

U. S. NUCLEAR REGULATORY COMMISSION
REGION V

Report Nos. 50-528/88-06, 50-529/88-06, 50-530/88-06

Docket Nos. 50-528, 50-529, 50-530

License Nos. NPF-41, NPF-51, NPF-74

Licensee: Arizona Nuclear Power Project
P. O. Box 52034
Phoenix, Arizona 85072-2034

Facility Name: Palo Verde Nuclear Generating Station Units 1, 2, and 3

Inspection at: Phoenix, Arizona

Inspection Conducted: February 1-5, 1988

Inspector: Charles Ramsey
C. Ramsey, Reactor Inspector

3/9/88
Date Signed

Approved by: S. Richards
S. Richards, Chief
Engineering Section

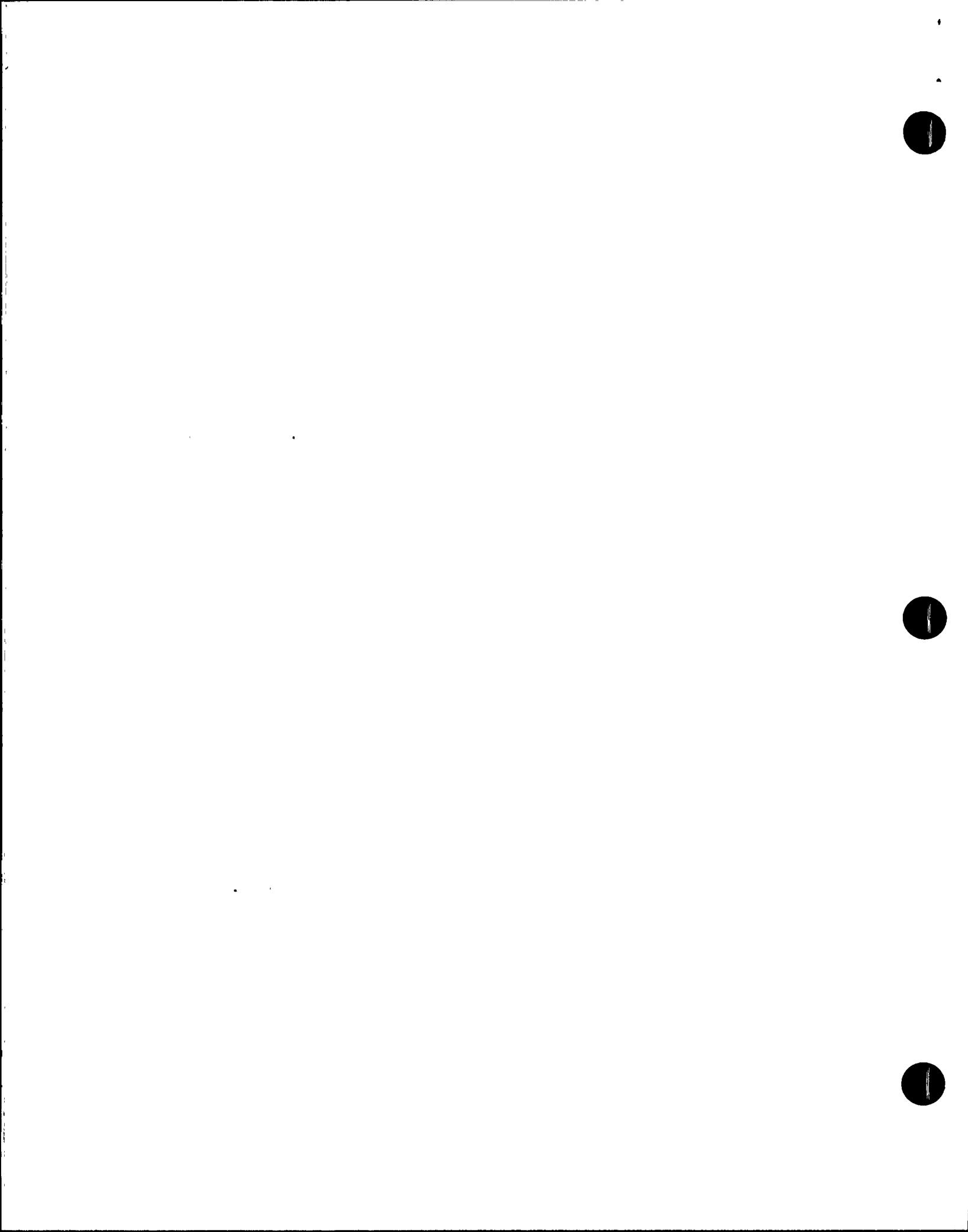
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Summary:

Inspection During the Period February 1-5, 1988 (Report Nos. 50-528/88-06,
50-529/88-06, and 50-530/88-06)

Areas Inspected: An unannounced inspection of Units 1, 2, and 3 to close out previously identified open items and to evaluate the adequacy of the implementation of the routine fire protection program for Units 1, 2, and 3. Inspection module Nos. 92701, 64704, and 30703 were used.

Results: In the areas inspected, no violations of NRC requirements were identified.



DETAILS

1. Persons Contacted

Arizona Public Service Company

*E. E. Van Brunt, Executive Vice President
*J. G. Haynes, Vice President
*W. F. Quinn, Nuclear Safety and Licensing Director
*L. G. Papworth, Quality Assurance Director
*T. J. Shriner, Compliance Manager
*P. J. Coffin, Compliance Liaison
*F. Garrett, Senior Fire Protection Engineer
*H. E. Bieling, Emergency Planning
 D. Yows, Emergency Planning Manager
 C. Belford, Fire Protection Supervisor
*J. E. Kirby, Site Services

NRC

T. Polich, Senior Resident Inspector

*Denotes those attending the exit meeting of February 5, 1988.

2. Licensee Actions on Previous Inspection Findings

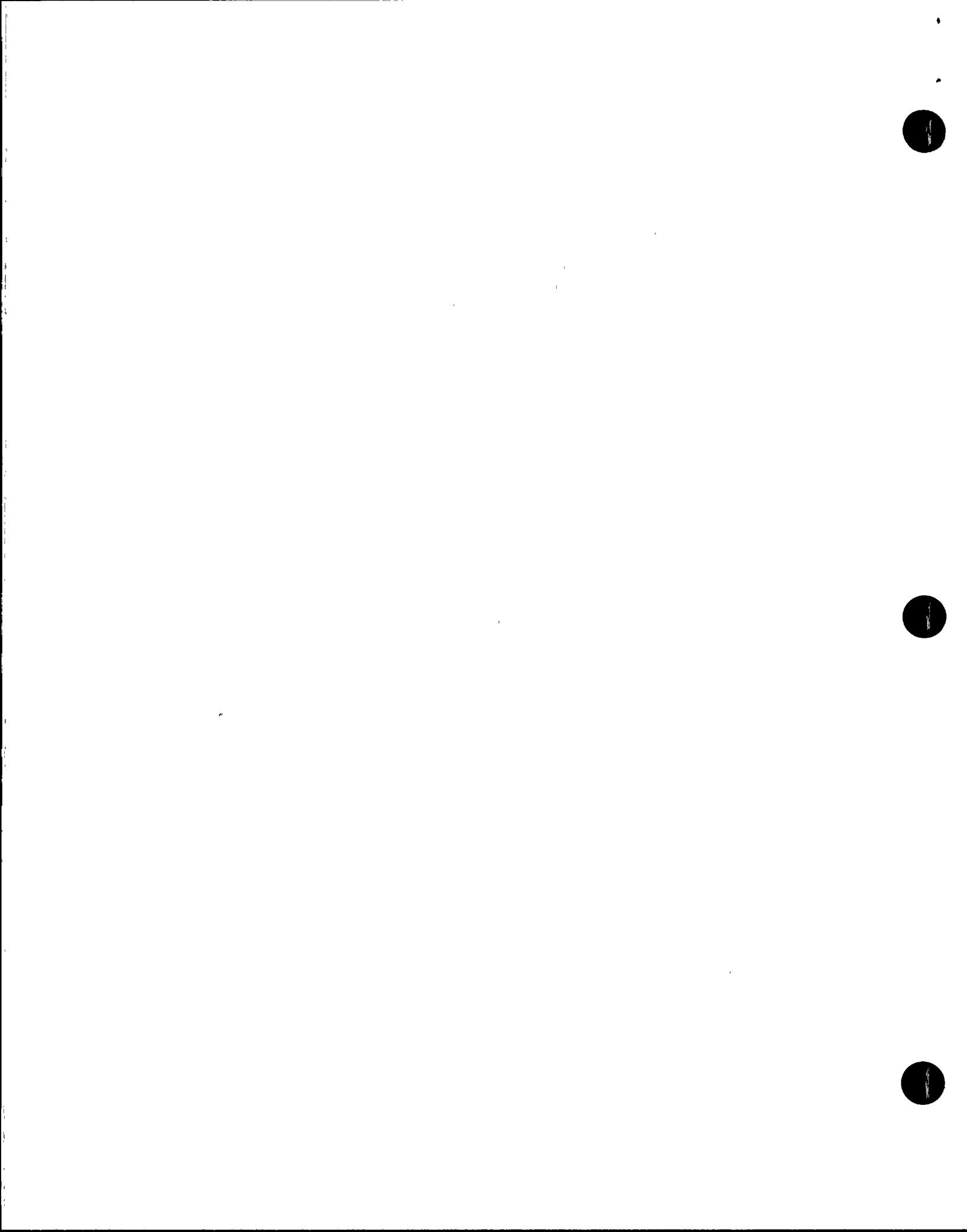
A. (Closed) Violation 529/86-33-09, "Failure to Properly Protect Safe Shutdown Cables with Thermolag Fire Barrier System."

In response to the violation, to address the concern for potential thermal shorting of safe shutdown circuits, the licensee performed an extensive evaluation of the thermal lag installation protecting safe shutdown circuits in all three units. The evaluation concluded that the appropriate engineering criteria had not been applied. Therefore, the licensee upgraded the thermal lag fire barrier installation to the appropriate criteria in most areas in Unit 3. In other areas, the licensee performed an evaluation of the fire potential affecting the protected safe shutdown circuits and determined that the existing thermolag installation provided equivalent protection for the circuits. Where such an evaluation was made based on fire potential, the assumptions made by the licensee were supported by actual fire testing results.

Based on the licensee's corrective actions, this item is considered closed.

3. Implementation of Units 1, 2, and 3 Fire Protection Program Requirements

Units 1, 2, and 3 are required to implement and to maintain in effect all provisions of the NRC approved fire protection program by Condition No. 1.C(7) of Facility Operating License NPF-41; Condition No. 1.C(7) of Facility Operating License No. NPF-51, and Condition No. 1.F of Facility Operating License No. NPF-74, respectively. The results of the



inspector's assessment of the licensee's activities in this area are as follows:

A. Organization and Staffing

The organizational responsibilities for implementing the routine aspects of fire protection for all three units are prescribed in the licensee's organizational structure by job title and classification, job position descriptions and administrative controls governing daily plant operations. The fire protection program activity is assigned to the Manager of Emergency Planning who reports directly to the Site Services Director for line implementation. The Site Services Director reports to the Executive Vice President, who has the overall responsibility for implementing the program.

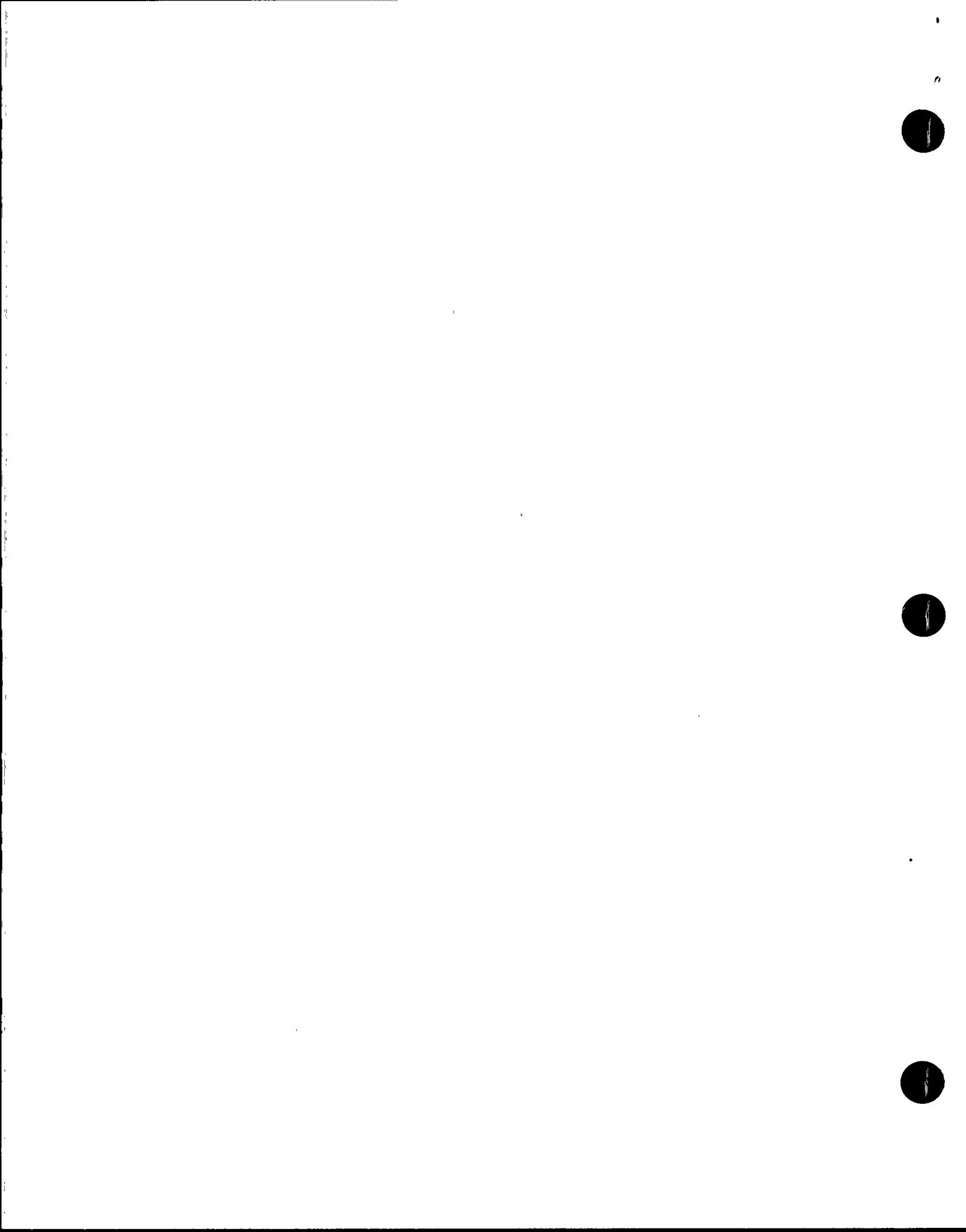
Line and staff personnel directly responsible for implementing the program appear to be qualified by training and experience in fire protection. Each of these position descriptions contains specific performance criteria that is intended to assure acceptable performance by individuals filling the positions. However, the overall effectiveness of the licensee's program appears to have been adversely affected by the performance of groups outside of the fire protection area. A mixture of weaknesses have been identified by the licensee's Quality Assurance Audit activities in the area of interfacing organizations. In particular, proper implementation of a design change control program and a continuing backlog of fire protection related work requests, appear to be areas in need of increased management attention (this is further discussed in paragraphs 4.A and 4.B of the report).

No violations or deviations were identified.

B. Automatic Pre-Action Fire Suppression Systems Protecting Nuclear Safety-Related and Safe Shutdown Components

There are approximately 45 automatic Pre-Action Fire Suppression System installations (15 in each unit) protecting nuclear safety-related and safe shutdown components at Palo Verde. According to the licensee's FSAR Table 9B.3-1 description of these systems, as a minimum, they were designed and installed to conform to NFPA Standard No. 13-1976.

The inspector performed followup on a licensee's Quality Assurance Audit (No. 87-021) finding concerning the licensee's supervision of sprinkler piping for the pre-action systems with the plant's service air system. The audit finding indicates that the actual installation arrangement of the systems creates "Double Interlocked Dry Systems" rather than "Single Interlocked Preaction Systems." That is, fire detector actuation combined with relief of high air pressure in the system piping is required to pressurize the system with water rather than the single actuation of a fire detector. It is also indicated in the audit finding that this arrangement will not work because the high air pressure in the sprinkler system piping will not allow the system deluge valve to open and pressurize



the system with water because the high air pressure in the system would hold the check valve closed (located downstream of the system deluge valve) until a sprinkler head exposed to fire operates and allows the air in the sprinkler piping to bleed off through the opened sprinkler head. This would create the potential for the systems to fail to operate or operation would be delayed for an unknown period of time during an actual fire.

The inspector reviewed the system manufacturer's technical data, drawings, associated working plans for the installations and performed an investigation of the Unit 1 pre-action systems. The inspector's determinations about the systems are as follows:

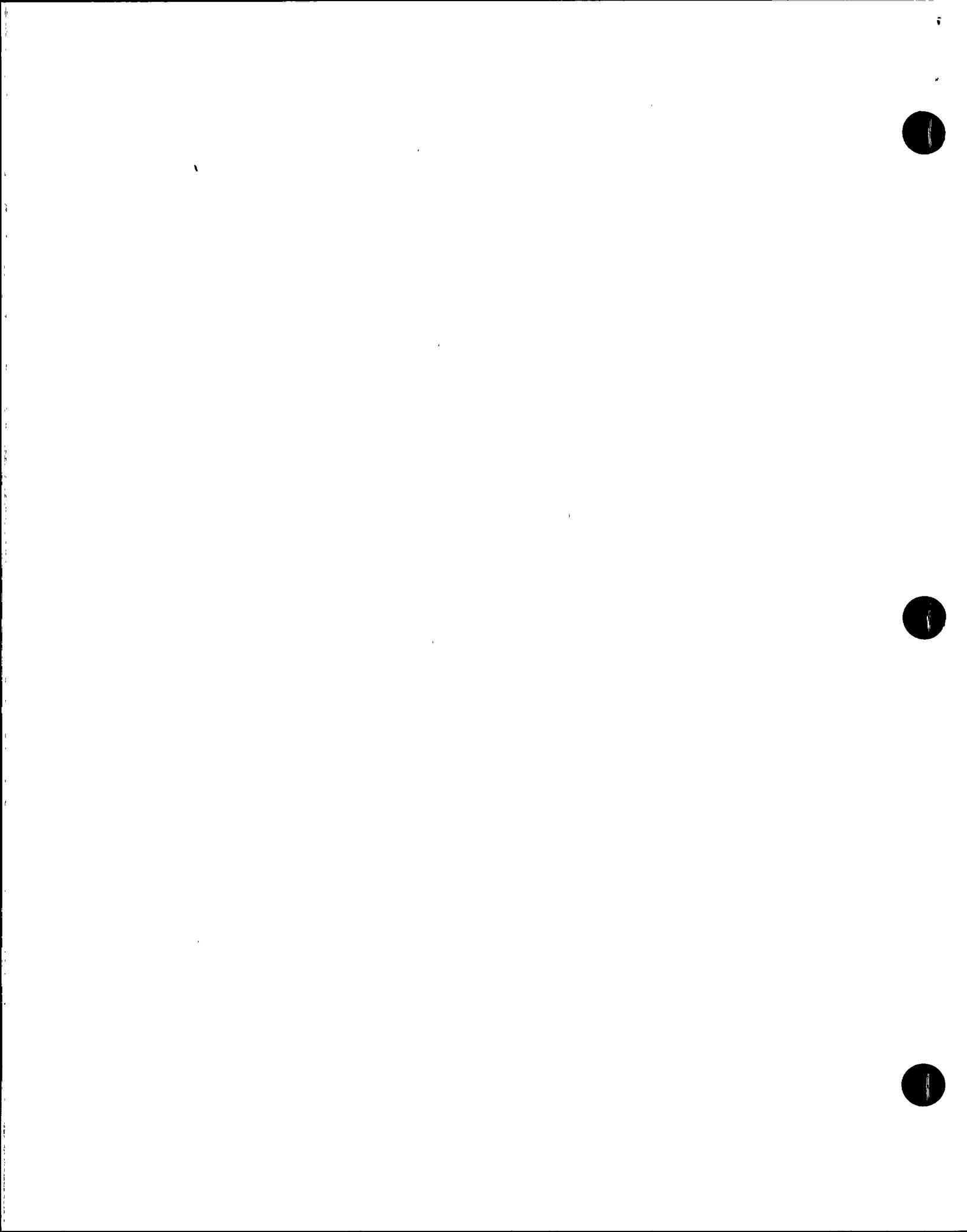
- Manufacturer's System Description

Viking Sprinkler Corporation's technical design data describes the systems as a single interlocked supervised, pre-action system using a model D-5 deluge valve, controlled by an electric release system. The manufacturer's technical data indicates that the system piping is pneumatically pressurized for supervisory purposes only. That is, if the system piping or sprinkler is damaged, the air pressure in the piping is reduced and an alarm is actuated. When an electric signal is provided by the actuation of a fire detector, a solenoid valve opens and an electric alarm is also provided but, in addition, the priming chamber of the deluge valve is vented faster than water is supplied through a strainer orifice check valve, allowing the deluge valve to open and fill the system piping with water. The discharge pressure of the deluge valve holds a Power Operated Relief Valve (P.O.R.V.) open, continuously venting the priming chamber and preventing the deluge valve from automatically resetting. If this occurs, a water flow alarm is also given by an alarm pressure switch.

The manufacturer's technical data provides specific instructions and warnings to refer to applicable codes and standards for proper installation. Upon the inspector's request, the licensee was unable to provide complete objective evidence that the systems and supervisory air supply were installed in accordance with the manufacturer's instructions.

- Maximum Permissible Supervisory Air Supply Pressure

Governing code NFPA Standard No. 13-1976 is not specific regarding the maximum permissible air supply pressure that should be maintained for supervisory air on pre-action sprinkler systems. The manufacturer's technical data refers to the dry pipe design section of the applicable code for air supply design. This section (5-2.7) of NFPA 13-1976 requires that the air pressure in a dry-pipe system be maintained 20 PSI in excess of the calculated trip pressure of the dry pipe valve, based on the highest normal water pressure of the system supply.



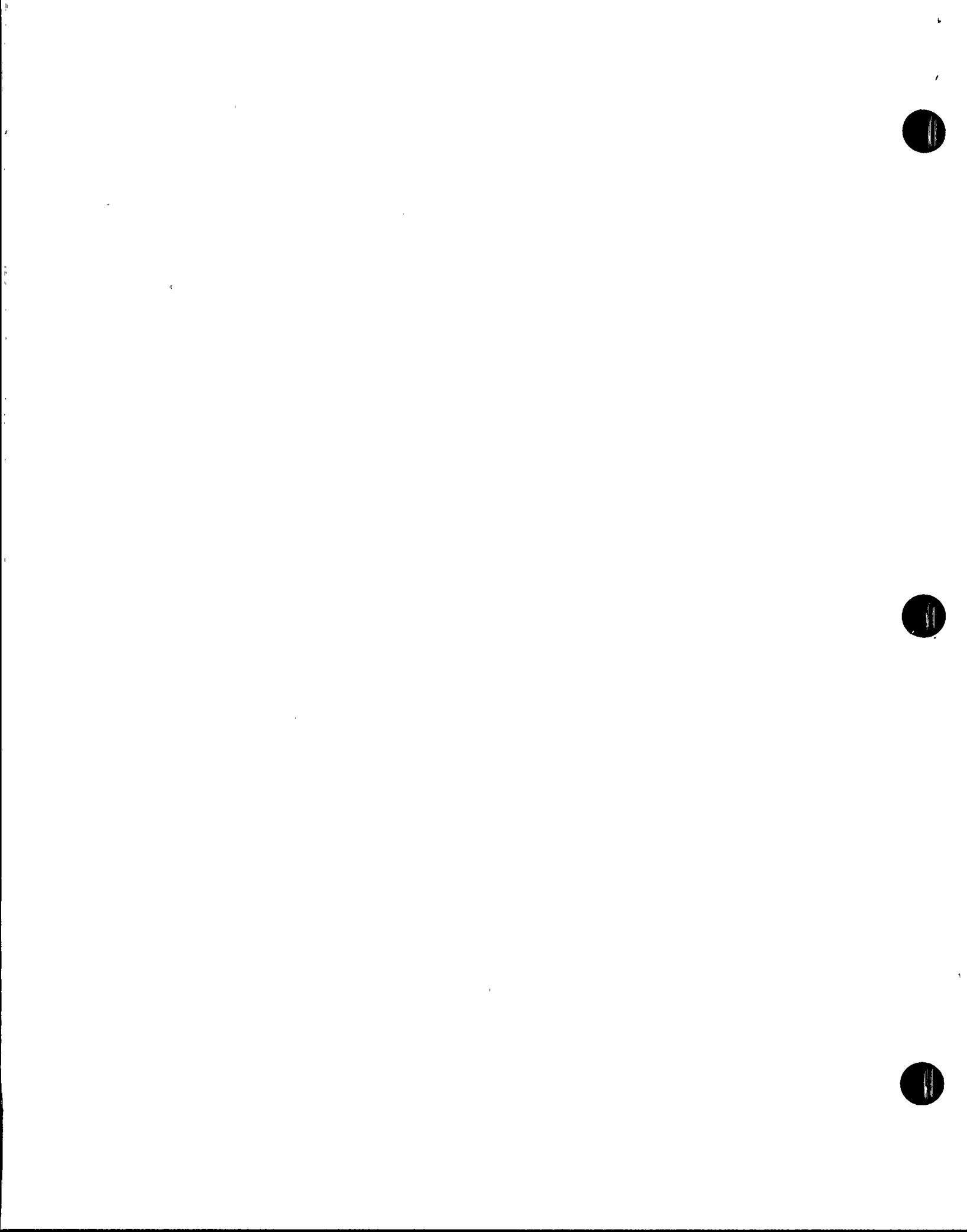
When placing the licensee's pre-action systems in service, the manufacturer's technical data indicates that an air pressure of 20 psi is to be established in the sprinkler piping. During the inspection, the inspector observed air pressure gauge readings of greater than 50 psi on the Unit 1 lower and upper cable spreading room pre-action systems. The licensee's Quality Assurance Audit No. 87-021 finding cited one case where this air pressure was as high as 70 psi.

In response to the concern over the observed high air pressures in the systems, the licensee's disposition of Engineering Evaluation Report (EER) No. 87-FP-078 concludes that "The system is designed such that the loss of air through a pipe break or open sprinkler head will result in a decrease in air pressure in the piping. When the low pressure setting (7 psi) is reached, both local and remote alarms are actuated. A higher air pressure setting may delay or prevent the alarm condition." Therefore, "The air pressures should be kept within the recommended range of 15-25 psi." The disposition further concludes that "The system should not be considered out of service as a result of the higher air pressure, since deluge valve operation will be unaffected. The inspector determined that this statement in the EER disposition failed to provide sufficient technical basis to satisfy the concern raised by the audit finding, as discussed below.

- Potential for Delayed Operation or Failure of the Systems to Perform as Intended

The licensee's disposition of EER No. 87-FP-078 acknowledges that the higher air pressures in the sprinkler piping may delay or prevent an alarm condition when sprinklers or sprinkler piping are damaged. However, the EER disposition did not adequately address the impact that high air pressure has on the operation of the deluge valve. Based on the inspector's understanding of the system design principles, it appears possible that the higher air pressures could impede system fire suppression to some extent by the service air system air compressors attempting to make up any detected loss in air pressure.

Furthermore, by apparent system design, to fill the system with water as intended, the water force (approximately 100 psi) beneath the deluge valve is greater than the force of air pressure in the system piping (50 or 70 psi). The system piping below and above the deluge valve is of the same size in diameter, and a rubber seat check valve installed in the system piping above the priming chamber and deluge valve prevents air and water pressure from coming into contact with each other prior to the deluge valve opening. Therefore, if the priming chamber vents faster than water is supplied through the strainer orifice check valve, the deluge valve will open upon fire detector actuation and fill the system with water to the



extent that compressed air trapped in the system piping will permit.

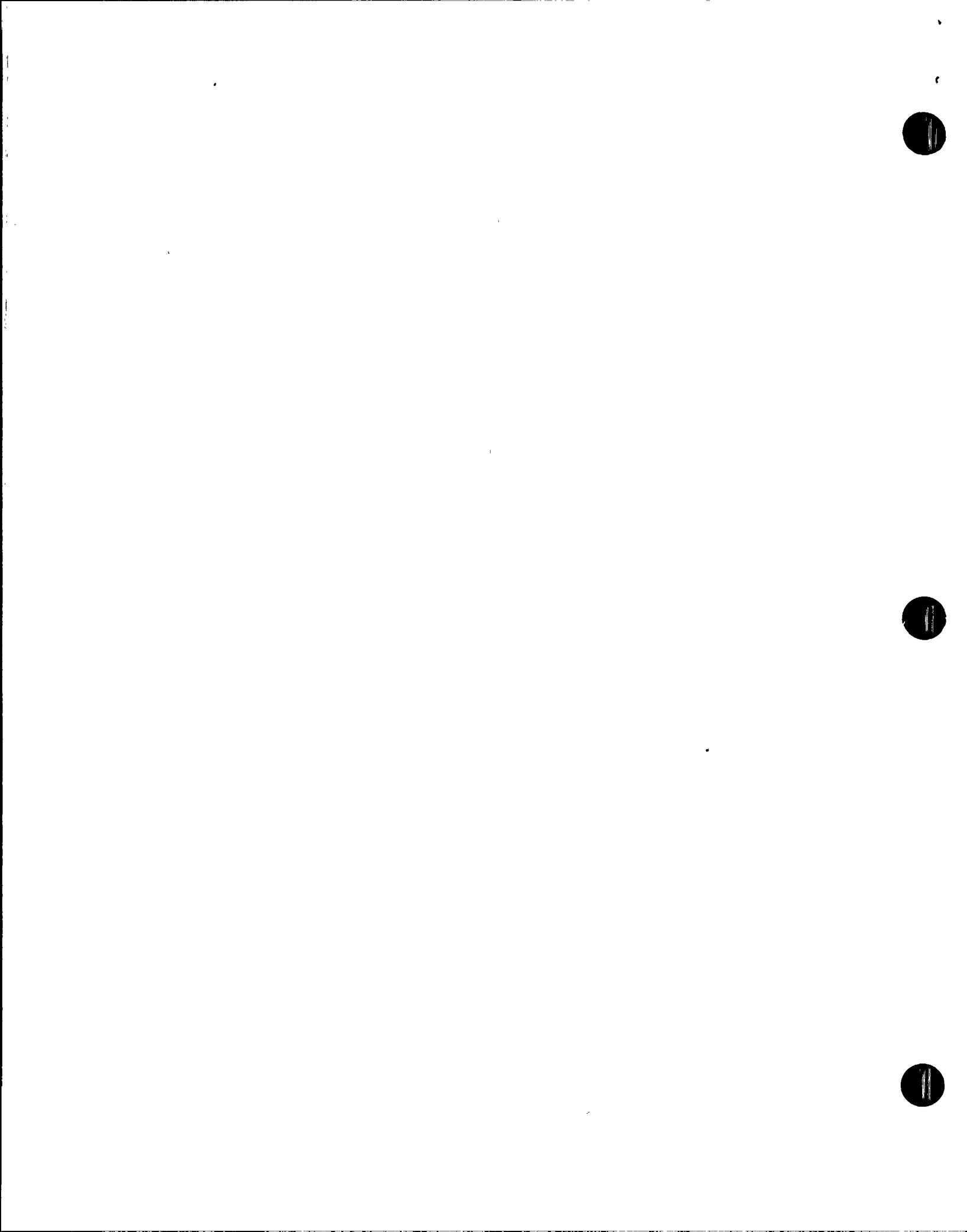
The licensee could not determine the amount of compressed air that would be trapped in a system and the time threshold for this air to be exhausted before water could be discharged from the most remote opened sprinkler head involved in fire. For dry pipe sprinkler systems, governing code NFPA 13-1976 requires that the systems be constructed so that the water will reach the furthest sprinkler head within one minute for each 400 feet of common sprinkler main. The code and the manufacturer's technical data are silent on this time limiting performance criteria for the licensee's pre-action systems.

- System Performance Test Results

The manufacturer's technical data and governing code require that sprinkler system discharge test be performed periodically, and that a contractor's material and test certificate certify that initial pre-operational field testing was properly conducted. Plant technical specifications also require that these systems be functionally tested and demonstrated operable every 18 months. In response to the inspector's request for test results that verify operability of the systems, the licensee indicated that contractor's material and test certificates were not available and periodic testing (i.e., technical specification surveillance tests) did not include actual discharge tests flowing water through the system. Therefore, the licensee could not provide evidence (based on actual system operation) that these systems have in the past or will now perform their intended function.

During the inspection, the inspector further requested that the licensee perform functional discharge testing of the largest capacity Pre-Action Fire Suppression System installed in Unit 1. The licensee provided the inspector with drawings of three Unit 1 systems, of which the lower cable spreading room system with approximately 100 feet of sprinkler main piping and 56 sprinkler heads was the largest system. The inspector requested that the licensee perform functional discharge testing of this system. However, the licensee's position was that this was not possible because the process of draining the system and restoring it back to service after the test would place an unplanned hardship on licensee personnel resources. The licensee further indicated that this testing would be scheduled and performed at a later date and the results documented for Region V to review.

This is considered an unresolved item (528/88-06-01).



C. Local Automatic Fire Suppression Provided for Cable Tray Protection Negated By Cable Tray Covers

Regarding protection for electrical cable trays, the licensee's response to NRC position No. D.3(c) of Branch Technical Position APCSB 9.5-1 states in part, "PVNGS provides automatic pre-action sprinkler systems in the Auxiliary Building areas which have significant cable concentrations." The licensee also states in Section 9.5-1 of the FSAR that this protection is provided in the upper and lower cable spreading rooms and east and west penetration rooms.

The inspector observed these installations in the Unit 1 upper and lower cable spreading room and east and west penetration rooms. The pre-action system sprinklers appear to be adequately positioned to provide effective fire suppression for the cable trays. However, this protection is negated by metal cable tray covers over the cable trays. Because of the tray covers, fires originating in the cable trays may not actuate the sprinklers and, if activated, water from the sprinklers would be discharged on the tray covers rather than the cables beneath them.

The licensee indicated that this condition existed because of conflicting NRC requirements. To satisfy Regulatory Guide 1.75 separation requirements, the cable tray covers were installed after the sprinkler systems had been installed. The licensee has been unable to determine if sprinklers alone, or the tray covers alone, can satisfy the intent of both design requirements.

This is considered an open item (528/88-06-02) and is being referred to NRR for resolution.

D. Fire Detection Alarm System

The licensee's response to position No. E.1 of NRC Branch Technical Position APCSB 9.5-1 requires the licensee to install a fire detection system which provides audible and visual alarms in the control room by means of a Cathode Ray Tube (CRT) which displays a printout description of any encountered alarm condition. The governing code used by the licensee for the system is NFPA Standard No. 72D-1975.

During Unit 1 control room observation, the inspector interviewed an operator on the CRT alarm system. The operator expressed a lack of confidence in the system because of the significant number of nuisance alarms received. The operator indicated that other control room operators were equally concerned about the nuisance alarms and the negative impact they have on operators' attention to reactor operations.

Normal actions taken by the control room upon receipt of an alarm consist of dispatching an auxiliary operator to the field to verify the alarm before advising the fire team to respond. Nuisance alarms

make this action necessary in order to limit the number of false alarms that the fire team responds to.

To correct this problem, the licensee indicated that an evaluation would be performed to determine if the cause is related to a system design deficiency or if the system as designed should be modified.

This is considered an open item (528/88-06-03) pending Region V verification of the licensee's corrective actions.

E. Manual Firefighting

The inspector reviewed the fire team training and response capability for compliance with NRC Position Nos. B.4 and B.5 of Branch Technical Position 9.5-1. The inspector's questions regarding the adequacy of fire team response and performance at actual fires, interior structure firefighting training and fire brigade drills were satisfactorily addressed by the licensee.

No violations or deviations were identified.

F. Addition of Radiation Contamination Area (RCA) Change Out Room on Elevation 140 Feet of the Auxiliary Building (Units 1, 2, and 3)

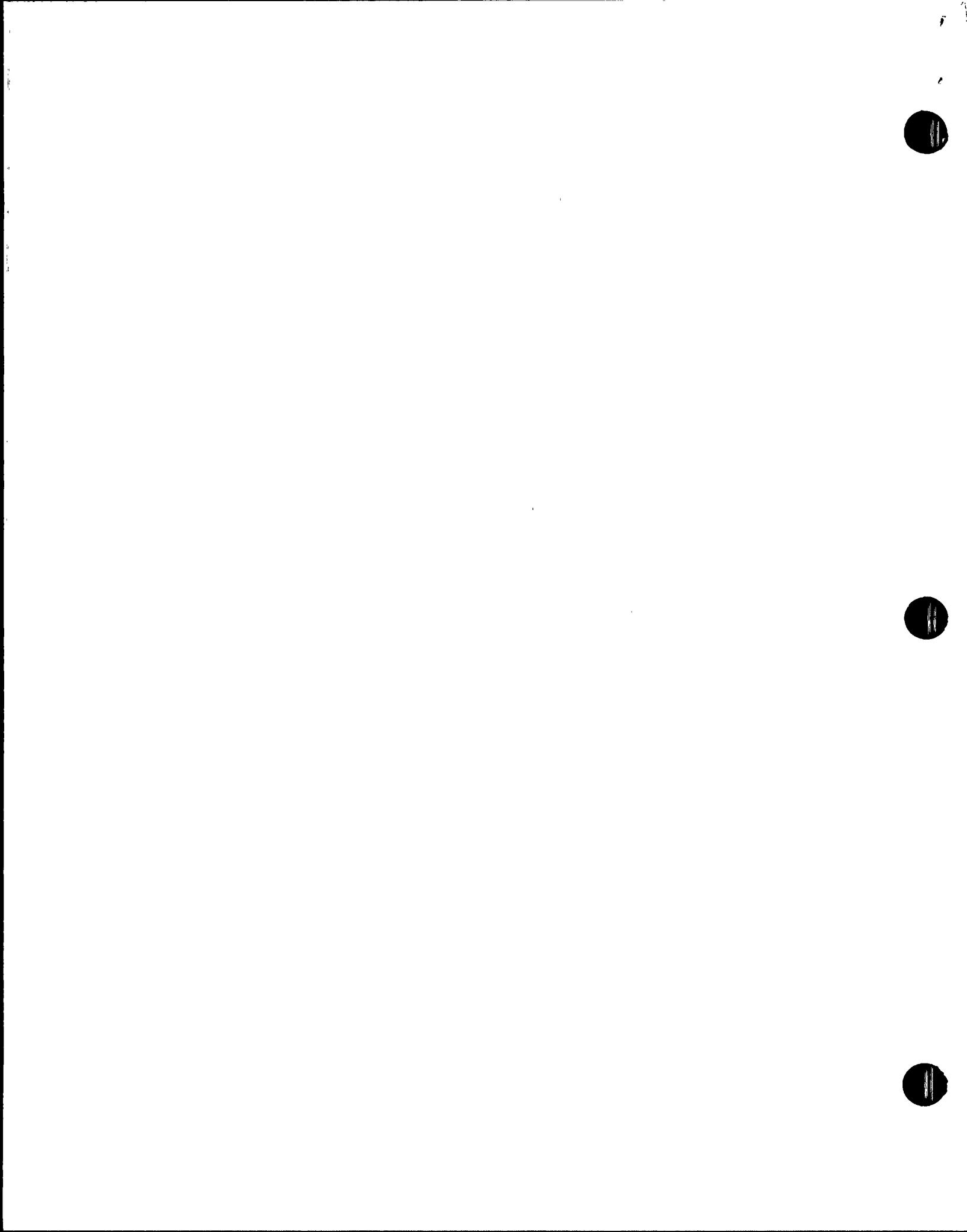
Pursuant to 10 CFR 50.59, the licensee installed a new RCA change out room in fire area XV and in fire zone 57M at elevation 140 feet of the Auxiliary Building in all three units (Ion Exchanger Access Area). The licensee estimated that the area fire potential was increased by approximately 1350 pounds of protective clothing and 300 pounds of rubber. This represents an increase in fire severity for the area from 1 minute to 18 minutes.

The inspector reviewed the licensee's fire hazard analysis (EER No. 86-ZA-031) for the additional combustible loading in fire zone 57M. The calculation is based on a total of 2025 pounds of fixed ordinary combustibles; 450 pounds of rubber and 52 pounds of plastic transient combustibles. This results in an equivalent fire severity of 18 minutes for the zone. This hazard is contained within a one hour fire rated envelope (walls, floors, and ceiling) which established the boundary for the Ion Exchanger Room. Because of this level of containment, the increase fire loading of the zone is not considered significant. However, in accordance with FSAR Section 9.5.1.1.1, the licensee had implemented fire watch compensatory measures for the absence of fire detectors in the zone.

No violations or deviations were identified.

4. Quality Assurance

The inspector reviewed the licensee's Quality Assurance Audit Report Nos. 85-025, 86-023, and 87-021. The audit reports appear to be thorough, broad in scope, and effective in assessing the controls established to provide assurance that fire protection program goals are satisfied. The audits were performed using the NRC guidance contained in Generic Letter



No. 82-21 and satisfied the criteria of Technical Specification No. 6.5.3.5 and NRC position Nos. C.1 through C.10 of Appendix A to Branch Technical Position 9.5-1.

The audit findings indicate that a number of weaknesses have been identified in the program's implementation. For example, fire protection materials were being procured as non-quality related; fire protection equipment surveillance and maintenance were not performed within the required intervals; administrative controls for welding and cutting and control of combustible materials were deficient; fire rated assemblies were not being properly maintained and requirements for installing fire detection/suppression systems were not adhered to. Corrective action for these identified weaknesses had been completed or were in the process of being addressed by the licensee. However, two weaknesses identified by the audit reports appear to require additional followup by the NRC. These are as follows:

A. Failure to Properly Review Design Changes to the Facility For Fire Protection Impact

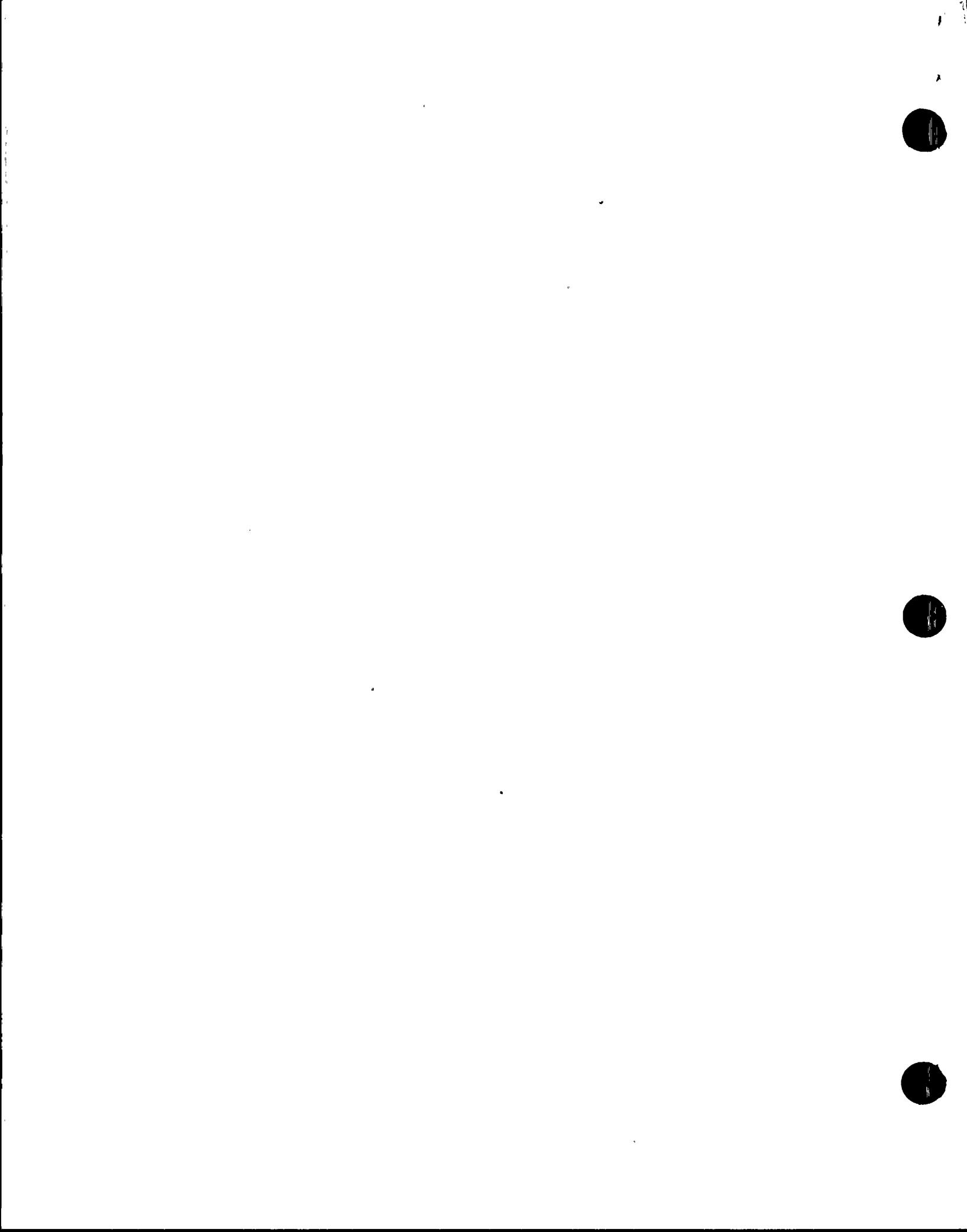
Audit Report No. 86-023, dated September 12, 1986, documents examples of the licensee's failure to describe or identify appropriate reference documents for fire protection activities that require review/analysis in design changes. This review is required by Technical Specification No. 6.5.2.1 and 6.8.1.

The Quality Assurance Department issued Corrective Action Report (CAR) No. 86-0161 for this deficiency. However, the inspector was unable to complete a review of the licensee's corrective action prior to the end of the inspection.

B. Significant Backlog of Fire Protection Equipment Related Work Request/Work Orders

Audit Report No. 87-021 documents examples of the licensee's failure to restore impaired fire protection systems and equipment to service in a timely fashion. The audit finding discusses the review of over 300 open Work Request/Work Orders for fire protection related equipment found that approximately 40 percent of these request were initiated prior to 1987. Although compensatory measures were established for these conditions, the audit report further documents the concern that these measures may be left in place indefinitely, and that many times, fire protection equipment at Palo Verde is compromised without proper consideration for its primary purpose.

During the inspection, the licensee provided the inspector with a copy of a computer listing of the subject outstanding Work Request/Work Orders which was dated February 4, 1988. Approximately 200 open fire protection related Work Request/Work Orders were listed. The licensee indicated that corrective action for this apparent programmatic weakness was under management review and would be resolved in the future.



This (items 4.A and 4.B) is considered an unresolved item (528/88-06-04) pending further licensee action and Region V review.

5. Open Items

Open items are matters which have been discussed with the licensee, which will be reviewed further by the inspector, and which involve some action on the part of the NRC, the licensee or both. Open items disclosed during the inspection are discussed in paragraphs 3.C and 3.D.

6. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. Unresolved items disclosed during the inspection are discussed in paragraphs 3.B, 4.A and 4.B.

7. Exit Interview

The inspector met with the licensee representatives at the conclusion of the inspection on February 5, 1988. The inspector summarized the scope and nature of the inspection findings at this meeting. The licensee representatives acknowledged the statements made by the inspector and the inspection was terminated.

