluation Document	-	06/17/88
15	-	Alison Controls Inc. Manual for A888-M664/A	-	09/15/86
16	-	Record of Conversation Between D. Kipley and B. Gerwe	-	07/27/90
17	PM 683	Plant Modification Project for the Installation of ACI A888-M664/A Panels	1	01/07/87

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		PROCEDURES		
18	1-0HP-4030-STP-123	Transformer Water Spray Test	2	07/25/88
19	2-0HP-4030-STP-123	Transformer Water Spray Test	2	12/29/88
20	PMI-2270	Fire Protection Program	16	02/09/87
21	12-0HP-4030-STP-125NS	Non-Tech Spec. Required Sprinkler Tests	1	10/12/89
22	12-THP-6030-IMP-142	Fire Det. & CO_2 System Surv. Testing (6 Mo.)	10	07/16/87
23	12-THP-4030-STP-239	RCP Fire Det. & Water System Test	7	07/06/90
24	12-0HP-4030-STP-125CF	Inside Containment Charcoal Filter Fire Prot. Valve Cycle	0	02/23/89
25	12-0HP-4030-STP-125CV	Inside Containment Charcoal Filter Fire Prot. Valve Cycle	0	02/23/89
26	1-MPH-4030-STP-032	Inspection of the Fire Prot. System Preaction Spray Headers in Unit 1 Containment Bldg.	1	03/13/86
27	2-MPH-4030-STP-032	Inspection of the Fire Prot. System Preaction Spray Headers in Unit 2 Containment Bldg.	1	02/22/86
28	12-0HP-4030-STP-120VC	Fire Prot. Yearly Valve Cycle and Lineup Verification	1	07/19/90
29	1-IHP-6030-IMP-190	Thermistor String Fire Det. System Operability and Calibration	3	04/05/90
30	2-IHP-6030-IMP-290	Thermistor String Fire Det. System Operability and Calibration	2	07/19/90
31	1-THP-6030-IMP-151	Containment Cable Tray Fire Det. System	4	07/19/90
32	2-THP-6030-IMP-251	Containment Cable Tray Fire Det. System	5	01/25/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
33	12-0HP-4030-STP-120VV	Fire Prot. Valve Lineup Verification	0	11/17/88
34	1-0HP-4024-101-001-100	Annun #1: Plant Fire System	2	03/10/86
35	2-0HP-4024-201-001-100	Annun #1: Plant Fire System	2	12/30/86
36	1-0HP-4024-102-001-050	Annun #2: Misc. Area Fire System	3	01/22/87
37	2-0HP-4024-202-001-050	Annun #2: Misc. Area Fire System	1	11/06/86
38	RFC#12-2521	Fire Detection Design Packet	-	08/14/85
39	RFC#12-2741	Fire Detection Design Packet	0	02/13/87
40	RFC#12-1843	Fire Detection Design Packet	3	10/23/87
41	RFC#01-2679	Fire Detection Design Packet	0&1	01/31/86
42	RFC#02-2694	Fire Detection Design Packet	0&1	05/02/86
43	RFC#12-2678	Fire Detection Design Packet	0&1	12/18/87
44	RFC#12-2231	RCP Pump Fire Detection Supp. Protection Modification Packet	0	03/27/87
		LICENSING DOCUMENTS		
50	Docket No. 50-315 50-316	Safety Evaluation Document of IMPC D.C. Cook Plant, Units 1 & 2	-	04/26/90
		DRAWINGS		
60	1-95907	Fire Prot. Transformer & Sprinkler Fire Systems Turb. & Aux. Bldgs.	16	04/01/87

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
61	2-95907	Fire Prot. Transformer & Sprinkler Fire Systems Turb. & Aux. Bldgs.	13	10/86
62	12-5152E	Flow Diagram Fire Prot. Water	3	01/03/90
63	12-5152J	Flow Diagram Fire Prot. Water	1	06/21/88
64	12-5152K	Flow Diagram Fire Prot. Water	2	06/21/88
65	12-5152L	Flow Diagram Fire Prot. Water	7	01/09/90
66	12-5152M	Flow Diagram Fire Prot. Water	4	09/29/89
67	12-5152N	Flow Diagram Fire Prot. Water	3	09/13/89
68	1-98972	Fire Prot. Water Systems Elementary Diagram	9	11/05/86
69	2-98972	Fire Prot. Water Systems Elementary Diagram	9	10/24/86
70	12-5152A	Flow Diagram Fire Prot. Water	3	03/23/88
71	12-5152B	Flow Diagram Fire Prot. Water	5	04/07/89
72	12-5152C	Flow Diagram Fire Prot. Water	2	08/04/88
73	12-5152D	Flow Diagram Fire Prot. Water	7	12/04/89
74	1-98612	Plant Fire System Annun. Elementary Diagram	12	07/01/86
75	2-98612	Plant Fire System Annun. Elementary Diagram	16	08/14/87
76	1-98613	Misc. Fire Area System & Vent Elementary Diagram	19	10/30/87
77	2-98613	Misc. Fire Area System & Vent Elementary Diagram	17	10/30/87
78	1-98969	FP Systems Annun. Elementary Diagram	7	06/08/87

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
79	1-12060	DC Aux. One-Line 250V DC Bus	2	02/26/87
80	2-12060	DC Aux. One-Line 250V DC Bus	0	10/06/86

TABLE 3.6-1

DEVIATION AND RECOMMENDATIONS/JUSTIFICATIONS
NFPA 72E - Automatic Fire Detectors

CODE SECTION	DEVIATION/OPEN ITEM	RECOMMENDATION/JUSTIFICATION
2-5.2.1	Open Item: Documentation was not available to verify initial acceptance testing was performed.	Justification: The NRC regulatory requirements dictated that surveillance tests be performed to confirm the operability of the detection systems. The performance of these surveillances incorporate the test requirements of NFPA 72D and the manufacturer's recommendations and confirms that the detection devices perform their required function.
7-3.1.4	Deviation: Loop resistance testing is not performed for Unit 1 & 2 RCP pump detection systems.	Recommendation: Incorporate loop resistance testing of the Unit 1 & 2 RCP pump detection systems into plant procedures.

APPENDIX A1

CODE COMPLIANCE VERIFICATION CHECKLIST

NFPA 10 - 1984 EDITION

CALCULATION / PROBLEM COVER SHEET

Calculation / Problem No: 0120-164-001

Title: NFPA 10 CODE COMPLIANCE CCVC

Client: AEPSC Job No: 0120-164

Project: D.C. COOK EXTENDED CODE REVIEW

Design Input / References:

SEE SECTION 5.0

Assumptions:

SEE SECTION 2.0

Method:

SEE SECTION 3.0

Remarks:

SEE SECTIONS 1.0 & 4.0

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE		12-14-90
1	REVISED FOR CLARIFICATION ON PG. 16		1/14/91

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

Activities performed by the fire extinguisher service company are performed in accordance with the appropriate sections of the code.

3.0 METHODOLOGY

Reference Section 2.1.1 of ABB Impell Project Instruction PI-0120-164-01 Revision 0.

The evaluation of the portable fire extinguisher system was reviewed under the 1984 edition of the code. Although the system was installed under different edition years from 1970 to 1984, the difference in the edition requirements were minimal and the 1984 edition year was deemed to be more applicable to the system installed.

Justifications for deviations and open items identified in the CCVC's are detailed in ABB Impell Technical Report Number 09-0120-0381.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

References

WALKDOWN VERIFICATION CHECKLISTS

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
1	0120-164-001A	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 79)	0	12/90
2	0120-164-001B	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 80)	0	12/90
3	0120-164-001C	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 84)	0	12/90
4	0120-164-001D	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 85)	0	12/90
5	0120-164-001E	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 28)	0	12/90

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
6	0120-164-001F	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 30)	0	12/90
7	0120-164-001G	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 90)	0	12/90
8	0120-164-001H	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 91)	0	12/90
9	0120-164-001I	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 96)	0	12/90
10	0120-164-001J	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 97)	0	12/90
11	0120-164-001K	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 129)	0	12/90
12	0120-164-001L	ABB Impell Calculation NFPA 10, 1984 Code Compliance Walkdown Verification Checklist (Fire Zone 130)	0	12/90

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		PROCEDURES		
13	12SHP2270 FIRE.001	Portable Fire Extinguisher Inspection	1	06/03/88
		TECHNICAL DATA		
		Catalog **DRAWINGS**		
14	F-8486	Ansul Fire Protection	-	1984
15	12-5267-6	Fire Facilities Basement Plan El. 591'-0" & El. 587'-0" Units 1 & 2	6	01/29/90
16	12-5268-5	Fire Facilities Mezzanine Floor El. 609'-0" Units 1 & 2	5	01/29/90
17	12-5269-5	Fire Facilities Turbine Bldg. Main Floor El. 633'-0" Units 1 & 2	5	01/29/90
		LICENSING DOCUMENTS		
18	50-315 50-316	Safety Evaluation Document of IMPC D.C. Cook Plant Units 1 & 2	-	04/26/90

NFPA 10 - 1984 EDITION

PORTABLE FIRE EXTINGUISHERS

This Review includes the following areas:

- These fire zones will be verified for all portions of the fire zone within 40 feet of column line H, and auxiliary feed water pump rooms or safety related trays. The portions of the fire zones reviewed included the area bounded by column coordinates: Fire Zones #79-80 (Col. Lines H-23, H-14, G-26, G-18, GA-23, GA-26, E-18 and E-14); Fire Zones #84-85 (Col. Lines H-13, H-4, G-9, G-1, GA-4, GA-1, E-13 and E-9), Fire Zones #90-91 (Col. Lines H-14, H-23, E-14, E-18, G-18, G-26, and GA-26); Fire Zones #96-97 (Col. Lines H-13, H-4, G-13, G-1, GA-4 and GA-1) Fire Zones 129 &130 (Col. Lines H-8, H-19, G-8 and G-19).

- Unit 1 & 2 Diesel Fire Pump Room
  Fire Zones 28 & 30

- Unit 1 & 2 Containment Building
  Fire Areas AAA & CCC

- Extinguishers located in Fire Zone 142 were used to verify adequate coverage of hazards within Fire Zones 28 & 30.

The evaluation of the portable fire extinguisher system was reviewed under the 1984 edition of the code. Although the system was installed under different edition years from 1970 to 1984, the difference in the edition requirements were minimal and the 1984 edition year was deemed to be more applicable to the installed system.

The evaluation of the portable fire extinguisher system verified the following features:

1. Proper types of fire extinguishers have been provided based upon the characteristics of the anticipated fires.

2. Fire extinguishers have been properly distributed throughout the plant.

3. Procedures for the Inspection, Maintenance and Recharging of fire extinguishers are satisfactory.

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 10-1984
PORTABLE FIRE EXTINGUISHERS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 1. INTRODUCTION		
1-6.2	Portable extinguishers shall be maintained in a fully charged and operable condition, and kept in their designated places at all times when they are not being used.	W, D	Complies: Fire Zones 28, 30, 90,97, 130 Ref: #5-7, 10, 12, 13, 15-17. Does Not Comply: Fire Zone-79, FES 591T-78BC, FES 591T-77 CO_2 are not readily accessible and are shown in wrong location on drawing #12-5267-6. FES 591T-79BC access is obstructed. Ref: #1, 13, 15. Does Not Comply: Fire Zone-80, FES 591T-75 CO_2 not clearly marked, FES 591T-72BC and FES 591T-73 CO_2 access is obstructed. FES 591T-68BC is designated on drawing #12-5267-6 as Foray dry Chemical, actual extinguisher agent is "Purple K" (BC). FES 591T-66BC is shown on drawing in wrong location and access is obstructed. Ref: #2, 13, 15. Does Not Comply: Fire Zone-84, FES 591T-96BC and CO_2 access obstructed. FES 591T-61BC has wrong designation on drawing #12-5267-6, extinguisher agent is shown as Foray Dry Chemical, actual agent is "Purple K" (BC). Ref: #4, 13, 15. Does Not Comply: Fire Zone-85, FES 591T-51BC is obstructed. Ref: #4, 13, 15. Does Not Comply: Fire Zone-91, FES 609T-42 CO_2, access obstructed, FES 609T-50 CO_2 shown in wrong location on drawing #12-5268-5. Ref: #8, 13, 16.

REV	BY	DATE	CHECKED	DATE
0	[illegible]	12/14/90	SFD	12/14/90

NFPA 10-CODE COMPLIANCE VERIFICATION CHECKLIST
DONALD C. COOK UNITS 1 AND 2
ABB Impell Corporation
JOB NO 0120-164
CALC NO 0120-164-001
PAGE 7 OF 10

REV	BY	DATE	CHECKED	DATE
0	[illegible]	12/14/90	SED	12/14/90

NFPA 10-CODE COMPLIANCE VERIFICATION CHECKLIST

DONALD C. COOK UNITS 1 AND 2

ABB Impell Corporation

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CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 10-1984
PORTABLE FIRE EXTINGUISHERS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
			Does Not Comply: Fire Zone-96, FES 609T-35BC, not properly marked. Ref: #9, 13, 16 Does Not Comply: Fire Zone-129, drawing #12-5269-5 indicates extinguisher on column G-17. No extinguisher found at this location. FES 633T-27BC found on column G-16 is not indicated on drawing #12-5269-5 and is obstructed from access. Ref: #11, 13, 17
3-1.2	Fire extinguishers shall be provided for the protection of both the building structure, extinguishers provided for hazards within if combustible, and the occupancy hazards contained therein.	W	Complies: Fire Zones-79, 80, 90. Ref: #1, 2, 7 Does Not Comply: Fire Zones-28, 30, 84, 85, 91, 96, 97, 129, 130. No extinguisher provided for protection of Class A - ordinary combustibles. Ref: #3-6, 8-12
3-1.2.2	Occupancy hazard protection shall be provided by fire extinguishers suitable for such Class A, B, C, or D fire potentials as may be present.	W	See results of Code Section 3-1.2
3-2.1	Minimal sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of Table 3-1.1 except a modified by 3-2.3. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table 3-2.1, except as modified by 3-2.3.	W, D	Complies: Fire Zones-28, 30, 79, 80, 90. Ref: #12, 5-7, 14-16. Does Not Comply: Fire Zones-84, 85, 91, 97. Travel distances for Class A extinguishers, Table 3-2.1 are exceeded. Ref: #3, 4, 8, 10, 14, 16. Does Not Comply: Fire Zones-96, 129, 130. Travel distances for Class A extinguishers, Table 3-2.1, and Class B extinguishers, Table 3-3.1 are exceeded. Ref: #9, 11, 12, 14, 16, 17.

ABB Impell Corporation

REV	BY	DATE	CHECKED	DATE
0	[illegible]	11/14/90	SEC	12/19/90

JOB NO 0120-164
CALC NO 0120-164-001

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 10-1984
PORTABLE FIRE EXTINGUISHERS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
			Does Not Comply: Fire Area-AAA, CCC. Travel distances for Class A extinguishers, Table 3-2.1, and Class B extinguishers, Table 3-3.1 are exceeded. Ref: #18
3-3.1	Minimal sizes of fire extinguishers for the listed grades of hazard shall be provided on the basis of Table 3-3.1. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in the table used. EXCEPTION: EXTINGUISHERS OF LESSER RATING, DESIRED FOR SMALL SPECIFIC HAZARDS WITHIN THE GENERAL HAZARD AREA, MAY BE USED, BUT SHALL NOT BE CONSIDERED AS FULFILLING ANY PART OF THE REQUIREMENTS OF TABLE 3-3.1.	W, D	See results of code section 3-2.1
3-3.3	The protection requirements may be fulfilled with extinguishers of higher ratings provided the travel distance to such larger extinguishers shall not exceed 50 ft (15.25 m).	W, D	Does Not Comply: Fire Zones-All. Extinguishers with higher ratings are provided and a travel distance of 50 feet was verified for in determining compliance to Section 3-3.1.. See results of Code Section 3-2.1 for deficiencies. Ref: #1-12, 14-17.
4-3.2	Procedure. Periodic inspection of extinguishers shall include a check of at least the following items: (a) Located in designated place. (b) No obstruction to access or visibility. (c) Operating instructions on nameplate legible and facing outward. (d) Seals and tamper indicators not broken or missing. (e) Determine fullness by weighing or "hefting." (f) Examine for obvious physical damage corrosion, leakage, or clogged nozzle. (g) Pressure gage reading or indicator in the operable range or position.	D	Does Not Comply: Fire Zones-All. Item. (B), (C) and (E) are not included in the inspection procedure #12-SHP2270 FIRE.001. Item (G) is not applicable. The extinguishers provided are cartridge operated Dry Chemical or CO_2 and need not to be equipped with a pressure gage. Ref: #13

REV	BY	DATE	CHECKED	DATE
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NFPA 10-CODE COMPLIANCE VERIFICATION CHECKLIST

DONALD C. COOK UNITS 1 AND 2

ABB Impell Corporation

JOB NO 0120-164

CALC NO 0120-164-001

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 10-1984
PORTABLE FIRE EXTINGUISHERS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4-3.4.2	At least monthly, the date the inspection was performed and the initials of the person performing the inspection shall be recorded.	W, D	Does Not Comply: Fire Zones-All. Date of inspection and initials of person who performed it, do not appear on tag. Ref: #1-13.
*4-4.3	RECORDKEEPING. Each extinguisher shall have a tag or label securely attached that indicates the month and year the maintenance was performed and shall identify the person performing the service.[1] The same record tag or label shall indicate if recharging was also performed.	W, D	Does Not Comply: Fire Zones-All. No tag or label is attached to the unit indicating the month and year maintenance was performed, who performed the service and if recharging was required. Ref. #1-13.

APPENDIX A2

CODE COMPLIANCE VERIFICATION CHECKLIST

NFPA 13 - 1971 EDITION

CALCULATION / PROBLEM COVER SHEET

Calculation / Problem No: 0120-164-002

Title: NFPA 13 - CODE COMPLIANCE CCVL

Client: AEPSC Job No: 0120-164

Project: D.C. COOK EXTENDED CODE REVIEW

Design Input / References:

SEE SECTION 5.0

Assumptions:

SEE SECTION 2.0

Method:

SEE SECTION 3.0

Remarks:

SEE SECTIONS 1.0 & 4.0

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	SJ Chmiel	12-14-90
1	REVISED FOR CLARIFICATION ON PAGES 2 & 10	MJ Sinclair	1/14/91

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

For the purpose of this report, it is assumed that under most conditions the authority having jurisdiction was the architect/engineer (A/E) for the plant who is American Electric Power Service Corporation (AEPSC) unless other wise indicated.

3.0 METHODOLOGY

3.1 Reference Section 2.1.1 of ABB Impell Project Instruction PI-0120-164-01, Revision 0.

Justifications for deviations and open items identified in the CCVC's are detailed in ABB Impell Technical Report Number 09-0120-0381. 1

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

5.0 REFERENCES

References

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		WALKDOWN VERIFICATION CHECKLISTS		
1	0120-164-002A	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Turbine Bldg., Zone 79)	0	12/90
2	0120-164-002B	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Turbine Bldg., Zone 80)	0	12/90
3	0120-164-002C	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Turbine Bldg., Zone 90)	0	12/90
4	0120-164-002D	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Turbine Bldg., Zone 91)	0	12/90
5	0120-164-002A	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Cable Trays, Zone 79)	0	12/90
6	0120-164-002F	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Cable Trays, Zone 80)	0	12/90

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
7	0120-164-002G	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Cable Trays, Zone 90)	0	12/90
8	0120-164-002H	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Cable Trays, Zone 91)	0	12/90
9	0120-164-002I	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Area & Tray, Zone 84)	0	12/90
10	0120-164-002J	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Area & Tray, Zone 85)	0	12/90
11	0120-164-002K	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Area & Tray, Zone 96)	0	12/90
12	0120-164-002L	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Area & Tray, Zone 97)	0	12/90
13	0120-164-002M	ABB Impell Calculation NFPA 13, 1971 Code Compliance Walkdown Verification Checklist (Diesel Fire Pump Rooms, Zones 28, 30)	0	12/90

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		PROCEDURES		
20	PO-050-508	Fire Protection - Water Preoperational Test Procedure	0	07/03/74
21	12-OHP-4030-STP-120VC	Fire Protection Yearly Valve Cycle and Lineup Verification	1	07/19/90
22	12-OHP-4030-STP-120VV	Fire Protection Valve Lineup Verification	0	11/17/88
23	12-OHP-4030-STP-120SF	Fire Protection Unobstructed Flow Test and Sprinkling Alarm Test	1	07/19/90
24	12-OHP-4030-STP-124	Fire Protection System Flush and Loop Flow Test	0	10/05/89
25	12-OHP-4030-STP-223	Fire Protection Water System Test	8	07/27/89
26	12-OHP-4030-STP-125NS	Non-Tech Spec Required Sprinkler Tests	1	10/12/89
		TECHNICAL DATA		
30	-	Letter From: R.J. Daley To: R.W. Jurgensen Instruction Book, "Grinnel and Star Fire Systems Equipment"	-	07/15/74
31	SD-DCC-FP101	System Description, Fire Protection System - Water	2	12/26/89
32	-	Specification for Fire Protection Systems of D.C. Cook Nuclear Plant	0	04/02/71
33	DCCPM104QCS	Piping Specification	4	11/09/72
34	DCCPM102QCS	Shop and Field Fabrication and Erection	4	05/24/73

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
35	ROC from D. Kipley to B. Gerwe	Ambient Temperature Conditions	-	08/06/90
36	0120-164-005	ABB Impell Calc., NFPA 72D, Code Compliance Verification Checklist	O	12/90
37	0120-164-006	ABB Impell Calc., NFPA 72E, Code Compliance Verification Checklist	O	12/90
38	-	Grinnel Hydraulic Calcs for Zone 79	-	02/18/72
39	-	Grinnel Hydraulic Calcs for Zone 80	-	03/13/72
40	-	Grinnel Hydraulic Calcs for Zone 90	-	03/30/72
41	-	Grinnel Hydraulic Calcs for Zone 91	-	03/30/72
42	-	Grinnel Hydraulic Calcs for Zone 79 Cable Trays	-	05/26/72
43	-	Grinnel Hydraulic Calcs for Zone 80 Cable Trays	-	07/05/72
44	-	Grinnel Hydraulic Calcs for Zone 90 Cable Trays	-	09/22/72
45	-	Grinnel Hydraulic Calcs for Zone 91 Cable Trays	-	11/09/72
46	-	Hodgeman Hydraulic Calcs for Zone 84	-	10/18/74
47	-	Hodgeman Hydraulic Calcs for Zone 85	-	12/27/72
48	-	Hodgeman Hydraulic Calcs for Zone 96	-	12/11/74

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
49	-	Hodgeman Hydraulic Calcs for Zone 97	-	05/19/75
50	ROC from D. Kipley to B. Gerwe	D.C. Cook Code Compliance Review	-	08/21/90
51	0120-164-007	ABB Impell Calc. Deviation Evaluation	0	12/90
		LICENSING DOCUMENTS		
60	Docket No. 50-315, 50-316	Safety Evaluation Document of Donald C. Cook Plant, Units 1 & 2	1	01/30/87
		DRAWINGS		
70	DWG 46-032-71M-20	Sprinkler Piping, Unit 1 Generator End Basement	2	12/18/71
71	DWG 46-032-71M-24	Sprinkler Piping, Unit 1 Turbine End Basement Zone 80	3	10/30/71
72	DWG 46-032-71M-29	Sprinkler Piping, Unit 1 Generator End, Mezz Floor Zone 90	0	12/10/71
73	DWG 46-032-71M-32	Sprinkler Piping, Unit 1 Turbine End Mezz Floor Zone 91	0	11/03/71
74	DWG 46-032-71M-22	Sprinkler Piping, Unit 1 Generator End Basement Cable Racks Zone 79	1	05/26/72
75	DWG 46-032-71M-26	Sprinkler Piping, Unit 1 Turbine End Basement Cable Racks Zone 80	0	05/26/72

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
76	DWG 46-032-71M-31	Sprinkler Piping, Unit 1 Generator End, Mezz Floor Cable Racks Zone 90	0	09/22/72
77	DWG 46-032-71M-35	Sprinkler Piping, Unit 1 Turbine End, Mezz Floor Cable Racks Zone 91	0	07/29/72
78	DWG 121-8	Sprinkler Piping, Unit 2 Turbine End, Mezz Floor Floor Zone 84	1	10/21/74
79	DWG 121-22	Sprinkler Piping, Unit 2 Turbine End Basement Cable Racks Zone 84	0	08/16/76
80	DWG 121-10	Sprinkler Piping, Unit 2 Generator End Basement Floor Zone 85	2	12/30/74
81	DWG 121-24	Sprinkler Piping, Unit 2 Generator End Basement Cable Trays Zone 85	0	09/23/76
82	DWG 121-12	Sprinkler Piping, Unit 2 Turbine End Mezz Floor Zone 96	1	11/27/74
83	DWG 121-31	Sprinkler Piping, Unit 2 Turbine End Mezz Floor Cable Racks, Zone 96	0	11/17/76
84	DWG 121-14	Sprinkler Piping, Unit 2 Generator End Mezz Floor Zone 97	1	05/19/75
85	DWG 121-28	Sprinkler Piping, Unit 2 General End Mezz Floor Cable Racks Zone 97	0	10/15/76
86	DWG 1-5152J-1	Flow Diagram, Unit 1 Details - Turbine Bldg. and Screen House	1	06/21/88

REF. NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
87	DWG 2-5152K-2	Flow Diagram, Unit 2 Details - Turbine Bldg. and Screen House	2	06/21/88
88	DWG 2-5152C-2	Flow Diagram, Unit 2 Turbine Bldg. and Screen House	2	08/04/88
89	DWG 1-5152B-1	Flow Diagram, Unit 1 Turbine Bldg. and Screen House	4	04/07/89
90	RDR-12-253	Sprinkler Piping Diesel Fire Pump Rooms	1	04/20/79

REV	BY	DATE	CHECKED	DATE
1	[illegible]	1/11/91	[illegible]	1-11-91

NFPA 13-CODE COMPLIANCE VERIFICATION CHECKLIST

DONALD C. COOK UNITS 1 AND 2

ABB Impell Corporation

JOB NO 0120-164

CALC NO 0120-164-002

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CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1971
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)

The Sprinkler Systems of D.C. Cook were originally designed under the jurisdiction of the 1971 Edition of NFPA 13. Over the course of D.C. Cooks history, modifications to the Sprinkler Systems were performed. The last of these modifications were completed under the jurisdiction of the 1983 Edition of NFPA 13. However, for the purpose of this evaluation, only the original (1971) Edition of NFPA 13 was utilized since no modifications after the initial design were performed on the systems being reviewed.

The following systems were evaluated under the requirements of NFPA 13, 1971 Ed.

System	Fire Zone*	Area
Wet Pipe	79, 80,84, 85, 90, 91, 96, 97	Unit 1 & 2 Turbine Building (Aux. Building Exposure Only)
Wet Pipe	28, 30	Unit 1 & 2 Diesel Fire Pump Room Sprinkler Systems

*NOTE: These fire zones will be verified for all portions of the fire zone within 40 feet of column line H, and auxiliary feed water pump rooms or safety related trays. The portions of the fire zones reviewed included the area bounded by column coordinates: Fire zones #79-80 (Col. Lines H-23, H-14, G-26, G-18, GA-23, GA-26, E-18 and E-14); Fire Zones #84-85 (Col. Lines H-13, H-4, G-9, G-1, GA-4, GA-1, E-13 and E-9), Fire Zones #90-91 (Col. Lines H-14, H-23, E-14, E-18, G-18, G-26, and GA-26); Fire Zones #96-97 (Col. Lines H-13, H-4, G-13, G-1, GA-4 and GA-1).

CHAPTER 1, GENERAL INFORMATION

1041	A sprinkler system installed under this Standard must be properly maintained for efficient service. The owner is responsible for the condition of his sprinkler and must use due diligence in keeping the system in good operating condition.	W, D	Comply: All systems reviewed in Zones 79, 80, 90, 91 are maintained and tested via plant procedures. Ref: 1-13, 21-24. Does Not Comply: For the system protecting Zone 80, the guards have been removed from the open bay sidewall sprinklers. Also, valve 1-FP-196 has no operator. Ref: 2, 21-24 Does Not Comply: For the system protecting the cable trays in Zone 80 several nozzles are misaligned. Ref: 6, 21-24

REV	BY	DATE	CHECKED	DATE
0	PBC	12/14/90	SEB	12/14/90

NFPA 13-CODE COMPLIANCE VERIFICATION CHECKLIST

DONALD C. COOK UNITS 1 AND 2

ABB Impell Corporation

JOB NO 0120-164

CALC NO 0120-164-002

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CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1971
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1042	The installing contractor shall provide the owner with: (a) Instruction charts describing operation and proper maintenance of sprinkler devices. (b) Published pamphlet on Care Maintenance of Sprinkler Systems. (NFPA No. 13A.)	D	Comply: Systems in Unit 1 consisting of Grinnel and Star fire protection equipment are provided with documentation. Ref:. 30 Open Item: Systems in Unit 2 installed by Hodgeman are not provided with documentation for review.
1141	Flooring should preferably be made tight and waterproof.	D	Open Item: Documentation could not be found which would verify that the floors have been waterproofed.
1412	Normally, only new materials and devices shall be employed in the installation of sprinkler systems. Second-hand sprinklers shall not be used. When special conditions warrant, listed devices shall as alarm valves, retarding chambers, circuit closers, water motor devices, dry pipe valves, and quick opening devices, etc., may be re-used, but if re-used they shall be reconditioned by the original manufacturer. On request of the authority having jurisdiction, the original manufacturer shall furnish a certificate, stating that such specified devices have been reconditioned and tested and are considered satisfactory for re-use.	D	Open Item: No documentation provided for verification of this code section. Does Not Comply: Non-approved isolation valves are installed at the Unit 1 sprinkler system risers. Ref: 32

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 13-1971
STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
1511	Before asking final approval of an automatic sprinkler equipment by the authority having jurisdiction the installation company should furnish a written statement to the effect that the work covered by its contract has been completed and tested in accordance with the approved specifications and plans. (See Section 1700).)(Sic)	D	Open Item: No documentation provided for verification of this code section.
1611	All tests should be made by contractor in presence of inspector of the authority having jurisdiction. When inspector is not available and permission is granted by the authority having jurisdiction, tests may be witnessed by owner or his representative and test certificate signed by same.	D	Open Item: Although the specifications require the presence of ANI (NEL-PIA) during all tests for approval, final test certificates are not provided for review. Ref: 32, Sect 1:03.
1620	Flushing of Underground Connections Underground mains and lead-in connections to system risers shall be flushed thoroughly before connection is made to sprinkler piping in order to remove foreign materials which may have entered the underground during the course of the installation. Underground mains supplying wet pipe, dry pipe or pre-action sprinkler systems should be flushed at a rate of flow of not less than 750 gallons per minute for 6-inch pipe, 1,000 gallons per minute for 8-inch pipe, 1,500 gallons per minute for 10-inch pipe and 2,000 gallons per minute for 12-inch pipe. The minimum rate of flow for flushing underground connections to open sprinkler, deluge, and hydraulically designed systems should not be less than the water demand rate of the system which is determined by system design. For all systems, the flushing operations should be continued for a sufficient time to insure thorough cleaning. When planning the flushing operations, consideration shall be given	D	Does Not Comply: The installation specifications do not require the lead in connections to be flushed. However, specification 12 OHP 4030.STP 124 requires regular system flushing with flushing connections provided at all automatic valve manifolds. Also, strainers are provided at the pumps. Ref: 24, 3 Sect. 1:07.3.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	to disposal of the water issuing from the test outlets. If the water supply will not produce the stipulated flow rate, the maximum flow rate available should be obtained by employing adequate discharge means.		
1631	Test-Pressure. All new systems including yard piping shall be tested hydrostatically at not less than 200 pounds per square inch pressure for two hours, or at 50 pounds per square inch in excess of the maximum static pressure when the maximum static pressure is in excess of 150 pounds.	D	Open Item: The piping specifications require hydrostatic testing of 1-1/2 times the design pressure, however test certificates are not provided for review. Ref: 34, Sect. 3.4.3
1632	Permissible Leakage. The inside sprinkler piping should be installed in such a manner that there will be no visible leakage when the system is subjected to the hydrostatic pressure test. Refer to Outside Protection Standard (NFPA No. 24) for permissible leakage in underground mains and lead-ins. The amount of leakage may be measured by pumping from a calibrated container.	W, D	Open Item: Piping specifications require repair of any leaks during hydrostatic testing and no visible leaks were found, however, test certificates were not provided for review. Ref: 1-13, 34 Sect. 3.4.1
1700	Contractor's Material and Test Criteria Sprinkler Systems - Water Spray Systems (Certificates and requirements appear on pages 24 - 29 of the code.)	D	Open Item: Documentation not provided for review.
	CHAPTER 2. WATER SUPPLIES		
2822	The required pressure gauges shall be of approved type and shall have a maximum limit not less than twice the normal working pressure at the point where installed. They shall be so installed as to permit easy removal, and shall be located where they will not be subject to freezing.	W, D	Comply: Pressure gauges are acceptable for Zones 79, 80, 90, 91. Ref: 1-8, 86 Does Not Comply: Walkdown and drawings indicate 300 psi gauges for fire zones 84, 86, 97. Working pressure is 162 psi. Ref: 9, 10, 12, 87

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			Does Not Comply: The gauge below the alarm valve protecting zone 96 is an Ashcroft (non U.L.) gauge. Ref. 11, 87 Does Not Comply: The gauges below the alarm valves protecting the Diesel Fire Pump Rooms are Ashcroft (non-U.L.). Gauges reading 210 psi on a scale of 300 psi. The Unit 1 Diesel Fire Pump gauge and bypass line are not freeze protected. Ref: 12, 86, 87
	CHAPTER 3. SYSTEM COMPONENTS		
3051	Branch lines should not exceed 6 sprinklers on either side of cross main. The following pipe schedules are given only as a guide for installations having no unusual features. Steel 1 in. pipe — 1 sprinkler 1-1/4 in. pipe — 2 sprinklers 1-1/2 in. pipe — 5 sprinklers 2 in. pipe — 8 sprinklers 2-1/2 in. pipe — 15 sprinklers 3 in. pipe — 27 sprinklers 3-1/2 in. pipe — 40 sprinklers 4 in. pipe — 55 sprinklers 5 in. pipe — 90 sprinklers 6 in. pipe — 150 sprinklers 8 in. pipe — See Paragraph 3032 Copper 1 in. pipe — 1 sprinkler 1-1/4 in. pipe — 2 sprinklers 1-1/2 in. pipe — 5 sprinklers 2 in. pipe — 8 sprinklers	W,D	Not Applicable: Documentation shows that all systems reviewed have been hydraulically designed with the exception of the Diesel Fire Pump Room systems which are sized based on an ordinary hazard pipe schedule. Ref: 1-13, 38-49, 70-85, 90, 50

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	2-1/2 in. pipe — 20 sprinklers 3 in. pipe — 30 sprinklers 3-1/2 in. pipe — 45 sprinklers 4 in. pipe — 65 sprinklers 5 in. pipe — 100 sprinklers 6 in. pipe — 170 sprinklers 8 in. pipe — See Paragraph 3032 The area protected by any one system on any one floor of one fire section shall not exceed 25,000 square feet. This permits exceeding the number of sprinklers specified above the 8-inch pipe.		
3091	All threaded fittings and pipe shall have threads cut to ANSI Standard B2.1. Care should be taken that the pipe does not extend into the fitting sufficiently to reduce the waterway.	D	Open Item: Documentation (Procedures of Specifications) not provided for review.
3092	Pipe shall be properly reamed after cutting to remove all burns and fins.	D	Open Item: See response to Code Section 3091.
3093	Joint compound shall be applied to the threads of the pipe and not in the fitting.	W, D	Open Item: See response to Code Section 3091. Ref: 1-13
3094	Other types of joints must be made or installed in accordance with the requirements of the listing thereof by a nationally recognized testing and inspection agency.	D	Open Item: See response to Code Section 3091.
3095	Brazed joints for the connection of pipe or tube and fittings may be used. The fire hazard of the process shall be suitably safeguarded.	W, D	Open Item: See response to Code Section 3091. Ref: 1-13

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3211	All sprinkler pipe and fittings shall be so installed that the system may be thoroughly drained. Where practicable, all piping should be arranged to drain to the main drain valve.	W, D	Comply: Walkdown and documentation verified acceptable drainage with aux. drains provided for trapped sections as required by the drawing. Ref: 1-13, 70-85, 90
3212	Pipe shall be straightened before installation to prevent pockets which would interfere with proper drainage.	W	Comply: Plant walkdowns verified the existence of straight pipe. See response to Code Section 3211. Ref: 1-13
3213	On wet pipe systems sprinkler pipes shall be pitched not less than 1/4 inch to 10 feet.	W	Comply: Plant walkdown verified acceptable drainage see response to Code Section 3211. Ref: 1-13
3241	Each drain pipe should preferably discharge outside the building at a point visible from the drain valve and free from the possibility of causing water damage. Where it is not possible to discharge outside the building wall, the drain should be piped to a sump, which in turn should discharge by gravity or be pumped to a waste water drain or sewer. Direct interconnections should not be made between sewers and sprinkler drains of systems supplied with public water. The drain discharge should be in conformity with any local health or water department regulations, or sanitary code. The drain connection should be of a size to carry off water from open drains while they are discharging under normal water pressures.	W	Does Not Comply: The Unit 1 systems reviewed (Zones 79, 80, 90, 91) are equipped with drain lines that are gauged and have hose couplings to facilitate drainage. One hose goes to a bucket with a portable sump pump. Ref: 1-8 Does Not Comply: The Unit 2 systems reviewed (Zones 84, 85, 96, 97) are equipped with main drain lines that are connected to the flushing header which goes to a sump. The drain line from the retard chamber, however, discharges to the floor. Ref: 9-12 Does Not Comply: The drain lines for the Unit 2 Diesel Fire Pump Room system are piped to a sump. However, the Unit 1 Diesel Fire Pump Room drains discharge to the floor. Ref: 13

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3562	The minimum distance between hangers and upright sprinklers should be in accordance with Table 3562.	W, D	Comply: Walkdown and documentation verified compliance for Zones 30, 90, 85, and 97 systems. Ref: 3, 7, 10, 12, 72, 76, 80, 81, 84, 85 Does Not Comply: Walkdown showed that hangers were too close to upright sprinklers in the Unit 1 Diesel Fire Pump Room (Zone 28) and on line #206 in Zone 79. Ref: 1, 5, 13, 70, 74, 90 Does Not Comply: Walkdown showed that hangers were missing in Fire Zone 84 (numerous), Zone 80 (missing on main "C1" and "L2"), and Zone 91 (no dead weight support on 6" riser, one hanger missing). Ref: 2, 6, 4, 8, 9, 71, 73, 75, 77, 78, 79 Does Not Comply: Walkdown showed that hangers were broke in Fire Zone 96. Ref: 11, 82, 83
3612	Automatic sprinklers with nominal 1/2-inch discharge orifice and of the ordinary degree temperature ratings will usually be required.	W	Comply: Walkdown verified compliance with all area systems in Fire Zones 80, 79, 90, 84, 85, 96 & 97. Ref: 1 thru 4 and 9 thru 13 Does Not Comply: Walkdown shows that Unit 1 & 2 cable tray systems (Zones 80, 79, 85, 90, 91, 96 & 97) used 1/4" orifice heads and small orifice heads were noted in Fire Zone 91. Ref: 5, 6, 7, 8

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3653	The use of sprinklers with temperature ratings higher than ordinary shall be in accordance with the maximum ceiling temperatures given in Table 3651, except as provided in Paragraph 3654.	W, D	Comply: Drawings and walkdowns show that the sprinklers used in the Unit 2 area protection systems (Zones 84, 95, 96, 97) are in accordance with the temperture given in Tabel 3651. Ref: 9-12, 78-85 Does Not Comply: Drawings and walkdowns show that the sprinklers used in the Unit 1 area and cable tray systems, Unit 2 cable tray systems, and in the Diesel Fire Pump Rooms are 250°F rated heads rather than 175°F to 225°F called out in Tabel 3651. Ref:- 1-13, 70-85, 90
3681	When the sprinkler piping is given any kind of coating, such as whitewash or paint, care must be exercised to see that no portion of the automatic sprinklers is coated. When painting sprinkler piping or painting in areas near sprinklers, the sprinklers may be protected by covering with a paper bag which shall be removed immediately after the painting has been finished.	W	Comply: Walkdown verified compliance for Zones 28, 30, 85, (Area Sys. Only) and 90 (area system only). Ref: 1,3, 10, 13 Does Not Comply: Walkdowns showed painted heads in Zone 79, 80, 91 & 96 and covers left in place after painting in Zones 79, 84 & 91. Ref: 9, 11

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3682	Sprinkler frames may be factory painted or enameled for the purpose of identifying sprinklers of different temperature ratings in accordance with Paragraph 3651. Otherwise, sprinklers shall not be painted and any sprinklers which have been painted, except for factory applied coatings applied for identification of temperature ratings shall be replaced with new approved sprinklers. Paintings of sprinklers may retard the thermal response of the fusible element, may interfere with the free movement of parts and may render the sprinkler inoperative. Moreover, painting may invite the application of subsequent coatings, thus increasing the possibility of a malfunction of the sprinkler.	W	Comply: Walkdowns verified compliance for this code section in Zones 28, 30 (Diesel Fire Pump Rooms), Zone 90, Zone 85, and Zone 97. Ref: 3, 7, 10, 12, 13 Does Not Comply: Walkdowns showed several heads which were painted or covered by plastic bags in Zone 79 (painted head in cable tray sys, covers left on area sys. line #504), Zone 80 (several painted heads on area sys), Zone 91 (painted and covered heads with plastic bags on area sys), Zone 84 (covers left in place), and Zone 96 (painted heads). Ref: 1, 2, 4-9, 11
3683	Ornamental finishes shall not be applied to sprinklers by anyone other than the manufacturer of the sprinklers and only sprinklers approved with such finishes shall be used.	W	Comply: See response to Code Section 3682. Does Not Comply: See the response to code section 3682.
3691	Arrangements should be made to keep at least 18 inches clearance below sprinkler deflectors to reduce possible obstruction to the distribution of water. For high piled combustible stock increased clearance of 36 inches or more should be provided.	W	Comply: Walkdowns verified that this code section is being met. Ref: 1-13

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3761	(a) Electrically operated alarm attachments forming part of an auxiliary, central station, proprietary or remote station signaling system shall be installed in accordance with the following applicable NFPA standards. 1. Central Station Protective Signaling Systems (NFPA No. 71). 2. Auxiliary Protective Signaling Systems (No. 72B). 3. Remote Station Protective Signaling Systems (NFPA No. 72C). 4. Proprietary Protective Signaling Systems (NFPA No. 72D). (b) Electrically operated alarm attachments forming part of a local sprinkler water flow alarm system shall be installed in accordance with the local alarm system provisions of NFPA No. 72A and in accordance with the provisions of the following Paragraphs 3762, 3763 and 3764. These standards permit local electrical waterflow alarms to be of open circuit type.	D	Comply: All devices are properly installed, and tested based on the review of the evaluations performed for NFPA 72D-1967 edition in Report No. 09-0120-0123. REF: 21, 22, 23 & 51.
3762	Waterflow devices, controlling electric alarm circuits, should be provided with means for testing the electrical supply, circuits, connection and devices. An actual waterflow, through the use of a test connection, shall be the method employed for testing the operation of the sprinkler alarm unit as a whole.	D	Comply: Test devices are provide for each system. Ref: 1-13, 23
3783	Drain from retarding chamber and electric alarm switch should preferably discharge through an open cone and be run separate from main system drains to a safe and visible point of free discharge or to sewer or ground drain. Drain from water-motor-	W, D	Comply: Walkdown and documentation verifies that retard chambers are provided and separate from main drain. Ref: 1-13, 86-89

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	operated alarm device may run separately to sewer or ground drain or may be connected to drain from retarding chamber at a point between such sewer and a check valve on this drain, a union or plug being inserted in the drain from the alarm device to permit inspection.		Does Not Comply: Walkdown and documentation showed retard chambers discharge to floor. Ref: 1-13, 86-89
	CHAPTER 4. SPACING, LOCATION AND POSITION OF SPRINKLERS		
4011	The authority having jurisdiction shall be consulted in every case as to location and spacing of sprinklers for the protection of buildings and contents.	D	Comply: The specifications require that the plans and final installation are subject to the approval of the authority having jurisdiction. Ref: 32 Sec 1:04.1
4032	Where such partial sprinkler installations are installed, the standards of this pamphlet should be used insofar as they are applicable. The authority having jurisdiction should be consulted in each case.	D	Not Applicable: The Fire Zones evaluated (79, 80, 84, 85, 90, 91, 96, 97, 28, 29) have full area coverage. Flow test are performed every 18 months for water supply. Ref: 1-13, 25, 38-49, 70-85, 90
4133	Extra Hazard Occupancy. The protection area per sprinkler shall not exceed 90 square feet for any type of building construction.	D	Comply: Walkdown and documentation verify compliance with this code section for Zones 79, 80, 84, 85, 90, 91, 96, and 97. Ref: 1-13, 70-85 Not Applicable: The Diesel Fire Pump Room systems are sized based on an ordinary hazard. Ref: 13, 90, 80
4143	The arrangement of branch lines depends upon such construction, features as the distance between girders or trusses, columns of mushroom type reinforced concrete, and beams of standard mill construction. Each space or bay should usually be treated as a unit, installing the same number of branch lines uniformly in each space. Where single branch lines will suffice, they should be	W	Comply: Walkdowns showed compliance for this Code Section in Zone 85. Ref: 10 Does Not Comply: Walkdowns showed numerous sprinklers missing from bays in Zone 79 (3 bays with no sprinklers), 80 (one branch line and numerous heads missing), 90 (missing heads), 91

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	placed midway in each bay or space. The arrangement of branch lines also depends upon the structural members available and suitable for the attachment of hangers and upon the need for properly locating sprinkler deflectors in accordance with Sections 4150 and 4200.		(several uprotected rooms, missing branch lines), 84 (missing heads), 85 (missing heads), 96 (one branch line missing) and 97 (branch lines missing). Ref: 1-9, 11, 12 Does Not Comply: Walkdowns showed improper installation of sprinkler heads for Zone 80 (area sys., upright in pendent position and standard heads installed in bays where sidewalls are preferred), Zone 97 (upright in pendent position), Zone 96 (upright at angle), and Zone 91 standard heads installed in bays where sidewalls are preferred). Ref: 2, 12, 11, 4 Not Applicable: The Diesel Fire Pump Room have no bays. Ref: 13
4156	Beams. It is essential that if deflectors of sprinklers in bays are above the bottom of the beam, they be at sufficient distances from the beams, as shown in Table 4156 and Fig. 4156 to avoid obstruction to the sprinkler discharge pattern.	W, D	Does Not Apply: Walkdowns identified numerous obstructions to discharge patterns in Zone 79 (obstructions due to cable trays and misc. piping, no suppression for storage area), Zone 80 (obstructions due to cable tray or 3/4" dia. guards), Zone 90 (obstructions due to cable tray, bus duct and misc 4' obs.), Zone 91 (obstruction due to steam piping and beams or 3/4" dia. guards), Zone 84 (piping obstructions, misc.), Zone 85 (sprinklers too close to each other, misc. obstructions from piping), Zone 96 (misc. obstructions), Zone 97 (obstructions from cable trays, piping, and baffle plates). Ref: 1-12, 70-85 Comply: The Diesel Fire Pump Rooms meet this code section. Ref: 13, 90

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4211	Where branch lines run across the beams, the deflectors of sprinklers located in the bays should preferably be located above the bottom of the beam and in no case more than 4 inches below the bottom level of the beams.	W	Comply: Walkdowns verified compliance for Zones 79, 84, 85. Ref: 1, 9, 10 Does Not Comply: Walkdowns showed deflectors too low or too high for Zone 90 (heads 24"-30" below deck), Zone 91 (head 6" from beam, pendent 2' from deck), Zone 96 (branch of heads > 12" below deck), Zone 97 (branch lines and heads > 12" below deck). Ref: 2-8, 11-12
4221	Deflectors of sprinklers under beams should be located 1 inch to 4 inches below beams, and not more than 14 inches below combustible ceilings or not more than 16 inches below noncombustible ceilings.	W	Not Applicable: No smooth ceiling construction for Zones 79, 80, 84, 85, 90, 91, 96, 97. Ref: 1-12 Comply: The Diesel Fire Pump Room walkdown verified compliance. Ref: 13
4231	Deflectors of sprinklers in bays should be located not less than 3 inches below and not more than 16 inches below combustible or noncombustible roof or floor decks.	W	Comply: See response to Code Section 4211. Does Not Comply: See response to Code Section 4211.
4316	Obstructions. Timbers, uprights, hangers, piping, lighting fixtures, duct, etc., are likely to interfere with the proper distribution of water from sprinklers. Therefore, sprinklers should be so located or spaced that any interference is held to a minimum. The required clearance between such members and sprinklers is dependent upon the size of the obstruction to water distribution. The clearances should not be less than those specified between sprinklers and truss members in Paragraph 4161 and 4168. (See Also Paragraph 4166.)	W	Does Not Comply: See response to Code Section 4156. Comply: See response to Code Section 4156.

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4319	Lighting Fixtures (a) Lighting fixtures of the pendent- or surface-mounted type may offer obstruction to discharge from sprinklers unless specified clearances are provided. (b) Branch sprinkler lines should be run parallel to and between lines of fixtures and should be sufficient in number to provide proper floor and ceiling coverage. Pendent fixtures located below the level of the sprinkler deflectors and also surface mounted fixtures may necessitate additional branch lines.	W	Does Not Comply: See response to Code Section 4156. Comply: See response to Code Section 4156.
	CHAPTER 5. TYPES OF SYSTEMS		
5341	Spacing of heat-responsive devices shall be in accordance with their listing by nationally recognized testing laboratories, unless conditions indicate the need for a closer spacing.	W, D	Not Applicable: Only wet pipe systems reviewed. Ref: 1-13
5343	Ceiling Heights. Where ceiling heights exceed 35 feet the heat-responsive devices should be so spaced that the area covered by each device will not exceed 75 percent of the area normally covered.	W, D	Not Applicable: Only wet pipe systems reviewed. Ref: 1-13
5352	Supervision. The sprinkler piping and heat-responsive devices shall be automatically supervised unless otherwise approved by the authority having jurisdiction.	W, D	Not Applicable: Only wet pipe systems reviewed. Ref: 1-13

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
5393	Pressure Gauges. Approved pressure gauges conforming to Paragraph 2822 shall be installed as follows: (a) Above and below pre-action valve and below deluge valve. (b) On air supply to pre-action and deluge valves.	W,D	Not Applicable: Only wet pipe systems reviewed. Ref: 1-13

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APPENDIX A3

CODE COMPLIANCE VERIFICATION CHECKLIST

NFPA 14 - 1971 EDITION

CALCULATION / PROBLEM COVER SHEET

Calculation / Problem No: 0120-164-003

Title: NFPA-14 CODE COMPLIANCE REVIEW

Client: AEPSC Job No: 0120-164

Project: D.C. COOK EXTENDED CODE REVIEW

Design Input / References:

SEE SECTION 5.0

Assumptions:

SEE SECTION 2.0

Method:

SEE SECTION 3.0

Remarks:

SEE SECTIONS 1.0 & 4.0

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE		12-14-90
1	REVISED PER CLARIFICATION ON PAGES 2 & 8		1/14/91

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

The intent of the standpipe service at the plant was to provide Class II service for those stations which have a single 1-1/2 inch hose valve and Class III service at those stations which have both 2-1/2 inch and 1-1/2 inch hose valves.

3.0 METHODOLOGY

Reference Section 2.1.1 of Impell Project Instruction PI-0120-164-01, Revision 0.

The basis for the review of the fire protection systems against a specific code edition was determined by reviewing the systems against the code edition in effect during the time of the original system installation.

The hose stations reviewed were based on the hose stations required for use in the fire zones within our scope of the evaluation. These hose stations are detailed in the Fire Hazards Analysis, Revision 4.

Justifications for deviations and open items identified in the CCVC's are detailed in ABB Impell Technical Report Number 09-0120-0381.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

References

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		WALKDOWN VERIFICATION CHECKLISTS		
1	0120-164-003A	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 79)	0	12/90
2	0120-164-003B	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 8[illegible])	0	12/90
3	0120-164-003C	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 84)	0	12/90
4	0120-164-003D	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 85)	0	12/90
5	0120-164-003E	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 28)	0	12/90
6	0120-164-003F	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 30)	0	12/90
7	0120-164-003G	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 90)	0	12/90
8	0120-164-003H	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 91)	0	12/90
9	0120-164-003I	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 96)	0	12/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
10	0120-164-003J	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 97)	0	12/90
11	0120-164-003K	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone - 129)	0	12/90
12	0120-164-003L	ABB Impell Calc., NFPA 14, 1971 Code Compliance Walkdown Verification Checklist (Fire Zone 130)	0	12/90
		PROCEDURES		
13	12-SHP2270 FIRE.004	Tests and Inspections of the Plant Fire Hose Standpipe Stations	0	2/12/88
14	12-OHP4030.STP.120VV	Fire Protection Valve Lineup Verification	0	4/14/88
14A	12-OHP4030.STP.124	Fire Protection System Flush and Loop Flow Test	0	9/10/87
		TECHNICAL DATA		
15	09-0120-0123	Impell Report	0	5/88
15A	0120-164-007	ABB Impell Calc. for Deviation Evaluations	0	12/90
16	SD-DCC-FP101	Fire Protection System-Water (Pg. 12)	2	12/26/89
17	Catalog (Page 25 + 78)	Fire End	-	-
18	P125-670	Jamesbury Catalog	-	6/70
19	Catalog-T (Ref 57)	Elkhart	-	-
20	NFPA 14	NFPA 14: 4-2.2	-	1987
21		ROC Kipley to Russell	-	8/7/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		DRAWINGS		
22	0120-164	ROC Kipley to Basset	-	8/7/90
23	1-5152B-5	Flow Diagram Fire Protection Fire Protection - Water Turbine Bldg & Screen House Unit 1	5	4/7/89
24	2-5152C-2	Flow Diagram Fire Protection Fire Protection - Water Turbine Bldg & Screen House Unit 2	2	8/4/88
25	2-5152A-3	Flow Diagram Fire Protection Fire Protection - Water Piping at Pumps Units 1 & 2	3	3/23/88
26	12-5267-6	Fire Facilities Basement Plan El. 591'-0" and 587'-0" Units 1 & 2	6	1/29/90
27	12-5268-5	Fire Facilities Mezzanine Floor El. 609'-0" Units 1 & 2	5	1/29/90
28	12-5269-5	Fire Facilities Turbine Bldg. Main Floor El. 633'-0" Units 1 & 2	5	1/29/90
29	1-FP-4	Turbine Room Fire Protection Piping Isometric	8	7/23/87
30	1-FP-5	Turbine Room Fire Protection Piping Isometric	3	8/31/71
31	1-FP-12	Turbine Room Fire Protection Piping Isometric	7	1/16/89
32	1-FP-13	Turbine Room Fire Protection Piping Isometric	6	4/20/73
33	1-FP-27	Turbine Room Fire Protection Piping Isometric	4	4/20/73
34	1-FP-28	Turbine Room Fire Protection Piping Isometric	3	8/31/71

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
35	1-FP-29	Turbine Room Fire Protection Piping Isometric	5	3/11/87
36	1-FP-30	Turbine Room Fire Protection Piping Isometric	6	7/27/87
37	2-FP-37	Turbine Room Fire Protection Piping Isometric	5	3/23/87
38	2-FP-38	Turbine Room Fire Protection Piping Isometric	7	3/23/87
39	2-FP-39	Turbine Room Fire Protection Piping Isometric	6	2/1/88
40	2-FP-40	Turbine Room Fire Protection Piping Isometric	10	3/23/87
41	2-FP-41	Turbine Room Fire Protection Piping Isometric	7	4/10/85
42	2-FP-42	Turbine Room Fire Protection Piping Isometric	5	1/30/78
43	2-FP-60, sht. 1 of 2	Turbine Room Fire Protection Piping Isometric	6	5/22/85
44	2-FP-60, sht. 2 of 2	Turbine Room Fire Protection Piping Isometric	1	2/1/72
45	2-FP-78	Turbine Room Fire Protection Piping Isometric	4	1/20/88
46	2-FP-86, sht. 1 of 2	Turbine Room Fire Protection Piping Isometric	5	1/30/88
47	2-FP-86, sht. 2 of 2	Turbine Room Fire Protection Piping Isometric	2	2/20/73
48	2-FP-90	Turbine Room Fire Protection Piping Isometric	0	6/28/72
49	1-FP-119	Turbine Room Fire Protection Piping Isometric	1	1/4/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		LICENSING DOCUMENTS		
50	50-315 50-316	Safety Evaluation Report for BTP.APCSB 9.5-1, Appendix A	-	07/31/79
51	50-315 50-316	10CFR50, Appendix R Safety Evaluation Document of IMPC D.C. Cook Plant, Units 1 & 2	-	04/26/90

NFPA 14 - 1971 EDITION

STANDPIPE & HOSE SYSTEMS

This review includes the majority of all hose stations which make up the following areas:

- Unit 1 & 2 Turbine Building
  Fire Zones 79-80, 84-85, 90-91, 96-97, 129-130
- Unit 1 & 2 Diesel Fire Pump Room
  Fire Zones 28 & 30
- Unit 1 & 2 Containment Buildings
  Fire Areas AAA & CCC
- Hose stations located in Fire Zone 142 were used to verify adequate coverage of hazards within Fire Zones 28 & 30.

NOTE: These fire zones will be verified for all portions of the fire zone within 40 feet of column line H, and auxiliary feed water pump rooms or safety related trays. The portions of the fire zones reviewed included the area bounded by column coordinates: Fire Zones #79-80 (Col. Lines H-23, H-14, G-26, G-18, GA-23, GA-26, E-18 and E-14); Fire Zones #84-85 (Col. Lines H-13, H-4, G-9, G-1, GA-4, GA-1, E-13 and E-9); Fire Zones #90-91 (Col. Lines H-14, H-23, E-14, E-18, G-18, G-26 and GA-26); Fire Zones #96-97 (Col. Lines H-13, H-4, G-13, G-1, GA-4 and GA-1); Fire Zones 129 & 130 (Col. Lines H-8, H-19, G-8, and G-19).

The evaluation of the standpipe and hose systems included the review of these systems under the 1971 Edition. The edition year selected was based on the edition that was in effect at the time the original system was specified in April, 1971.

The following hose stations were used to determine compliance within the Unit 1 & 2 Containment Buildings. Since the hose stations located in Fire Zones 69, 33A & 34A were previously reviewed in Report No. 09-0120-0123, these hose stations were only reviewed for compliance with hose reach requirements within the containment areas.

FIRE ZONE	HOSE STATION	ELEVATION	ORIGINAL INSTALLATION	MODIFICATION NO.
69	209	650'	-	12-2229
	209A	650'	-	12-2229
	210	650'	-	12-2229
	210A	650'	-	12-2229
33A	203	612'	-	12-2229
	203A	612'	-	12-2229
34A	207	612'	-	12-2229
	207A	612'	-	12-2229

The evaluation of the standpipe and hose systems verified the following features:

1. Size and arrangement of standpipes and hose outlets.
2. Number and location of standpipes.
3. Adequate support of piping.
4. Adequate water supplies.
5. Arrangement of piping, valves and fittings.

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 14-1971
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 1. GENERAL INFORMATION		
151.	All devices and materials used in standpipe systems shall be of approved type.	W, D	Complies: Fire Zones - All. Ref: # 1-12, 15, 17, 18.
171.	Plans showing the location, sizes and connections of the fixed portion of the standpipe system shall be furnished to the authority having jurisdiction. The plans shall be drawn to scale, and shall include the details necessary to indicate clearly all of the equipment and its arrangements. The plans shall be accompanied by specifications covering the character of the material and the features relating to the installation in detail.	D	Open Item: Documentation is not available to determine compliance.
	CHAPTER 2. SIZE AND ARRANGEMENT OF STANDPIPES		
212.	In standpipe systems for Class I and Class III services, each standpipe shall be sized for a minimum flow of 500 gallons per minute. Where only one standpipe is required, its supply piping shall be sized for a minimum flow of 500 gallons per minute. Where more than one standpipe is required, all common supply piping shall be sized for a minimum flow of 500 gallons per minute for the first standpipe plus 250 gallons per minute for each additional standpipe, the total not to exceed 2500 gallons per minute. (a) Standpipes not exceeding 100 feet in height shall be at least 4 inches in size.	W, D	Open Item: Will require hydraulic calculations to confirm compliance with 500 gpm minimum flow requirement. a) Supply does not exceed 100' in height, however, piping is not all 4 inch. It appears the intent of the code section is being met, however further evaluation is required. The calculations should verify the adequacy of the water supply for the following: Hose No. 77, 78 & 80 for Unit 1 and Hose No. 66, 68 & 81 for Unit 2.

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CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 14-1971
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
216.	An approved means of maintaining a pressure on all zones of standpipe systems shall be provided.	D	Complies: Fire Zones - All. Ref: # 16, 25.
217.	In standpipe systems for Class II service each standpipe shall be sized for a minimum flow of 100 gallons per minute (379 1/min). Where one or more standpipes are required, all common supply piping shall be sized for a minimum flow of 100 gallons per minute (379 1/min).	W, D	Not Applicable: Fire Zones - All. No Class 2 service hose stations provided. Ref: #1-12, 23, 24
	CHAPTER 3, NUMBER AND LOCATION OF STANDPIPE AND HOSE CONNECTIONS		
321.	The number of hose stations for Class I and Class III services in each building and in each section of a building divided by fire walls shall be such that all portions of each story of the building are within 30 feet of a nozzle attached to not more than 100 feet of hose. Equipment should be so arranged as to permit directing the discharge from the nozzle into all portions of important enclosures such as closets and like enclosures.	W, D	Does Not Comply: Portions of Fire Area - AAA, CCC, Elevations 598', 609 are not protected within 30 feet of a nozzle attached to 100 feet of hose maximum. All other fire zones comply. Ref: # 1-12, 26-29 Does Not Comply: The following hose station exceeds 100 feet of hose; Fire Zone 129 - Hose Station #80 - 125 feet of hose. Ref: # 11, 28
322.	The number of hose stations for Class II service in each building and each section of a building divided by fire walls shall be such that all portions of each story of the building are within 20 feet of a nozzle when attached to not more than 75 feet of hose. Equipment should be so arranged as to permit directing the discharge from the nozzle into all portions of important enclosures such as closets and like enclosures.	W, D	Not Applicable: Fire Zones - All. No Class 2 service hose stations provided. Ref: #1-12, 23, 24

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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	NOTE: The standpipes supplying the 2-1/2 inch hose streams may also be used to supply the small hose streams. When the area of the building is large, separate standpipes or branches for the small hose streams may be necessary. Small hose streams may sometimes be supplied from an automatic sprinkler system. (See Standard for the Installation of Sprinkler Systems, NFPA No. 13.)		
334.	In buildings divided by numerous partitions, standpipes shall be so located that the streams can be brought to bear in any room.	W, D	Does Not Comply: Fire Area - AAA, CCC. See Section 321 of this Code.
	CHAPTER 4. HOSE OUTLETS		
413.	Valves of approved type should be provided at the main riser for controlling branch lines to hose station outlets so that in the event that the branch is broken during the fire, the fire department may shut off this branch, conserving the water for their use.	W, D	Does Not Comply: Fire Zones - All. Turbine building hose system is not properly sectionalized. Ref: # 1-12, 24
421.	Each hose outlet provided for the use of building occupants (Class II and III services) shall be equipped with not more than 75 feet and preferably not more then 50 feet of approved small fire hose attached and ready for use.	W, D	Not Applicable: Fire Zones - All. Per Section 321 of this Code, 100 feet of hose is allowed.
	NOTE: Long lengths of hose should be avoided as they are difficult to handle likely to kink and interfere with the effectiveness of the streams and cause loss of time when it is most valuable. For information on the selection of hose, see Care of Fire Hose, NFPA No. 198.		

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 14-1971
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
431.	Each station provided with small hose shall be equipped with an approved rack securely fastened in position. NOTE: With hose racks of the "semi-automatic" or "one-man" type, the hose valve should first be opened wide. The nozzle should then be grasped firmly and the hose lines drawn toward the fire. The water is automatically restored as the last few feed of those are pulled form the rack.	W, D	Does Not Comply: Fire Zones - All. No signs provided at hose stations. Ref: # 1-12, 17
432.	Each rack for small hose should be provided with a sign reading "Fire Hose for Use by Occupants of Building". Signs shall be securely fastened in position.	W	
442.	Where the static pressure at any standpipe outlet for small hose exceeds 100 pounds per square inch, an approved device shall be installed at the outlet to reduce the pressure so that the nozzle pressure will be approximately 80 pounds per square inch. NOTE: Pressure reducers are not required on standpipe outlets for 2-1/2 inch hose because it is assumed 2-1/2 inch hose will be attached only when the person likely to use it are trained in handling large streams.	W, D	Does Not Comply: Fire Zones - All. Static pressures exceed 100 psi and are not provided with reducers. Ref: # 1-12
443.	Each hose valve on a wet system should be provided with a suitable open or automatic grip connection so installed that any slight leakage past the valve seat will be carried off and prevented from entering the fire hose.	W, D	Complies: Fire Zones - All. Although no grip connection is provided, Code Section is in compliance due to use of lined fire hose per NFPA 14, 1981. Ref: # 1-12, 15, 19, 20

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CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 14-1971
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 5. WATER SUPPLIES		
511.	The water supply requirements for standpipe systems are dependent upon the size and number of fire streams likely to be needed at any fire, and the length of time such streams will have to be used. Both of these factors are largely influenced by the conditions at the building or plant to be equipped and it is necessary that the probable number of standard streams for the protection of both interior and exterior of the building be carefully ascertained before the water supply is decided upon. The selection of water supplies for each installation shall be determined in cooperation with the authority having jurisdiction.	D	Open Item: Hydraulic calculations are required to confirm compliance.
524.	Supply for Class I and Class III services should be capable of furnishing the number of streams required for full protection for long periods.	D	Comply: (5) fire pumps are available to support the hose demands. Ref: 16, 23-25.
525.	Where the system will supply sprinklers in addition to standpipes, the water supply requirements of both shall be considered. NOTE: See also Standard for the Installation of Sprinkler Systems, NFPA No. 13.	D	Open Item: Hydraulic calculations are required to confirm compliance.
531.	The minimum supply for Class I service shall be sufficient to provide 500 gallons per minute for a period of at least thirty (30) minutes. Where more than one standpipe is required by Chapter 3, the minimum supply shall be 500 gallons per minute for the first standpipe and 250 gallons per minute for each additional standpipe, the total supply not to exceed	D Verify that the requirements for this section are met for Class III service. Ref: Code Section 551. Not applicable for Class I service, not provided at this plant.	Not Applicable: Fire Zones - All. No Class 1 service hose stations are provided. Ref: # 23, 24 Open Item: Will require hydraulic calculations to confirm compliance.

CODE COMPLIANCE VERIFICATION CHECKLIST
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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	2500 gallons per minute for a period of at least thirty (30) minutes. The supply shall be sufficient to maintain a residual pressure of 65 pounds per square inch at the topmost outlet of each standpipe with 500 gallons per minute flowing from the topmost outlet of the most remote standpipe and 250 gallons per minute flowing from the topmost outlet of each of the other standpipes up to a maximum of 2500 gallons per minute flowing. The supply shall be sufficient to maintain a residual pressure of 65 pounds per square inch at the topmost outlet of each standpipe (including the roof outlet) with 500 gallons per minute flowing.		
541.	The minimum supply of Class II service shall be sufficient to provide 100 gallons per minute for a period of at least thirty (30) minutes. The supply shall be sufficient to maintain a residual pressure of 65 pounds per square inch at the topmost outlet of each standpipe (including the roof outlet) with 100 gallons per minute flowing.	D	Not Applicable: Fire Zones - All. No Class 2 service hose stations are provided. Ref: # 23, 24
551.	The minimum supply for Class III service shall be the same as for Class I service.	D	Open Item: See response to Section 531.
	CHAPTER 6. PIPING AND VALVES AND FITTINGS		
622.	Sufficient stop valves or check valves should be provided to permit cutting off a standpipe riser without interrupting the supply to other risers from the same source of supply.	W, D	Complies: Fire Zones - All. sectionalizing valves are not provided for individual risers. Ref: # 1-12, 24

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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search		Summary of Results (List results and reference details in calculations, sketches, etc., as required)
624.	Where the standpipes are supplied from a yard main or header in another building, the connection shall be provided with an approved outside indicator post gate valve at a safe distance from the building or an approved indicator valve at the header.	W, D		Complies: Fire Zones - All. Valves are provided but not approved. Reference Code Section 151. Ref: # 1-12, 15, 17-19, 24
651.	The pipe hangers shall be of approved type, so arranged that they will sustain the loads and retain the piping securely in position. They shall be used in sufficient number to prevent vibration in the piping when the standpipe is in use.	W, D	Verify for non-seismically qualified systems identified by AEPSC only.	Open Item: Will require additional documentation to confirm compliance.
671.	An approved 3-1/2 inch dial spring pressure gage shall be connected with each discharge pipe from fire pump and public water works, at the pressure tank, at the air pump supplying pressure tank and at the top of each standpipe. Gages shall be located in a suitable place where water will not freeze. Each gage will be controlled by a valve having arrangement for draining. NOTE: Where several standpipes are interconnected at the top, a single gage properly located may be substituted for the gages at the top of each standpipe. Additional pressure gages at the base of the standpipes may be desirable in some equipments, particularly in large plants and high buildings.	W, D		Does Not Comply: Fire Zones - All. No gage provided at top of risers. Ref: # 1-12 Complies: Fire Zones - All. Gage is provided at pump discharge and gages are controlled by a drain valve. Ref: # 1-12, 21, 25 Not Applicable: No gage required for water works and no pressure tank or air pump provided. Ref: # 1-12, 21, 25
681.	Water flow alarms should be provided on all standpipe risers, where required by the authority having jurisdiction.	W, D		Does Not Comply: Fire Zones - All. Waterflow alarms are required by the authority having jurisdiction and are not provided. Ref: # 1-12, 23-25

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 14-1971
STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 7. TESTS AND MAINTENANCE		
711.	All new systems including yard piping shall be tested hydrostatically at no less than 200 pounds per square inch pressure for two house, or at 50 pounds per square inch in excess of the normal pressure when the normal pressure is in excess of 150 pounds per square inch. NOTE: Where standpipe connections are built in the walls or partitions the above tests should be made before they are covered in or permanently concealed.	D	Complies: Fire Zones - All. Systems are existing, no new systems installed since original installations. Ref: # 13
712.	The amount of leakage in underground piping shall be measured at the specified test pressure by pumping from a calibrated container.	D	Complies: Fire Zones - All. Based on reference, hose standpipes and underground piping are verified for their operability. Also, since these systems have remained operable since their original installation, the intent of these sections are met. Ref: # 13, 14A
713.	(a) New pipe laid with gasketed joints should, if the workmanship is satisfactory, have no leakage at the joints. Unsatisfactory amounts of leakage usually result from twisted, pinched, or cut gaskets. However, some leakage might result from small amounts of grit or small imperfections. The amount of leakage at the joints should not exceed 2 quarts per hour per 100 joints irrespective of pipe diameter. The leakage should be distributed over all joints. If such leakage occurs at a few joints the installation should be considered unsatisfactory and necessary repairs made.	D	Complies: Fire Zones - All. Based on reference, hose standpipes and underground piping are verified for their operability. Also, since these systems have remained operable since their original installation, the intent of these sections are met. Ref: # 13, 14A

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STANDPIPE AND HOSE SYSTEMS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
723.	The valves in the main connection to the automatic sources of water supply shall be open at all times. The hose valves shall be frequently examined to see that they are tight. NOTE: Leakage at the hose valves may be detected by inspection of the drips at the valves, and care should be taken to see that these are not clogged with dirt or sediment.	D	Complies: Fire Zones - All. Valves in the main connection to the automatic sources of water supply are open at all times. Valves are examined to insure they are tight. Ref: # 13, 14
724.	Inspections shall be made frequently to assure that the hose is in proper position on the racks, and that all of the equipment is in place and in good condition. The hose should be removed and re-racked at intervals at least annually and new gaskets installed in the couplings, both at the hose valves and at the nozzles. When couplings are polished, care should be taken to see that polish used does not touch fabric of hose. NOTE: For further details, see Care of Fire Hose, NFPA No. 198.	D	Does Not Comply: . Fire Zones - All. New gaskets are not installed in the couplings annually. All other items comply. Ref: # 13, 22

APPENDIX A4

CODE COMPLIANCE VERIFICATION CHECKLIST

NFPA 15 - 1973 EDITION

CALCULATION / PROBLEM COVER SHEET

Calculation / Problem No: 0120-164-004

Title: NFPA 15 - CODE COMPLIANCE CIVIL

Client: AEPSC Job No: 0120-164

Project: D.C. COOK EXTENDED CODE REVIEW

Design Input / References:

SEE SECTION 5.0

Assumptions:

SEE SECTION 2.0

Method:

SEE SECTION 3.0

Remarks:

SEE SECTIONS 1.0 & 4.0

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE		12-14-90
1	REVISED PAGES 2 & 10 FOR CLARIFICATION		1/14/91

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

Due to ALARA (high radiation) concerns, the charcoal filter units were inaccessible during the walkdowns. Therefore, the water spray nozzle arrangements within the filtration units are assumed similar to the previous walkdown sketch as documented in the AEPSC evaluation document of June 17, 1988 for all units.

The fire protection systems at the D.C. Cook Plant are not "subject to earthquake" as it pertains to NFPA codes.

The water spray systems were installed per April 2, 1971 specifications.

It is assumed that the spray nozzle arrangement for the charcoal filter units are typical with exception of change in the number of charcoal filter beds.

3.0 METHODOLOGY

Reference Section 2.1.1 of ABB Impell Project Instruction PI-0120-164-01, Revision 0.

The basis for the review of the fire protection systems against a specific code edition was determined by reviewing the systems against the code edition in effect during the time of the original system installation.

Justifications for deviations and open items identified in the CCVC's are detailed in ABB Impell Technical Report Number 09-0120-0381. △1

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

References

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		WALKDOWN VERIFICATION CHECKLISTS		
1	0120-164-004A	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Start-Up XFRM 101 AB)	0	12/90
2	0120-164-004B	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Start-Up XFRM 101 CD)	0	12/90
3	0120-164-004C	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Aux XFRM 1 CD)	0	12/90
4	0120-164-004D	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Aux XFRM 1 AB)	0	12/90
5	0120-164-004E	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (345KV Main XFRM)	0	12/90
6	0120-164-004F	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Unit 1 Exposure Prot)	0	12/90
7	0120-164-004G	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Aux XFRM 2 AB)	0	12/90
8	0120-164-004H	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Aux XFRM 2 CD)	0	12/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
9	0120-164-004I	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Unit 2-Main XFRM's 01,02,03)	0	12/90
10	0120-164-004J	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Start-Up XFRM's 201 AB, 201 CD)	0	12/90
11	0120-164-004K	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Unit 2 Exposure Prot)	0	12/90
12	0120-164-004L	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (Charcoal Filter Units)	0	12/90
13	0120-164-004M	ABB Impell Calc., NFPA 15, 1973 Code Compliance Walkdown Verification Checklist (RCP Pump Systems)	0	12/90
		PROCEDURES		
20	P0-050-508	Fire Protection - Water Preoperational Test Procedure	0	07/03/74
21	12-0HP-4030-STP120VC	Fire Protection Yearly Valve Cycle and Lineup Verification	1	07/19/90
22	12-0HP-4030-STP120VV	Fire Protection Valve Lineup Verification	0	11/17/88
23	12-0HP-4030-STP120SF	Fire Protection Unobstructed Flow Test and Sprinkling Alarm Test	1	07/19/90
24	12-0HP-4030-STP.124	Fire Protection System Flush and Loop Flow Test	0	10/05/89
25	12-0HP-4030-STP.223	Fire Protection Water System Test	8	07/27/89
26	12-0HP-4030-STP.125NS	Non-Tech Spec Required Sprinkler Tests	1	10/12/89

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
27	1-0HP-4030-STP.123	Transformer Water Spray Test	2	07/25/88
28	2-0HP-4030-STP.123	Transformer Water Spray Test	2	12/29/88
29	1-0HP-4030-STP.125CV	Unit 1 Yearly Charcoal Filter Valve Cycle	0	09/21/89
30	2-0HP-4030-STP.125CV	Unit 2 Yearly Charcoal Filter Valve Cycle	0	05/19/88
31	12-0HP-4030-STP.125CF	Inside Containment Charcoal Filter F.P. Valve Cycling	0	02/23/89
32	1-MPH-4030-STP.032	Inspection of Preaction Spray Headers Inside Unit 1 Containment	1	03/13/86
33	2-MPH-4030-STP.032	Inspection of Preaction Spray Headers Inside Unit 2 Containment	1	02/27/86
34	12THP-4030-STP.239	RCP Fire Det. and Water System Test	7	07/06/90
35	120HP-4030-STP.120PS	RCP F.P. Strainer Blowdown and Isolation Valve Cycling	2	01/09/89
		TECHNICAL DATA		
40	-	Letter From: R.J. Daley To: R.W. Jurgensen Instruction Book, "Grinneland Star Fire Systems Equipment"	-	07/15/74
41	SD-DCC-FP101	System Description, Fire Protection System - Water	2	12/26/89
42	-	Specification for Fire Protection Systems of D.C. Cook Nuclear Plant	0	04/02/71
43	DCCPM104ECS	Shop and Field Fabrication and Erection	4	05/24/73
45	ROC from D. Kipley to B. Gerwe	Ambient Temperature Conditions		08/06/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
46	0120-164-005	ABB Impell Calc. NFPA 72D, Code Compliance Verification Checklist	0	12/90
47	0120-164-006	ABB Impell Calc. NFPA 72E, Code Compliance Verification Checklist	0	12/90
48	-	Grinnel Hydraulic Calcs. for Unit 1 Main XFRM	0	01/06/72
49	-	Grinnel Hydraulic Calcs. for Unit 1 Start-Up XFRM	0	09/20/71
50	-	Grinnel Hydraulic Calcs. for Unit 1 Aux XFRM	0	09/20/71
51	-	Grinnel Hydraulic Calcs. for Unit 1 Spare Main XFRM	1	07/31/72
52	-	Hodgeman Hydraulic Calcs. for Unit 1 Spare Main XFRM	0	09/15/76
53	-	Hodgeman Hydraulic Calcs. for Unit 1 Exposure Prot	0	02/12/76
54	-	Hodgeman Hydraulic Calcs. for Start-Up XFRMs 201 AB & 201 CD	0	11/08/74
55	-	Hodgeman Hydraulic Calcs. for Unit 2 Main XFRMs 01, 02, 03	0	07/08/74
56	-	Hodgeman Hydraulic Calcs. for Unit 2 Exposure Protection	0	06/02/76
57	DCCFP01HS02-F	AEPSC Hydraulic Calc. for Unit 1 HVAC Equip Vestibule	0	02/24/88
58	DCCFP02HS25-F	AEPSC Hydraulic Calc. for Unit 2 HVAC Equip	0	02/24/88
59	-	Grinnel and Hodgeman Sprinkler Head Spec Sheets	-	-

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
60	-	Phoenix Hydraulic Calcs. & FC 12-2231 (RCP & Diesel Pump Room)	0	04/26/79
61	RFCDC-12-2231	Phoenix Contractors Hydraulic Calcs. (RCP & Diesel F.P Rooms)	0	03/27/87
62	-	AEPSC Evaluation Document	0	06/17/88
63	0120-164-007	ABB Impell Calc. Deviation Evaluation	0	12/90
		LICENSING DOCUMENTS		
70	DRP No. 74	Donald C. Cook, FHA Docket No. 50-316	4	01/31/87
		DRAWINGS		
80	Dwg. 46-032-71M-11	Plot Plan and Header Details, Unit 1 Trans.	4	09/30-71
81	Dwg. 121-25	Unit 1 Main XFRM Bottom Ring	0	09/15/76
82	Dwg. 121-26	Unit 1 Main XFRM Top Ring	0	09/15/76
83	Dwg. 46-032-71M-7	Unit 1 Start-Up XFRM 101 AB & 101 CD	3	09/23/71
84	Dwg. 46-032-71M-8	Unit 1 Aux XFRM 1 AB & 1 CD	2	09/24/71
85	Dwg. 46-032-71M-10	Unit 1 345 KV Main XFRM	2	01/12/72
86	Dwg. 121-18 121-17	Unit No. 1 Exposure Protection	0	02/12/76
87	Dwg. 46-032-71M-43	Unit 2 Aux XFRMs	0	12/15/72
88	Dwg. 121-15	Unit No. 2 Aux XFRMs	-	-
89	Dwg. 121-6	Unit No. 2 Start-Up Transformers 201 AB, 201 CD	1	11/08/74

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
90	Dwg. 121-2	Unit 2 Plot Plan and Header Details	5	06/13/74
91	Dwg. 46-032-71M-42	Unit 2 Plot Plan and Header Details	0	12/15/72
92	Dwg. 121-3	Unit 2 Main XFRMs 01, 02, 03	2	06/14/74
93	Dwg. 46-032-71M-44	Unit 2 Main XFRMs 01, 02, 03	0	12/14/72
94	Dwg. 121-19 & 121-20	Unit No. 2 Exposure Protection	1	05/12/76
95	RFC No. 12-2231	RCP Spray Piping Plans (Phoenix sheets 3, 4, 5, 14, 15 & 16)	0	09/17/79
96	Dwg. 12-5152-4	Flow Diagram Fire Prot - Water Yard Piping Unit 1 & 2	4	07/25/89
97	Dwg. 1-5152B-5	Flow Diagram Fire Prot - Water Turb. Bldg. and Screen House Unit 1	5	04/07/89
98	Dwg. 2-5152C-2	Flow Diagram Fire Prot - Water Turb. Bldg. and Screen House Unit 2	2	08/04/88
99	Dwg. 12-5152D-7	Flow Diagram Fire Prot - Water Aux & Containment Unit 1 and 2	0	12/04/89
100	Dwg. 12-5152E-3	Flow Diagram Fire Prot - Water Charcoal Filters Units 1 and 2	3	01/08/90
101	Dwg. 1-5152J-1	Flow Diagram Fire Prot - Water Details - Turbine Bldg. and Screen House Unit 1	1	06/21/88
102	Dwg. 1-5152K-1	Flow Diagram Fire Prot - Water Details - Turbine Bldg. and Screen House Unit 2	2	06/21/88

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
103	Dwg. 12-5152L-7	Flow Diagram Fire Prot - Water Sys. Details Turb. Bldg. and Service Bldg. Unit 1 & 2	7	01/08/90
104	Dwg. 12-5152M-4	Flow Diagram Fire Prot - Water Details - RCP's Units 1 & 2	4	09/29/89
105	Dwg. 12-5152N-3	Flow Diagram Fire Prot - Water Sys. Details - Yard Piping & Aux Bldg. Units 1 & 2	3	09/18/89

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)

The water spray systems evaluated for the D.C. Cook Nuclear Plant were evaluated using the requirements of the 1973 edition of NFPA 15 which was the code of record during system installation. The following systems were evaluated.

System	Zone
Unit 1 & 2 Containment Charcoal Filter Units and Reactor Coolant Pumps Suppression Systems.	66, 67, 68, 74, 75, 76, 101, 102, 103, 104
Unit 1 & 2 Transformers and Turbine Bldg. Wall Exposure Water Spray Systems	Yard

CHAPTER 1. GENERAL PROVISIONS

1061	The contractor shall prepare and submit a description and diagram of the system and its purpose, maintenance and instruction bulletins, and the applicable parts of the Sprinkler Contractors Certificate covering material and tests (see "Standard for the Installation of Sprinkler Systems", NFPA 13, 1973) certifying that the work has been completed and tested in accordance with plans and specifications; before requesting final approval of the water spray system.	D	Open Item: No documentation was found providing verification to this code section.
2012	Only listed new materials and devices shall be employed in the installation of systems except that, where age and condition permit, listed devices such as special system water control valves and their accessories, circuit closers, water motor alarm devices, nonautomatic pattern spray nozzles, etc., may be reused, but if reused they shall be reconditioned by the original manufacturer. The original manufacturer shall furnish a certificate, stating that such specified devices have been reconditioned and tested and are considered satisfactory for reuse.	D	Open Item: Although visual inspection found components to be approved, no documentation was available indicating new procurement. Ref: 41-43 Does Not Comply: The system isolation valves and automatic valves for the spray systems are not approved for their application. Ref: 62

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2031	CHAPTER 2. SYSTEM COMPONENTS Care shall be taken in the application of nozzle types. Distance of "throw" or location of nozzle from surface shall be limited by the nozzle's discharge characteristics (see 4010). Care shall also be taken in the selection of nozzles to obtain waterways which are not easily obstructed by debris, sediment, sand, etc., in the water. Requirements for strainers and their replacement are described in 2110 and 4110.	W, D	Does Not Comply: a) Unit 1 exposure prot.: field survey reflects 4 unprotected openings: (1) at top of elevator shaft & (3) at service building wall. b) Unit 2 main: Trans. No. 2 TR-Main-3: nozzle obstructions c) Unit 2 RCA: nozzle obstruction (HVAC ductwork) Ref: 1-7, 41, 84, 88, 90, 92 94, 95 101
2082	Control of automatic valves shall be by means of approved accessories for special systems,	D	Does Not Comply: Charcoal filter units do not have approved type solenoid valves all others comply. Ref: 41
2111	Pipeline strainer shall be specifically approved for use in water supply connections. Strainers shall be capable of removing from the water all solids of sufficient size to obstruct the spray nozzles (normally 1/8 in. perforations are suitable). In addition, the strainer shall be capable of continued operation without serious increase in head loss, for a period estimated to be ample when considering the type of protection provided, the condition of the water, and similar local circumstances (see 4113).	W, D	Does Not Comply: With exception of charcoal filter units. Provisions for strainers between the water supply and controlling valve have not been provided for all other spray systems. Ref: 1-13, 41, 101

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 4. SYSTEM DESIGN AND INSTALLATION		
4011	Before a water spray system is installed or existing equipment remodeled, complete working plans, specifications and hydraulic calculations shall be prepared and made available to interested parties. For details concerning plans, specifications and hydraulic calculations, see Chapter 7.	D	Comply: Systems were designed by experienced firms (i.e., Grinnell, Hodgeman, Phoenix) submitted for owners review. Ref: 83, 84, 86, 88, 104
4032	Control of Burning		
	(b) Nozzles shall be installed to impinge on the areas of the source of fire, and where spills may travel or accumulate. The water application rate on the probable surface of the spill shall be at the rate of not less than 0.50 gpm per sq. ft.	W, D	Comply: All systems were designed considering duration of water supply capabilities with specific location and arrangement of hazard being protected. Ref: 1-13, 27, 101, 41
4052	Area Drainage		
	(a) Adequate provisions shall be made to promptly and effectively dispose of all liquids from the fire area during operation of all systems in the fire area. Such provisions shall be adequate for:		
	(1) Water discharged from fixed fire protection systems at maximum flow conditions.	D	Comply: Considerations for drainage and or storage of run-off was found. Ref: 27, 41, 101
	(2) Water likely to be discharged by hose streams.		
	(3) Surface water.		
	(4) Cooling water normally discharged to the system.		

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4063	Drain Valves. Readily accessible drains shall be provided for low points in underground and aboveground piping.	W, D	Comply: Adequate provisions for piping drainage was found via low point plugged drains and or as applicable open nozzles. Ref: 80-105, 1-13, 41
4072	Position. Spray nozzles may be placed in any position necessary to obtain proper coverage of the protected area. Positioning of nozzles with respect to surface to be protected, or to fires to be controlled or extinguished, shall be guided by the particular nozzles design and the character of water spray produced. The effect of wind and fire draft on very small drop sizes or on larger drop sizes with little initial nozzle velocity shall be considered, since these factors will limit the distance between nozzle and surface, and will limit the effectiveness of exposure protection, fire control or extinguishment. Care shall be taken in positioning nozzles that water spray does not miss the target surface and reduce the efficiency or calculated discharge rate (gpm/ft^3). Care shall also be exercised in placement of spray nozzles protecting pipe lines handling flammable liquids under pressure, where such protection is intended to extinguish or control fires resulting from leaks or ruptures.	W, D	Does Not Comply: Reference the results of code section 2031.
4081	Size. As effective protection is dependent on having adequate pressure and quantity of water available at all spray nozzles, each system requires individual consideration as to the size of the piping. This requires that the size of the piping be based upon hydraulic computations (see Chapter 7). However, piping shall not be less than one-inch nominal diameter.	D	Comply: With the exception of the Charcoal Filter Units, all systems were properly designed and meet this code section. Ref: 41, 81-84, 88 Does Not Comply: The Charcoal Filter Units utilize 3/8" pipe. Ref: 41, 81-84, 88
4082	INSTALLATION (d) Provision shall be made for test gages at or near the highest or most remote nozzle on	D	Does Not Comply: Test gauge connections or provisions not provided for Unit 2

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	each major separate section of the system. At least one gage, connection shall be provided at or near the nozzle calculated as having the least pressure under normal flow conditions.		RCP pumps, charcoal filter units, Unit 2 main transformers (01, 02, 03), Unit 2 start up transformers, and Unit 2 exposure protection. Ref: 80, 89-95
4101	System piping shall be adequately supported. All supports in the fire area should be protected by the system. In any area where possibility of explosion may be recognized, special care shall be taken to support the piping from portions of the structure least liable to disruption.	W, D	Comply: Physical inspection reflected hangers which were properly installed and which imposed no adverse impairments to the existing steel members. Ref: 1-13, 80-95
4102	Tapping or drilling of load-bearing structural members is not permitted unless the design of the structural members contemplates this feature or their design is such that the additional load can be safely tolerated, and no other arrangement is feasible. Attachments may be made to existing steel or concrete structures and in some cases to equipment and its supports. Where welding of supports directly to vessels or equipment is necessary, it shall be done in a safe manner in conformation with the provisions of all safety, structural, and fire codes and standards.	W, D	Comply: See response to code section 4101.
4103	Where the usual methods of supporting piping for the fire protection purposes cannot be used, the piping shall be supported in such a manner as to produce the strength equivalent to that afforded by such usual means of support. In such cases, piping arrangements which are essentially self-supporting may be employed together with such hangers as are necessary.	W, D	Comply: See response to code section 4101.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4121	Gages shall be installed as follows: (a) Below the seat of the automatic valve and arranged so as to indicate the residual pressure in the riser with the test pipe valve wide open. (b) At each independent pipe from an air supply to an automatic valve. (c) On the water supply connection to hydraulically controlled automatic valves. (d) At the air pump supplying an air receiver. (e) At an air receiver.	W, D	Does Not Comply: Gauges are not provided for the charcoal filter units and the gauges provided for the unit 2 systems are unapproved/listed reading 165 psi on a scale of 300 psi. Ref: 1-13, 99-105
5011	Hydrostatic Tests. All new system piping shall be hydrostatically tested in accordance with the provisions of the Standard for Installation of Sprinkler Systems, NFPA No. 13, 1973.	D	Open Item: Piping and installation spec requires hydrostatic testing at 1-1/2 times design pressure. However, no test certificates are provided for review. Water spray tests are performed every eighteen months. Ref: 20, 27, 28, 34, 41; 42
5021	When practicable, full flow tests with water shall be made of system piping as a means of checking the nozzle layout, discharge pattern, any obstructions and determination of relation between design criteria and actual performance, and to insure against clogging of the smaller piping and the discharge devices by foreign matter carried by the water	D	Open Item: See response to code section 5011.
5023	The discharge pressure at the highest, most remote nozzle, shall be at least that for which the system was designed.	D	Open Item: See response to code section 5011.
5031	All operating parts of the system shall be fully tested to assure they are in operating condition.	D	Open Item: See response to code section 5011.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 6. PERIODIC TESTING AND MAINTENANCE		
6001	Water spray systems require competent and effective care and maintenance to assure that they will perform their purpose effectively at the time of fire. Systems shall be serviced and tested periodically by men trained in this work. An inspection contract with a qualified agency for service, test, and operation at regular intervals is recommended and may be required.	D	Comply: All systems are tested and maintained as required per this code section, instruction booklets provided for Grinnel and Star equipment. (Unit 2 systems use star equip.). Ref: 21-35, 40, 41
6002	Operating and maintenance instructions and layouts shall be available or can be posted at control equipment and at the plant fire headquarters. Selected plant personnel shall be trained and assigned to the task of operating and maintaining the equipment.	D	Comply: See results of code section 6001.
6003	At weekly, or other frequent regularly scheduled plant inspections, equipment shall be checked visually for obvious defects, such as broken or missing parts, nozzle loading, or other evidence of impaired protection.	D	Comply: See results of code section 6001.
6013	Piping. All piping shall be examined at regular intervals to determine condition and proper drainage. Frequency of inspections will be dependent upon local conditions and shall be at intervals of not more than one year.	D	Comply: All systems are inspected and tested via plant procedures. Water spray or air flow tests are performed, valve cycle and lineup verification is performed. Ref: 21-35, 41
6014	Flow tests of open head spray systems shall be made at least every five years or more frequently, as determined from experience.	D	Comply: See results of code section 6013.
6015	Control Valves & Devices. Control valves and automatic detection equipment shall be tested at least annually, by qualified personnel.	D	Comply: See results of code section 6013.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
6016	Manual tripping devices and valves, including O. S. & Y. gate and post indicator valves, shall be operated at least annually.	D	Comply: See results of code section 6013.
6017	Where normally opened valves are closed following system operation or test, suitable procedures shall be instituted to insure that they are reopened and that the system is promptly and properly restored to full normal operating condition. Main drain flow tests shall be made after valves are reopened (see Recommended Practice for the Care and Maintenance of Sprinkler Systems, NFPA No. 13A, 1971 - Flow Tests).	D	Comply: See results of code section 6013.
6018	Spray Nozzles. All spray nozzles shall be inspected for proper positioning, external loading, and corrosion, and cleaned if necessary at intervals of not more than twelve months or more frequently if necessary, based on experience. Local conditions may require such inspections and cleaning more frequently and may require internal inspection. After each operation open spray nozzles equipped with individual screens shall be removed and the spray nozzle and screen cleaned, unless observation under flow conditions indicates this is not necessary. CHAPTER 7, PLANS, SPECIFICATIONS & HYDRAULIC CALCULATIONS	D	Comply: See results of code section 6013.
7000	Plans and Specifications Working plans, including elevations, shall be drawn to an indicated scale, show all essential details, and the following data: Date Name of owner and occupant Location, including street address Point of compass Structural features	D	Does Not Comply: No design drawings exist to show the configuration of the nozzles within the charcoal filter units. However, a sketch was made during the 4/4/88 walkdown to justify the original noncompliance. Ref: 80-105

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	Relative elevations of nozzles, junction points and supply or reference points Full information concerning water supplies, including pumps, underground mains, etc., and flow test results. Make, type, size, location, position, and direction of spray nozzles. Make, type model, and size of special system valve. Types of alarms to be provided. Number of each size and type of spray nozzles on each system. Lengths of pipe and whether center to center or cutting lengths are shown. Size of all pipe and fittings. Heat responsive equipment, including type, arrangement and location. Hydraulic reference points. Design purpose of system. Make and type of hangers and inserts. All control and check valves, strainers, drain pipes, and test pipes. Small hand hose and hose equipment. The weight or class, lining and size of underground pipe and the depth that the top of the pipe is to be laid below grade. Provisions for flushing underground pipe.		
7010	Hydraulic Calculations General. Hydraulic calculations shall be prepared on forms that include a summary sheet, detailed work sheets, and a graph sheet.	D	Open Item: Although hydraulic calculations were performed for all systems, a graph sheet showing the available supply is not provided. Ref: 48-61

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 8. AUTOMATIC DETECTION EQUIPMENT		
8051	The heat detection system shall be designed to cause actuation of the special system water control valve within 20 seconds under expected fire conditions. Under test conditions when exposed to a standard heat source, the system shall operate within 40 seconds. These are to be considered maximum response times subject to the considerations described in 8011 and 8031.	D	Open Item: Procedures indicate that activation of the control valve be within a reasonable amount of time. Further evaluation is needed to determine what that time is.

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APPENDIX A5

CODE COMPLIANCE VERIFICATION CHECKLIST

NFPA 72D - 1967 EDITION

CALCULATION / PROBLEM COVER SHEET

Calculation / Problem No: 0120-164-005

Title: NFPA 72D - CODE COMPLIANCE CALC

Client: AEPSC Job No: 0120-164

Project: D.C. COOK EXTENDED CODE REVIEW

Design Input / References:

SEE SECTION 5.0

Assumptions:

SEE SECTION 2.0

Method:

SEE SECTION 3.0

Remarks:

SEE SECTIONS 1.0 & 4.0

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	[signature]	12-14-90

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

For the purpose of this report, it is assumed that under most conditions the authority having jurisdiction was the architect/engineer (A/E) for the plant who is American Electric Power Service Corporation (AEPSC) unless otherwise indicated.

3.0 METHODOLOGY

Reference Section 2.1.1 of ABB Impell Project Instruction PI-0120-164-01 Revision 0.

Justifications for deviations and open items identified in CCVC's, are detailed in Impell Technical Report No. 09-0120-0381. The basis for the review of the fire protection systems against a specific code edition was determined by reviewing the systems against the code edition in effect during the time of the original system installation.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

References

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		WALKDOWN VERIFICATION CHECKLISTS		
1	0120-164-005A	Fire Zone 79 - Unit 1	0	12/90
2	0120-164-005B	Fire Zone 80 - Unit 1	0	12/90
3	0120-164-005C	Fire Zone 84 - Unit 2	0	12/90
4	0120-164-005D	Fire Zone 85 - Unit 2	0	12/90
5	0120-164-005E	Fire Zone 90 - Unit 1	0	12/90
6	0120-164-005F	Fire Zone 97 - Unit 2	0	12/90
7	0120-164-005G	Yard - Unit 1	0	12/90
8	0120-164-005H	Yard - Unit 2	0	12/90
9	0120-164-005I	Fire Zone 28 - Unit 1	0	12/90
10	0120-164-005J	Fire Zone 30 - Unit 2	0	12/90
		TECHNICAL DATA		
11	0120-108-007.1	NFPA 72D Document Verification Checklist	0	5/11/88
12	09-0120-0123	ABB Impell Code Compliance Compliance Report	0	5/88
13	-	AEP NFPA Code Justification Evaluations	-	6/17/88
14	-	Alison Controls Inc. Manual for A888-M664/A	-	9/15/86
15	-	Record of Conversation Between D. Kipley and B. Gerwe	-	7/27/90
16	PM 683	Plant Modification Project for the Installation of ACI A888-M664/A Panels	1	01/07/87

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
16A	--	ABB Impell Memo No.M-007 on Alarm Circuit Supervision	-	7/6/90
		PROCEDURES		
17	1-0HP-4030-STP-123	Transformer Water Spray Test	2	07/25/88
18	2-0HP-4030-STP-123	Transformer Water Spray Test	2	12/29/88
19	PMI-2270	Fire Protection Program	16	02/09/87
20	12-0HP-4030-STP-125NS	Non-Tech Spec. Required Sprinkler Tests	1	10/12/89
21	12-THP-6030-IMP-142	Fire Det. & CO_2 System Surv. Testing (6 Mo.)	10	07/16/87
22	12-THP-4030-STP-239	RCP Fire Det. & Water System Test	7	07/06/90
23	12-0HP-4030-STP-125CF	Inside Containment Charcoal Filter Fire Prot. Valve Cycle	0	02/23/89
24	12-THP-4030-STP.223	Fire Protection Water System Test	8	07/27/89
25	1-MPH-4030-STP-032	Inspection of the Fire Prot. System Preaction Spray Headers in Unit 1 Containment Bldg.	1	03/13/86
26	2-MPH-4030-STP-032	Inspection of the Fire Prot. System Preaction Spray Headers in Unit 2 Containment Bldg.	1	02/22/86
27	12-0HP-4030-STP-120VC	Fire Prot. Yearly Valve Cycle and Lineup Verification	1	07/19/90
28	1-IHP-6030-IMP-190	Thermistor String Fire Det. System Operability and Calibration	3	04/05/90
29	2-IHP-6030-IMP-290	Thermistor String Fire Det. System Operability and Calibration	2	07/19/90
30	1-THP-6030-IMP-151	Containment Cable Tray Fire Det. System	4	07/19/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
31	2-THP-6030-IMP-251	Containment Cable Tray Fire Det. System	5	01/25/90
32	12-0HP-4030-STP-120VV	Fire Prot. Valve Lineup Verification	0	11/17/88
33	1-0HP-4024-101-001-100	Annun #1: Plant Fire System	2	03/10/86
34	2-0HP-4024-201-001-100	Annun #1: Plant Fire System	2	12/30/86
35	1-0HP-4024-102-001-050	Annun #2: Misc. Area Fire System	3	01/22/87
36	2-0HP-4024-202-001-050	Annun #2: Misc. Area Fire System	1	11/06/86
		LICENSING DOCUMENTS		
37	Docket No. 50-315 50-316	Safety Evaluation Document of IMPC D.C. Cook Plant, Units 1 & 2	-	04/26/90
37A	50-315 50-316	Safety Evaluation Report for BTP.APCSB 9.5-1, Appendix A	-	07/31/79
		DRAWINGS		
38	1-95907	Fire Prot. Transformer & Sprinkler Fire Systems Turb. & Aux. Bldgs.	16	04/01/87
39	2-95907	Fire Prot. Transformer & Sprinkler Fire Systems Turb. & Aux. Bldgs.	13	10/86
40	12-5152E	Flow Diagram Fire Prot. Water	3	01/03/90
41	12-5152J	Flow Diagram Fire Prot. Water	1	06/21/88
42	12-5152K	Flow Diagram Fire Prot. Water	2	06/21/88
43	12-5152L	Flow Diagram Fire Prot. Water	7	01/09/90
44	12-5152M	Flow Diagram Fire Prot. Water	4	09/29/89

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
45	12-5152N	Flow Diagram Fire Prot. Water	3	09/13/89
46	1-98972	Fire Prot. Water Systems Elementary Diagram	9	11/05/86
47	2-98972	Fire Prot. Water Systems Elementary Diagram	9	10/24/86
48	12-5152A	Flow Diagram Fire Prot. Water	3	03/23/88
49	12-5152B	Flow Diagram Fire Prot. Water	5	04/07/89
50	12-5152C	Flow Diagram Fire Prot. Water	2	08/04/88
51	12-5152D	Flow Diagram Fire Prot. Water	7	12/04/89
52	1-98612	Plant Fire System Annun. Elementary Diagram	12	07/01/86
53	2-98612	Plant Fire System Annun. Elementary Diagram	16	08/14/87
54	1-98613	Misc. Fire Area System & Vent Elementary Diagram	19	10/30/87
55	2-98613	Misc. Fire Area System & Vent Elementary Diagram	17	10/30/87
56	1-98969	FP Systems Annun. Elementary Diagram	7	06/08/87
57	1-12060	DC Aux. One-Line 250V DC Bus	2	02/26/87
58	2-12060	DC Aux. One-Line 250V DC Bus	0	10/06/86

NFPA 72D - 1967 EDITION

PROPRIETARY PROTECTIVE SIGNALING SYSTEMS

Review includes the following systems:	INITIAL SYSTEM INSTALLATION DATE
Alison Controls Detection Panels which include:	
*a. Charcoal Filter Units:	2/72
° 1&2-HV-CFT-1 (Detection Only)	
° 1&2-HV-CFT-2 (Detection Only)	
*b. Reactor Coolant Pumps	
° Units 1&2 Rcp Pump # 1-4 (Detection only)	4/79
*c. Containment Alarm System Unit 1&2 (Detection Only)	6/71
d. Transformers	
° Unit 1 Main	9/86
° Unit 2 Main, Phases 1-3	2/72
° Transformer 1AB & 2AB	2/72
° Transformer 1CD & 2CD	2/72
° Transformer 101AB	2/72
° Transformer 101CD & 201CD	2/72
° Transformer 201AB	9/86
e. Unit 1 & 2 Turbine Building Wall Spray Systems	7/72
The "EF" Annunciator Panel Signaling Line Circuits only for the Associated Detection and Sprinkler Waterflow/Supervisory Systems were Reviewed in Items a through e above	2/72
The Waterflow, Manual Alarm and Supervisory Devices for Suppression Systems installed in Fire Zones 79, 80, 84, 85, 90, 91, 96, 97, Yard Transformers and Turbine Bldg. Walls*	2/72

*NOTE: The control panels for these detection, waterflow, manual alarm and supervisory circuits and devices for suppression systems were reviewed for compliance with NFPA 72D standard in ABB Impell Report No. 09-0120-0123.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2032.	Equipment. All devices, combinations of devices, and equipment constructed and installed in conformity with this standard shall be approved for the purposes for which they are intended.	W, D	Comply: All sprinkler Alarm and supervisory devices and ACI A909 Panels are considered approved based on the evaluation performed in Report No. 09-0120-0123 Ref: #11, 12, 15 Does Not Comply: All push button manual stations and ACI A888-M664/A Panels are not approved. Ref: # 11, 12, 15
2033.	Acceptance Tests. Upon completion of a system, a satisfactory test of the entire installation shall be made in the presence of a representative of the authority having jurisdiction.	D	Open Item: Data was not available for review of ACI A909 panels and sprinkler alarm devices. Ref: # 1 Comply: The review of plant modification (PM) package No. 683 indicated that acceptance testing was performed with project managers present (I&MPC). Ref: 16
2034.	Maintenance Agreement. Where required by the authority having jurisdiction, a satisfactory agreement on the maintenance, operation, and efficiency of the system shall be provided. All systems shall be under the supervision of qualified persons satisfactory to the authority having jurisdiction. These persons shall cause proper tests and inspections to be made to prescribed intervals and shall have general charge of all alterations and additions to the systems under their supervision. For sprinkler waterflow alarm tests, an actual water flow, through the use of a test connection, shall be the method employed for testing the reliability of the sprinkler alarm unit as a whole. For a wet pipe system, the test connection at the extremity of the system shall be used.	D	Comply: With the exception of charcoal filter units, all systems are maintained and tested by qualified personnel. Ref: # 11, 17-26 Does Not Comply: Charcoal filter unit spray systems are not verified by flowing water during testing. Ref: # 11, 17-26

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2046.	Voltage Variation. A system shall be so designed and installed that it shall be capable of performing its intended function at 85 percent and at 110 percent of the rated voltage.	D	Comply: Panels are connected to the 250 VDC plant emergency power system which is a regulated system such that voltage fluctuations are unlikely. Ref: # 12, 14, 38, 39
2047.	Rewinding of Resetting. All apparatus requiring rewinding or resetting to maintain normal operation shall be restored to normal as promptly as possible after each test or alarm, and kept in normal condition for operation	D	Comply: With the exception of the wet systems, transformer systems, and exposure protection systems isolation valve tamper switches, the alarm system is promptly reset to normal after each alarm or test. Ref: # 11,17,18,20,22-24,27 Does Not Comply: Valve tamper switches for all wet, transformer, and exposure protection systems are not verified for operability during testing. Ref: 11, 17, 18, 20, 22, 23, 24, 27
2122.	Wiring cables, and terminal and junction facilities, unless adequately protected, shall be located where they are not exposed to hazardous or corrosive atmospheres, stored combustible materials, or to other potential hazards which might cause disruption of service.	W	Not Applicable: The areas reviewed are not corrosive or hazardous to the equipment installed. Ref: # 1-10
2154.	Limited Energy Applications. Approved cable meeting the requirements of Paragraphs 2155 and 2156 may be used in circuits having energy limiting characteristics as follows: a. Circuit voltages not to exceed those shown in Column 1 of Table 1. b. Maximum fault currents designed into the circuit not to exceed those shown in Column 2 of Table 1.	D	Comply: Based on the former AEP evaluation for NFPA 72D Section 2154, in Report No. 09-0120-0123, this code section is considered acceptable. Ref: 13

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	c. Noninterchangeable overcurrent protection not to exceed that shown in Column 3 of Table 1.		
	d. Energy limitations not to exceed those shown in Column 4 of Table 1.		
2212.	Equipment. The equipment shall be approved for the particular application.	W, D	Comply: See response to Code Section 2032. Does Not Comply: See response to Code Section 2032.
2220.	Light and Power Services.		
2221.	General. A reliable electrical light or power service may be used as a source of supply for fire-protective signaling systems under the following conditions: a. Two-Wire Supplies. A two-wire supply circuit may be used for either the main operating power supply or the trouble signal power supply of the signaling system. b. Three-Wire Supplies. A three-wire a-c and d-c supply circuit having a continuous unfused neutral conductor, or a polyphase a-c supply circuit having a continuous unfused neutral conductor where interruption or one phase does not prevent operation by the other phase may be used with one side or phase for the trouble signal power supply of the signaling system.	D	Comply: All ACI A909 and A888-H664/A panels are supplied VIA a two wire conduit for the main supply only. Based on the justification made in Ref. 12 for 72D Section 2221, this condition is considered equivalent. Ref: # 12, 14

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2223.	An overcurrent protective device of suitable current-carrying capacity and capable of interrupting the maximum short-circuit current to which it may be subjected shall be provided in each ungrounded conductor. The overcurrent protective device shall be enclosed in a locked or sealed cabinet located immediately adjacent to the point of connection to the light and power conductors.	W, D	Comply: A review of wiring diagrams indicates that all breakers are properly labeled. All transformer detection panels are connected to one dedicated circuit for Unit 1&2 accordingly. Ref. # 46,47,57,68
2251.	A rectifier power supply, employed as a direct source of supply for a signalling system, shall be approved for the purpose and of adequate capacity to maintain voltage regulation between 130 percent of rated voltage at no load and 100 percent of rated voltage at maximum rated load.	D	Open Item: Documentation was not available to verify compliance for this code section.
2331.	A system control unit shall be protected on the supply side by overcurrent devices having a rating not greater than 150 percent of the rating of the control unit.	W, D	Comply: Based on the review of the engineering evaluation performed on 6/17/88 for Sections 2251 and 2331 deficiencies, the intent of this code section is being met. Ref: # 46,47,13 Open Item: ACI data on the A888-H664/A power supply was not available to verify compliance for this code section.
2341.	A transformer shall be protected on either the primary or secondary side by overcurrent devices having a rating not greater than the continuous duty rating of the transformer unless the current is limited to the same value by other approved means.	D	Open Item: Documentation was not available to verify compliance for this code section.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2411.	Except as otherwise permitted in this standard, a system shall be electrically supervised so that the occurrence of a break or a ground fault condition of its installation-wiring circuits which prevents the required operation of the system, or failure of the main power supply source, will be indicated by a distinctive trouble signal.	D	Comply: All ACI A888-H664/A panels properly supervise all required functions. Ref: # 11,14,46,47 Does not comply: All Sprinkler alarm/supervisory devices are not supervised by the "EF" panel. All ACI A909 panels properly supervise all functions except manual station and release circuits. Ref: # 11,14,46,47
2422.	Signal Initiating Circuits. All circuits for signals initiated by the operation of fire alarm boxes, fire detectors, automatically operated transmitters, or other appliances or devices which initiate or transmit signals either manually or automatically, except: a) A noninterfering shunt circuit, provided that a fault condition of the shunt circuit wiring results only in the loss of the noninterfering feature of operation. b) The circuits of a supplementary signal annunciator, provided that the fault condition of this circuit wiring results only in the loss of annunciation. c) The circuits within initiating devices where wiring terminals of such devices are connected in multiple across electrically supervised circuits.	D	Does Not Comply: See response to Code Section 2411.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
2431.	Distinctive Trouble Signals. Trouble signals shall be distinctive from both alarm and supervisory signals and shall be indicated by the continuous operation of a sounding appliance or where there is supervisory attendance at all times, a suitable coded signal. An audible trouble signal may be common to several supervised circuits.	D	Not Applicable: Since all ACI panels are in remote locations from the hazards, audible devices are not provided. All signals are sent to the control room. Ref: # 11,14,46,47
2432.	Silencing Switch. A switch for silencing the trouble signal sounding appliance shall be permitted only if it transfers the trouble indication to a lamp or other acceptable visible indicator adjacent to the switch. The visual indication shall remain operated until the silencing switch is restored to its normal position unless the audible trouble signal will be obtained when a fault occurs without restoring the switch to normal, or unless the audible trouble signal is again energized upon correction of the fault.	D	Not Applicable: See response to Code Section 2431.
2631.	When both sprinkler supervisory signals and fire or waterflow alarm signals are transmitted over the same signaling line circuit, provision shall be made to either obtain alarm signal precedence or sufficient repetition of the alarm signal to prevent the loss of any alarm signal transmittal devices. The trouble signal of a combined alarm and supervisory signal circuit shall not be used for the supervisory signal feature, except as indicated in Paragraph 3422.	W, D	Comply: ACI A909 and A888-H664/A panels transmit alarm/trouble signals over separate circuits and all sprinkler alarm and supervisory signals are transmitted separately to the "EF" panel. Ref: # 22, 46, 47 Does Not Comply: RCP Pump and Charcoal filter unit alarm and trouble signals are transmitted as a non-distinctive signal to the "EF" panel. Ref: # 22, 46, 47

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	ARTICLE 310. MANUAL FIRE ALARM SERVICE.		
3111.	General. Manual fire alarm boxes shall be approved for the particular application and shall be used only for fire protective signaling purposes. Combined fire alarm and watchmen's signalling boxes are acceptable.	D	Does Not Comply: Based on the review of Ref. 12, Section 3111.4)a., the XFRM Push Buttons cannot be considered equivalent to approved devices since they are typical of the Hose System Manual Stations Ref: # 11, 5, 6
3112.	Mounting. Each box shall be securely mounted. It is recommended that the bottom of the box be not less than 4-1/2 feet and not more than 6 feet above the floor level.	W	Does Not Comply: The push button manual stations were mounted 4' or 4'-3" above the finished floor which is lower than the 4' - 6" AFF requirement. Ref: 1-10
	ARTICLE 340. SPRINKLER ALARM & SUPERVISORY SERVICE.		
3423.	Signal Identification. The signals received shall indicate the particular element of the sprinkler property which is abnormal and when it has been restored.	D	Comply: See response to code section 2631 Does Not Comply: Distinctive signals are not provided for the waterflow and supervisory devices for the RCP pump spray systems.
3424.	Tampering. A signal attachment and its circuits shall be so designed and installed that they cannot be readily tampered with or removed without causing a signal to be produced.	W, D	Comply: See response to Code Section 2411 Does Not Comply: See response to Code Section 2411

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3431.	General. Provision shall be made to indicate the flow of water in a sprinkler system, except movement of water due to waste, surges, or variable pressure, by an alarm signal. The waterflow signaling attachment shall operate to indicate any loss of low of water occurring at a rate of ten or more gallons per minute.	W, D	Comply: Waterflow switches are provided for all wet type systems reviewed. Ref: 1-10, 40-45 Does Not Comply: Waterflow devices are not provided for hose station risers, Transformer, exposure protection and charcoal filter spray systems. Ref: 1-10, 40-45
3441.	General. Provisions shall be made for supervising the required conditions, which are essential for the proper operation of sprinkler systems, except those related to water mains, tanks, cisterns, reservoirs, and other containers of water controlled by a municipality or a public utility.	D	Does Not Comply: See the response to code Sections 3442 and 3443.
3442.	Gate Valve Position Supervision. A gate valve shall be supervised to obtain two separate and distinctive signals, one indicating movement of the valve to its normal position and the other indicating restoration of the valve to its normal position. The off-normal signal shall be obtained either during the first two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal position. a) Where the signaling attachments of two or more valves utilize a common circuit, a restoration signal shall be obtained only when all of the valves of the group are in their normal positions. b) An attachment for supervising the position of a gate valve shall not interfere with the operation of the valve nor obstruct the view of its indicator nor prevent access to its stuffing box.	W, D	Comply: The tamper switch devices do not obstruct the operation or servicing of valves and are wired such that all tampers are required to be restored to "normal" prior to restoration of the circuit. Ref: 1-11, 52-56 Does Not Comply: The "EF" panels do not provide restoration signals. Ref: 1-11, 52-56 Open Item: Transmission of tamper off-normal signal could not be verified. Ref: 1-11, 52-56

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
3443.	Pressure Supervision. Pressure sources shall be supervised to obtain two separate and distinctive signals, one indicating that the required pressure has been decreased or increased and the other indicating restoration of the pressure to its normal value. a) A pressure supervisory signal attachment for a pressure tank shall indicate both high and low pressure conditions. A signal shall be obtained when the pressure is increased or decreased ten pounds from the required pressure valve. b) A pressure supervisory signal attachment for a dry pipe sprinkler system shall indicate both high and low pressure conditions. A signal shall be obtained when the required pressure is increased or decreased in accordance with the requirements of the authority having jurisdiction. c) A steam pressure supervisory attachment shall indicate a low pressure condition. A signal shall be obtained when the normal pressure is reduced to a value which is not less than 110 percent of the minimum operating pressure of the steam-operated equipment supplied. d) An attachment for supervising the pressure of other sources than those specified above shall be capable of being applied and operated as required by the authority having jurisdiction.	W, D	Not Applicable: There are no pressure tanks, dry pipe systems, or steam pumps in the areas reviewed. Comply: RCP pump sprinkler piping is supervised. Ref: 22, 33, 34, 48-51 Does Not Comply: RCP pump piping supervision to A700 panel not to "EF" panel, it is non-distinctive. Ref: 22, 33, 34, 48-51

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	ARTICLE 350. AUTOMATIC SHOCK ALARM SERVICE.		
3541.	All equipment requiring servicing shall be readily accessible and shall provide practical means of cleaning parts which accumulate dust, replacement of illuminating lamps, etc.	W	Comply: All pressure, valve tamper, actuators and alarm panels are accessible for maintenance. Ref: 1-10
3542.	Suitable and practical facilities shall be provided to permit periodic testing for sensitivity.	W, D	Does Not Comply: Line type heat detectors are verified for their loop resistance value under the referenced procedures with a Fluke Model #8050 digital multimeter. This is true for all detectors except the RCP pump detection circuit since these circuits are not verified for their loop resistance value. Ref: 21-23, 28-31
3543.	The equipment shall be inspected monthly and maintained in proper operating condition.	D	Does Not Comply: ACI A700-9 and 6007 panels are inspected every 18 months. ACI A909 and A888-H664/A panels inspected at 6 months and 12 months respectively. Ref: 19 Comply: Sprinkler system piping and valve verification is inspected monthly. Waterflow testing is done at 6 month and 18 month intervals. Hose racks are inspected monthly and hoses hydro tested every 12 months. Ref: 19

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PROPRIETARY PROTECTIVE SIGNALING S...

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	CHAPTER 4. PROPRIETARY SYSTEMS.		
4011.	The provisions of this article shall apply to a system supervised by competent and experience personnel in a central supervising station at the property protected. The system is to include equipment and other facilities required to permit the operators to test and operate the system and, upon receipt of signal, to take such action a shall be required under the rules established for their guidance by the authority having jurisdiction. The system shall be maintained and tested by owner personnel or an organization satisfactory to the authority having jurisdiction. These systems are designated "Class A" and "Class B", except as indicated in Paragraphs 4012, below. Class A system provides emergency operation for fire alarm, waterflow alarm, and guard's tour signals during a single break or a single ground fault of the signaling line circuit. A Class B system does not include this emergency operating feature.	D	Comply: The ACI A909 detection and A888-M664/A circuits are Class B circuits. Ref: 11, 14, 46, 47 Does Not Comply: The "EF" panel and ACI A909 manual station and release circuits are intended to be Class B. However, the circuits for the "EF" panel do not supervise for an open circuit and the ACI manual station release circuits are not supervised for open or ground fault conditions. Ref: 11, 14, 46, 47

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4031.	General. The central supervisory station shall have reliable means for transmitting fire alarms to the fire department over wires electrically supervised and under the control of the plant owner or occupant. a. Where permissible and deemed necessary the means shall consist of a direct electrically-supervised line to the fire department, with suitable code-sending device and register, or a municipal fire alarm box, either of ordinary or auxiliary type, within fifty feet of the central supervising station. b. It is recommended that there be a telephone line from the central supervising station to the fire department, such line to available at all times and independent of the plant telephone switchboard.	D	Comply: Although a "reliable" means of transmitting fire alarm signals to off site fire departments is not provided, the justification provided for 72D Section 4031 in Ref. 12 still applies. Ref: 12, 19

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4041.	The proprietary system shall be arranged to receive and record all signals received at its central supervisory station and transmit to the fire department, indication of the buildings or group of buildings from which an alarm has been received.	W, D	Comply: Although the "EF" panel is not provided with an automatic printer for signals received, the justification for section 4041 and 4042 of NFPA 72D in Ref. 12 still applies. Ref: 1-12 Does Not Comply: Containment area detection does not provide adequate data on location of Fire (i.e. elevation or section of containment) Ref: #33,34
4042.	Recording Devices. Recording devices shall be designed and arranged to provide a permanent record. The time of receipt of all recorded signals shall be marked adjacent to the signal preferably by automatic means.	W, D	Comply: Reference the results of code Section 4041.
4051.	Circuits. Facilities shall be provided at the central supervising station on all circuits extending from the central supervisory station and on all legal current sources at the central supervisory station for making the following daily tests: a. Current strength on each circuit. b. Voltage across terminals of each circuit at the inside terminals of protective devices. c. Voltage between ground and each side of each circuit.	D	Comply: Although daily alarm circuit tests are not performed, the NFPA 72D section 4051 justification in Ref. 12 still applies. Ref: 12
4052.	Devices. Except as otherwise permitted by the authority having jurisdiction and as otherwise indicated in Paragraph 3335 complete and satisfactory tests of all coded and non-coded signaling devices shall be made quarterly.	D	Comply: See response to code section 2034. Does Not Comply: See response to code section 2034.

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4053.	Records. A complete record shall be kept of the tests and operations of each system. The record shall be available for examination and, where required, reported to the authority having jurisdiction.	D	Comply: All tests are properly documented, however, valve tamper devices are not verified for operability. The justification for NFPA 72D Section 2034 in Ref. 12 is still valid. Ref: 11, 12, 14, 32, 46, 47
4061.	General. The devices and circuits shall be designed and installed so as to meet successfully the most severe conditions liable to be met in practice. No change or alteration shall be made without approval by the authority having jurisdiction.	W, D	Comply: The flexible conduit for all waterflow and supervisory alarm devices except for the Unit 2 201AB & 201CD transformer spray systems, were not "seal tight" type conduit. However, based on the 72D Section 2122 justification in Ref. 12, this code section is being met. Ref: 1-12
4091.	General. Circuits shall be so arranged that a single break or a single ground shall not cause a false alarm signal. A break or a ground which prevents the normal functioning of any circuit shall be automatically indicated at the central supervisory station by a trouble signal which will compel the attention of attendants. The trouble signal shall be distinguishable from other signals, except where such other signals denote an abnormal condition of supervised parts of a fire-extinguishing system.	D	Comply: ACI 6007, A700-9, A924 and A888-M664 panels supervise all circuits properly. Ref: 11, 14, 46, 47 Does Not Comply: The "EF" panel will indicate a ground fault but not an open circuit as a trouble condition. ACI A909 detection circuits are properly supervised but the manual station and release circuits are not supervised for open and ground fault conditions. Ref: 11, 14, 46, 47
4101.	General. Arrangements shall be made to furnish such reports of signals that may be received and in such form as may be required by the authority having jurisdiction. Daily reports may be required.	D	Does Not Comply: Fire reports are generated with the exception of supervisory or trouble reports which are not generated. Ref: 19

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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4111.	Upon receipt of trouble signals or other signals referring to matters of purely equipment maintenance of the signaling system, the station operator shall immediately send a runner to investigate and, if possible, see that the trouble is remedied at once. Written notice shall be given the authority having jurisdiction and the property owner in all cases where service of the signaling system is interrupted and is not immediately corrected.	D	Comply: The operators are required to take corrective action upon receipt of a trouble condition. Ref: 19, 33-36 Does Not Comply: A written notice of system impairment is not required to be documented by operator procedure. Ref: 19, 33-36
4121.	Two alternate main power supply sources shall be provided within the supervisory central station. The secondary source shall be independent of other sources and a high degree of reliability. The secondary source shall be arranged as follows: a. It shall not operate through or be dependent upon the same motor-generator, convertor, or other device having moving parts which supplies the primary or normal supply, except that no additional source of power is required when a storage battery floating on a rectifier or generator is capable of carrying the load without the battery. The same regulation shall be provided as required in Paragraph 2251. b. It shall be of such capacity and reliability as to assure system operation, in case of interruption of the normal supply, for a period of 24 hours, and shall have, in addition, at the conclusion of this 24 hour period, a residual capacity sufficient to operate the system through at least one complete cycle of alarm initiation, transmission, and registration.	D	Comply: Secondary power is provided and in compliance with this code section. Ref: 11, 12, 46, 47

CODE COMPLIANCE VERIFICATION CHE[illegible]:
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Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)

c. It shall automatically supply the circuit or circuits upon loss of the normal source within 30 seconds: this automatic feature may be omitted if suitable provisions are made for manually transferring to the secondary source within 30 seconds.

d. The secondary source may be used for trouble signal power supply.

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APPENDIX A6

CODE COMPLIANCE VERIFICATION CHECKLIST

NFPA 72E - 1974 EDITION

CALCULATION / PROBLEM COVER SHEET

Calculation / Problem No: 0120-164-006

Title: NFPA 72E - CODE COMPLIANCE CKVL

Client: AEPSC Job No: 0120-164

Project: D.C. COOK EXTENDED CODE REVIEW

Design Input / References:

SEE SECTION 5.0

Assumptions:

SEE SECTION 2.0

Method:

SEE SECTION 3.0

Remarks:

SEE SECTIONS 1.0 & 4.0

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	[signature]	12-14-90

1.0 PURPOSE

1.1 The purpose of this calculation is to identify the applicable sections of the NFPA Code addressed, determine a method of verification for each applicable code section and confirm compliance for the plant fire protection systems within our review.

2.0 ASSUMPTIONS

It is assumed that the detection arrangement for the charcoal filter units are typical with exception of change in the number of charcoal filter beds.

3.0 METHODOLOGY

Reference Section 2.1.1 of ABB Impell Project Instruction PI-0120-164-01, Revision 0.

The basis for the review of the fire protection systems against a specific code edition was determined by reviewing the systems against the code edition in effect during the time of the original system installation.

4.0 RESULTS

Reference the Code Compliance Verification Checklist.

5.0 REFERENCES

References

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		WALKDOWN VERIFICATION CHECKLISTS		
1	0120-164-006A	XFRM 101AB	0	12/90
2	0120-164-006B	Start Up XFRM 101CD	0	12/90
3	0120-164-006C	Aux. XFRM 1CD	0	12/90
4	0120-164-006D	Aux. XFRM 1AB	0	12/90
5	0120-164-006E	345KV Main XFRM	0	12/90
6	0120-164-006F	Unit 2 Aux. XFRM 2AB	0	12/90
7	0120-164-006G	Unit 2 Aux. XFRM 2CD	0	12/90
8	0120-164-006H	Unit 2 Main XFRM	0	12/90
9	0120-164-006I	Unit 2 Start Up XFRMS	0	12/90
10	0120-164-006J	Charcoal Filter Units	0	12/90
11	0120-164-006K	RCP Pumps	0	12/90
		TECHNICAL DATA		
12	0120-164-005	NFPA 72D Code Compliance Verification Checklist	0	12/90
13	09-0120-0123	ABB Impell Code Compliance Report	0	05/88
14	-	AEP Evaluation Document	-	06/17/88
15	-	Alison Controls Inc. Manual for A888-M664/A	-	09/15/86
16	-	Record of Conversation Between D. Kipley and B. Gerwe	-	07/27/90
17	PM 683	Plant Modification Project for the Installation of ACI A888-M664/A Panels	1	01/07/87

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
		PROCEDURES		
18	1-0HP-4030-STP-123	Transformer Water Spray Test	2	07/25/88
19	2-0HP-4030-STP-123	Transformer Water Spray Test	2	12/29/88
20	PMI-2270	Fire Protection Program	16	02/09/87
21	12-0HP-4030-STP-125NS	Non-Tech Spec. Required Sprinkler Tests	1	10/12/89
22	12-THP-6030-IMP-142	Fire Det. & CO_2 System Surv. Testing (6 Mo.)	10	07/16/87
23	12-THP-4030-STP-239	RCP Fire Det. & Water System Test	7	07/06/90
24	12-0HP-4030-STP-125CF	Inside Containment Charcoal Filter Fire Prot. Valve Cycle	0	02/23/89
25	12-0HP-4030-STP-125CV	Inside Containment Charcoal Filter Fire Prot. Valve Cycle	0	02/23/89
26	1-MPH-4030-STP-032	Inspection of the Fire Prot. System Preaction Spray Headers in Unit 1 Containment Bldg.	1	03/13/86
27	2-MPH-4030-STP-032	Inspection of the Fire Prot. System Preaction Spray Headers in Unit 2 Containment Bldg.	1	02/22/86
28	12-0HP-4030-STP-120VC	Fire Prot. Yearly Valve Cycle and Lineup Verification	1	07/19/90
29	1-IHP-6030-IMP-190	Thermistor String Fire Det. System Operability and Calibration	3	04/05/90
30	2-IHP-6030-IMP-290	Thermistor String Fire Det. System Operability and Calibration	2	07/19/90
31	1-THP-6030-IMP-151	Containment Cable Tray Fire Det. System	4	07/19/90
32	2-THP-6030-IMP-251	Containment Cable Tray Fire Det. System	5	01/25/90

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
33	12-0HP-4030-STP-120VV	Fire Prot. Valve Lineup Verification	0	11/17/88
34	1-0HP-4024-101-001-100	Annun #1: Plant Fire System	2	03/10/86
35	2-0HP-4024-201-001-100	Annun #1: Plant Fire System	2	12/30/86
36	1-0HP-4024-102-001-050	Annun #2: Misc. Area Fire System	3	01/22/87
37	2-0HP-4024-202-001-050	Annun #2: Misc. Area Fire System	1	11/06/86
38	RFC#12-2521	Fire Detection Design Packet	-	08/14/85
39	RFC#12-2741	Fire Detection Design Packet	0	02/13/87
40	RFC#12-1843	Fire Detection Design Packet	3	10/23/87
41	RFC#01-2679	Fire Detection Design Packet	0&1	01/31/86
42	RFC#02-2694	Fire Detection Design Packet	0&1	05/02/86
43	RFC#12-2678	Fire Detection Design Packet	0&1	12/18/87
44	RFC#12-2231	RCP Pump Fire Detection Supp. Protection Modification Packet	0	03/27/87
		LICENSING DOCUMENTS		
50	Docket No. 50-315 50-316	Safety Evaluation Document of IMPC D.C. Cook Plant, Units 1 & 2	-	04/26/90
		DRAWINGS		
60	1-95907	Fire Prot. Transformer & Sprinkler Fire Systems Turb. & Aux. Bldgs.	16	04/01/87

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
61	2-95907	Fire Prot. Transformer & Sprinkler Fire Systems Turb. & Aux. Bldgs.	13	10/86
62	12-5152E	Flow Diagram Fire Prot. Water	3	01/03/90
63	12-5152J	Flow Diagram Fire Prot. Water	1	06/21/88
64	12-5152K	Flow Diagram Fire Prot. Water	2	06/21/88
65	12-5152L	Flow Diagram Fire Prot. Water	7	01/09/90
66	12-5152M	Flow Diagram Fire Prot. Water	4	09/29/89
67	12-5152N	Flow Diagram Fire Prot. Water	3	09/13/89
68	1-98972	Fire Prot. Water Systems Elementary Diagram	9	11/05/86
69	2-98972	Fire Prot. Water Systems Elementary Diagram	9	10/24/86
70	12-5152A	Flow Diagram Fire Prot. Water	3	03/23/88
71	12-5152B	Flow Diagram Fire Prot. Water	5	04/07/89
72	12-5152C	Flow Diagram Fire Prot. Water	2	08/04/88
73	12-5152D	Flow Diagram Fire Prot. Water	7	12/04/89
74	1-98612	Plant Fire System Annun. Elementary Diagram	12	07/01/86
75	2-98612	Plant Fire System Annun. Elementary Diagram	16	08/14/87
76	1-98613	Misc. Fire Area System & Vent Elementary Diagram	19	10/30/87
77	2-98613	Misc. Fire Area System & Vent Elementary Diagram	17	10/30/87
78	1-98969	FP Systems Annun. Elementary Diagram	7	06/08/87

REF NO.	DOCUMENT NUMBER	TITLE	REV. NO.	DATE
79	1-12060	DC Aux. One-Line 250V DC Bus	2	02/26/87
80	2-12060	DC Aux. One-Line 250V DC Bus	0	10/06/86

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DONALD C. COOK UNITS 1 AND 2

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 72E 1974
AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)

The evaluation of the installation and maintenance of the automatic fire detectors was based on the edition that was in effect at the time the alarm system was specified on April 2, 1971. Since NFPA 72E was not adopted until 1974, this edition was used as the basis for the initial installation of the devices.

The following systems/areas were evaluated under the requirements of NFPA 72E, 1974 Edition:

Area	Fire Zone
Unit 1 & 2 Turbine Building Wall	Yard
Unit 1 & 2 Containment Charcoal Filter Unit and Reactor Coolant Pump Suppression Systems, Unit 1 & 2 Containment Cable Tray Detection Circuits	66-68, 74-76, 101-104
Unit 1 & 2 Transformer and Turbine Wall Water Spray Systems	Yard

2-5.2	ACCEPTANCE TEST		
2-5.2.1	Upon completion of the installation, a satisfactory test of the fire detectors shall be made in the presence of a representative of the authority having jurisdiction.	D	Open Item: Documentation was not provided to verify the presence of the A/E (AEPSC) during testing. Ref: 38-44
2-6	INSTALLATION		
2-6.1	Where subject to mechanical damage, detectors shall be protected.	W	Comply: All detectors reviewed were installed such that the potential for mechanical damage was negligible. Ref: 1-11
2-6.5	Detectors shall be installed in all areas where required by appropriate NFPA Standard or the authority having jurisdiction. Where total coverage is required this shall include all rooms, halls, storage areas, basements, attics, lofts, spaces above suspended ceilings, and other sub-	W, D	Not Applicable: The systems reviewed utilized line type Thermistor wire to monitor specific hazards such as transformers. Ref: 1-11

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AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	divisions and accessible spaces, and inside all closets, elevator shafts, enclosed stairways, dumbwaiter shafts and chutes. Inaccessible areas which contain combustible material shall be made accessible and protected by detector(s). EXCEPTION NO. 1: DETECTORS MAY BE OMITTED FROM COMBUSTIBLE BLIND SPACES WHEN ANY OF THE FOLLOWING CONDITIONS PREVAIL: a) When the ceiling is attached directly to the underside of the supporting beams of a combustible roof or floor deck. b) When the concealed space is entirely filled with a noncombustible insulation. In solid joisted construction the insulation need fill only the space from the ceiling to the bottom edge of the joist of the roof or floor deck. c) When there are small concealed spaces in question does not exceed 50 square feet in area. d) In spaces formed by sets of facing studs or solid joists in walls, floors or ceilings where the distance between the facing studs or solid joists is less than 6 inches.		
2-6.7	Where codes, standards, laws, or authorities having jurisdiction require the protection of selected areas only, the specified areas shall be protected in accordance with this standard.	W,D	Not Applicable: See response to code section 2.6.5.
3-5.3	BEAM CONSTRUCTION. It shall be treated as a smooth ceiling if the beams project no more than 4 inches below the ceiling. If the beams project more than 4 inches below the ceiling, detectors shall be located at no more than two-thirds the spacing schedule in the direction at right angles to the direction of beam travel. If the beam projects more than 18 inches below the ceiling,	W, D	Not Applicable: Construction of this type is not applicable to the systems reviewed. Ref: 1-11

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AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	each bay formed by the beams shall be treated as a separate area.		
4-1	GENERAL		
*4-1.2	Smoke detectors shall be installed in all areas where required either by the appropriate NFPA Standard, or by the authority having jurisdiction.	W, D	Not Applicable: No smoke detection systems were reviewed. Only line-type fixed temperature detectors (thermistor wire) were evaluated.
4-3	LOCATION		
4-3.1	Spot-type smoke detectors shall be located on the ceiling not less than 6 inches from a sidewall, or if on the sidewall, between 6 to 12 inches from the ceiling.		
4-3.2	Line-type smoke detectors shall be located on the ceiling or on the sidewalls not more than 20 inches from the ceiling. Exception: See paragraph 4-4.5.	W	Not Applicable: See response to code section 4-1.2.
4-4	SPACING		
4-4.1	General. Spacing of smoke detectors shall result from an evaluation based upon engineering judgement supplemented, if feasible, by field tests. Ceiling shape and surfaces, ceiling height, configuration of contents, burning characteristics of the stored combustible, and ventilation are some of the parameters that shall be considered.	W, D	Not Applicable: See response to code section 4-1.2.
4-4.2	Smooth Ceilings. On smooth ceilings, with no forced air flow, spacing of 30 feet may be used as a guide. In all cases, the manufacturer's recommendations shall be followed. Other spacing may be used depending on ceiling height, different conditions for response requirements.	W, D	Not Applicable: See response to code section 3-5.3.

CODE COMPLIANCE VERIFICATION CHECKLIST
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AUTOMATIC FIRE DETECTOR

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4-4.5	HIGH CEILINGS.		
*4-4.5.2	For proper protection for buildings with high ceilings, detectors shall be installed alternately at two levels; one half at ceiling level, and the other half at least three feet below the ceiling.	W, D	Not Applicable: See response to code section 3-5.3.
4-4.6	Beam Construction. Beams 8 inches or less in depth can be considered equivalent to a smooth ceiling in view of the "spill over" effect of smoke. In beam construction over 8 inches in depth, movement of heated air and smoke may be slowed by the pocket or bay formed by the beams. In this case, spacing shall be reduced. If the beams exceed 18 inches in depth and are more than 8 feet on centers, each bay shall be treated as a separate area requiring at least one detector.	W	Not Applicable: See response to code section 3-5.3.

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AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
4-5	SPECIAL CONSIDERATIONS		
4-5.1	The selection and installation of smoke detectors shall take into consideration both the design characteristics of the detector and the areas into which the detectors will be installed so as to prevent false operation or nonoperation after installation. Some of the considerations are as follows:	W, D	Not Applicable: See response to code section 4-1.2.
4-5.1.5	Air Conditioned Facilities. In air conditioned facilities and others, where forced ventilation or open windows are present, detectors shall not be mounted near fresh air inlets. Detectors located shall favor air flow toward air outlet openings. The manufacturer shall be consulted before installation of detectors.	W	Not Applicable: See response to code section 3-5.3.
5-3.2	The detector(s) shall respond to the radiation from the area of fire that is to be detected. This usually involves expert application engineering. The time in which a fire must be detected and the area or intensity thereof may have to be related to the capabilities of associated extinguishing media and equipment.	W, D	Not Applicable: See response to code section 4-1.2.
5-4.1	Except as otherwise permitted herein, flame detectors shall not be spaced beyond their listed or approved maximums. Closer spacing shall be utilized where the structural and other characteristics of the protected hazard would otherwise impair the effectiveness of the detection.	W, D	Not Applicable: See response to code section 4-1.2.
5-4.2	Flame detector shall be so designed and installed that their field of vision will be sufficient to assure detection of a specified area of fire.	W	Not Applicable: See response to code section 4-1.2.

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AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
5-5.1	Since flame detectors are essentially line-of-sight devices, special care shall be taken in applying them to assure that their ability to respond to the required area of fire in the zone which is to be protected will not be unduly compromised by the presence of intervening structural members or other opaque objects or materials.	W	Not Applicable: See response to code section 4-1.2.
5-5.2	The overall situation shall be reviewed frequently to assure that changes in structural or usage conditions could interfere with fire detection capabilities are remedied promptly.	D	Not Applicable: See response to code section 4-1.2.
7-3	PERIODIC TESTS		
7-3.1.2	For restorable spot-type heat detectors, at least one detector on each signal initiating circuit shall be tested semiannually and different detectors shall be selected for each test.	D	Not Applicable: See response to code section 4-1.2.
7-3.1.4	Line-type fixed-temperature detectors shall have their loop resistance measured and recorded in the control cabinet at least semiannually.	D	Comply: Loop resistance testing is performed for the transformer systems, charcoal filter units, and cable tray systems. Ref: 22, 23, 29-32 Does Not Comply: Loop resistance testing is not performed for the RCP pump detection systems. Ref: 23, 29-32
8-1.1	GENERAL		
8-1.1.1	The function of air duct smoke detectors is to detect smoke for the primary purpose of controlling blowers and dampers of air conditioning and ventilating systems in an attempt to prevent possible panic and damage from	D	Not Applicable: See response to code section 4-1.2.

CODE COMPLIANCE VERIFICATION CHECKLIST
NFPA 72E 1974
AUTOMATIC FIRE DETECTORS

Code Section No.	Code Section	Information Required Verification Method W = Walkdown D = Document Search	Summary of Results (List results and reference details in calculations, sketches, etc., as required)
	distribution of smoke and gaseous products.		
8-1.2	APPLICATION OF DUCT DETECTORS		
8-1.2.1	Air duct smoke detectors shall be provided as required by the Standard on Air Conditioning and Ventilation Systems, NFPA No. 90A.	W, D	Not Applicable: See response to code section 4-1.2.

APPENDIX B1

DEVIATION EVALUATION

CALCULATION NO. 0120-164-007

CALCULATION/PROBLEM COVER SHEET

Calculation/Problem No: 0120-1164-007

Title: NFPA CODE DEVIATION EVALUATION

Client: AEPSC Project: D.C. COOK EXTENDED CODE REVIEW

Job No: 0120-1164

Design Input/References:

SEE SECTION 5.0

Assumptions:

SEE SECTION 2.0

Method:

SEE SECTION 3.0

Remarks:

SEE SECTION 1.0 & 4.0

REV. NO.	REVISION	APPROVED	DATE
0	ORIGINAL ISSUE	M.A. Sullivan	12/14/90
1	REVISED FOR CLARIFICATIONS	M.A. Sullivan	1/14/91

1.0 PURPOSE

The purpose of this calculation is to provide technical evaluations for the code deficiencies that are listed in ABB Impell Technical Report No. 09-0120-0381, Revision 1 which are identified by a reference to this calculation in the "Recommendation/Justification" section of Tables 3.2-1, 3.3-1, and 3.4-1. The techincal evaluations will determine if the deficient conditions compromise an equivalent level of protection as specified by the codes in consideration of other existing fire protection features or the installation of new features.

2.0 ASSUMPTIONS

2.1 NFPA 13

2.1.1 Floor drains in the area of the suppression headers are of adequate size to drain water being discharged from a 2" drain line from one system in operation.

2.1.2 Only one system is assumed to be in operation at any one moment based on BTP APCSB 9.5-1, Appendix A single failure criteria. The hose systems reviewed for compliance with NFPA 14, Section 651 (sectionalizing valves), were also verified for the potential of degrading an associated suppression system in both the Auxiliary and Turbine Buildings

3.0 METHODOLOGY

Code deviations identified in ABB Impell Technical Report No. 09-0120-0381 which require further evaluation are identified in the following matrix. The basis for the evaluations was the performance of a combination of one or several of the following methods including; a walkdown of the area where the deficient portion of the fire protection system is located to document the current physical conditions(e.g., combustible materials present, nozzle obstructions, other compensating protection features, etc.), review of existing plant documents (e.g., HVAC drawings, hydraulic calculations, etc.) and a review of NFPA Standards which provide exceptions to the requirements of the earlier code editions based on recent technological advancements within the industry.

The physical aspects in each of the deficient areas were then evaluated to determine if the code deviations were adequately compensated for by equivalent fire protection

features [i.e., adjacent unobstructed nozzle(s)], lack of combustible materials present (i.e., transient and fixed loads), NFPA Standard exceptions and good engineering practices.

Where an equivalent level of protection could not be justified, recommendations for correcting the deficient condition was provided.

The evaluations performed include the following:

NFPA CODE	CODE EDITION	CODE SECTION	EVALUATION NUMBER	STATUS
13	1971	1041	13A	Justification and Recommendation
13	1971	1141,3241 &3783	13B	Justified
13	1971	3562	13C	Justification and Recommendation
13	1971	3612	13D	Justified
13	1971	4143	13E	Justification and Recommendation
13	1971	4156,4316 & 4319	13F	Justification and Recommendation
13	1971	4211&4231	13G	Justification and Recommendation
14	1971	651	14A	Justified
15	1973	2012	15A	Justified
15	1973	2031&4072	15B	Justified
15	1973	2111	15C	Justified
15	1973	4121	15D	Justified
15	1973	8051	15E	Justified

4.0 RESULTS

See the technical evaluations listed above in subsections 4.1 through 4.3 of this calculation for the detailed results of the evaluations.

5.0 REFERENCES

The references are listed as part of the evaluations detailed in subsections 4.1 through 4.3.

4.1 Technical Evaluations for NFPA 13-1971

4.1.1 Evaluation No.13A-NFPA 13 Code Section 1041

Deviation: (a) Protective guards were not installed for three spinklers located within the hatchway near column G-16 at elevation 591'-0" in Fire Zone 80. (b) Misaligned sprinklers were identified in several areas of the plant. (c) A water supply header valve was identified as not having a manual actuator installed for operating the valve.

Justification: (a) A review of the area during the walkdown performed on 10/9/90 concluded that the purpose of the protective guards currently installed was to prevent damage to the sprinklers during the periods when the hatchway was removed and equipment was being transported through the opening. It is ABB Impell's belief that the intent of the guards was not to protect the sprinklers from equipment passing underneath in the isleway below, since the sprinklers are located up in the hatchway and are approximately 16 feet above the finished floor. Based on discussions with plant personnel, it was stated that this hatchway is infrequently used and that during the times when the hatchway might be open, safety procedures are implemented to ensure that adequate precautions are taken to prevent damage during lifting operations.

Recommended Action: (b)&(c) Items which require additional corrective action have been detailed below with the action recommended to provide compliance with the code.

Fire Zone	Column	Floor Elevation	Corrective Action
79	G-22,H-22 & H-20A	591'-0"	Realign (4) Cable Tray Nozzles and heat collectors
80	Near G-16	591'-0"	Install hand wheel on Valve No. 1-FP-196
80	GC-19&G-18	591'-0"	Realign (1) sprinkler near GC-19 and (2) sprinklers near G-18
80	GC-18,GC-18A	591'-0"	Realign (1) Cable

	& G-19		Tray Nozzle at each location
80	GC-18 & G-15	591'-0"	Realign (1) Cable Tray Heat collector at each location
84	FB-12	591'-0"	Realign Sidewall Nozzle deflector and adjust so as to ensure it remains in place
84	GC-9	591'-0"	Realign (1) Cable Tray Nozzle
84	G-10	591'-0"	Realign (1) Cable Tray Nozzle away from VCC 2-TBV
85	Near GC-7	591'-0"	Realign branch line with (2) sprinklers
91	H-14 to G-14	609'-0"	Realign (5) Cable Tray nozzles
91	H-17	609'-0"	Realign (1) Cable Tray nozzle

Based on the discussion above and the implementation of the recommended corrective actions, it is ABB Impell's conclusion that the deficient conditions are considered acceptable.

References:-ABB Impell walkdown notes of 9/13 to 10/11/90
-ROC between D.Kipley(ABB Impell) and P.Jaques(IMPC) dated 11/28/90

4.1.2 Evaluation No.13B-NFPA 13 Code Section 1141, 3241 & 3783

Deviation: (a) The drain lines for the retard chambers and alarm switch test lines drain directly to the floor for the suppression headers located near columns A-21, A-9, A-2, AB-18, AB-9, G-2, H-11 and H-7 at elevation 591'-0", and G-25 at elevation 609'-0".

Also, (b) PVC type piping was used for the main drain line at several suppression headers installed along Column line H at elevation 591'-0" of the Turbine Building. Also, the header at Column H-20 had the PVC type drain pipe discharge into a bucket containing a small sump pump.

Justification: (a) A review of the ABB Impell walkdown notes of 10/8/90 and AEPSC Drawing No.s 1-5152J,

2-5152K, 12-5267 and 12-5268 verified that the alarm switch drain lines discharge directly onto the floor. However, the area in which the majority of the suppression headers are installed are essentially located at the lowest level of the Turbine Building, with the exception of the Basement at elevation 570'-6"(Fire Zone 2). Safety related components and cables are not exposed to an inadvertant spray of water from the floor above due to lack of openings in the ceiling. In addition, it was noted that floor drains are typically provided in the area of the suppression headers and would drain the water discharged from the 1-1/2" or 2" drain line of the system. A review of the Fire Hazards Analysis for Fire Zone 2 indicated that safety related components or cables are not present in this zone thus eliminating the concern for water damage to safety related components.

The suppression header located at column G-25 on elevation 609'-0" was verified to have a solid concrete floor in the area of the header with penetrations being sleeved approximately 1" to 2" above the finished floor line and a floor drain located in the immediate area of the header location. Therefore, the exposure of safety related cables which may be located in Fire Zone 79 below the system header, from water accumulation on the floor above is mitigated by the raised sleeves and floor drain.

Justification: (b) The review of ABB Impell walkdown notes of 9/13 to 10/11/90 verified that the PVC drain pipe installation was only temporary since all the PVC pipe had been removed and replaced with steel pipe.

Based on the dicussion above, it is ABB Impell's conclusion that adequate drainage is provided to handle the discharge of water from the suppression headers and is considered an acceptable condition.

References: -AEPSC Drawing No.
a. 1-5152J-1, 6/21/88
b. 2-5152K-2, 6/21/88
c. 12-5267-6, 1/29/90
d. 12-5268-5, 1/29/90
-AEPSC FHA Rev.4, 1/31/90
-ABB Impell walkdown notes of 9/13 thru 10/11/90

4.1.3 Evaluation No.13C-NFPA 13 Code Section 3562

Deficiency: (a) Hangers were found to be missing from sprinkler piping in several fire zones and (b) hangers were found to be obstructing sprinkler spray patterns.

Justification:(a) A review of ABB Impell walkdown notes of 9/13 to 10/11/90 identified a hanger installation which did not meet the intent of code requirements. However, due to the provision of adequate supports on either side of the missing support this condition is considered acceptable. This area includes Fire Zone 80 near V-20 on the feed main piping where a pipe support required by the system drawings has not been installed.

Justification:(b) A review of the ABB Impell walkdown notes of 9/13 to 10/11/90 verified that several hangers were installed within 3" of the associated sprinkler deflector which obstructs the sprinkler spray pattern. The walkdown performed however, identified that the component obstructing the spray typically was a 1/2" or less diameter all threaded rod. Based on the review of NFPA 13-1989, Section 4-2.4.5 components of 1/2" in diameter should be located a minimum of 3 inches from the sprinkler deflector. For Components less than 1/2" in diameter there should be no adverse affects on the spray pattern of the adjacent sprinkler. Since the threaded rod is typically 3/8" in diameter, sprinklers could be located within 3" of the rod and this would not have an adverse affect on the performance on the spray pattern. The Fire Zones in which this deficiency occured includes; No.28 near A-18, No.79 at GC-21, No.84 at GD-11, No.96 at H-9 and 97 at GC-6.

Recommended Action: (a) Hangers which were noted with either portions missing, never installed or are being recommended for installation include the following;

Fire Zone	Column*	Floor Elevation	Corrective Action
80	V-21	591'-0"	Install (2) new
	GC-18	591'-0"	hangers.Replace (1) hanger
84	GC-9B	591'-0"	Reinstall (6) hangers
	H-9	591'-0"	Reinstall (1) hanger
	GC-9	591'-0"	Reinstall (3) hangers
90	H-21	609'-0"	Reinstall (1) hanger (Cable Tray)
91	GD-14	609'-0"	Reinstall (1) hanger
	H-17	609'-0"	Install (1) new 6" Dia. dead weight support at floor
	H-20	609'-0"	Install (1) new 6" Dia. dead weight support at floor
96	G-9	609'-0"	Replace (1) hanger

*Note: Column Line "V" is located by the Condenser area of the asssociated turbine building.

Based on the review of the discussion above and the impementation of the recommended corrective action, this condition is considered acceptable.

4.1.4 Evaluation No.13D-NFPA 13 Code Sections 3612

Deviation: (a) Sprinklers protecting the Cable Tray systems in Fire Zones 79,80&90 use 1/4" orifice sprinklers which are less than the 1/2" orifices required. (b) Small orifice sprinklers have been installed in the area coverage system in Fire Zone 91.

Justification: (a) Although Code Section 3612 clearly states that 1/2" orifices for sprinklers are required, the review of Code Sections 3616 and 3617 provide an exception for the use of smaller orifice sprinklers based on special applications where larger amounts of water normally required by 1/2" orifices are not necessary.

Recommended Action: The two small orifice sprinklers located near the Consdensor area near column V-22 in Fire Zone 91 at elevation 609'-0", should be replaced with a 1/2" orifice sprinkler as required for Ordinary Hazard Occupancies.

Based on the review of the discussion above and the implementation of the recommended corrective action, this condition is considered acceptable.

References: -NFPA 13-1971

4.1.5 Evaluation No.13E-NFPA 13 Code Sections 4143

Deviation: Sprinklers were found to be (a) missing or (b) improperly installed in Fire Zones 79,80,84,85,90,91,96 & 97.

Justification: (a) Sprinklers which are missing and can be justified based on the lack of fixed combustible loads in the area (i.e., non combustible piping insulation, cable in conduit, and steel pipe and components present), the provision of adjacent unobstructed sprinklers to control a postulated fire, or are located over frequently used access/egress pathways which do not present a fire exposure from below the obstruction. The basis for the sprinkler coverage adequacy has been determined by walkdown performed in the associated area between 9/13 and 10/8/90.

Fire Zone	Column	Floor Elevation	No. Missing
80	GC-19A	591'-0"	2
84	H-11	591'-0"	1
84	G-11 to G-9B	591'-0"	7(Spray Impingement Concern)*
85	H-4	591'-0"	1
90	GA-23	609'-0"	2
90	H-22	609'-0"	1
97	GC-6	609'-0"	3
97	G-5	609'-0"	1

*NOTE: Equipment exposed includes MCC Units 2-TBC-B, 2-TBC-CS & 2-TBV.

The review of the walkdown notes of 10/11/90 also verified that the following areas were not protected by sprinklers. However, due to the limited amount of combustible materials present,the addition of sprinklers in these areas would not significantly increase the fire protection features. These areas include:

Fire Zone	Column*	Elevation	Deficiency
91	H-18	609'-0"	Sprinklers are not installed at the top of the Main Steam piping shaft which is open to Fire Zone 91.
91	FB-16 to CC-16	609'-0"	Sprinklers are not installed over the Main Steam Stop Valves.

Recommended Action: The areas where corrective action is being recommended includes;

Fire Zone	Column*	Floor Elevation	Corrective Action
79	GC-20A	591'-0"	Install (1) Upright
79	GC-21	591'-0"	Install (1) Upright
79	G-22	591'-0"	Install nipple on (1) cable tray nozzle
80	V-21	591'-0"	Install (1) Upright
84	V-52	591'-0"	Install (1) Upright & (1)Pendent
91	H-15 to H-17	609'-0"	Install sprinklers to protect (2)

			Radiation Protection offices
91	H-17 to H-18	609'-0"	Install sprinklers to protect (1) womens bathroom
91	G-17	609'-0"	Install (1)Cable Tray Nozzle
96	GC-7A	609'-0"	Install (1) Upright
96	G-11	609'-0"	Install (1) Cable Tray Nozzle
96	G-13	609'-0"	Install (1) Cable Tray Nozzle

*Note: Column Line "V" is located near the Condenser area of the associated turbine building.

Based on the review of the discussion above and the provision of the sprinklers recommended for installation, these conditions are considered acceptable.

Justification: (b) The improper installation of sprinklers identified during the compliance review include upright sprinklers which have been installed in the pendent position and standard sprinklers installed in applications where sidewall type sprinklers are prefered. Those sprinklers which have been justified based on engineering judgement are detailed below:

Fire Zone	Justification
80&91	Standard type sprinklers have been installed near column G-16 in two hatchways where sidewall type sprinklers would be preferred. The review of ABB Impell walkdown notes dated 10/9 to 10/11/90 verfied that the standard sprinklers are typically not installed within 4" of the edge of the beams surrounding the hatchway openings. A review of NFPA 13, 1989 Edition Code Section 4-2.1.5 requires that sprinklers not be installed closer than 4" from any wall. Since the sprinkler deflectors are typically greater than 4" from the edge of the beam flange and not less than 7" from the beam web, the amount of spray disturbance produced by water deflection from the beam web is not considered to be significant. Also, a walkdown of the area verified that the floor area being protected is an aisleway and does not contain fixed combustible loads which would expose the hatchway areas. All areas surrounding the hatchway areas are properly protected with sprinklers. Therefore, this condition is considered acceptable.

Recommendation Action: The sprinklers recommended for replacement include the following;

Fire Zone	Column	Floor Elevation	Corrective Action
80	G-20A	591'-0"	Replace (2) Upright Sprinklers with Pendent type
96	GC-7	609'-0"	Reinstall (1) sprinkler currently at right angle to upright position
97	GC-6	609'-0"	Replace (1) Upright Sprinkler with Pendent type

References:-ABB Impell walkdown notes of 9/13 thru 10/11/90.
-AEP FHA Document, Rev.4, 1/31/90

4.1.6 Evaluation No.13F-NFPA 13 Code Sections 4156,4316 & 4319

Deficiency: Sprinklers were found to be obstructed by structural members or system components (i.e., large piping, cable trays, etc.).

Justification: A walkdown of the protected areas performed between 9/13 to 10/11/90 verified the type of obstruction, the amount of combustible materials present including fixed and transient, and other available fire protection features. Based on the negligible combustibles in the areas, the operation of adjacent sprinklers to control a postulated fire under the area, the provision of hose stations in the immediate area to extinguish the fire and the fact that minimal combustible materials are located below the obstructed area, ABB Impell concludes that additional sprinklers are not required to provide protection under the obstruction. The areas that are considered to be acceptable based on these conditions include:

Fire Zone	Column*	Elevation	Area of Obstruction
79	H-22	591'-0"	(2) sprinklers are obstructed by expanded metal type cable tray and steam piping with aisleway located below
79	GA-23 to GA-24	591'-0"	(9) sprinklers are obstructed by solid type cable tray and large diameter piping with aisleway and small storage room located

			directly below.
79	GC-22	591'-0"	(2) sprinklers are within 3" of beam and are obstructed on south side of beam. They are located over Condensate Heater Unit 1-HE-3B.
80 & 91	G-16	591'-0" and 609'-0"	Hatchway sprinklers are obstructed by 3/4" Dia. guard rod. The area below the hatchway is an aisleway and does contain any fixed or transient combustibles. Adjacent sprinklers around the hatchway are unobstructed.
80	GC-16	591'-0"	(1) sprinkler is within 2" of beam and is obstructed. The sprinkler is located over the aisleway near the passenger elevator. Adjacent sprinklers are unobstructed.
80	GC-17A to GC-20A	591'-0"	Obstruction of several area sprinklers by (4) expanded metal type cable trays located over Condensate Heater 1-HE-3A.
84	GC-10	591'-0"	(1) sprinkler is obstructed by 12" dia. pipe within 2" of the deflector. The sprinkler is located between Condensate Heaters 2-HE-2A & 2-HE-5A. Adjacent sprinklers are unobstructed.
84	GD-11	591'-0"	(1) sprinkler is within 2" of solid type cable tray and is obstructed. The sprinkler is located adjacent to the aisleway. Adjacent sprinklers are unobstructed.
84	V-78	591'-0"	(1) sprinkler is within 6" of angle iron and is obstructed. The sprinkler is located over Main Feed Pump Seal Water Pump. Minimal lube oil hazard is present and adjacent sprinklers are unobstructed.

84	H-11 to H-9	591'-0"	Several area sprinklers are obstructed by (8) steam pipes near the ceiling. The obstructed area below includes the aisleway and the area directly adjacent to the aisleway.
85	H-5	591'-0"	(2) sprinklers are obstructed by (3) 4'x4'solid type cable tray platforms. The obstruction is located adjacent to the aisleway. Adjacent sprinklers will assist in protecting fire dampers # 2-HV-TS-1 & 2-HV-TX-FD-1, approximately (7) conduit penetration seals and (1) 3 hour rated fire door #314.
85	H-5 to H-6	591'-0"	Area sprinklers are obstructed by (3) steam pipes and (1) 4'x4' solid type cable junction box. The obstruction is located directly over the aisleway and will not present an exposure hazard.
90	H-22	609'-0"	Several area sprinklers are obstructed by (3) 4'x4' solid type cable platforms. The obstructions are located primarily over the aisleway. Adjacent sprinklers are unobstructed and will adequately protect the 3' hour fire door to Fire Zone 42A.
91	H-15	609'-0"	(1) sprinkler is within 2" of beam and is obstructed. Unprotected area is a stairwell and adjacent sprinklers are unobstructed.
91	G-14 to GC-17	609'-0"	Several sprinklers are obstructed by solid type cable trays and steam piping. The obstruction is located directly over the aisleway. Cable trays are

			protected by cable tray sprinklers.
91	V-20	609'-0"	(1) sprinkler is obstructed by solid type cable tray and a beam. Adjacent sprinklers are unobstructed.
91	G-17 to V-20	609'-0"	Several area sprinklers are obstructed by a 5' dia. steam pipe. Transient and fixed combustible loading does not exist under the obstruction.
91	H-20 to H-18	609'-0"	Several sprinklers are obstructed by approximately (5) steam pipes. The obstruction is located directly over aisleway with minimal exposure from below.
91	V-22 to GC-18 & G-19A to GC-19A	609'-0"	Numerous steam pipes obstruct the area sprinklers located above. The area below the obstruction contain Heater Units 1-HE-2A & 1-HE-5A and Drain Tank 1-TK-90. All adjacent area sprinklers are unobstructed.
96	G-7 to G-10, GC-8 to GC-10 & H-10 to H-7	609'-0"	Numerous steam pipes obstruct area sprinklers above. The area below the obstruction contains Heater Units 2-HE-2A & 2-HE-5A. This is normally an unocuppied space and contains minimal fixed or transient combustible loads.
96	GD-10	609'-0"	(1) sprinkler is within 6" of a beam and is obstructed. The obstruction is located over the Reheater Condensate Drain Tank 2-K-95. Adjacent sprinklers are unobstructed and will provide protection.
97	G-5	609'-0"	Preseparator 2-QT-416-LS obstructs area sprinklers located above. Minimal fixed or transient

combustible loads exist. Adjacent sprinklers are unobstructed.

*Note: Column line "V" is located near the Condenser area of the associated turbine building.

Recommended Action: The areas where corrective action is being recommended includes;

Fire Zone	Column	Corrective Action
91	GC-17 to V-20 & 11'North of G-16 to FB-16	Provide area sprinklers below the solid type cable tray and steam piping that are located in this area. The cable tray in this area are exposed by the transient load staging area located directly below.
91	G-16	(2) cable tray system sprinklers are obstructed by numerous cable transitioning between two different cable trays. Relocate the sprinklers above and away from cables.
96	GD-12	Relocate (1) upright sprinkler from between two beams which are located within 3" on either side of the sprinkler deflector. The area below contains a lube oil hazard for the air compressor units.
97	G-2	The heat collector plates for the sprinklers located over the overhead door are misaligned and obstruct the spray pattern of the sprinklers. Adjust the collector plates accordingly.

Based on the implementation of the recommendations listed and the justification discussions above, the deficiencies identified are considered acceptable.

References: -ABB Impell Walkdown Notes dated 9/13 to 10/11/90
-ROC between D.Kipley (ABB Impell) and P.Jaques (IMPC) Dated 11/28/90.

4.1.7 Evaluation No.13G-NFPA 13-1971, Section 4211, 4231

Deficiency: Sprinklers are located greater than 12 inches below the ceiling deck.

Justification: Per the review of the ABB Impell walkdown notes dated 10/8/90, a branch line of sprinklers in Fire Zone 97 between Column GA-4 to G-4 & GA-2 to G-2 are located approximately 16 inches from the deck. Based on the review of NFPA 13-1989, Section 4-3.2.1, the 16" distance from the deck is acceptable.

Recommended Action: Corrective action required to comply with as a minimum, NFPA 13-1989, Section 4-3.2.1 for installing sprinkler deflectors within 16" of the ceiling deck should be applied to the following:

Fire Zone	Column	Corrective Action
90	G-22	Reinstall (4) sprinklers currently located approximately 30" below the deck to within 16".
90	GC-21	Reinstall (1) sprinkler currently located approximately 24" below the deck to within 16". This is being required due to presence of other system deficiencies in the immediate area.
91	H-19	Reinstall (3) branch lines with (3) sprinklers each currently located approximately 24" below the deck to within 16".
96	GD-12 to GD-13	Reinstall (4) sprinklers currently located approximately 24" below the deck to within 16".
97	H-6	Reinstall (4) sprinklers currently located approximately 24" below the deck to within 16".

Based on the review of the justification discussions and the implementation of the recommendations listed above, these conditions are considered acceptable.

References:-ABB Impell walkdown notes dated 9/13 to 10/11/90
-NFPA 13-1989 Edition

4.2 Technical Evaluations for NFPA 14-1971 Edition

4.2.1 Evaluation No. 14A-NFPA 14 Section 413 & 622

Deficiency: Sectionalizing valves have not been provided for isolating hose station risers from the fire main loop contained within the Turbine and Screen House Buildings. The areas affected include, Fire Zone No. 80 for Hose No. 32A, 33A 59B,79B & 60, 245, TSC Sprinkler system (Col. H-17 & H-16), Fire Zone No. 84 for Hose No.7A, 10A, 44A & 67A (Col. H-8) and Fire Zone No. 142 for Hose No.19B, 20B, 23B, 24B and Unit 1&2 diesel fire pump room sprinkler systems (Col. A-13).

Justification: The review of AEPSC Drawing No. 12-5152, 1-5152B, 2-5152C and 12-5152D has verified that should the hose station risers fail at the identified locations adequate back-up protection features would be available. These protection features may include adjacent hose systems or yard fire hydrants. The justified conditions include:

Fire Zone	Col.	Problem Condition	Justification
80	H-17 & H-16	A failure of these hose risers would require the closure of Valve No.s 1-FP188, 12-FP193 & 1-FP195. This will isolate 12-ZMO-20, the sprinklers for the Unit 1 Aux. Feedpump rooms, Turb. Bldg. and the hose stations for Fire Zones 7-12, 33-33B, 55 & 105.	Hose stations will still be available in the"T"-shaped section of the Aux. Bldg. via 12-ZMO-10 connection for Fire Zones 33-33B ,55 & 105. Hose is also available at hose Sta.No 36 near the Aux. Feedpump rms.(17A-G) and hose from adjacent hose stations will be provided for the Turb. Bldg. areas. Yard Hydrant No.8 is also located outside Fire Zone 33 and would provide additional manual hose capability for Fire Zones 33-33B, 55 & 105. Hose for Fire Zones 7-12 is available from Hose Sta.No.32 in the Turb. Bldg.
84	H-8	A failure of this hose riser would require the closure of Valves 2-FP188 &	Hose stations for the "T"-shaped section of the Aux. Bldg. are available for Fire

		2-FP195. This will isolate the sprinkler systems for Unit 1&2 Aux. Bldg."T"-shaped area, U2 Aux. Feed-pump Rms, U2 Cable Vault,U2 Turb.Bldg. and hose sta.s for Fire Zones 22-27, 34-34B & 60.	Zones 34-34B, 60 & Cable Vault(58). Hose Sta. No.8 is available for Aux. Feedpump Rms (17A-G). Hose sta.s are also available for the U2 Turb. Bldg. areas. Yard Hydrant No.8 is also available for manual hose capabilities for Fire Zones 34-34B. Fire Zones 22-27 are afforded protection from Hose Sta.No.7 in the Turb. Bldg.
142	A-13	A failure of the 12" fire main loop would require the closure of Valves 1 & 2-FP253. This will isolate Unit 1&2 Diesel fire pump room sprinkler systems and the Screen House hose stations.	Additional hose may be supplied from Yard Hydrant No. 1&14 and from Hose Stations No. 21 (Unit 2) & 22 (Unit 1) to protect Fire Zones 28, 30 & 142.

Based on the review of the discussions above, this condition is considered acceptable.

Reference: -AEPSC Drawing No.s
12-5152-4, 7/25/89
1-5152B-5, 4/7/89
2-5152C-2, 8/4/88
12-5152D-7,10/4/89

4.3 Technical Evaluations for NFPA 15-1973 Edition

4.3.1 Evaluation No.15A-NFPA 15 Section 2012

Deficiency: Non-approved automatic valves are provided for the Unit 1&2 charcoal filter units.

Justification: The review of the original installation specifications dated 4/2/71 and 1/21/71 (DCCPM104QCS), the Pre-operational test procedure PO-050-508

and current surviellance test procedures, The Hammel-Dahl Model 830 automatic valve installed responds to an alarm condition within the required timeframe (i.e., 40 seconds) and is constructed to operate under the high radiation conditions within containment.

Reference:-AEPSC Spec. Dated 4/1/71
-AEPSC Spec.No. DCCPM104QCS, Dated 1/21/71
-AEPSC Pre-op Test Procedure PO-050-508, Dated 1/31/78
-AEPSC Surviellance Procedure 12-OHP-4030-STP.125CF, Rev. 0

4.3.2 Evaluation No.15B-NFPA 15, Section 2031

Deficiency: Four unrated openings are exposed to a postulated fire from the Unit 1 Main transformer.

Justification: The review of AEPSC Drawing No. 12-5979, Grinnell Drawing No. 121-26, AEPSC FHA for Fire Zone 129 and ABB Impell Walkdown Notes of 9/13/90 verified that an opening of approximately 2.5'x 1' is located in the three hour fire rated barrier at Column line Ga of the Turbine building approximately 13' above the top of the Unit 1 Main transformer. Three other openings are located in the south wall near Col. H-26 of the Service building approximately 35' from the Main transformer.

The three openings in the Service building are afforded protection from the water spray system installed on the transformer and the spacial separation of the opening to the transformer hazard.

The one opening in the Turbine building wall has an actual linear distance of 19' from the top of the transformer. This opening penetrates through the 3 hour fire rated barrier and into the freight elevator shaft located near column Ga-24 at elevation 648'-0". The review of AEPSC FHA discussion for Fire Zone 129 indicates that the elevator shaft is constructed primarily of 6" and 8" concrete block, with all structural steel members supporting the shaft enclosed in 4" face brick. Based on the review of NFPA Fire Protection Handbook, Section 7, Figure 7-8H, Item A, verifies that the shaft construction has a minimum fire rating of one hour. Since a water spray system has been provided at the transformer to protect all exposures, the opening has a spacial separation of approximately 19' and the opening enters into a minimum one hour fire rated shaft, this condition is considered acceptable based on the fire protection features present.

Reference:-AEPSC FHA Rev.4
-AEPSC Drawing No.12-5979, Rev.3
-Grinnell Drawing No. 121-26
-ABB Impell Walkdown Notes of 9/13/90 to 10/11/90
-NFPA Fire Protection Handbook, Sixteenth Edition, Page 7-99

4.3.3 Evaluation No.15C-NFPA 15, Section 2111

Deficiency: Strainers have not been provided for either the 1/4" orifice Cable Sprinklers (NFPA 13) or the Exposure protection and Transformer spray systems.

Justification: Based on the review of System Description No. SDDCCFP101. AEPSC code compliance review for NFPA 20-1969 and IMPC surveillance program for fire main flush and flow testing, and deluge system flow testing, adequate facilities are provided to ensure the operabilty of the small orifice nozzles and prevent their clogging.

Reference:-AEPSC Description No. SDDCCFP101, Rev.2
-AEPSC NFPA 20 Code Review, Dated 8/14/90
-IMPC test procedure series OHP-4030-STP.120
-ROC Between P.Jaques(IMPC) and D.Kipley (ABB Impell), Dated 11/28/90

4.3.4 Evaluation No.15D-NFPA 15, Section 4121

Deficiency: (a) Non-approved gauges are installed at the suppression system headers for the Unit 2 Transformer and Exposure protection systems. (b) Gauges have also not been provided for the Unit 1 & 2 CFT Charcoal Filter unit water spray systems.

Justification: (a) Based on the review of the Ashcroft gauge Bulletin No. DU-1, this equipment is adequate for the normal operating pressure of the fire protection systems (175 psi) and is considered acceptable for the application.

Justification: (b) The review of AEPSC System Desription No. SDDCCHV102 has verified that a total flow of 160 GPM is being supplied to the upper containment cooling

components through a 3" pipe. Based on ANI's criteria for protecting charcoal filter beds a density of .25 GPM/FT2 is required to protect each filter bed. Since the area of each filter bed is 5 FT2, and one nozzle is required to protect each bed, each nozzle must deliver 1.25 GPM. The total flow for each filter unit, assuming the filter arrangement is typical of filter units 1&2-HV-ACFR-1, would be 23 GPM with a minimum pressure requirement at the base of the filter unit supply connection of 25 PSI (assuming a minimum nozzle pressure requirement of 5 PSI per Spraying System Co. data sheet No. 29A). The actual flow for the spray nozzle at 5 PSI is 1.4 GPM with a total for each filter unit of 25 GPM. The 2" feed main supplied from the 3" pipe should be an adequate supply for each filter unit. This is based on NFPA 13-1989, Section 8-3.2 and Grinnell Duraspeed sprinkler data sheet which indicate that a 3" pipe will flow 400 GPM with (40) sprinklers flowing a minimum of 10 GPM each. A 2" pipe will flow a minimum of 100 GPM with (10) sprinklers flowing a minimum of 10 GPM each. These pipe sizes are more than adequate for flowing the total flows of 185 GPM (3"pipe) and 25 GPM (2"pipe) required. Therefore, the lack of pressure gauges installed at each filter unit's automatic valve location is considered acceptable.

Reference:
- -Ashcroft Bulletin No. DU-1, Dated 4/86
- -AEPSC System Description No. SDDCCHV102, Rev.4, 4/25/89
- -Spraying System Co. "Unijet" nozzle Model 3/8 TT9540, Catalog No. 29A, pages 22-23, 1973 Edition
- -AEPSC Evaluation Document Dated 6/17/88
- -NFPA 13-1989 Edition
- -Grinnell "Duraspeed" data sheet N-2, 1/1/69
- -ANI Recommendations for Charcoal Filters, dated 9/77
- -ROC between B.Gerwe(AEPSC) and D. Kipley(ABB Impell), dated 12/10/90

4.3.5 Evaluation No.15E-NFPA 15, Section 8051

Deficiency: Data was not available to verify if the response time for the Unit 1 & 2 Transformer and Exposure protection systems were within the 40 second time limit required by the code.

Justification: Based on the review of the ROC between P. Jaques (IMPC) and D. Kipley (ABB Impell) dated

11/28/90, the response time for these detection systems is typically between 60 and 90 seconds. The intent of this code section is to provide a detection system which will respond rapidly to a fire where an unstable combustible liquid is stored in large quantities and presents a significant exposure hazard. Based on the review of the plant FHA text and Drawing No.12-5979, a spacial separation of not less than 13' is provided from any one building structure, building structures (i.e., Auxiliary and Turbine) are primarily provided with fire barriers of three hour construction, and openings through the fire rated barriers are typically protected with three hour fire rated protective devices or the openings are approximately 19' from the top of the transformer. Fixed water spray systems have been provided for most of the unrated openings located near Unit 1 Main Transformer (Unit 2 Turbine wall adjacent to the Main transformer does not contain unprotected openings). Manual electric actuation switches have been provided to furnish a manual means of actuating the affected water spray system should the automatic detection system fail to operate.

Based on the review of the discussion above, this response time and detection system condition are considered acceptable.

Reference: -AEPSC FHA Rev.4, Dated 1/31/90
-AEPSC Drawing 12-5979 Rev.3
-Grinnell Drawing 121-26
-ROC between P.Jaques (IMPC) and D.Kipley (ABB Impell) Dtaed 11/28/90

Appendix B2

Supplemental Justifications

Appendix B2 of the Extended NFPA Code Compliance Evaluation Report 09-0120-0381 has been added by AEPSC. The report was originally prepared by ABB Impell. This section was added by AEPSC in order to keep the entire report and its final justifications and recommendations together as a complete package. These supplemental justifications have been prepared to remove prior recommendations from the "Deviation and Recommendations/Justifications" Tables found in Sections 3.1-1 to 3.6-1 of the report.

AEP
AMERICAN ELECTRIC POWER

Date November 20, 1991

Subject Cook Nuclear Plant
NFPA 10 Code Compliance Review
Impell Report 09-0120-0381

From B.J. Gerwe

To Extended NFPA Code Compliance Report 09-0120-0381, Appendix B2

ABB Impell code compliance review for NFPA 10 identified the following code deviation.

NFPA 10, 1984 Edition, Section 1-6.2

Deviation: Several fire extinguishers were found to be obstructed from direct access. Several fire extinguishers were not in their designated places or of the type of extinguisher designated. Two fire extinguisher locations were not properly marked.

Resolution: The plant has advised that these deviations have been corrected. Revision 2 of Procedure 12 SHP 2270 FIRE.001 included the requirement that all fire extinguisher locations be checked each month to ensure that the area is clear of obstructions. In addition, the fire extinguishers have undergone numerous surveillance inspections since the original findings and since Revision 2 of the procedure in March of 1991. These inspections have ensured that these deviations have been corrected. Due to normal work activities around the plant, fire extinguishers are sometimes moved to a new location on a temporary basis. Should a workman forget to restore the fire extinguisher to its normal location after completion of the work, the monthly inspection would discover the problem and correct it.

References: Conversation on 11-14-91 with P.H. Jacques -- Plant Fire Protection Coordinator.
Procedure 12 SHP 2270 FIRE.001, Revision 2.

B.J. Gerwe

cc: J.D. Grier/B.J. Gerwe
P.H. Jacques - Bridgman
MF: Yes

AEP
INDIANA MICHIGAN POWER

Date November 18, 1991

Subject Fire Protection Code Compliance Review

From P.H. Jacques

To B.J. Gerwe

Per your request I have reviewed the status of Plant implementation of maintenance items and procedure revisions as outlined in the Code Compliance Review, Expanded Code Compliance Review, NFPA 30 Compliance Review and ESW Pump Room Area Extinguishers. With the exception of the items listed below all maintenance items and procedure revisions have been completed.

NFPA 30 Code Compliance

P.J. Russell memo dated June 29, 1990

Status

Complete

P.J. Russell memo dated July 2, 1990

Status

To be completed by Operations Department per your discussion with A. Puplis.

P.J. Russell memo dated July 10, 1990

Status

In some fire zones there are more than three flammable liquid cabinets. In these areas flammable liquid cabinets are used to store Class A combustibles such as cleaning materials, aerosols, grease, etc. We consider this to be an acceptable practice and monitor the additional cabinets on a regular basis.

Code Compliance Review - Impell Report No. 09-0120-0123

NFPA ~~13~~ 12A, Paragraph 1-9.5.6

BJG 11-20-91

Status

Signs will be made for the Unit 1 and Unit 2 Halon systems by December 31, 1991.

NFPA 72D, Paragraph 2034, 4052

Status

Plant procedures will be revised or new procedures developed to verify that alarms are received in the Control Room from those Auxiliary Building standpipes that are fed from piping equipped with a flow alarm or are controlled by ZMO-10 and ZMO-20 by June 1, 1992.

NFPA 12, Paragraph 1625

Status

The vent lines referred to in this item were not part of the original installation and will not be reinstalled for safety reasons. In the event of a blockage in any part of the vent line pressure can back up through the back side of the pilot valves opening the valves and allowing an uncontrolled discharge of CO2 into all of the areas connected to the vent line.

NFPA 13, Paragraphs 3-16.2.2, 3-16.3.5, 3-16.9.2

Status

This item will be completed with the Expanded Code Compliance review items.

NFPA 72D, Paragraph 2042 Item b.

Status

Relocation of fire detectors or installation of protective guards will require a design change.

FOR JUSTIFICATION OF THIS ITEM SEE 11-14-91 MEMO BY B.J. GERWE. BJG 11-20-91

Expanded Code Compliance Review
Impell Report No. 09-0120-0381

NFPA 10, Paragraph 4-3.2

Status

Procedure 12 SHP 2270 FIRE.001 has been revised to verify that fire extinguishers are clear. On fire extinguishers the operating instructions are applied by the manufacturer as is the hanging bracket. Since the extinguisher can only be hung one way we will not change the procedure. The monthly inspection is the document that verifies that the extinguisher has been inspected. The inspection procedures meet NFPA criteria.

NFPA 13, Paragraph 1041

Status

A walk down of the sprinklers will be completed and the sprinklers realigned as needed by December 31, 1992.

Valve 1-FP-196 was installed without a hand wheel. A determination will have to be made on whether one can be added without a design change.

Paragraph 3612

Status

A field walk down will be conducted and sprinkler heads changed as required by December 31, 1992.

Paragraphs 3681, 3682, 3683

Status

This item will be completed in 1992 or 1993 depending on budget allocation.

Paragraph 4143

Status

A walk down will be completed and sprinklers installed per applicable drawings by December 31, 1992.

NFPA 72D, Paragraphs 2034, 4052

Status

Procedures for the testing of the CFT Charcoal Filter Units will be completed by the start of the 1992 refueling outages for each unit.

ESW Extinguishers

Status

Per your request we have verified that the fire extinguishers in the ESW Pump Room area are all ABC Dry Chemical extinguishers.

P.H. Jacques

c: P.F. Carteaux
File

AMERICAN ELECTRIC POWER

Date November 18, 1991

Subject Cook Nuclear Plant
NFPA Code Compliance
Procedure Revisions

From B.J. Gerwe

To P. Carteaux - Bridgman
J. Sampson - Bridgman
T. Beilman - Bridgman

The NFPA Code Compliance reviews performed by ABB Impell, Report No. 09-0120-0123 and 09-0120-0381, identified procedures which required revision to incorporate surveillance and testing issues. A review of these plant procedures shows that several of the previously identified changes under Report No. 09-0120-0123 have not been incorporated as previously requested. The required changes are given below. Please direct this listing to the appropriate personnel for incorporation of these surveillance requirements.

These procedural changes are being committed to the NRC and require completion by the end of 1992. In reviewing the changes with the various departments, the end of 1992 date has been agreed to due to the two unit refueling outages occurring in 1992, and the additional procedural burden associated with the outages. Each department also indicated that they should be able to better this date. Please advise the writer in writing when the procedures have been revised.

NFPA Code	Edition	Code Section	Procedure	Deviation/Requirement
15	1973	5011 5021 5031 6001-6003 6013-6018	12MHP4030.STP.020 Series	Deviation: Charcoal filter unit 12-HV-SATFU is not included in any of the procedures. Requirement: The charcoal filter unit 12-HV-SATFU fire protection system is to be tested. Nozzle operability should be confirmed. NOTE: The 12-HV-SATFU water spray system is supplied water through Hose Station No. 4. Hose Station No. 4 angle valve operability, ZMO-10 and ZMO-20 operability and connecting fire hose operability are already being performed under separate procedures which can be used to satisfy the first part of this requirement.

NFPA Code	Edition	Code Section	Procedure	Deviation/Requirement
72D	1967	2034 4052 2047	12SHP2270.FIRE.004 1&2OHP4030.STP.121 Series	Deviation: The procedures do not perform surveillance tests or verify the receipt of alarm or supervisory signals at the control room from fire pump supervisory signals and hose system manual stations alarm initiating devices to confirm their operability. Requirement: The procedures should be enhanced to verify the receipt of all required signals at the control room. Each hose station device should also be activated to verify operability of the device and its circuit. Deviation: The procedures do not verify the reset of signals received by the control room from the fire pumps. Requirement: The surveillance test should be revised to verify the reset of each signal prior to continuing the test.
			12THP4030.STP.223	Deviation: Air flow testing is not performed for the Unit 1 and 2 containment CFT charcoal filter units. Requirement: Incorporate the air flow testing of the Unit 1 and 2 CFT charcoal filter units into the plant procedures.
72D 72E	1967 1974	3542 7-3.1.4	12THP4030.STP.239	Deviation: Loop resistance testing for the Unit 1 and 2 reactor coolant pumps (RCP) thermistor line type detectors is not performed. Requirement: Incorporate loop resistance testing of the Unit 1 and 2 RCP detection systems into the plant procedures.

NFPA Code	Edition	Code Section	Procedure	Deviation/Requirement
72E	1974	5-5.2	12THP6030.IMP.153	Deviation: The procedures do not confirm the changes in the alignment of the infrared flame detectors. Requirement: The procedures should be revised to verify the alignment of the flame detectors. Deviation: The line type heat detectors for the RCP pumps are not verified for their operability by loop resistance testing. Requirement: The procedures should be revised to verify the operability of the line type heat detectors as required.

Please call if you have any questions.

B.J. Gerwe

BJG/gh

cc: E.E. Fitzpatrick
A.A. Blind - Bridgman
P.H. Jacques - Bridgman
A. Arent - Bridgman
T. Walsh - Bridgman
C. Miles - Bridgman
R.L. Shoberg
J.D. Grier/B.J. Gerwe
File: NFPA Code Compliance Report 09-0120-0123
NFPA Code Compliance Report 09-0120-0381
MF: N

AEP INDIANA MICHIGAN POWER

DONALD C. COOK NUCLEAR PLANT

PROCEDURE COVER SHEET

CLOSEOUT FOR NFPA 10, SECTION 4-3.2 CONCERNING OBSTRUCTION OF FIRE EXTINGUISHERS.

Procedure No.	12 SHP 2270 FIRE.001
Revision No.	2

TITLE PORTABLE FIRE EXTINGUISHER INSPECTIONS

SCOPE OF REVISION

Revision 2: Minor revision. Marginal markings used. Updated references. Added references to Halon extinguishers, requirements for verifying clear access to extinguishers and updated Attachments 3, 4, 5 and 6 to reflect current extinguisher locations. Reworded body paragraph 8.1.3 to require verification that access to fire extinguishers is clear during monthly inspection and verification that extinguishers have not passed there hydrostatic test date on semiannual inspections. Updated hydrostatic test frequencies for pressurized dry chemical extinguishers in Attachment No. 2.
QA/NSDRC Audit No. QA-90-27/NSDRC 176.

SIGNATURES	REVISION NUMBER			
• • • • • •	REVISION 2			
PREPARED BY	Pat Sharp			
DEPARTMENT HEAD APPROVAL	[signature]			
INTERFACING DEPARTMENT HEAD CONCURRENCE	[signature]			
QUALITY ASSURANCE SUPERVISOR APPROVAL	[signature]			
PLANT NUCLEAR SAFETY COMMITTEE	Meeting #2490			
PLANT MANAGER APPROVAL	[signature]			
APPROVAL DATE	3/14/91			
EFFECTIVE DATE				

INDIANA MICHIGAN POWER COMPANY
DONALD C. COOK NUCLEAR PLANT

1.0 TITLE: Portable Fire Extinguisher Inspections

2.0 OBJECTIVE

2.1 To establish the criteria by which the Safety and Assessment Department will perform inspections of the portable fire extinguishers (excluding the new Training Facility).

2.2 To assure that all the portable fire extinguishers are in operable condition and are in their proper locations.

3.0 REFERENCES

3.1 PMI-2270, Fire Protection.

3.2 12 PMP 6010 RAD.001 and .002 Radiation Protection Manual.

3.3 Fire Facilities Plan - Drawing Numbers 12-5265, 12-5266, 12-5267, 12-5268, 12-5268A, 12-5269, 12-5270 and 12-5271. Service Building extension 12-4510, 12-4511, 12-4512 and 12-4513. Security Control Center - 12-4507.

3.4 NFPA-10.

3.5 QA Audit 86-21-4A - Requires inspection of all Fire Extinguishers that are assigned to the Fire Watches.

3.6 QA Audit/NSDRC Audit No. QA-90-27/NSDRC 176.

4.0 PREREQUISITES/PRECAUTIONS/INITIAL CONDITIONS

4.1 The following equipment and supplies are necessary:

4.1.1 Paper Punch

4.1.2 Fire Extinguisher Cards

4.1.3 Plastic Seals

4.1.4 50# Spring Scale

8.1.3 Attachment Nos. 3, 4, 5 and 6 are used to document the monthly inspection of the plant portable fire extinguishers. Following completion of the Attachments, the data sheets (Attachments) are submitted for Supervisor Review.

Monthly Inspection - To assure that all portable extinguisher locations have an operable fire extinguisher and that access to the fire extinguisher is clear.

Semiannual Inspection - To assure that all portable extinguishers are properly charged and that the extinguisher has not passed its hydrostatic test date.

8.1.4 Extinguishers found with no Inspection tag may be inspected and retagged to indicate the extinguisher is acceptable for use. The Inspection Tag will be punched to be in agreement with the last monthly extinguisher inspection. This will insure that the extinguisher is inspected during the next completion of this procedure. No procedure data entry is necessary for re-inspection/ re-tagging of extinguishers.

8.2 The fire extinguishers located on 598 and 609 in the Containments shall only be inspected on a monthly basis during refueling or extended non-refueling outages. The first inspection of the outage duration will be performed within seven (7) days after Containment integrity is broken. The monthly inspections shall continue until Containment integrity is restored.

8.3 Outage support fire extinguishers designated for containment use are normally stored on the 633' elevation of the Auxiliary Building.

9.0 RESTORATION

9.1 Replace deficient Fire Extinguishers with an operable unit.

9.2 Provide arrangements for a contractor to come in and service unacceptable fire extinguishers.

CO_2 PORTABLE FIRE EXTINGUISHER
Monthly Inspection Detailed Procedure

1. Check that the correct type of fire extinguisher is in the designated location. Replace any missing/inoperable fire extinguishers.

2. Check that the pin is in its proper position and that the seal is intact. The seal should be around the handle and through the eye of the pin. If the seal is broken, weigh the fire extinguisher using the 50# spring scale. The weight of a fully charged fire extinguisher is stamped on the side of the valve body. If the difference in weight is more than 1½ pounds under the weight stamped on the side of a valve body, the fire extinguisher shall be replaced. Reseal fire extinguisher if the difference in weight is acceptable.

3. Check the fire extinguisher visually for signs of damage. Damaged fire extinguishers shall be replaced.

4. Punch card for the applicable month and replace any missing cards.

5. Verify that access to the fire extinguisher is clear.

DRY CHEMICAL PORTABLE FIRE EXTINGUISHERS
Monthly Inspection Detailed Procedure

1. Check that the correct type of fire extinguisher is in the designated location. Replace any missing/inoperable fire extinguishers.

2. Check that the seal is intact. If the seal is broken and the plunger, if applicable, is in the down position, check the charge bottle to see if it has been fired. To do this, squeeze the nozzle to find out if the fire extinguisher is charged or under pressure. Check hose for packed chemical by flexing hose. If there is no pressure then proceed and remove charge bottle. If the seal on the charge bottle is still intact, reassemble extinguisher and put on the new seal. If the seal on the charge bottle is broken, take the whole extinguisher out of service and replace it with a spare.

3. Check those extinguishers with a red plunger to assure that the plunger is down. A charged or pressurized fire extinguisher plunger would be in the up or visible position. If the plunger is up but the seal is not broken, follow the above procedure for checking the charge bottle. If the charge bottle is still intact and the fire extinguisher has not been pressurized, remove the top of the fire extinguisher and pull the plunger down. Reassemble and reseal the acceptable fire extinguisher. Replace fired or charged fire extinguishers.

4. Check fire extinguisher for signs of damage. Damaged extinguishers shall be replaced.

5. Punch card for the applicable month and replace any missing cards.

6. Verify that access to the fire extinguisher is clear.

HALON AND PRESSURIZED DRY CHEMICAL EXTINGUISHERS
Monthly Inspection

1. Check gauge indication and ensure tank pressure is in green band.

2. Check hose and valve for damage and ensure extinguisher has a seal.

3. Punch card for monthly inspection and record inspection on data sheet.

4. Verify that access to the fire extinguisher is clear.

WHEELED N_2 CHARGED DRY CHEMICAL FIRE EXTINGUISHER
Monthly Inspection Detailed Procedure

1. Check that the fire extinguisher is in its proper location. Relocate misplaced units.

2. Check the pressure gauge on the N_2 bottle. The pressure reading should be in the black portion of the gauge. This pressure is greater than 1500 PSI. Tanks which read in the red or under 1500 PSI shall be replaced.

3. Check that the pin is properly located in the hand wheel on the N_2 bottle valve and that the seal is intact. If the seal is broken or the pin has been removed, check further to verify if unit may have been fired. Replace pin and reseal if unit has not been fired. Fired units shall be taken out for servicing even if the N_2 bottle pressure gauge still shows a pressure of more than 1500 PSI.

4. If it appears that the unit may have been fired remove the hose and thoroughly inspect it. If the hose is packed with dry chemical clean the hose prior to re-racking.

5. Check the unit visually for signs of damage. Damaged units should be replaced.

6. Punch card for the applicable month and replace any missing cards.

7. Verify that access to the fire extinguisher is clear.

SEMI-ANNUAL INSPECTION OF 150 LB. AND 350 LB. WHEEL UNITS

1. Check for proper location and ensure area is clear of obstructions.

2. Remove cover and check wheel operation.

3. Check nitrogen tank pressure. Remove from service if nitrogen tank pressure is unacceptable.

4. Check nozzle for operation and presence of powder. If powder is present, replace unit. Ensure hose is wrapped neatly (has not been pulled and put back incorrectly).

5. Invert unit to mix powder and return to upright position.

6. Remove cap and check powder. If powder balls exist, they should crumble if dropped from 6 inches. (If powder balls do not crumble, replace unit.) Replace cap.

7. Check high and low pressure primary lines for cuts, cracks and distortion.

8. Dust cylinder and check cylinders for:

   a. Dents.
   b. Corrosion.
   c. Labels - Manufacturer.
      - Picturesque fire identification labels.
   d. Hydrostatically tested in last:
      - 12 years for chemical cylinder.
      - 5 years for nitrogen cylinder.
   e. Arc welds or flashes.

9. Update inspection card for monthly and semiannual inspections. Record inspection on data sheet.

NOTE If the extinguisher does not meet the above acceptance criteria, replace the extinguisher and note the deficiency/ replacement under comments.

SEMIANNUAL INSPECTION OF 5 LB. CARTRIDGE EXTINGUISHERS

1. Check cylinder for:

   a. Dents.
   b. Corrosion.
   c. Hydrostatically tested in last 12 years.
   d. Labels - Manufacturer.
      - Picturesque fire identification labels.
   e. Arc welds or flashes.

2. Check hose for:

   a. Cracks.
   b. Cuts.
   c. Distortion.
   d. Nozzle operation.

3. Remove cap and cartridge.

4. Weigh cartridge and inspect cartridge for corrosion and damage to frangible disc. Replace cartridge if disc is damaged or cartridge is below minimum weight listed on cartridge.

5. Check lever operation and install cartridge.

6. Insure chemical is powdery and not caked. Replace cap and reseal. Update inspection card for monthly and semiannual inspections. Record inspection on data sheet.

NOTE If the extinguisher does not meet the above acceptance criteria, replace the extinguisher and note the deficiency/ replacement under comments.

SEMIANNUAL INSPECTION OF CO2 FIRE EXTINGUISHERS

1. If applicable, check extinguisher location. The hanger must be attached solidly and the area be free of obstructions.

2. Check hose for:

   a. Conductivity.
   b. Cracks.
   c. Cuts.
   d. Distortion.
   e. Coupling attachment.

3. Check horn for:

   a. Cracks.
   b. Distortion.

4. Clean cylinder (dust) and inspect for:

   a. Dents.
   b. Corrosion.
   c. Arc welds or flashes.
   d. Hydrostatically tested in last 5 years.
   e. Labels - Manufacturer.
   - Picturesque fire inspection labels.

5. Check band and clamp for:

   a. Proper horn fit (wrong fit will damage horn).
   b. Corrosion.
   c. Missing screws.

   Correct deficiencies or replace extinguisher.

6. Check valve for:

   a. Hose connection at valve is straight and hose is properly attached (damaged connection could make a rocket out of unit when discharged).
   b. Pin should be straight and moveable.
   c. Handle rivets intact.

7. Weigh extinguisher, weight usually stamped on valve. If extinguisher has lost more than 1½ pounds of weight stamped on the valve, replace it.

8. Seal unit and update inspection card for monthly and semiannual inspections. Record inspection on data sheet.

NOTE If the extinguisher does not meet the above acceptance criteria, replace the extinguisher and note the deficiency/ replacement under comments.

SEMIANNUAL INSPECTION OF CARTRIDGE OPERATED EXTINGUISHERS
(Other Than 5 Lb. Extinguishers)

1. If applicable, check extinguisher location. The hanger must be attached solidly and the area be clear of obstructions.

2. Invert unit and remove cartridge cover and cartridge.

3. Weigh cartridge and inspect cartridge for corrosion and damage to frangible disc. Replace cartridge if disc is damaged or cartridge is below minimum weight listed on cartridge.

4. Clean cylinder (dust) and inspect the cylinder for:

   a. Dents.
   b. Corrosion.
   c. Hydrostatically tested in last 12 years.
   d. Arc welds or flashes.
   e. Missing screws from nozzle bracket.
   f. Labels - Manufacturer
      - Picturesque fire identification labels.

   Replace the fire extinguisher if any deficiencies exist.

6. Inspect hose for cuts, cracks and correct nozzle operation. Replace the fire extinguisher if any deficiency exists.

7. Set cylinder upright and remove cap. Blow in nozzle and check for disturbance in chemical. If nozzle is plugged replace extinguisher.

8. Replace cap, cartridge and cartridge cover. Seal unit and update inspection card for monthly and semiannual inspections. Record inspection on data sheet.

NOTE If the extinguisher does not meet the above acceptance criteria, replace the extinguisher and note the deficiency/ replacement under comments.

[illegible]

[illegible]

[illegible]

SEMI-ANNUAL INSPECTION OF HALON AND PRESSURIZED DRY CHEMICAL EXTINGUISHERS

1. Dust and inspect cylinder for:

   a. Dents
   b. Corrosion
   c. Hydrostatically tested in last 12 years.
   d. Labels - Manufacturer
      - Picturesque Fire Identification Labels
   e. Arc Welds or Flashes

2. Check hose for:

   a. Cuts
   b. Cracks
   c. Distortion
   d. Connection at Tank

3. Weigh extinguisher, weight and tolerances are on label.

4. Check gauge indication and ensure tank pressure is in green band.

NOTE If the extinguisher does not meet the above acceptance criteria, replace the extinguisher and note the deficiency/ replacement under comments.

5. Update the inspection card and data sheet for the monthly and Semi-Annual Inspections.