NFPA 805 Pilot Observations Meeting
Progress Energy Transition Status

November 7, 2006

Jeff Ertman
Paul Gaffney

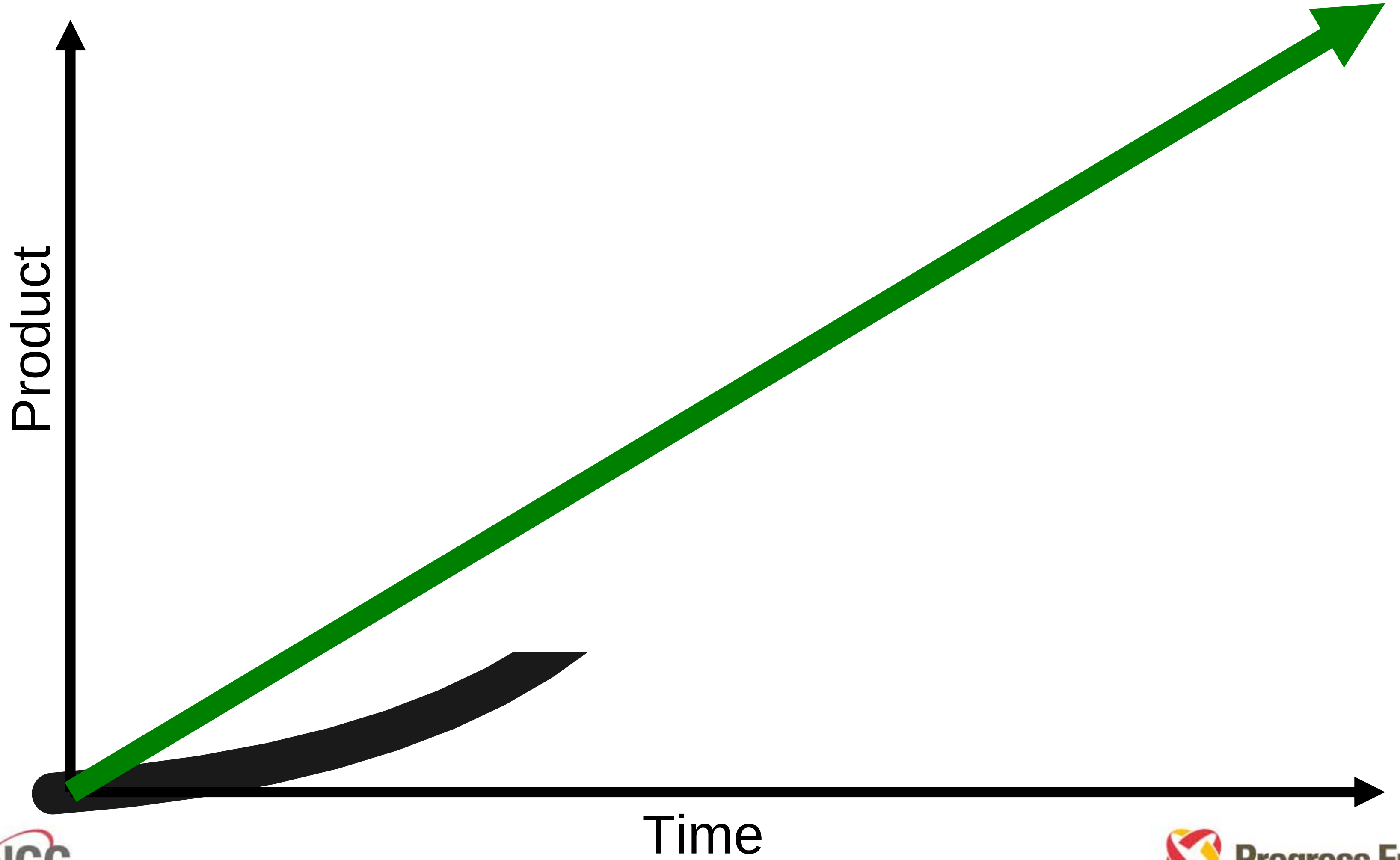
Nuclear Generation Group

Progress Energy

PE NFPA 805 Transition Status Discussion Points

- PE Objectives this meeting - Paul Gaffney
- General project information
- Harris transition plant status

PE NFPA 805 Transition Status
Project Track



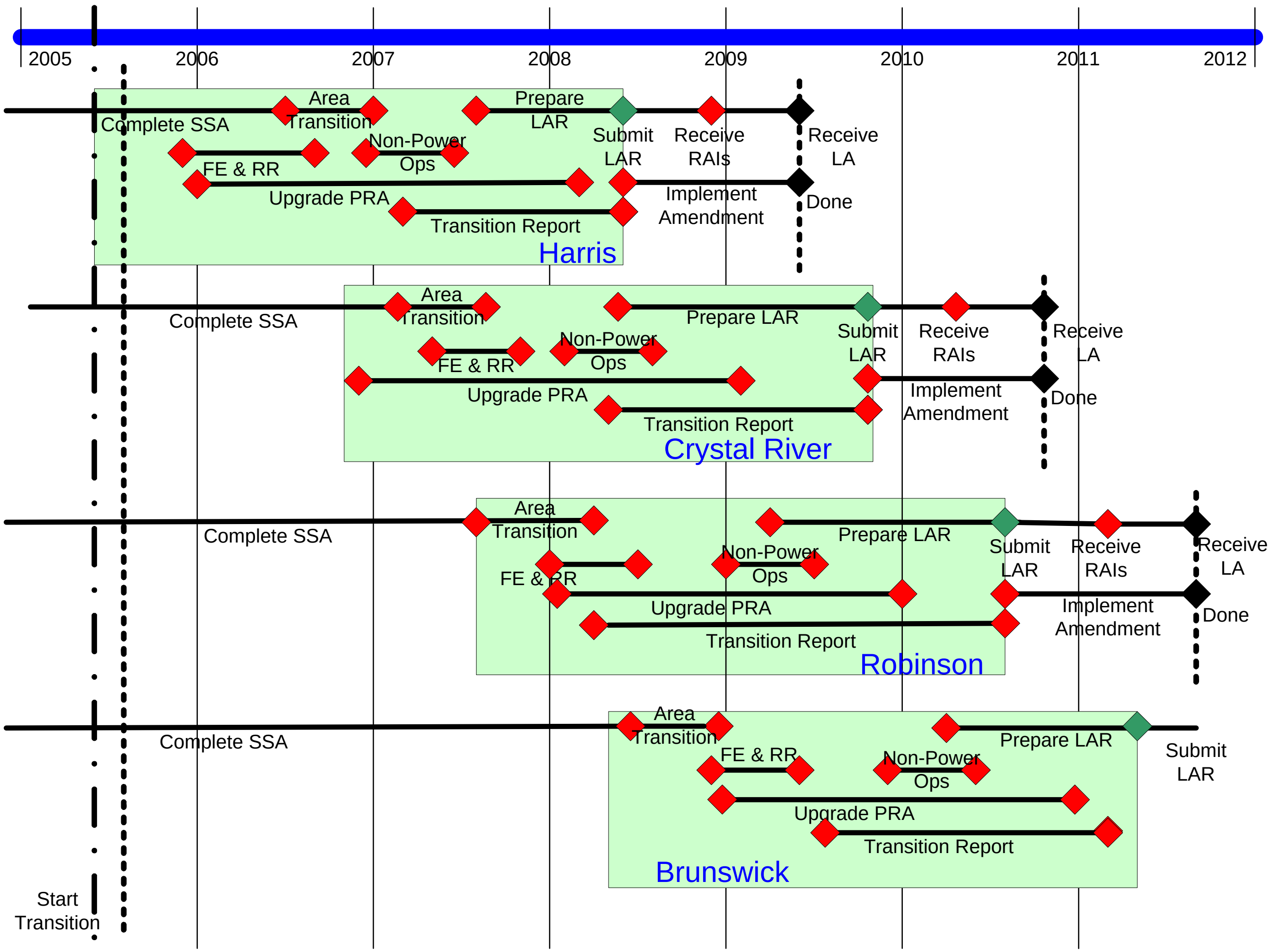
The Challenge
Progress Energy Perspective

- Open FAQs
  - FAQ 4 – Clarification on Chapter 3 / 4 Linkage
  - FAQ 8 – Evaluation Process
  - FAQ 12 – Manual Action Clarification (free from fire damage)

PE NFPA 805 Transition Status
Pilot Meeting Objectives

- Technical Presentations
- Identify FAQs with near term Pilot impacts
  - Review / establish schedule with NEI Task Force / NRC
- Clear the Parking Lot
  - Close items to FAQs where possible
    - Resolution schedule for the new FAQs
  - Identify and schedule new items
- Look ahead
  - Next meeting specific date and scope
  - Approximate meeting dates next 12 months
    - Dates and anticipated scopes

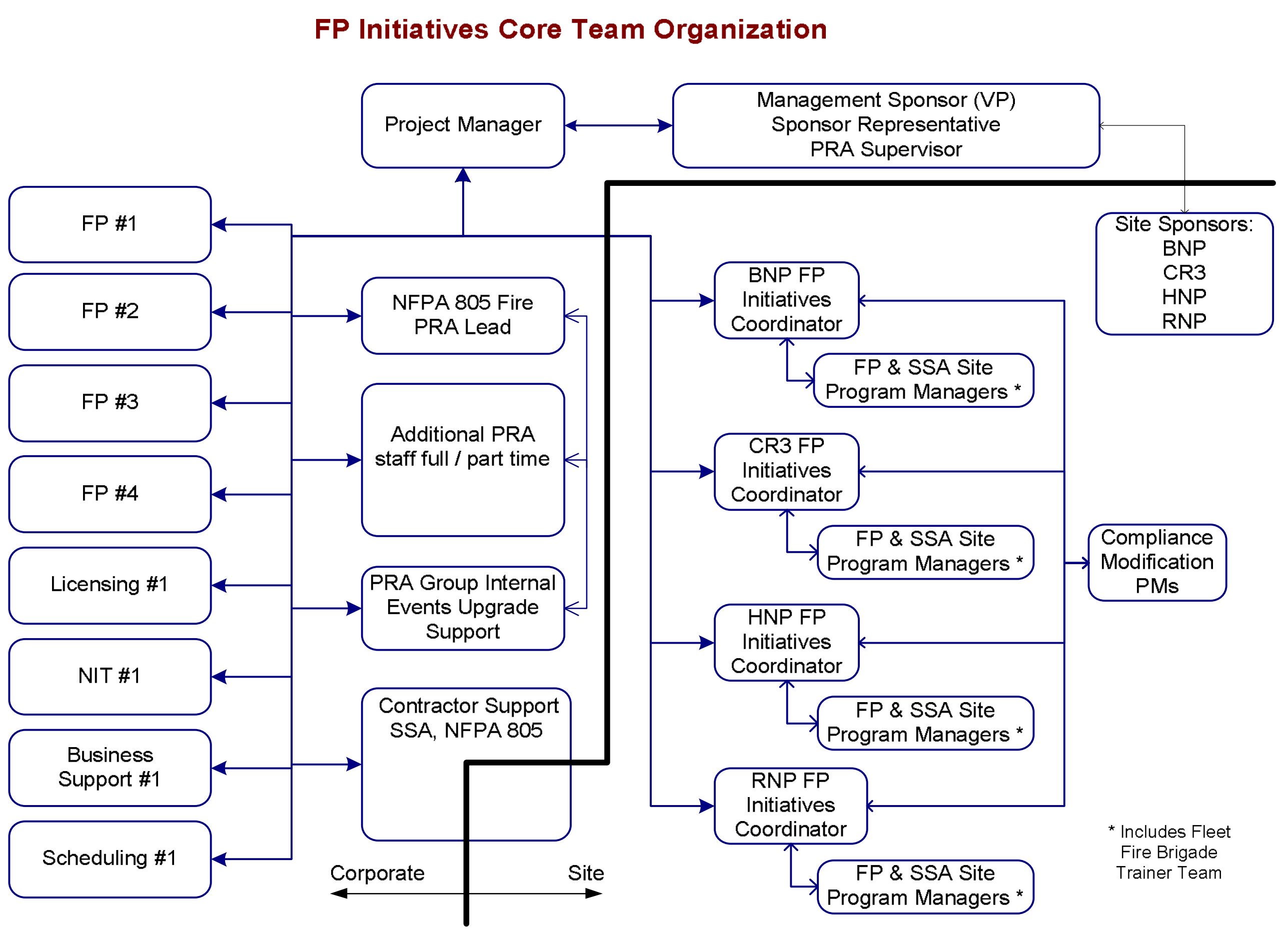
PE NFPA 805 Transition Status
General Information – Overview Plan



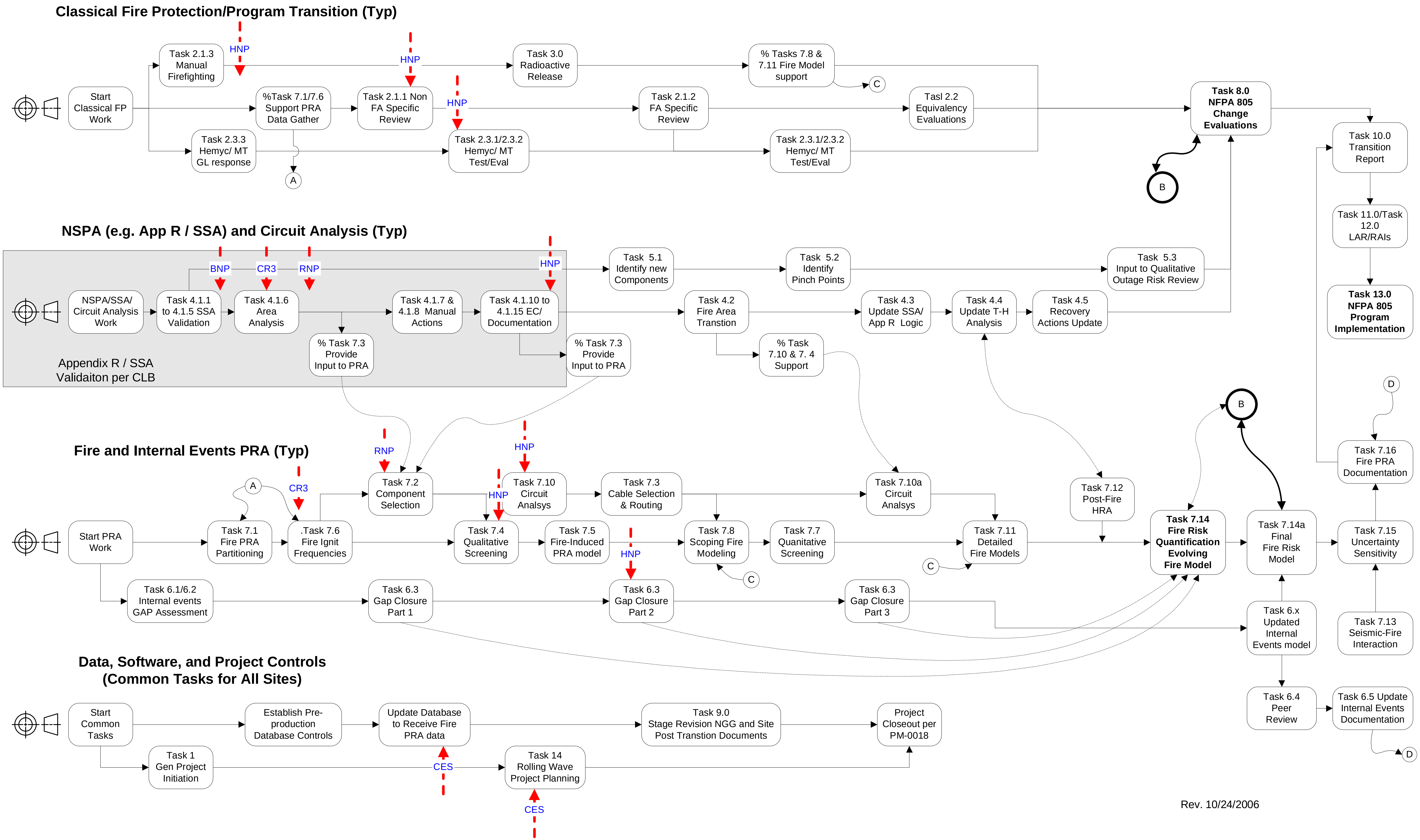
PE NFPA 805 Transition Status
General Information – Fleet Plan LARs

- HNP LAR May 2008
- CR3 LAR August 2009
- RNP LAR August 2010
- BNP LAR August 2011

PE NFPA 805 Transition Status
General Information – Organization

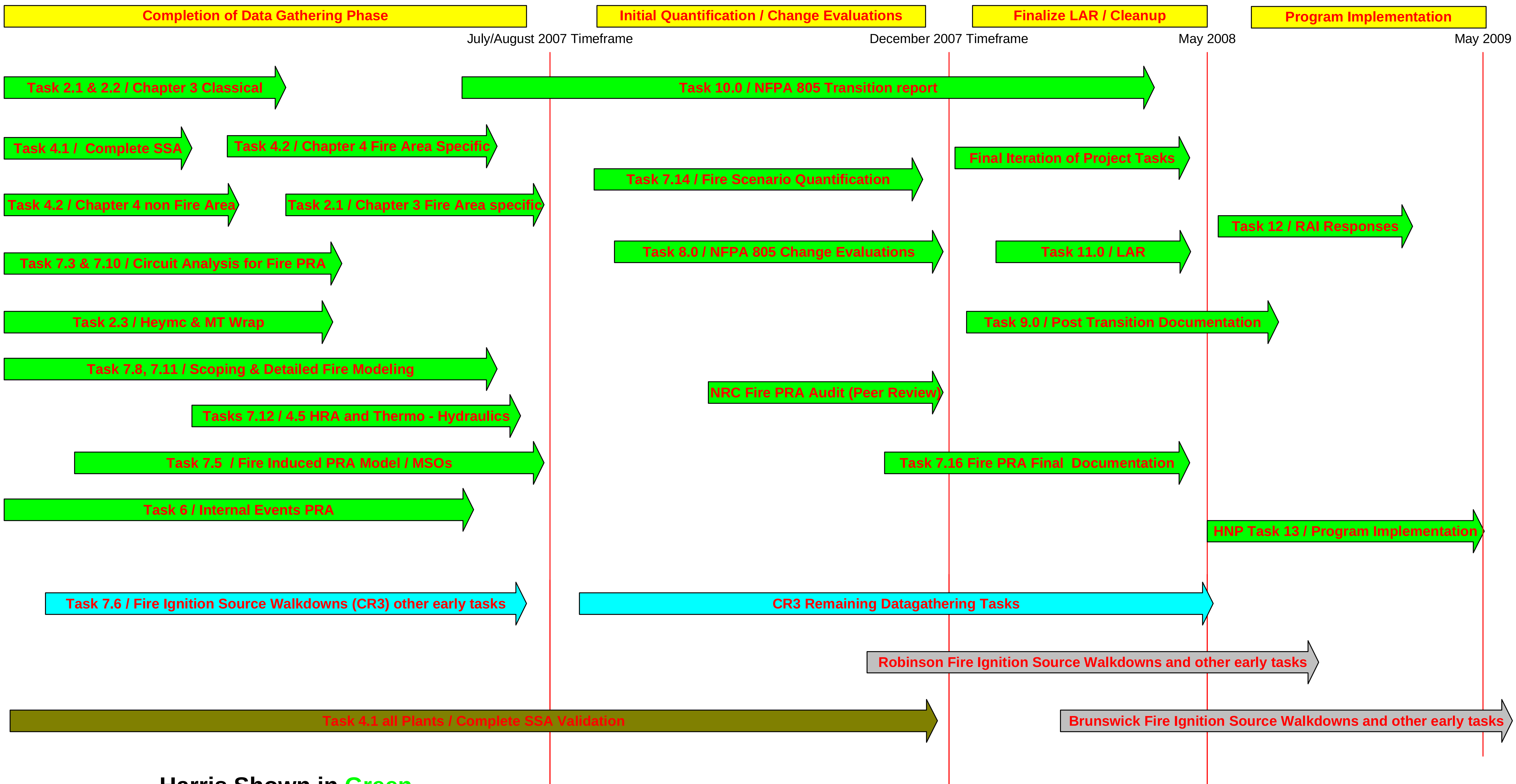


PE Fire Protection Initiatives Project with NFPA 805 Transition



Rev. 10/24/2006

Progress Energy NFPA 805 Transition Outlook 2007



Harris Shown in Green
Same General Approach all plants
Priority from NFPA 805 perspective is Harris

Rev Date
November 3,
2006

Strawman Schedule 2007 NRC Harris Pilot Observation Reviews

This is a Strawman to initiate discussion relative to 2007 observation meetings. Detail Review meeting under "Type of Review" is conceptually intended to be a small team from the NRC to focus on a narrow scope. There would be a minimal meeting preparation other than the products themselves. Results would be reported to the NEI task force at the next meeting/phone call. Duke representatives at the focused observation meetings are always welcome.

Pilot Plant	**Meeting Location**	**Date**	**Topic**	**Type of Review**
Harris	Harris	Jan 15-17	Fire PRA Products Task 7.1 Plant Partitioning Task 7.6 Ignition Frequencies Task 7.2 Component Selection	Detail Review of Products / Calculations
Harris	Harris	Jan 17-19	Classical Fire Protection Task 2.1.1 Chapter 3 Non Fire Area Transition Results Tasks 2.3.2 MT Wrap Barrier Worth Calculation	Detail Review of Products / Calculations
Harris	Harris	Feb 26-28	Fire PRA Products Task 7.8 Scoping Task 7.11 Detailed Fire Modeling	Detail Review of Products / Calculations
Harris	Harris	Feb 28-March 2	Classical Fire Protection Task 2.1.3 Manual Firefighting Tasks 3.0 Radioactive Release Task 2.2 Equivalency Evaluations	Detail Review of Products / Calculations
Harris	Harris	April 9-10	Fire PRA Products Task 7.5 Fire Induced PRA model selected fire scenarios and Treatment of MSOs	Detail Review of Products / Results
Harris	Harris	April 11-13	SSA / Electrical Task 7.3/7.10 Circuit Analysis for PRA Task 5.3 Non-power operations review Task 4.2 Fire Area Transition selected results	Detail Review of Products / Calculations
Harris	Harris	May 14-16	Fire PRA Products Task 7.12 Post Fire HRA	Detail Review of Products / Results
Harris	Harris	May 16-18	SSA / Plant Systems Task 4.4 Update T-H	Detail Review of Products /

Strawman Schedule 2007 NRC Harris Pilot Observation Reviews

Pilot Plant	Meeting Location	Date	Topic	Type of Review
			Analysis Task 4.5 Recovery Action Update	Calculations
Harris	Harris	July 9-11	Fire PRA Products Task 7.14 Fire Risk Quantification Selected Scenarios	Detail Review of Products / Results
Harris	Harris	July 11-13	FP Program Task 8.0 Change Evaluations Selected Items / Scenarios	Detail Review of Products / Results
Harris / Oconee	Charlotte / RII ?	August 6-8	Combined meeting general status, Additional review of Change Process, LAR content, etc.	Meeting Presentations
Harris	Harris	Oct 15-19	NRC Fire PRA Audit	Detail Review of Products / Results
Harris / Oconee	Raleigh /Charlotte / RII ?	Nov 12-14	Combined meeting general status, methodologies, LAR content, etc	Meeting Presentations

Hemyc / MT

Mike Fletcher
Progress Energy

Hemyc / MT

- MT 3 HR ERFBS
  - HNP only user, 1250 ft installed
  - Completed site specific fire testing
  - Tested terminations, wall mounted configurations with site specific cable fills
  - Working on a “barrier worth” calculation.
  - Based on testing appears all applications may be acceptable using performance based approach

Hemyc / MT

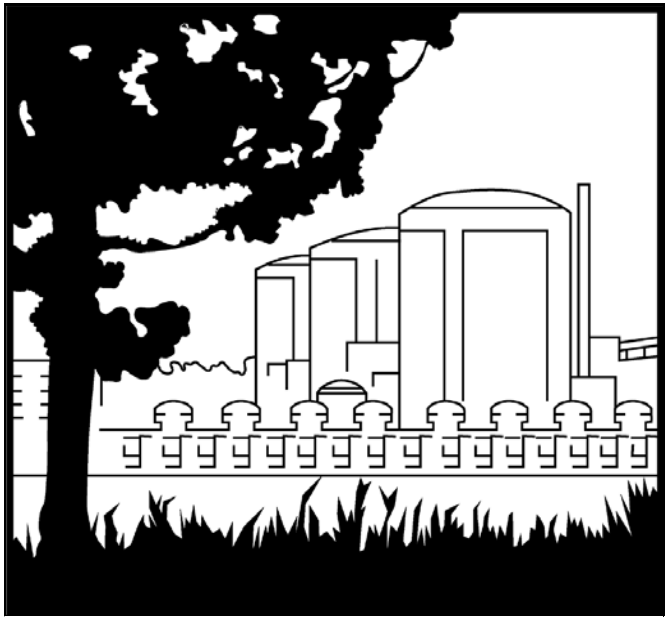
Item	Raceway / Configuration	Fill %	Rating (Minutes)
A	1-1/2" conduit free air	21.5	134
B	2-3" conduits free air	11.5 & 13.2	180
C	1-1/2" conduit free air w/support (baseline)	21.5	115
D	1-1/2" conduit free air w/support (upgrade)	21.5	153
E	2-1-1/2" conduits free air	21.5 & 28.2	159
F	2" Conduit wall mounted	28.2	180
G	18 X 18 X 13 J-Box	n/a	163

Hemyc / MT

- Hemyc 1 HR ERFBS
  - 6500 ft installed
  - Conducting 2 fire tests at Intertek Labs
  - Multiple tray, multiple conduits, supports, terminations W/ plant specific cable fills
  - Test 1- November 17^{th}
  - Test 2- December 14^{th}

Item	Raceway / Configuration	Fill %	Rating (Minutes)
A	1-1/2” conduit free air	21.5	134
B	2-3” conduits free air	11.5 & 13.2	180
C	1-1/2 “ conduit free air w/support (baseline)	21.5	115
D	1-1/2 “ conduit free air w/support (upgrade)	21.5	153
E	2-1-1/2” conduits free air	21.5 & 28.2	159
F	2” Conduit wall mounted	28.2	180
G	18 X 18 X 13 J-Box	n/a	163

Duke Energy



Duke Power NFPA-805 Transition Pilot Observation Project Status

Oconee (ONS)

Harry Barrett

November 7, 2006

Agenda

- Reconstitution Project Status
- NFPA-805 Project Status
- Fire PRA Status
- Duke 3-Site Transition Schedule
- Oconee Transition Schedule
- Near Term Tasks

Reconstitution Project Status

- ONS Units 2 & 3 /Common Reconstitution Analysis is complete
  - Need to review Mods since analysis snapshot
- MNS is approximately 67% complete with expected completion date of April 2007
- CNS is approximately 55% complete with expected completion date of June 2007

NFPA-805
Transition Status

- Fire Protection Program Fundamental Program Elements (Chapter 3)
  - Have completed Fire Hazards Analysis validation walkdowns
    - Data currently under review
    - Ignition Source walkdowns to be discussed later this week
  - Chapter 3 element mapping into the NEI 04-02 Table B-1 is approximately 80% complete

NFPA-805
Transition Status

- Nuclear Safety Performance Criteria Transition (Chapter 4)
  - Have completed mapping Appendix R (NEI 00-01) methodology to NFPA-805
    - Alternate approach referenced in parking lot has been developed
    - Information placed in Table B-2 is abbreviated for better clarity

NFPA-805 Transition Status - continued

- Nuclear Safety Performance Criteria Transition (Chapter 4) - continued
  - Fire Area Assessment in progress for first fire area
    - Working on Table B-3 for Fire Area BH12
  - Continuing to work on Recovery Action Feasibility
  - Pilot of CAFTA EFW Logics completed
- Non-Power Operational Mode Transition
  - Developed Philosophy and Methodology
  - Finalized list of components for additional analysis
  - Performed circuit analysis and cable routing on added components

Fire PRA Status

- Sub-Task 5.1 - Plant Boundary Definition and Partitioning
  - In progress (incorporating lessons learned from Oct Pilot mtg)
- Sub-Task 5.2 - Fire Ignition Frequencies
  - In progress (incorporating lessons learned from Oct Pilot mtg)
- Sub-Task 5.3 – Fire PRA Component Selection
  - In progress
- Sub-Task 5.4 - Fire PRA Cable Selection
  - In Progres
- Sub-Task 5.5 - Qualitative Screening
  - Not going to perform Qualitative Screening (will quantify all Fire Compartments)

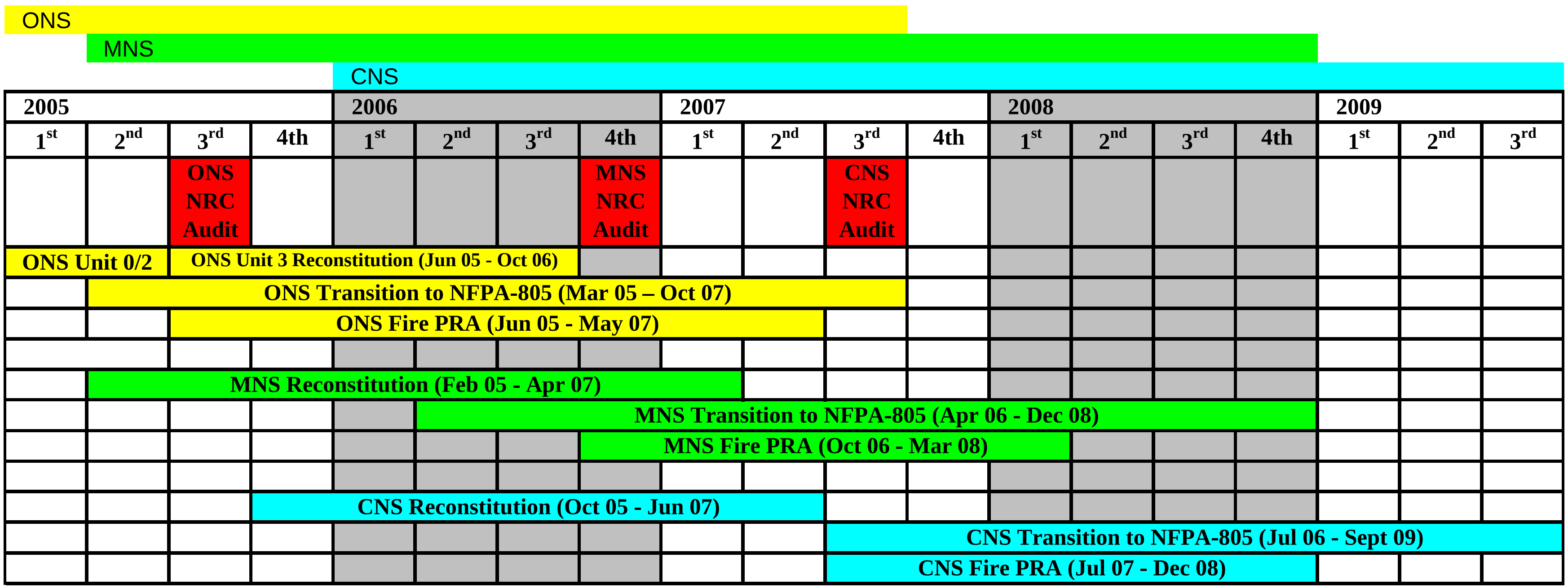
Fire PRA Status

- Sub-Task 5.6 - Fire-Induced Risk Model – to be discussed later this week
- Sub-Task 5.7 - Quantitative Screening
- Sub-Task 5.8 - Scoping Fire Modeling
- Sub-Task 5.9 - Detailed Circuit Failure Analysis (combined w/ 5.10)
- Sub-Task 5.10 - Circuit Failure Mode Likelihood Analysis
- Sub-Task 5.11 - Detailed Fire Modeling
- Sub-Task 5.12 - Post-Fire Human Reliability Analysis
- Sub-Task 5.13 - Seismic-Fire Interactions Assessment
- Sub-Task 5.14 - Fire Risk Quantification
- Sub-Task 5.15 - Uncertainty and Sensitivity Analysis
- Sub-Task 5.16 - Fire PRA Documentation

Armored Cable Fire Testing

- We have performed additional fire damage testing to more accurately determine spurious actuation probabilities for our armored cable
  - Testing was performed at Intertek Testing Laboratories (Omega Point Labs) in Texas
  - Test Plan was reviewed and commented on by NRC
  - Testing was observed by NRC
  - Testing Results
    - 120V AC grounded control circuits are very robust – **NO** observed spurious actuations
    - Ungrounded 120V AC and 125V DC control circuits exhibit hot short probabilities in the range of normal thermoset cables
    - Unjacketed Armored Cable is not an effective approach to achieve “no intervening combustibles”

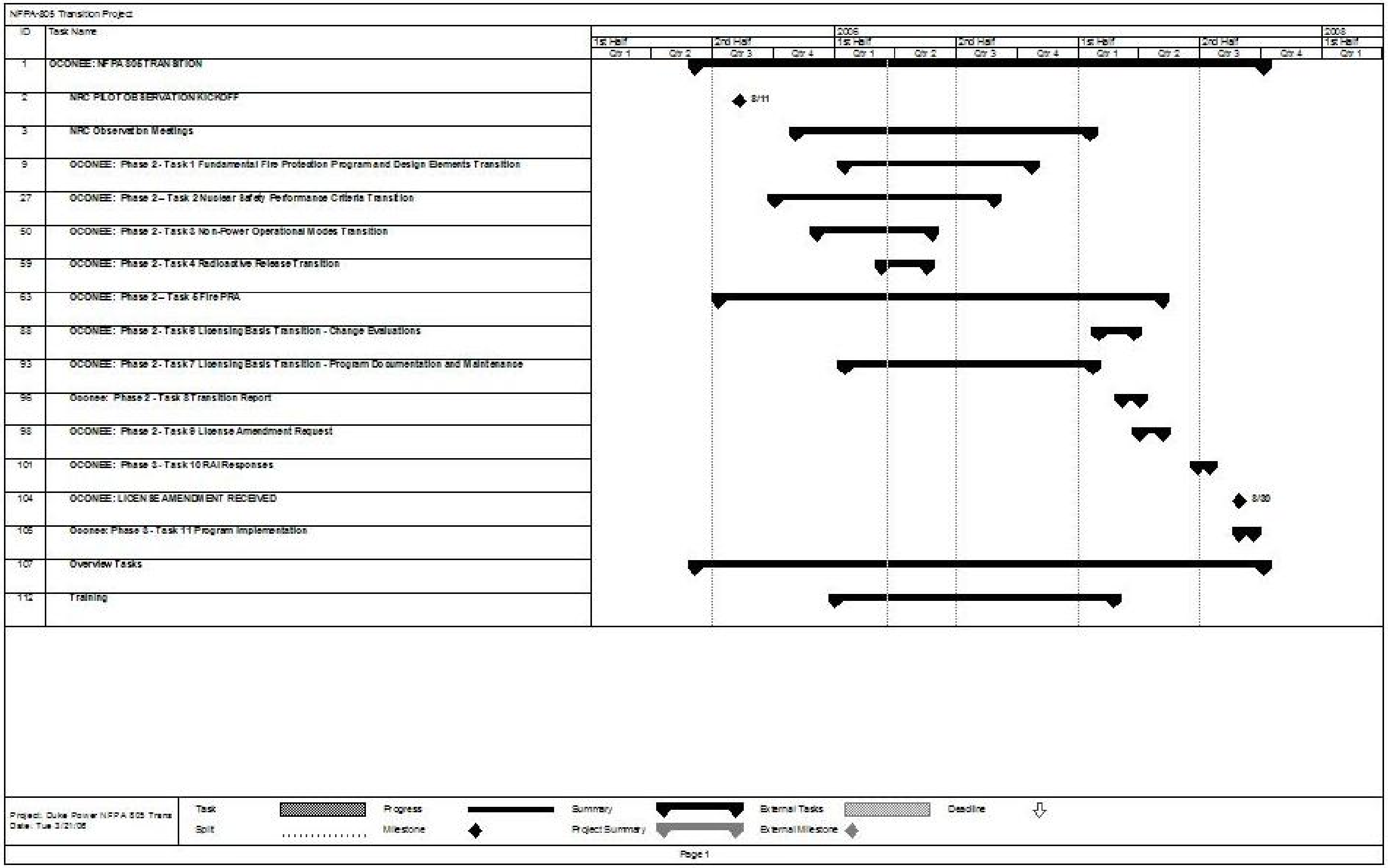
Duke 3-Site Transition Schedule



MNS and CNS Fire PRA Tasks have been extended by 6 months due to Peer Review

MNS and CNS Transition have been extended 9 months beyond PRA to allow time for addressing major peer review issues and submittal of LAR

Oconee NFPA-805 Transition Schedule



Near Term Tasks (Next Six Months)

- Chapter 4 Transition (Nuclear Safety Performance Criteria)
- Chapter 3 Transition (Fundamental Fire Protection Program Elements)
- Transient Analysis
- Manual Action Feasibility

FAQ 06-004, Clarifying the Relationship Between Chapter 3 & 4 of NFPA 805 and Defense-in-Depth

Alan Holder, CES
November 7, 2006

FAQ 06-004, What it Asks

- *NEI 04-02 needs to be clearer on the relationship between NFPA 805 Chapter 3 and 4 requirements. There are a number of sections in Chapter 3 that are dependent upon the requirements for protection in Chapter 4 (e.g., Electrical Raceway Fire Barrier System (ERFBS), traditional fire barriers, suppression, and detection).*

FAQ 06-004, Where We’re At

- Concerns;
  - If utilities could inadvertently remove Defense-in-Depth for systems under consideration based on risk alone.
  - Application of the determination process, (Flow charting the method of choice).
  - When/ Where does Defense-in-Depth and Safety Margin apply under NFPA 805?

Figure B-1, Process for Determining if an Active Fire Protection Feature is Required for NFPA 805 Chapter 4 Compliance

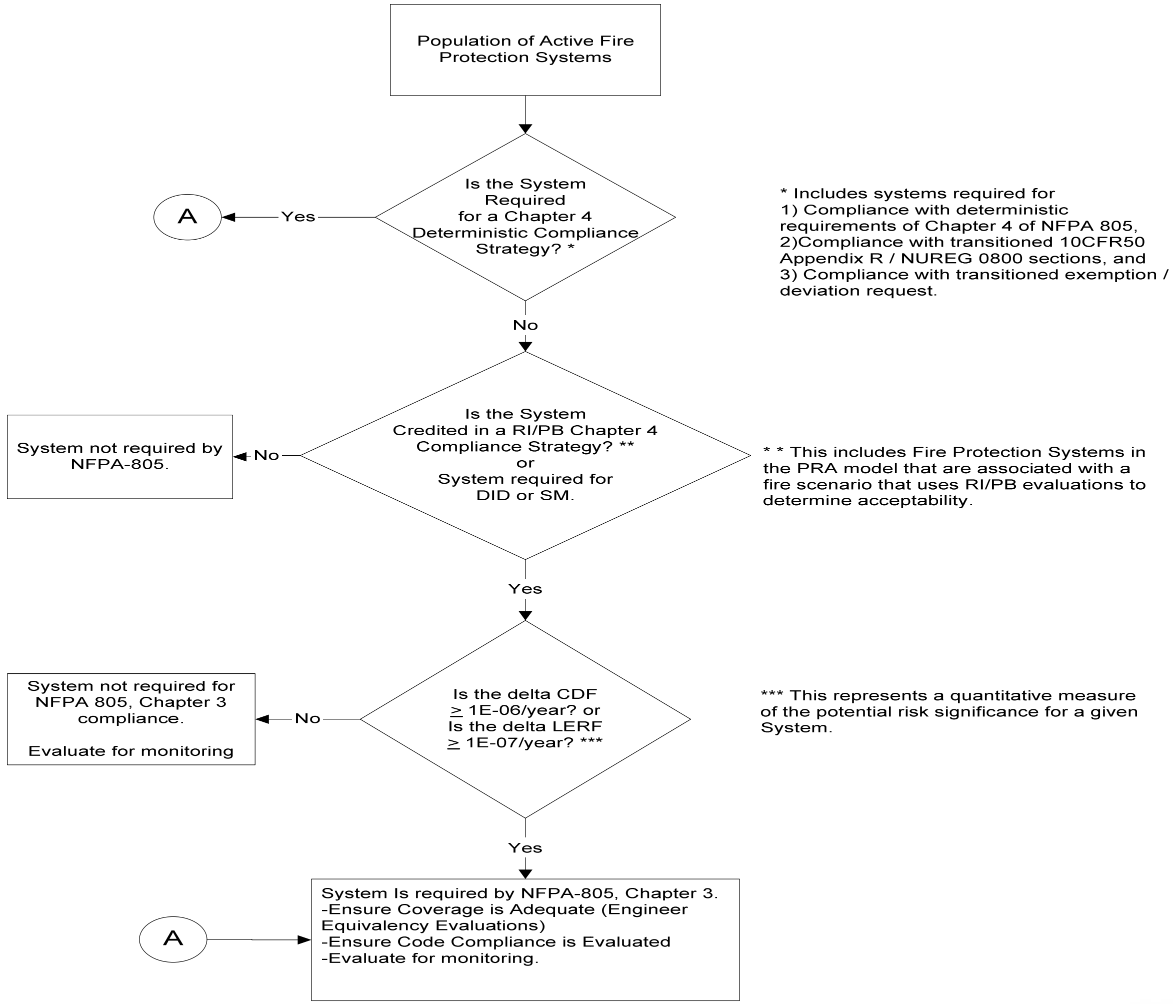
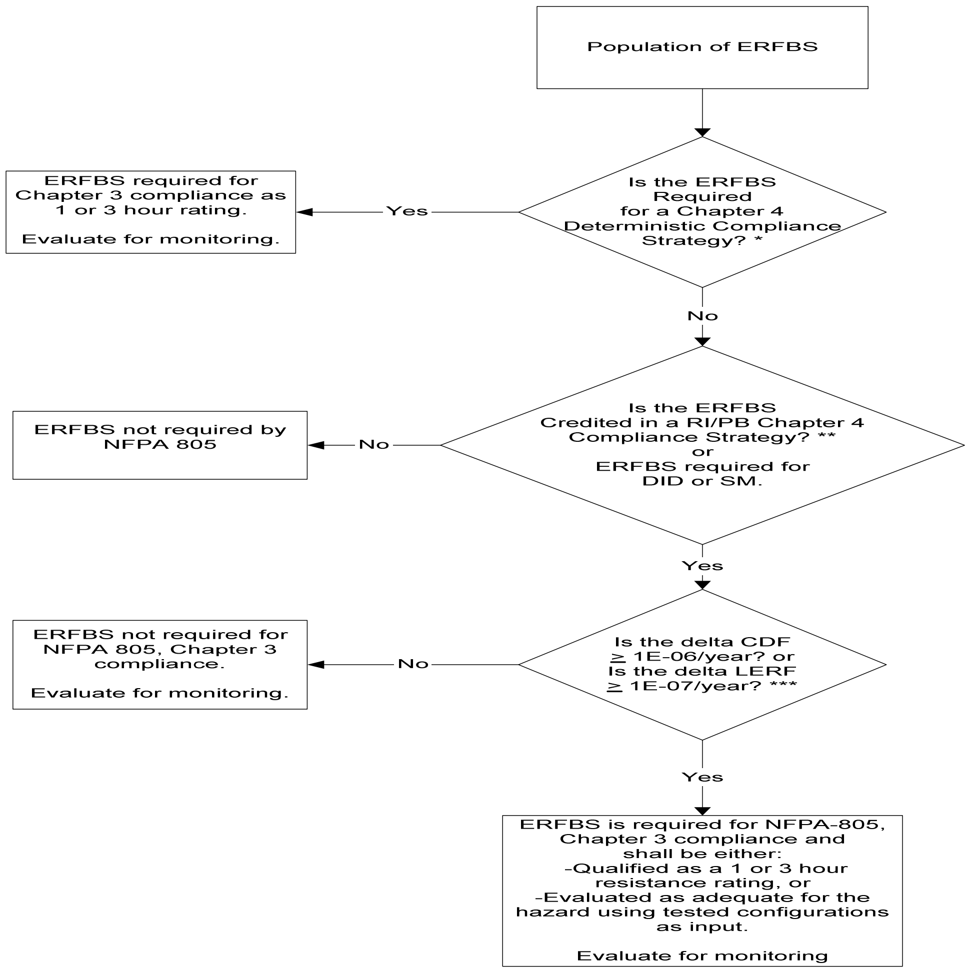


Figure B-2, Process for Determining if an ERFBS is Required for NFPA 805 Chapter 4 Compliance

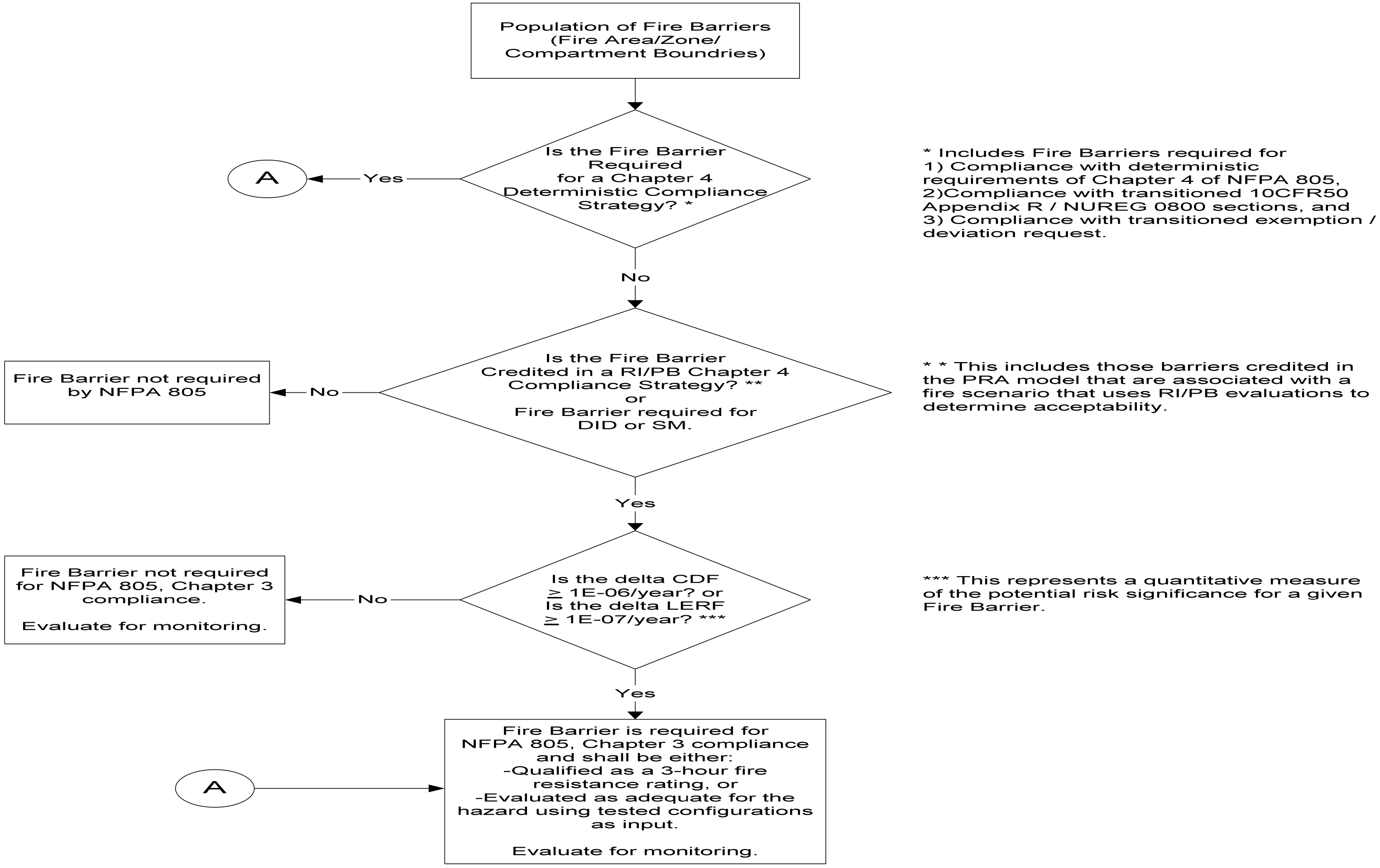


* Includes systems required for
1) Compliance with deterministic requirements of Chapter 4 of NFPA 805,
2)Compliance with transitioned 10CFR50 Appendix R / NUREG 0800 sections, and
3) Compliance with transitioned exemption / deviation request.

* * This includes those barriers credited in the PRA model that are associated with a fire scenario that uses RI/PB evaluations to determine acceptability.

*** This represents a quantitative measure of the potential risk significance for a given ERFBS.

Figure B-3, Process for Determining if a Fire Barrier is Required for NFPA 805 Chapter 4 Compliance



NGG

Progress Energy

Defense-in-Depth Strategy Applied via NFPA 805

- The Defense-in-Depth requirement is satisfied when there is no substantial imbalance in:
  - Preventing fires from starting
  - Detecting fire quickly and extinguishing those that occur, thereby limiting damage
  - Providing adequate level of fire protection for structures, systems and components important to safety so that a fire that is not promptly extinguished will not prevent essential plant safety functions from being performed.

Defense-in-Depth Strategy Applied via NFPA 805

- For 805 plants, SSCs described in the third element of the DID trinity are equated to SSCs required to meet NFPA 805, Section 1.5.1, Nuclear Safety Performance Criteria.
- *In other words*, Providing an adequate level of fire protection for SSCs which satisfy the “Nuclear Safety Performance Criteria” so that a fire that is not promptly extinguished, will not prevent essential plant safety functions from being performed.

Defense-in-Depth Strategy Applied via NFPA 805

Further clarified in RIN 3150-AG48 (Statement of Considerations);

"NFPA 805 does not supersede the requirements of GDC 3, 10CFR50.48(a), or 10CFR50.48(f). Those regulatory requirements continue to apply to licensees that adopt NFPA 805. However, under NFPA 805, the means by which GDC 3 or 10CFR50.48(a) requirements may be met is different than under 10CFR50.48(b). Specifically, whereas GDC 3 refers to SSCs important to safety, NFPA 805 identifies fire protection systems and features required to meet the Chapter 1 performance criteria through the methodology in Chapter 4 of NFPA 805. Also, under NFPA 805, the 10CFR50.48(a)(2)(iii) requirement to limit fire damage to SSCs important to safety so that the capability to safely shut down the plant is ensured is satisfied by meeting the performance criteria in Section 1.5.1 of NFPA 805. The Section 1.5.1 criteria include provisions for ensuring that reactivity control, inventory and pressure control, decay heat removal, vital auxiliaries, and process monitoring are achieved and maintained."

Defense-in-Depth Strategy Applied via NFPA 805

RIN 3150-AG48 continues;

> "This methodology specifies a process to identify the fire protection systems and features required to achieve the nuclear safety performance criteria in Section 1.5.1 of NFPA 805. Once a determination has been made that a fire protection system or feature is required to achieve the performance criteria of Section 1.5.1, its design and qualification must meet any applicable requirements of NFPA 805, Chapter 3. Having identified the required fire protection systems and features, the licensee selects either a deterministic or performance-based approach to demonstrate that the performance criteria are satisfied. This process satisfies the GDC 3 requirement to design and locate SSCs important to safety to minimize the probability and effects of fires and explosions."

Defense-in-Depth Strategy Applied via NFPA 805

Conversely;

Once a determination has been made that a fire protection system or feature is **not** required to achieve the performance criteria of Section 1.5.1, its design and qualification is **not** required to meet any applicable requirements of NFPA 805, Chapter 3. **As such those systems and features may be removed from further regulatory consideration.**

Defense-in-Depth Strategy Applied via NFPA 805

Examples of systems no longer applicable under NFPA 805;

- Automatic Suppression Systems protecting SSCs (plant fire areas) with no redundant required equipment present.
- Suppression Systems for existing non-safety HVAC charcoal filters, or Reactor Coolant Pumps.

Defense-in-Depth Strategy Applied via NFPA 805

Considerations;

- Some fire protection systems and features may become eligible for removal from further regulatory consideration.
- Other standards may affect these systems, NEIL Insurance, state or local codes and regulations.
- Any changes would be via the approved change process and applicable configuration management tools would be applied.

Chapter 3 Transition

Mike Fletcher, Shirelle Johnson
Progress Energy

Chapter 3 Transition - Process

- Completed “First Pass” through Chapter 3
  - Developed Project Instruction FPIP-0120
  - Used site experts
  - Exposed the site team to the basic FP Program element requirements
  - Used a “Self Assessment” type process

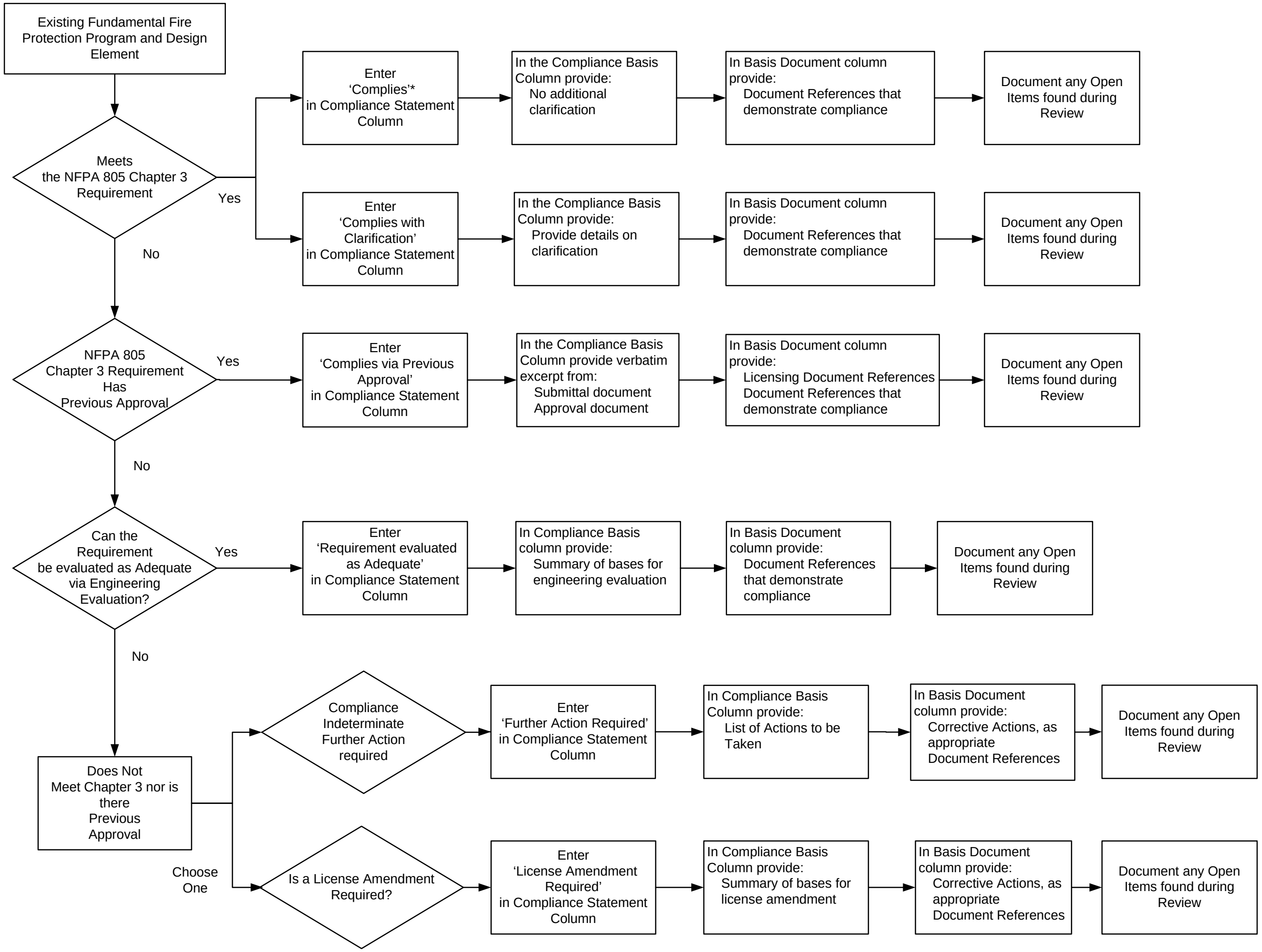
Chapter 3 Transition - Process

- HNP started with well defined Fire Protection Program documentation including
  - Fire Hazards Analysis
  - FP Commitment database
  - Design Basis Documents for fire barriers and FP systems
  - NFPA Code comparison calculations for selected codes such as - 20, 24,13,15…

Chapter 3 Transition - Process

- Goal of first pass review to bin each of the requirements into one of the following categories
  - Comply
  - Complies with Clarification
  - Complies via Previous Approval
  - License Amendment Request
  - Further Action Required

Chapter 3 Transition- Flow Chart



Progress Energy

Chapter 3 Transition - Results

- Spent approximately 200 man-hours
- 82 paragraphs reviewed
  - Comply - 39
  - Complies with clarification – 8
  - Complies via previous approval - 11
  - License Amendment Request - 3
  - Further Action Required – 31
  - N/A – Section 3.10 -Gaseous Systems
- 17 paragraphs are new requirements
- Used Table B-1 format from NEI 04-02

Chapter 3 Transition - Examples

- **Comply**
  - Verbatim compliance with program documentation with no other action required.
- **Complies with Clarification**
  - Compliance meets the chapter 3 requirement but with minor clarification for items such as scope or to describe site specific condition

Chapter 3 Transition - Examples

- **Complies Via Previous Approval**
  - NRC approval for the existing plant condition is addressed by an SER.
- **Further Action Required**
  - Used in cases where any other action is required such as revisions to site documents, NFPA Code comparisons, evaluation of existing 86-10 type documentation, and the sections that require Chapter 4 inputs.
  - These cases will be eventually be binned into one of the other categories

Chapter 3 Transition - Examples

- LAR
  - Used in cases where HNP does not comply with the requirement and the basis for acceptability will be documented and submitted for NRC approval as part of the LAR.

Chapter 3 Transition – Likely FAQ Items

- Section 3.3.1.1- General Prevention Activities
  - FAQ to clarify intent of the phrase “familiarization with plant fire prevention procedures, fire reporting, and plant emergency alarms” regarding scope of or depth of the training.
  - Clarify the intent is to provide training within the General Employee Orientation type process.

Chapter 3 Transition – Likely FAQ Items

- In Chapter 3 various sections such as 3.3.1.2, define scope or applicability in terms such as “plant” or “power block”.
  - Clarify that when used the intent these terms is “areas in which a fire could jeopardize the ability to meet the performance criteria described in section 1.5.1”

Chapter 3 Transition – Likely FAQ Items

- Section 3.3.1.2 Control of Combustible Materials part (6) Controls on use and storage of flammable gases shall be in accordance with applicable NFPA standards.
  - FAQ needed to specifically identify what the “applicable” codes are.

Progress Energy

Chapter 3 Transition – Likely FAQ Items

- Section 3.3.5.2 **-** Only metal tray and metal conduits shall be used for electrical raceways. Thin wall metallic tubing shall not be used for power, instrumentation, or control cables. Flexible metallic conduits shall only be used in short lengths to connect components.
  - FAQ needed to allow use of short cable drops.

Chapter 3 Transition – Likely FAQ Items

- Section 3.3.5.3 - Electric Cable Construction
  - FAQ to identify and approve typical cable testing methods used for non-IEEE cable.

Chapter 3 Transition – Likely FAQ Items

- Section 3.3.8 Bulk Storage of Flammable and Combustible Liquids. Bulk storage of flammable and combustible liquids shall not be permitted inside structures containing systems, equipment, or components important to nuclear safety. As a minimum, storage and use shall comply with NFPA 30, Flammable and Combustible Liquids Code.
  - FAQ needed to identify that DG Day tanks are acceptable.

Progress Energy

Chapter 3 Transition – Likely FAQ Items

- Section 3.3.11 - Electrical Equipment
  - FAQ to define what is “adequate” clearance.

- Section 3.4.2.1- Fire Pre-plans.
  - FAQ needed to define the minimum acceptable pre-plan scope using existing guidance.

Progress Energy

Chapter 3 Transition – Likely FAQ Items

- Section 3.4.4 – Fire Fighting Equipment.
  - FAQ to clarify intent of “this equipment shall conform with applicable NFPA codes” statement.
    - Fire fighting equipment shall be designed and purchased to NFPA code requirements. Care and maintenance does not have to be conducted per the applicable codes.

Chapter 3 Transition – Likely FAQ Items

- Section 3.7 Fire Extinguishers.
  - FAQ to clarify intent of statement “where provided”.

Chapter 3 Transition – Code Evaluations

- If NFPA Code compliance evaluations are conducted, if we are committed to specific code we will keep that code year of record. Examples are
  - NFPA 30 - 1977, “Flammable and Combustible Liquids”
  - NFPA 20 – 1972, “Centrifugal Fire Pumps”
  - NFPA 24 – 1977, “Outside Protection”

Chapter 3 Transition – Code Evaluations

- Where new codes are identified evaluations will use the latest code, examples include
  - NFPA 51- "Oxygen-Fuel Gas Systems for Welding Cutting…"
  - NFPA 55 - "Std for Storage Use and Handling Compressed Gasses…."
  - NFPA 51B – "Std For Fire Prevention During Welding Cutting and Hot Work"
  - NFPA 241 – "Std for Safeguarding Construction, Alteration, and Demolition Operations" appears to be NA.

Progress Energy

Chapter 3 Transition – Fire Brigade

- Transitioning to common NFPA 600 Compliant Fire Brigade / Training Program across PE fleet
- Gap Analysis of applicable standards
  - NFPA-805, Performance Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants
  - NFPA-600, Standard on Industrial Fire Brigades
  - NFPA-1500, Standard on Fire Department Occupational Safety and Health Program
  - NFPA-1403, Standard on Live Fire Training Evolutions

Progress Energy

Chapter 3 Transition – Lessons Learned

- Benefits
  - Need for barriers on out side buildings is removed which allowed some deviations to be retired
  - Clarify/simplify ‘going forward’ licensing basis
- Transitioning Existing Engineering Equivalency Evaluations
  - Anticipate transitioning numerous engineering evaluations
  - FAQ 06-0008 is the basis

Progress Energy

I
Information Use

FIRE PROTECTION INITIATIVES PROJECT

PROJECT INSTRUCTION

FPIP-0120

NFPA 805 Chapter 3
Fundamental Transition

REVISION 1A DRAFT

	Name	Date
Preparer:		
Reviewer:		
Project Manager:		

NGG Nuclear Generation Group

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this project instruction is to provide instructions for site specific reviews associated with the Chapter 3 Fundamental Element / Minimum Design Requirement Transition Reviews, under the NGG Fire Protection Improvement Initiatives Project.

This project instruction is provided to ensure compliance with the requirements of NFPA 805, NEI 04-02 and Regulatory Guide 1.205.

This project instruction is intended for use under the Fire Protection Improvement Initiatives Project. When this project is complete, the calculation documentation developed as a result of the instruction will be included in the overall NGG Fire Protection Improvement Initiatives Project report and applicable licensing documentation.

2.0 REFERENCES

2.1 NGG Fire Protection Program Improvement Initiatives Project Plan

2.2 National Fire Protection Association (NFPA) Standard 805-2001, Performance Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants

2.3 Nuclear Energy Institute (NEI) 04-02, Revision 1, Guidance for Implementing a Risk-Informed, Performance-Based Program Under 10CFR50.48(c)

2.4 Regulatory Guide 1.205, Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants, May 2006

2.5 10CFR50, Appendix R, Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

2.6 NUREG-0800, Standard Review Plan, Section 9.5.1 Fire Protection Program

2.7 EGR-NGGC-0017, Preparation and Control of Design Analysis and Calculations

2.8 FPIP-0100, Fire Protection Initiatives Project, Project Controls

3.0 DEFINITIONS

3.1 AHJ – Authority having jurisdiction. For the purposes of satisfying the nuclear safety requirements of NFPA 805, this is the NRC.

3.2 Other definitions shall be consistent with those found in section 1.6 of NFPA-805.

4.0 RESPONSIBILITIES

4.1 CES Fire Protection Initiatives Project Manager

4.1.1 Review and approval of project procedures issued for use on the Fire Protection Initiatives Project.

4.1.2 Overall responsibility for ensuring that personnel assigned to prepare and review Project documents under their direct control have the required training and/or experience to perform the role to which they are assigned.

4.2 Site Fire Protection Initiative Project Manager

4.2.1 Ensuring that Fire Protection Program tasks and deliverables associated with their plant are performed in accordance with this procedure.

4.2.2 Participate in, or assign a designee, the review of fundamental fire protection program and design elements.

4.3 Assessment Panel Chairman

4.3.1 Preparing a review plan or agenda, and information package(s) that lists the potential fundamental fire protection program and design elements that will be reviewed. Distribute information to panel members.

4.3.2 Documenting (or assigning designee) review activities, to include recording of any meeting minutes as necessary, participants progress report and tie records for reviews, discussion of decisions reached, basis for decisions reached.

4.4 Assessment Panel Members

4.4.1 Reviews will be conducted in an assessment format, with individuals working on independent sections as best suited to their background (i.e. FP, Training, OPS, Site Incident Commander (SIC), and RP) led by each site's Fire Protection Program Manager, with support from CES fire protection engineers.

4.4.2 Providing constructive input based on area of expertise, and maintaining objectivity to be able to challenge others (as necessary) so as to prevent "group think".

4.4.3 Participate in the review of the fundamental fire protection program and design elements.

4.4.4 A punch-list, maintained by the Fire Protection Program Manager, will be used to update or revise procedures, documentation and provide ECs as required incorporating the results of the review.

5.0 PREREQUISITES

N/A

6.0 PRECAUTIONS AND LIMITATIONS

N/A

7.0 SPECIAL TOOLS AND EQUIPMENT

N/A

8.0 ACCEPTANCE CRITERIA

N/A

9.0 INSTRUCTIONS

9.1 General

The fire protection program elements listed in Chapter 3 of NFPA 805 are minimum design requirements and shall not be subject to the performance-based methods permitted elsewhere in the standard without submittal of a License Amendment Request. Previously approved alternatives from the fundamental protection program attributes of this chapter by the AHJ take precedence over the requirements contained herein.

Using the Licensing Basis Documentation as it relates to the appropriate licensing documents, the transition team (reviewers) systematically steps through the requirements outlined in NFPA 805, Chapter 3. Each of the Chapter 3 Fundamental Elements is reviewed with the basis for compliance documented. Attachment 1 details the compliance review in flow chart format. The basis for compliance shall be either:

- Literal "Complies" with the requirement as listed in NFPA 805, or;
- "Complies with Clarification", meets intent with simple clarifying statement or;
- "Complies via Previous Approval" for an alternate means of compliance as documented in an NRC Safety Evaluation.

Fundamental elements that do not have one of these two methods of compliance demonstrated must either be brought into compliance or have NRC approval of the deviation as part of the NFPA 805 Transition approval.

Fire protection program features and systems associated with the pre-transitional licensing basis, although previously reviewed and approved by the NRC, may have been changed since initial NRC approval. Such changes are part of the Licensee's approved Fire Protection Program if they have been made in accordance with the correct application of the guidelines of Generic Letter 86-10, and evaluated under the requirements of 10 CFR 50.59, or the fire protection standard license condition (Fire Protection Program Regulatory Reviews). The fire protection standard license condition allows changes to the "approved fire protection program without prior approval of the Commission if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire." Where the changes from the original NRC review and approval have been made appropriately using an approved change process, but do not meet NFPA 805 Chapter 3 requirements, the changes are considered an acceptable part of the Current License Basis (CLB). Licensees may rely on these changes to claim compliance but the NRC may inspect those changes and conclude that they do not comply with NFPA 805. However, they are not considered previously approved by the NRC for the purposes of superseding requirements in Chapter 3 and as such should be submitted to the NRC for approval as a license amendment request.

Comment [R/S1]: Jeff questioned that this seems to be a conflict. Pointed out that it is copied from NEI 04-02.

9.2 Documentation Requirements

Comment [EK2]: This has always been confusing – the way I understand this is….

If you had something that was previously approved. And you changed that 'thing' through the standard license condition review – so it was no longer what the NRC approved. Then you can't claim previous approval – because technically it isn't what the NRC approved – does that make sense?

The Chapter 3 Fundamental Transition Package should be documented using NEI-04-02, Table B-1, as provided in template format (Attachment 2) as guidance. The applicable document(s) which constitute the individual plant's CLB (i.e. NUREG -0800, 10CFR50, Appendix R) should be included in Attachment 2. This package will be in the form of data collected in calculation format using ENG-NGGC-0017 as a vehicle to review and approve the data. If additional actions are identified during the reviews these should be put in punch-list fashion and tracked using an NTM. The completed calculation data and sign-off cover pages will become a portion of the final NFPA 805 Transition Report for each site.

The following types of information need to be documented to demonstrate the compliance status of the fundamental elements. If the plant is fully compliant, a general statement that the plant is compliant with the current requirement shall be provided.

<u>Explicit NRC Approval</u>

These may be for items that are transitioning fully compliant "as-is" as well as those where the NRC has previously approved an alternative to meeting the requirement.

- An excerpt of the previous plant commitment correspondence as well as the excerpt from the NRC Safety Evaluation Report that provided the formal approval.

<u>Administrative Requirements</u>

These include such items as required procedures, control of combustibles and ignition sources, fire brigade requirements, etc.

- Reference to the site or corporate procedure that provides the control required by the program. In general, the reference should be to the highest level document that satisfies the requirement. For example the requirement for ensuring the plant has procedures for inspection and maintenance of systems would reference the program procedure that establishes this requirement, rather than providing a list of all testing and inspection procedures.

<u>System Related Requirements</u>

These include items such as water supply, automatic detection and suppression, manual suppression, fire extinguishers, and fire barriers. Note that only the suppression and detection systems required by Chapter 4 of NFPA 805 need to be transitioned in the new program.

- For active systems (including extinguishers), a reference to the code compliance evaluation packages with a listing of evaluated deviations.
- For passive systems, a reference to specifications, design documents or test reports that demonstrate compliance with the systems.

Note that specific care should be given to transitioning methodology and acceptance criteria, such that equivalency evaluations that are currently allowed continue to be allowed in the future.

<u>NFPA Code Compliance Evaluations</u>

Each NFPA standard referenced by NFPA 805 shall be evaluated point by point and shall consider the following points.

- Identify the applicable edition, "code of record" of the standard.
- Identify the applicable sections of the standard
- Identify the deviations to the applicable sections and submit for NRC approval if required by the subject standard.

Note that NFPA standards not a part of the CLB, but contained in NFPA 805 may be disposition as guidance only, based on previous approval of the existing fundamental elements applicable to the standard. No code compliance evaluation would be necessary.

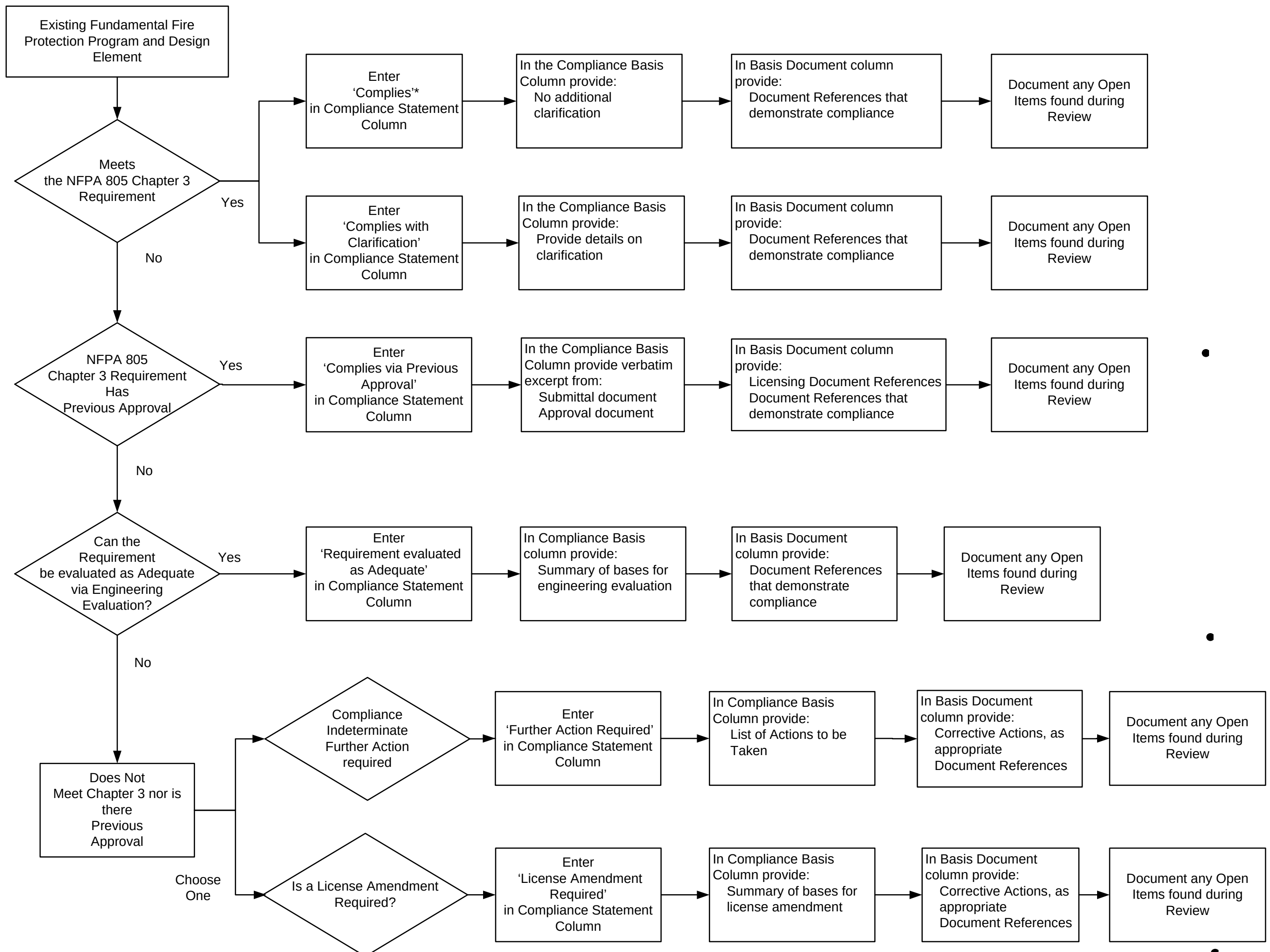
<u>Evaluated Deviations</u>

These would include the various engineering equivalency evaluations (i.e. GL 86-10 evaluations).

- A reference to the engineering equivalency evaluations that were used to evaluate the acceptability of the deviation.
- For the purposes of the license amendment request, a copy of the evaluation will need to be provided to allow the NRC to determine the adequacy of the evaluation.

10.0 RECORDS

N/A


Existing Fundamental Fire Protection Program and Design Element
Meets the NFPA 805 Chapter 3 Requirement
Yes
No
Enter ‘Complies’* in Compliance Statement Column
In the Compliance Basis Column provide: No additional clarification
In Basis Document column provide: Document References that demonstrate compliance
Document any Open Items found during Review
Enter ‘Complies with Clarification’ in Compliance Statement Column
In the Compliance Basis Column provide: Provide details on clarification
In Basis Document column provide: Document References that demonstrate compliance
Document any Open Items found during Review
NFPA 805 Chapter 3 Requirement Has Previous Approval
Yes
No
Enter ‘Complies via Previous Approval’ in Compliance Statement Column
In the Compliance Basis Column provide verbatim excerpt from: Submittal document Approval document
In Basis Document column provide: Licensing Document References Document References that demonstrate compliance
Document any Open Items found during Review
Can the Requirement be evaluated as Adequate via Engineering Evaluation?
Yes
No
Enter ‘Requirement evaluated as Adequate’ in Compliance Statement Column
In Compliance Basis column provide: Summary of bases for engineering evaluation
In Basis Document column provide: Document References that demonstrate compliance
Document any Open Items found during Review
Does Not Meet Chapter 3 nor is there Previous Approval
Choose One
Compliance Indeterminate Further Action required
Enter ‘Further Action Required’ in Compliance Statement Column
In Compliance Basis Column provide: List of Actions to be Taken
In Basis Document column provide: Corrective Actions, as appropriate Document References
Document any Open Items found during Review
Is a License Amendment Required?
Enter ‘License Amendment Required’ in Compliance Statement Column
In Compliance Basis Column provide: Summary of bases for license amendment
In Basis Document column provide: Corrective Actions, as appropriate Document References
Document any Open Items found during Review

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
3.1* General. This chapter contains the fundamental elements of the fire protection program and specifies the minimum design requirements for fire protection systems and features. These fire protection program elements and minimum design requirements shall not be subject to the performance-based methods permitted elsewhere in this standard. Previously approved alternatives from the fundamental protection program attributes of this chapter by the AHJ take precedence over the requirements contained herein.			
3.2 Fire Protection Plan. **3.2.1 Intent.** A site-wide fire protection plan shall be established. This plan shall document management policy and program direction and shall define the responsibilities of those individuals responsible	**I. <u>AREAS OF REVIEW</u>** The CMEB reviews the total fire protection program described in the applicant's Safety Analysis Report (SAR) with respect to the-criteria of Branch Technical Position CMEB 9.5-1 attached to this SRP section, specifically with respect to the following:		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
for the plan's implementation. This section establishes the criteria for an integrated combination of components, procedures, and personnel to implement all fire protection program activities.	**1.** Overall fire protection program requirements, including the degree of involvement and assigned responsibility of management; fire protection administrative controls and quality assurance program; fire brigade training activities and coordination with offsite fire fighting organizations, including their capability in assisting in the extinguishment of plant fires. **C.1.a Fire Protection Program** **(1)** The fire protection program should be under the direction of an individual who has been delegated authority commensurate with the responsibilities of the position and who has available staff personnel knowledgeable in both fire protection and nuclear safety. **(2)** The fire protection program should extend the concept of defense-in-depth to fire protection in fire areas important to safety, with the following objectives: • to prevent fires from starting; • to detect rapidly, control, and extinguish promptly those fires		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	that do occur; • to provide protection for structures, systems, and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant. **(3)** Responsibility for the overall fire protection program should be assigned to a person who has management control over all organizations involved in fire protection activities. Formulation and assurance of program implementation may be delegated to a staff composed of personnel prepared by training and experience in fire protection and personnel prepared by training and experience in nuclear plant safety to provide a balanced approach in directing the fire protection program for the nuclear power plant. The staff should be responsible for: **(a)** Fire protection program requirements, including consideration of potential hazards		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	associated with postulated fires, with knowledge of building layout and systems design. **(b)** Post-fire shutdown capability. **(c)** Design, maintenance, surveillance, and quality assurance of all fire protection features (e.g., detection systems, suppression systems, barriers, dampers, doors, penetration seals, and fire brigade equipment). **(d)** Fire prevention activities (administrative controls and training). **(e)** Fire brigade organization and training. **(f)** Prefire planning.		
3.2.2* Management Policy Direction and Responsibility. A policy document shall be prepared that defines management authority and responsibilities and establishes the general policy for the site fire protection program.	CMEB 9.5-1, NUREG 0800 does not specifically require the preparation of a policy document to define management authority and responsibilities. **C.1.a F<u>ire Protection Program</u>** **(3)** Responsibility for the overall fire protection program should be assigned to a person who has management control over all		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	organizations involved in fire protection activities. Formulation and assurance of program implementation may be delegated to a staff composed of personnel prepared by training and experience in fire protection and personnel prepared by training and experience in nuclear plant safety to provide a balanced approach in directing the fire protection program for the nuclear power plant. The staff should be responsible for: **(a)** Fire protection program requirements, including consideration of potential hazards associated with postulated fires, with knowledge of building layout and systems design. **(b)** Post-fire shutdown capability. **(c)** Design, maintenance, surveillance, and quality assurance of all fire protection features (e.g., detection systems, suppression systems, barriers, dampers, doors, penetration seals, and fire brigade equipment).		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	(d) Fire prevention activities (administrative controls and training). **(e)** Fire brigade organization and training. **(f)** Prefire planning.		
3.2.2.1* The policy document shall designate the senior management position with immediate authority and responsibility for the fire protection program.	**C.1.a F<u>ire Protection Program</u>** **(1)** The fire protection program should be under the direction of an individual who has been delegated authority commensurate with the responsibilities of the position and who has available staff personnel knowledgeable in both fire protection and nuclear safety. **(3)** Responsibility for the overall fire protection program should be assigned to a person who has management control over all organizations involved in fire protection activities. Formulation and assurance of program implementation may be delegated to a staff composed of personnel prepared by training and experience in fire protection and personnel prepared by training and experience in nuclear plant safety to provide a balanced		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	approach in directing the fire protection program for the nuclear power plant.		
3.2.2.2* The policy document shall designate a position responsible for the daily administration and coordination of the fire protection program and its implementation.	**C.1.a <u>Fire Protection Program</u>** **(3)** …Formulation and assurance of program implementation may be delegated to a staff composed of personnel prepared by training and experience in fire protection and personnel prepared by training and experience in nuclear plant safety to provide a balanced approach in directing the fire protection program for the nuclear power plant. The staff should be responsible for: **(a)** Fire protection program requirements, including consideration of potential hazards associated with postulated fires, with knowledge of building layout and systems design. **(b)** Post-fire shutdown capability. **(c)** Design, maintenance, surveillance, and quality assurance of all fire protection features (e.g., detection systems, suppression systems, barriers, dampers, doors, penetration		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	seals, and fire brigade equipment). **(d)** Fire prevention activities (administrative controls and training). **(e)** Fire brigade organization and training. **(f)** Prefire planning.		
3.2.2.3* The policy document shall define the fire protection interfaces with other organizations and assign responsibilities for the coordination of activities. In addition, this policy document shall identify the various plant positions having the authority for implementing the various areas of the fire protection program.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.2.2.4* The policy document shall identify the appropriate AHJ for the various areas of the fire protection program.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.2.3* Procedures. Procedures shall be	**2. <u>Administrative Controls</u>** **k.** Successful fire protection		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
established for implementation of the fire protection program. In addition to procedures that could be required by other sections of the standard, the procedures to accomplish the following shall be established: (1) * Inspection, testing, and maintenance for fire protection systems and features credited by the fire protection program (2) * Compensatory actions implemented when fire protection systems and other systems credited by the fire protection program and this standard cannot perform their intended function and limits on impairment duration (3) * Reviews of fire protection program — related performance and trends (4) Reviews of physical plant modifications and procedure changes for impact on the fire protection program (5) Long-term maintenance	requires testing and maintenance of the fire protection equipment and the emergency lighting and communication. A test plan that lists the individuals and their responsibilities in connection with routine tests and inspections of the fire detection and protection systems should be developed. The test plan should contain the types, frequency, and detailed procedures for testing. Procedures should also contain instructions on maintaining fire protection during those periods when the fire protection system is impaired or during periods of plant maintenance, e.g., fire watches or temporary hose connections to water systems. **j.** Disarming of fire detection or fire suppression systems should be controlled by a permit system. Fire watches should be established in areas where systems are so disarmed. **C.3 <u>Fire Brigade</u>** **d. (7) Drills** **(c)** The drills should be preplanned to establish the training objectives of the drill and should be critiqued to determine		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
and configuration of the fire protection program (6) Emergency response procedures for the plant industrial fire brigade	how well the training objectives have been met. Unannounced drills should be planned and critiqued by members of the management staff responsible for plant safety and fire protection. Performance deficiencies of a fire brigade or of individual fire brigade members should be remedied by scheduling additional training for the brigade or members. **C.2 <u>Administrative Controls</u>** **o.** Define the strategies for fighting fires in all safety-related areas and areas presenting a hazard to safety-related equipment.		
3.3 Prevention. A fire prevention program with the goal of preventing a fire from starting shall be established, documented, and implemented as part of the fire protection program. The two basic components of the fire prevention program shall consist of both of the following: (1) Prevention of fires and fire spread by controls on	**C.1.a <u>Fire Protection Program</u>** **(2)** The fire protection program should extend the concept of defense-in-depth to fire protection in fire areas important to safety, with the following objectives: • to prevent fires from starting; • to detect rapidly, control, and extinguish promptly those fires that do occur; • to provide protection for structures, systems, and components important to safety		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
operational activities (2) Design controls that restrict the use of combustible materials The design control requirements listed in the remainder of this section shall be provided as described.	so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant. **(3)** Responsibility for the overall fire protection program should be assigned to a person who has management control over all organizations involved in fire protection activities. Formulation and assurance of program implementation may be delegated to a staff composed of personnel prepared by training and experience in fire protection and personnel prepared by training and experience in nuclear plant safety to provide a balanced approach in directing the fire protection program for the nuclear power plant. The staff should be responsible for: **(d)** Fire prevention activities (administrative controls and training). **(4)** The organizational responsibilities and lines of communication pertaining to fire		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	protection should be defined between the various positions through the use of organizational charts and functional descriptions of each position's responsibilities. The following positions/organizations should be designated: **(d)** The onsite position(s) which: **i.** Implements periodic inspections to: minimize the amount of combustibles in safety-related areas; determine the effectiveness of housekeeping practices; assure the availability and acceptable condition of all fire protection systems/equipment, emergency breathing apparatus, emergency lighting, communication equipment, fire stops, penetration seals, and fire retardant coatings; and assures the prompt and effective corrective actions are taken to correct conditions adverse to fire protection and preclude their recurrence. **iv.** Reviews and evaluates proposed work activities to identify potential transient fire loads.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
3.3.1 Fire Prevention for Operational Activities. The fire prevention program activities shall consist of the necessary elements to address the control of ignition sources and the use of transient combustible materials during all aspects of plant operations. The fire prevention program shall focus on the human and programmatic elements necessary to prevent fires from starting or, should a fire start, to keep the fire as small as possible.			
3.3.1.1 General Fire Prevention Activities. The fire prevention activities shall include but not be limited to the following program elements: (1) Training on fire safety information for all employees and contractors including, as a minimum, familiarization with plant fire prevention procedures, fire reporting, and plant emergency alarms (2) * Documented plant	**1. <u>Fire Protection Program Requirements</u>** **C.1.a <u>Fire Protection Program</u>** **4) (d)** The onsite position(s) which: **i.** Implements periodic inspections to: minimize the amount of combustibles in safety-related areas; determine the effectiveness of housekeeping practices; assure the availability and acceptable condition of all fire protection systems/equipment, emergency breathing apparatus,		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
inspections including provisions for corrective actions for conditions where unanalyzed fire hazards are identified (3) * Administrative controls addressing the review of plant modifications and maintenance to ensure that both fire hazards and the impact on plant fire protection systems and features are minimized.	emergency lighting, communication equipment, fire stops, penetration seals, and fire retardant coatings; and assures the prompt and effective corrective actions are taken to correct conditions adverse to fire protection and preclude their recurrence. **iv.** Reviews and evaluates proposed work activities to identify potential transient fire loads. **v.** Implements a program for indoctrination of all plant contractor personnel in appropriate administrative procedures which implement the fire protection program, and the emergency procedures relative to fire protection.		
3.3.1.2* Control of Combustible Materials. Procedures for the control of general housekeeping practices and the control of transient combustibles shall be developed and implemented. These procedures shall include but not be limited to the following program elements:	**C.1.a <u>Fire Protection Program</u>** **4) (d)** The onsite position(s) which: **i.** Implements periodic inspections to: minimize the amount of combustibles in safety-related areas; determine the effectiveness of housekeeping practices; assure the availability and acceptable condition of all fire protection systems/equipment,		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
(1) * Wood used within the power block shall be listed pressure-impregnated or coated with a listed fire-retardant application. Exception: Cribbing timbers 6 in. by 6 in. (15.2 cm by 15.2 cm) or larger shall not be required to be fire-retardant treated. (2) Plastic sheeting materials used in the power block shall be fire-retardant types that have passed NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films, large-scale tests, or equivalent. (3) Waste, debris, scrap, packing materials, or other combustibles shall be removed from an area immediately following the completion of work or at the end of the shift, whichever comes first. (4) * Combustible storage or staging areas shall be designated, and limits shall be established on the types and quantities of stored	emergency breathing apparatus, emergency lighting, communication equipment, fire stops, penetration seals, and fire retardant coatings; and assures the prompt and effective corrective actions are taken to correct conditions adverse to fire protection and preclude their recurrence. **C.2 <u>Administrative Controls</u>** Administrative controls should be used to maintain the performance of the fire protection system and personnel. These controls should establish procedures to: **a.** Prohibit bulk storage of combustible materials inside or adjacent to safety-related buildings or systems during operation or maintenance periods. Regulatory Guide 1.39 provides guidance on housekeeping, including the disposal of combustible materials. **b.** Govern the handling and limitation of the use of ordinary combustible materials, combustible and flammable gases and liquids, high efficiency particulate air and charcoal filters, dry ion exchange resins, or other		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
materials. (5) * Controls on use and storage of flammable and combustible liquids shall be in accordance with NFPA 30, Flammable and Combustible Liquids Code, or other applicable NFPA standards. (6) * Controls on use and storage of flammable gases shall be in accordance with applicable NFPA standards.	combustible supplies in safety-related areas. **c.** Govern the handling of and limit transient fire loads such as combustible and flammable liquids, wood and plastic products, or other combustible materials in buildings containing safety-related systems or equipment during all phases of operating, and especially during maintenance, modification, or refueling operations. **d.** Designate the onsite staff member responsible for the in plant fire protection review of proposed work activities to identify potential transient fire hazards and specify required additional fire protection in the work activity procedure. **f.** Control the removal from the area of all waste, debris, scrap, oil spills, or other combustibles resulting from the work activity immediately following completion of the activity, or at the end of each work shift, whichever comes first. **h.** Maintain the periodic housekeeping inspections to ensure continued compliance with		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	these administrative controls. **i.** Control the use of specific combustibles in safety-related areas. All wood used in safety-related areas during maintenance, modification, or refueling operation (such as lay-down blocks or scaffolding) should be treated with a flame retardant. Equipment or supplies (such as new fuel) shipped in untreated combustible packing containers may be unpacked in safety-related areas if required for valid operating reasons. However, all combustible materials should be removed from the area immediately following unpacking. Such transient combustible material, unless stored in approved containers, should not be left unattended during lunch breaks, shift changes, or other similar periods. Loose combustible packing material such as wood or paper excelsior, or polyethylene sheeting should be placed in metal containers with tight-fitting self-closing metal covers. **C.5.d. <u>Control of Combustibles</u>** **(3)** The use of plastic materials		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	should be minimized. In particular, halogenated plastics such as polyvinyl chloride (PVC) and neoprene should be used only when substitute noncombustible materials are not available. All plastic materials, including flame and fire retardant materials, will burn with an intensity and BTU production in a range similar to that of ordinary hydrocarbons. When burning, they produce heavy smoke that obscures visibility and can plug air filters, especially charcoal and HEPA. The halogenated plastics also release free chlorine and hydrogen chloride when burning which are toxic to humans and corrosive to equipment. **(4)** Storage of flammable liquids should, as a minimum, comply with the requirements of NFPA 30, "Flammable and Combustible Liquids Code." **REFERENCES** Regulatory Guide 1.39, "Housekeeping Requirements for Water-Cooled Nuclear Power Plants."		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
3.3.1.3 Control of Ignition Sources. **3.3.1.3.1*** A hot work safety procedure shall be developed, implemented, and periodically updated as necessary in accordance with NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, and NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.	**2. <u>Administrative Controls</u>** **e.** Govern the use of ignition sources by use of a flame permit system to control welding, flame cutting, brazing, or soldering operations. A separate permit should be issued for each area where work is to be done. If work continues over more than one shift, the permit should be valid for not more than 24 hours when the plant is operating or for the duration of a particular job during plant shutdown.		
3.3.1.3.2 Smoking and other possible sources of ignition shall be restricted to properly designated and supervised safe areas of the plant.	**2. <u>Administrative Controls</u>** **e.** Govern the use of ignition sources by use of a flame permit system to control welding, flame cutting, brazing, or soldering operations. A separate permit should be issued for each area where work is to be done. If work continues over more than one shift, the permit should be valid for not more than 24 hours when the plant is operating or for the duration of a particular job during plant shutdown.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
3.3.1.3.3 Open flames or combustion-generated smoke shall not be permitted for leak or air flow testing.	**2. <u>Administrative Controls</u>** **g.** Govern leak testing; similar procedures such as airflow determination should use one of the commercially available techniques. Open flames or combustion-generated smoke should not be permitted.		
3.3.1.3.4* Plant administrative procedure shall control the use of portable electrical heaters in the plant. Portable fuel-fired heaters shall not be permitted in plant areas containing equipment important to nuclear safety or where there is a potential for radiological releases resulting from a fire.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.3.2 Structural. Walls, floors, and components required to maintain structural integrity shall be of noncombustible construction, as defined in NFPA 220, Standard on Types of Building Construction.	**5.a <u>Building Design</u>** **(9)** Interior wall and structural components, thermal insulation materials, radiation shielding materials, and soundproofing should be noncombustible.		
3.3.3 Interior Finishes.	**5.a <u>Building Design</u>**		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
Interior wall or ceiling finish classification shall be in accordance with NFPA 101®, Life Safety Code®, requirements for Class A materials. Interior floor finishes shall be in accordance with NFPA 101 requirements for Class I interior floor finishes.	**(9)** Interior wall and structural components, thermal insulation materials, radiation shielding materials, and soundproofing should be noncombustible. Interior finishes should be non-combustible. Materials that are acceptable for use as interior finish without evidence of test and listing by a nationally recognized laboratory are the following: • Plaster, acoustic plaster, gypsum plasterboard (gypsum wallboard), either plain, wallpapered, or painted with oil- or water-base paint; • Ceramic tile, ceramic panels; • Glass, glass blocks; • Brick, stone, concrete blocks, plain or painted; • Steel and aluminum panels, plain, painted, or enameled; • Vinyl tile, vinyl-asbestos tile, linoleum, or asphalt tile on concrete floors.		
3.3.4 Insulation Materials. Thermal insulation materials, radiation shielding materials,	**5.a Building Design** **(9)** Interior wall and structural components, thermal insulation		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
ventilation duct materials, and soundproofing materials shall be noncombustible or limited combustible.	materials, radiation shielding materials, and soundproofing should be noncombustible. Interior finishes should be non-combustible. Materials that are acceptable for use as interior finish without evidence of test and listing by a nationally recognized laboratory are the following: • Plaster, acoustic plaster, gypsum plasterboard (gypsum wallboard), either plain, wallpapered, or painted with oil- or water-base paint; • Ceramic tile, ceramic panels; • Glass, glass blocks; • Brick, stone, concrete blocks, plain or painted; • Steel and aluminum panels, plain, painted, or enameled; • Vinyl tile, vinyl-asbestos tile, linoleum, or asphalt tile on concrete floors.		
3.3.5 Electrical. **3.3.5.1** Wiring above suspended ceiling shall be kept to a	**5.a <u>Building Design</u>** **(11)** Suspended ceiling and their supports should be of noncombustible construction. Concealed spaces should be		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
minimum. Where installed, electrical wiring shall be listed for plenum use, routed in armored cable, routed in metallic conduit, or routed in cable trays with solid metal top and bottom covers.	devoid of combustibles except as noted in Position C.6.b. **7.b <u>Control Room Complex</u>** All cables that enter the control room should terminate in the control room. That is, no cabling should be routed through the control room from one area to another. Cables in underfloor and ceiling spaces should meet the separation criteria necessary for fire protection. Air-handling functions should be ducted separately from cable runs in such spaces; i.e., if cables are routed in underfloor or ceiling spaces, theses spaces should not be used as air plenums for ventilation of the control room. Fully enclosed electrical raceways located in such underfloor and ceiling spaces, if over 1 square foot in cross-sectional area, should have automatic fire suppression inside. Area automatic fire suppression should be provided for underfloor and ceiling spaces if used for cable runs unless all cable is run in 4-inch or smaller steel conduit or the cables are in fully enclosed		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	raceways internally protected by automatic fire suppression.		
3.3.5.2 Only metal tray and metal conduits shall be used for electrical raceways. Thin wall metallic tubing shall not be used for power, instrumentation, or control cables. Flexible metallic conduits shall only be used in short lengths to connect components.	**5.e <u>Electrical Cable Construction, Cable Trays, and Cable Penetrations</u>** **(1)** Only metal should be used for cable trays. Only metallic tubing should be used for conduit. Thin-wall metallic tubing should not be used. Flexible metallic tubing should only be used in short lengths to connect components to equipment. Other raceways should be made of noncombustible material.		
3.3.5.3* Electric cable construction shall comply with a flame propagation test as acceptable to the AHJ.	**5.e <u>Electrical Cable Construction, Cable Trays, and Cable Penetrations</u>** **(3)** Electric cable construction should, as a minimum, pass the flame test in the current IEEE Std 383. (This does not imply that cables passing this test will not require fire protection.)		
3.3.6 Roofs. Metal roof deck construction shall be designed and installed so the roofing system will not sustain a self-	**5.a <u>Building Design</u>** **(10)** Metal deck roof construction should be noncombustible and listed as "acceptable for fire" in the UL Building Materials		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
propagating fire on the underside of the deck when the deck is heated by a fire inside the building. Roof coverings shall be Class A as determined by tests described in NFPA 256, Standard Methods of Fire Tests of Roof Coverings.	Directory, or listed as Class I in the Factory Mutual System Approval Guide.		
3.3.7 Bulk Flammable Gas Storage. Bulk compressed or cryogenic flammable gas storage shall not be permitted inside structures housing systems, equipment, or components important to nuclear safety.	**5.d Control of Combustibles** **(2)** Bulk gas storage (either compressed or cryogenic), should not be permitted inside structures housing safety-related equipment.		
3.3.7.1 Storage of flammable gas shall be located outdoors, or in separate detached buildings, so that a fire or explosion will not adversely impact systems, equipment, or components important to nuclear safety. NFPA 50A, Standard for Gaseous Hydrogen Systems at Consumer Sites, shall be followed for hydrogen	**5.d Control of Combustibles** **(2)** Storage of flammable gas such as hydrogen should be located outdoors or in separate detached buildings so that a fire or explosion will not adversely affect any safety-related systems or equipment. (Refer to NFPA 50A, "Gaseous Hydrogen Systems.")		

Chapter 3 Fundamental Fire Protection Program and Design Elements	**Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981**	**Basis Statement**	**Basis Document References**
storage.			
3.3.7.2 Outdoor high-pressure flammable gas storage containers shall be located so that the long axis is not pointed at buildings.	**5.d** **Control of Combustibles** **(2)** Care should be taken to locate high pressure gas storage containers with the long axis parallel to building walls. This will minimize the possibility of wall penetration in the event of a container failure. Use of compressed gases (especially flammable and fuel gases) inside buildings should be controlled. (Refer to NFPA 6, "Industrial Fire Loss Prevention.")		
3.3.7.3 Flammable gas storage cylinders not required for normal operation shall be isolated from the system.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.3.8 Bulk Storage of Flammable and Combustible Liquids. Bulk storage of flammable and combustible liquids shall not be permitted inside structures containing systems, equipment, or components important to nuclear safety. As a minimum, storage and use	**2.** **Administrative Controls** Administrative controls should be used to maintain the performance of the fire protection system and personnel. These controls should establish procedures to: **a.** Prohibit bulk storage of combustible materials inside or adjacent to safety-related buildings or systems during operation or maintenance periods.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
shall comply with NFPA 30, Flammable and Combustible Liquids Code.	Regulatory Guide 1.39 provides guidance on housekeeping, including the disposal of combustible materials. **5.d <u>Control of Combustibles</u>** **(4)** Storage of flammable liquids should, as a minimum, comply with the requirements of NFPA 30, "Flammable and Combustible Liquids Code." **7.j <u>Diesel Fuel Oil Storage Areas</u>** Diesel fuel oil tanks with a capacity greater than 1,100 gallons should not be located inside buildings containing safety-related equipment. If above-ground tanks are used, they should be located at least 50 feet from any building containing safety-related equipment or, if located within 50 feet, they should be housed in a separate building with construction having a minimum fire resistance rating of 3 hours. Potential oil spills should be confined or directed away from buildings containing safety-related equipment. Totally buried tanks are acceptable outside or under buildings (see NFPA 30, "Flammable and Combustible		

Chapter 3 Fundamental Fire Protection Program and Design Elements	**Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981**	**Basis Statement**	**Basis Document References**
	Liquids Code," for additional guidance).		
3.3.9* Transformers. Where provided, transformer oil collection basins and drain paths shall be periodically inspected to ensure that they are free of debris and capable of performing their design function.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.3.10* Hot Pipes and Surfaces. Combustible liquids, including high flashpoint lubricating oils, shall be kept from coming in contact with hot pipes and surfaces, including insulated pipes and surfaces. Administrative controls shall require the prompt cleanup of oil on insulation.	**2. <u>Administrative Controls</u>** **f.** Control the removal from the area of all waste, debris, scrap, oil spills, or other combustibles resulting from the work activity immediately following completion of the activity, or at the end of each work shift, whichever comes first.		
3.3.11 Electrical Equipment Adequate clearance, free of combustible material, shall be maintained around energized electrical equipment.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
3.3.12* Reactor Coolant Pumps. For facilities with non-inerted containments, reactor coolant pumps with an external lubrication system shall be provided with an oil collection system. The oil collection system shall be designed and installed such that leakage from the oil system is safely contained for off normal conditions such as accident conditions or earthquakes. All of the following shall apply. (1) The oil collection system for each reactor coolant pump shall be capable of collecting lubricating oil from all potential pressurized and nonpressurized leakage sites in each reactor coolant pump oil system. (2) Leakage shall be collected and drained to a vented closed container that can hold the inventory of the reactor coolant pump lubricating oil system. (3) A flame arrestor is	**5.d <u>Control of Combustibles</u>** **(1)** Safety-related systems should be isolated or separated from combustible materials. When this is not possible because of the nature of the safety system or the combustible material, special protection should be provided to prevent a fire from defeating the safety system function. Such protection may involve a combination of automatic fire suppression, and construction capable of withstanding and containing a fire that consumes all combustibles present. Examples of such combustible materials that may not be separable from the remainder of its system are: (a) Emergency diesel generator fuel oil day tanks. (b) Turbine-generator oil and hydraulic control fluid systems. **(c)** Reactor coolant pump lube oil system. **7.a <u>Primary and Secondary Containment</u>** **1. (e)** The reactor coolant pumps should be equipped with an oil collection system if the containment is not inerted during		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
required in the vent if the flash point characteristics of the oil present the hazard of a fire flashback. (4) Leakage points on a reactor coolant pump motor to be protected shall include but not be limited to the lift pump and piping, overflow lines, oil cooler, oil fill and drain lines and plugs, flanged connections on oil lines, and the oil reservoirs, where such features exist on the reactor coolant pumps. (5) The collection basin drain line to the collection tank shall be large enough to accommodate the largest potential oil leak such that oil leakage does not overflow the basin.	normal operation. The oil collection system should be so designed, engineered, and installed that failure will not lead to fire during normal or design basis accident conditions and that there is reasonable assurance that the system will withstand the safe shutdown earthquake. Such collection systems should be capable of collecting lube oil from all potential pressurized and unpressurized leakage sites in the reactor coolant pump lube oil systems. Leakage should be collected and drained to a vented closed container that can hold the entire lube oil system inventory. A flame arrester is required in the vent if the flash point characteristics of the oil present the hazard of fire flashback. Leakage points to be protected should include lift pump and piping overflow lines, lube oil cooler, oil fill and drain lines and plugs, flanged connections on oil lines, and lube oil reservoirs where such features exist on the reactor coolant pumps. The drain line should be large enough to		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	accommodate the largest potential oil leak.		
3.4 Industrial Fire Brigade. **3.4.1 On-Site Fire-Fighting Capability.** All of the following requirements shall apply. (a) A fully staffed, trained, and equipped fire-fighting force shall be available at all times to control and extinguish all fires on site. This force shall have a minimum complement of five persons on duty and shall conform with the following NFPA standards as applicable: (1) NFPA 600, Standard on Industrial Fire Brigades (interior structural fire fighting) (2) NFPA 1500, Standard on Fire Department Occupational Safety and Health Program (3) NFPA 1582, Standard on Medical Requirements for Fire Fighters and Information	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
for Fire Department Physicians (b) * Industrial fire brigade members shall have no other assigned normal plant duties that would prevent immediate response to a fire or other emergency as required. (c) During every shift, the brigade leader and at least two brigade members shall have sufficient training and knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on nuclear safety performance Exception: Sufficient training and knowledge shall be permitted to be provided by an operations advisor dedicated to industrial fire brigade support criteria. (d) * The industrial fire brigade shall be notified immediately upon verification of a fire. (e) Each industrial fire brigade member shall pass an annual physical			

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
examination to determine that he or she can perform the strenuous activity required during manual fire-fighting operations. The physical examination shall determine the ability of each member to use respiratory protection equipment.			
3.4.2* Pre-Fire Plans. Current and detailed pre-fire plans shall be available to the industrial fire brigade for all areas in which a fire could jeopardize the ability to meet the performance criteria described in Section 1.5.	**C.1.a <u>Fire Protection Program</u>** **(6)** The following NFPA publications should be used for guidance to develop the fire protection program: No. 4 - "Organization for Fire Services" No. 4A - "Organization of a Fire Department" No. 6 - "Industrial Fire Loss Prevention" No. 7 - "Management of Fire Emergencies" No. 8 - "Management Responsibilities for Effects of Fire on Operations" No. 27 - "Private Fire Brigades" **C.2 <u>Administrative Controls</u>** **n.** Control actions to be taken by the fire brigade after notification by the control room operator of a		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	fire, for example, assembling in a designated location, receiving directions from the fire brigade leader, and discharging specific fire fighting responsibilities, including selection and transportation of fire fighting equipment to fire location, selection of protective equipment, operating instructions for use of fire suppression systems, and use of preplanned strategies for fighting fires in specific areas.		
3.4.2.1* The plans shall detail the fire area configuration and fire hazards to be encountered in the fire area, along with any nuclear safety components and fire protection systems and features that are present.	**C.2 <u>Administrative Controls</u>** **o.** Define the strategies for fighting fires in all safety-related areas and areas presenting a hazard to safety-related equipment. These strategies should designate: **(1)** Fire hazards in each area covered by the specific prefire plans. **(2)** Fire extinguishants best suited for controlling the fires associated with the fire hazards in that area and the nearest location of these extinguishants. **(3)** Most favorable direction from which to attack a fire in each area in view of the ventilation direction,		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	access hallways, stairs, and doors that are most likely to be free of fire, and the best station or elevation for fighting the fire. All access and egress routes that involve locked doors should be specifically identified in the procedure with the appropriate precautions and methods for access specified. **(4)** Plant systems that should be managed to reduce the damage potential during a local fire and the location of local and remote controls for such management (e.g., any hydraulic or electrical systems in the zone covered by the specific fire fighting procedure that could increase the hazards in the area because of overpressurization or electrical hazards). **(5)** Vital heat-sensitive system components that need to be kept cool while fighting a local fire. Particularly hazardous combustibles that need cooling should be designated. **(6)** Organization of fire fighting brigades and the assignment of special duties according to job title so that all fire fighting functions		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	are covered by any complete shift personnel complement. These duties include command control of the brigade, transporting fire suppression and support equipment to the fire scenes, applying the extinguishant to the fire, communication with the control room, and coordination with outside fire departments. **(7)** Potential radiological and toxic hazards in fire zones. **(8)** Ventilation system operation that ensures desired plant air distribution when the ventilation flow is modified for fire containment or smoke clearing operation. **(9)** Operations requiring control room and shift engineer coordination or authorization. **(10)** Instructions for plant operators and general plant personnel during fire.		
3.4.2.2 Pre-fire plans shall be reviewed and updated as necessary.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.4.2.3* Pre-fire plans shall be	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
available in the control room and made available to the plant industrial fire brigade.			
3.4.2.4* Pre-fire plans shall address coordination with other plant groups during fire emergencies.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.4.3 Training and Drills. Industrial fire brigade members and other plant personnel who would respond to a fire in conjunction with the brigade shall be provided with training commensurate with their emergency responsibilities. (a) Plant Industrial Fire Brigade Training. All of the following requirements shall apply. (1) Plant industrial fire brigade members shall receive training consistent with the requirements contained in NFPA 600, Standard on Industrial Fire Brigades, or NFPA 1500, Standard on Fire Department Occupational Safety and	**C.3 <u>Fire Brigade</u>** **a.** The need for good organization, training, and equipping of fire brigades at nuclear power plant sites requires that effective measures be implemented to ensure proper discharge of these functions. The guidance in Regulatory Guide 1.101, "Emergency Planning for Nuclear Power Plants," should be followed as applicable.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
Health Program, as appropriate. (2) Industrial fire brigade members shall be given quarterly training and practice in fire fighting, including radioactivity and health physics considerations, to ensure that each member is thoroughly familiar with the steps to be taken in the event of a fire. (3) A written program shall detail the industrial fire brigade training program. (4) Written records that include but are not limited to initial industrial fire brigade classroom and hands-on training, refresher training, special training schools attended, drill attendance records, and leadership training for industrial fire brigades shall be maintained for each industrial fire brigade member. (b) Training for Non-Industrial Fire Brigade Personnel. Plant personnel who respond with the			

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
industrial fire brigade shall be trained as to their responsibilities, potential hazards to be encountered, and interfacing with the industrial fire brigade. (c) * Drills. All of the following requirements shall apply. (1) Drills shall be conducted quarterly for each shift to test the response capability of the industrial fire brigade. (2) Industrial fire brigade drills shall be developed to test and challenge industrial fire brigade response, including brigade performance as a team, proper use of equipment, effective use of pre-fire plans, and coordination with other groups. These drills shall evaluate the industrial fire brigade's abilities to react, respond, and demonstrate proper fire-fighting techniques to control and extinguish the fire and smoke conditions being simulated by the drill scenario.			

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
(3) Industrial fire brigade drills shall be conducted in various plant areas, especially in those areas identified to be essential to plant operation and to contain significant fire hazards. (4) Drill records shall be maintained detailing the drill scenario, industrial fire brigade member response, and ability of the industrial fire brigade to perform as a team. (5) A critique shall be held and documented after each drill.			
3.4.4 Fire-Fighting Equipment. Protective clothing, respiratory protective equipment, radiation monitoring equipment, personal dosimeters, and fire suppression equipment such as hoses, nozzles, fire extinguishers, and other needed equipment shall be provided for the industrial fire brigade. This equipment	**C.3** **<u>Fire Brigade</u>** **a.** The need for good organization, training, and equipping of fire brigades at nuclear power plant sites requires that effective measures be implemented to ensure proper discharge of these functions. The guidance in Regulatory Guide 1.101, "Emergency Planning for Nuclear Power Plants," should be followed as applicable. **b.** A site fire brigade trained and		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
shall conform with the applicable NFPA standards.	equipped for fire fighting should be established to ensure adequate manual fire fighting capability for all areas of the plant containing structures, systems, or components important to safety. The fire brigade should be at least five members on each shift. The brigade leader and at least two brigade members should have sufficient training in or knowledge of plant safety-related systems to understand the effects of fire and fire suppressants on safe shutdown capability. The qualification of fire brigade members should include an annual physical examination to determine their ability to perform strenuous fire fighting activities. The shift supervisor should not be a member of the fire brigade. The brigade leader shall be competent to assess the potential safety consequences of a fire and advise control room personnel. Such competence by the brigade leader may be evidenced by possession of an operator's license or equivalent knowledge of plant safety-related systems. **c.** The minimum equipment		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	provided for the brigade should consist of personal protective equipment such as turnout coats, boots, gloves, hard hats, emergency communications equipment, portable lights, portable ventilation equipment, and portable extinguishers. Self-contained breathing apparatus using full-face positive-pressure masks approved by NIOSH (National Institute for Occupational Safety and Health--approval formerly given by the U.S. Bureau of Mines) should be provided for fire brigade, damage control, and control room personnel. At least 10 masks shall be available for fire brigade personnel. Control room personnel may be furnished breathing air by a manifold system piped from a storage reservoir if practical. Service or rated operating life shall be a minimum of one-half hour for the self-contained units. At least two extra air bottles should be located onsite for each self-contained breathing unit. In addition, an onsite 6-hour supply of reserve air should be provided		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	and arranged to permit quick and complete replenishment of exhausted supply air bottles as they are returned. If compressors are used as a source of breathing air, only units approved for breathing air shall be used; compressors shall be operable assuming a loss of offsite power. Special care must be taken to locate the compressor in areas free of dust and contaminants. **C.3.d. (9) <u>Guidance Documents</u>** NFPA 27, "Private Fire Brigade," should be followed in organization, training, and fire drills. This standard also is applicable for the inspection and maintenance of fire fighting equipment. Among the standards referenced in this document, NFPA 197, "Training Standard on Initial Fire Attacks," should be utilized as applicable. NFPA booklets and pamphlets listed in NFPA 27 may be used as applicable for training references. In addition, courses in fire prevention and fire suppression that are recognized or sponsored by the fire protection industry should be utilized.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	**Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981**	**Basis Statement**	**Basis Document References**
3.4.5 Off-Site Fire Department Interface. **3.4.5.1 Mutual Aid Agreement.** Off-site fire authorities shall be offered a plan for their interface during fires and related emergencies on site.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.4.5.2* Site-Specific Training. Fire fighters from the off-site fire authorities who are expected to respond to a fire at the plant shall be offered site-specific training and shall be invited to participate in a drill at least annually.	**C.2 <u>Administrative Controls</u>** **o.** Define the strategies for fighting fires in all safety-related areas and areas presenting a hazard to safety-related equipment. These strategies should designate: **(6)** Organization of fire fighting brigades and the assignment of special duties according to job title so that all fire fighting functions are covered by any complete shift personnel complement. These duties include command control of the brigade, transporting fire suppression and support equipment to the fire scenes, applying the extinguishant to the fire, communication with the control room, and coordination with outside fire departments.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
3.4.5.3* Security and Radiation Protection. Plant security and radiation protection plans shall address off-site fire authority response.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.4.6* Communications. An effective emergency communications capability shall be provided for the industrial fire brigade.	**C.3 <u>Fire Brigade</u>** **c.** The minimum equipment provided for the brigade should consist of personal protective equipment such as turnout coats, boots, gloves, hard hats, emergency communications equipment, portable lights, portable ventilation equipment, and portable extinguishers. Self-contained breathing apparatus using full-face positive-pressure masks approved by NIOSH (National Institute for Occupational Safety and Health--approval formerly given by the U.S. Bureau of Mines) should be provided for fire brigade, damage control, and control room personnel. At least 10 masks shall be available for fire brigade personnel. Control room personnel may be furnished breathing air by a manifold system piped from a storage reservoir if		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	practical. Service or rated operating life shall be a minimum of one-half hour for the self-contained units. **C.3.d.7 <u>Drills</u>** **(f)** Drills should as a minimum include the following: ii. Assessment of each brigade member's knowledge of his or her role in the fire fighting strategy for the area assumed to contain the fire. Assessment of the brigade members' conformance with established plant fire fighting procedures and use of fire fighting equipment, including self-contained emergency breathing apparatus, communication equipment, and ventilation equipment, to the extent practicable.		
3.5 Water Supply. **3.5.1** A fire protection water supply of adequate reliability, quantity, and duration shall be provided by one of the two following methods. (a) Provide a fire protection	**C.6.b <u>Fire Protection Water Supply</u>** **(9)** Two separate, reliable freshwater supplies should be provided. Saltwater or brackish water should not be used unless all freshwater supplies have been exhausted. If tanks are used, two 100% (minimum of 300,000		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
water supply of not less than two separate 300,000-gal (1,135,500-L) supplies. (b) Calculate the fire flow rate for 2 hours. This fire flow rate shall be based on 500 gpm (1892.5 L/min) for manual hose streams plus the largest design demand of any sprinkler or fixed water spray system(s) in the power block as determined in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, or NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection. The fire water supply shall be capable of delivering this design demand with the hydraulically least demanding portion of fire main loop out of service.	gallons each) system capacity tanks should be installed. They should be so interconnected that pumps can take suction from either or both. However, a failure in one tank or its piping should not cause both tanks to drain. Water supply capacity should be capable of refilling either tank in 8 hours or less. **(11)** The fire water supply should be calculated on the basis of the largest expected flow rate for a period of 2 hours, but not less than 300,000 gallons. This flow rate should be based (conservatively) on 500 gpm for manual hose streams plus the largest design demand of any sprinkler or deluge system as determined in accordance with NFPA 13 or NFPA 15. The fire water supply should be capable of delivering this design demand over the longest route of the water supply system.		
3.5.2* The tanks shall be interconnected such that fire	**C.6.b <u>Fire Protection Water Supply</u>** **(9)** Two separate, reliable		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
pumps can take suction from either or both. A failure in one tank or its piping shall not allow both tanks to drain. The tanks shall be designed in accordance with NFPA 22, Standard for Water Tanks for Private Fire Protection. Exception No. 1: Water storage tanks shall not be required when fire pumps are able to take suction from a large body of water (such as a lake), provided each fire pump has its own suction and both suctions and pumps are adequately separated. Exception No. 2: Cooling tower basins shall be an acceptable water source for fire pumps when the volume is sufficient for both purposes and water quality is consistent with the demands of the fire service.	freshwater supplies should be provided. Saltwater or brackish water should not be used unless all freshwater supplies have been exhausted. If tanks are used, two 100% (minimum of 300,000 gallons each) system capacity tanks should be installed. They should be so interconnected that pumps can take suction from either or both. However, a failure in one tank or its piping should not cause both tanks to drain. Water supply capacity should be capable of refilling either tank in 8 hours or less. **(12)** Freshwater lakes or ponds of sufficient size may qualify as sole source of water for fire protection but require separate redundant suctions in one or more intake structures. These supplies should be separated so that a failure of one supply will not result in a failure of the other supply. **(13)** When a common water supply is permitted for fire protection and the ultimate heat sink, the following conditions should also be satisfied: **(a)** The additional fire protection water requirements are designed		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	into the total storage capacity, and **(b)** Failure of the fire protection system should not degrade the function of the ultimate heat sink.		
3.5.3* Fire pumps, designed and installed in accordance with NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, shall be provided to ensure that 100 percent of the required flow rate and pressure are available assuming failure of the largest pump or pump power source.	**C.6.b** **Fire Protection Water Supply** **(6)** If pumps are required to meet system pressure or flow requirements, a sufficient number of pumps should be provided to ensure that 100% capacity will be available assuming failure of the largest pump or loss of offsite power (e.g., three 50% pumps or two 100% pumps). This can be accomplished, for example, by providing either: **(a)** Electric motor-driven fire pump(s) and diesel-driven fire pump(s); or **(b)** Two or more seismic Category I Class 1E electric motor-driven fire pumps connected to redundant Class 1E emergency power buses (see Regulatory Guides 1.6, 1.32, and 1.75). Individual fire pump connections to the yard fire main loop should be separated with sectionalizing valves between connections.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	Each pump and its driver and controls should be located in a room separated from the remaining fire pumps by a fire wall with a minimum rating of 3 hours. The fuel for the diesel fire pump(s) should be separated so that it does not provide a fire source exposing safety-related equipment. Alarms indicating pump running, driver availability, failure to start, and low fire-main pressure should be provided in the control room. The fire pump installation should conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."		
3.5.4 At least one diesel engine-driven fire pump or two more seismic Category I Class IE electric motor-driven fire pumps connected to redundant Class IE emergency power buses capable of providing 100 percent of the required flow rate and pressure shall be	**C.6.b <u>Fire Protection Water Supply</u>** **(6)** If pumps are required to meet system pressure or flow requirements, a sufficient number of pumps should be provided to ensure that 100% capacity will be available assuming failure of the largest pump or loss of offsite power (e.g., three 50% pumps or two 100% pumps). This can be		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
provided.	accomplished, for example, by providing either: **(a)** Electric motor-driven fire pump(s) and diesel-driven fire pump(s); or **(b)** Two or more seismic Category I Class 1E electric motor-driven fire pumps connected to redundant Class 1E emergency power buses (see Regulatory Guides 1.6, 1.32, and 1.75). Individual fire pump connections to the yard fire main loop should be separated with sectionalizing valves between connections. Each pump and its driver and controls should be located in a room separated from the remaining fire pumps by a fire wall with a minimum rating of 3 hours. The fuel for the diesel fire pump(s) should be separated so that it does not provide a fire source exposing safety-related equipment. Alarms indicating pump running, driver availability, failure to start, and low fire-main pressure should be provided in the control room.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	The fire pump installation should conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."		
3.5.5 Each pump and its driver and controls shall be separated from the remaining fire pumps and from the rest of the plant by rated fire barriers.	**C.6.b <u>Fire Protection Water Supply</u>** **(6)** If pumps are required to meet system pressure or flow requirements, a sufficient number of pumps should be provided to ensure that 100% capacity will be available assuming failure of the largest pump or loss of offsite power (e.g., three 50% pumps or two 100% pumps). This can be accomplished, for example, by providing either: **(a)** Electric motor-driven fire pump(s) and diesel-driven fire pump(s); or **(b)** Two or more seismic Category I Class 1E electric motor-driven fire pumps connected to redundant Class 1E emergency power buses (see Regulatory Guides 1.6, 1.32, and 1.75). Individual fire pump connections to the yard fire main loop should be separated with sectionalizing valves between connections.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	Each pump and its driver and controls should be located in a room separated from the remaining fire pumps by a fire wall with a minimum rating of 3 hours. The fuel for the diesel fire pump(s) should be separated so that it does not provide a fire source exposing safety-related equipment. Alarms indicating pump running, driver availability, failure to start, and low fire-main pressure should be provided in the control room. The fire pump installation should conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."		
3.5.6 Fire pumps shall be provided with automatic start and manual stop only.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800. May be tacitly covered by the following statement. **C.6.b <u>Fire Protection Water Supply Systems</u>** **(6)** The fire pump installation should conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
3.5.7 Individual fire pump connections to the yard fire main loop shall be provided and separated with sectionalizing valves between connections.	**C.6.b <u>Fire Protection Water Supply</u>** **(6)** If pumps are required to meet system pressure or flow requirements, a sufficient number of pumps should be provided to ensure that 100% capacity will be available assuming failure of the largest pump or loss of offsite power (e.g., three 50% pumps or two 100% pumps). This can be accomplished, for example, by providing either: **(a)** Electric motor-driven fire pump(s) and diesel-driven fire pump(s); or **(b)** Two or more seismic Category I Class 1E electric motor-driven fire pumps connected to redundant Class 1E emergency power buses (see Regulatory Guides 1.6, 1.32, and 1.75). Individual fire pump connections to the yard fire main loop should be separated with sectionalizing valves between connections. Each pump and its driver and controls should be located in a room separated from the remaining fire pumps by a fire wall		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	with a minimum rating of 3 hours. The fuel for the diesel fire pump(s) should be separated so that it does not provide a fire source exposing safety-related equipment. Alarms indicating pump running, driver availability, failure to start, and low fire-main pressure should be provided in the control room. The fire pump installation should conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."		
3.5.8 A method of automatic pressure maintenance of the fire protection water system shall be provided independent of the fire pumps.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800. May be tacitly covered by the following statement. **C.6.b <u>Fire Protection Water Supply Systems</u>** **(6)** The fire pump installation should conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."		
3.5.9 Means shall be provided to immediately notify the control room, or other suitable	**C.6.b <u>Fire Protection Water Supply</u>** **(6)** If pumps are required to meet system pressure or flow		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
constantly attended location, of operation of fire pumps.	requirements, a sufficient number of pumps should be provided to ensure that 100% capacity will be available assuming failure of the largest pump or loss of offsite power (e.g., three 50% pumps or two 100% pumps). This can be accomplished, for example, by providing either: **(a)** Electric motor-driven fire pump(s) and diesel-driven fire pump(s); or **(b)** Two or more seismic Category I Class 1E electric motor-driven fire pumps connected to redundant Class 1E emergency power buses (see Regulatory Guides 1.6, 1.32, and 1.75). Individual fire pump connections to the yard fire main loop should be separated with sectionalizing valves between connections. Each pump and its driver and controls should be located in a room separated from the remaining fire pumps by a fire wall with a minimum rating of 3 hours. The fuel for the diesel fire pump(s) should be separated so that it does not provide a fire source exposing safety-related		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	equipment. Alarms indicating pump running, driver availability, failure to start, and low fire-main pressure should be provided in the control room. The fire pump installation should conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."		
3.5.10 An underground yard fire main loop, designed and installed in accordance with NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, shall be installed to furnish anticipated water requirements.	**C.6.b** **<u>Fire Protection Water Supply</u>** **(1)** An underground yard fire main loop should be installed to furnish anticipated water requirements. NFPA 24, "Standard for Outside Protection," gives necessary guidance for such installation. It references other design codes and standards developed by such organizations as the American National Standards Institute (ANSI) and the American Water Works Association (AWWA). Type of pipe and water treatment should be design considerations with tuberculation as one of the parameters. Means for inspecting and flushing the systems should be provided.		
3.5.11	**C.6.b** **<u>Fire Protection Water</u>**		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
Means shall be provided to isolate portions of the yard fire main loop for maintenance or repair without simultaneously shutting off the supply to both fixed fire suppression systems and fire hose stations provided for manual backup. Sprinkler systems and manual hose station standpipes shall be connected to the plant fire protection water main so that a single active failure or a crack to the water supply piping to these systems can be isolated so as not to impair both the primary and backup fire suppression systems.	**Supply** **(3)** Valves should be installed to permit isolation of outside hydrants from the fire main for maintenance or repair without interrupting the water supply to automatic or manual fire suppression systems in any area containing or presenting a fire hazard to safety-related or safe shutdown equipment.		
3.5.12 Threads compatible with those used by local fire departments shall be provided on all hydrants, hose couplings, and standpipe risers. Exception: Fire departments shall be permitted to be provided with adapters that allow interconnection	**C.6.b Fire Protection Water Supply** **(3)** Threads compatible with those used by local fire departments should be provided on all hydrants, hose couplings, and standpipe risers.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
between plant equipment and the fire department equipment if adequate training and procedures are provided.			
3.5.13 Headers fed from each end shall be permitted inside buildings to supply both sprinkler and standpipe systems, provided steel piping and fittings meeting the requirements of ANSI B31.1, Code for Power Piping, are used for the headers (up to and including the first valve) supplying the sprinkler systems where such headers are part of the seismically analyzed hose standpipe system. Where provided, such headers shall be considered an extension of the yard main system. Each sprinkler and standpipe system shall be equipped with an outside screw and yoke (OS&Y) gate valve or other approved shutoff valve.	**C.6.c <u>Water Sprinkler and Hose Standpipe Systems</u>** **(1)** Sprinkler systems and manual hose station standpipes should have connections to the plant underground water main so that a single active failure or a crack in a moderate-energy line cannot impair both the primary and backup fire suppression systems. Alternatively, headers fed from each end are permitted inside buildings to supply both sprinkler and standpipe systems, provided steel piping and fittings meeting the requirements of ANSI B31.1, "Power Piping," are used for the headers up to and including the first valve supplying the sprinkler systems where such headers are part of the seismically analyzed hose standpipe system. When provided, such headers are considered an extension of the yard main system. Each sprinkler and standpipe system should be equipped with OS&Y (outside		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	screw and yoke) gate valve or other approved shutoff valve and waterflow alarm. Safety-related equipment that does not itself require sprinkler water fire protection but is subject to unacceptable damage if wet by sprinkler water discharge should be protected by water shields or baffles.		
3.5.14* All fire protection water supply and fire suppression system control valves shall be under a periodic inspection program and shall be supervised by one of the following methods. (a) Electrical supervision with audible and visual signals in the main control room or other suitable constantly attended location. (b) Locking valves in their normal position. Keys shall be made available only to authorized personnel. (c) Sealing valves in their normal positions. This option shall be utilized only where	**C.6.c <u>Water Sprinkler and Hose Standpipe Systems</u>** **(2)** Control and sectionalizing valves in the fire water systems should be electrically supervised or administratively controlled. The electrical supervision signal should indicate in the control room. All valves in the fire protection system should be periodically checked to verify position (see NFPA 26, "Supervision of Valves").		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
valves are located within fenced areas or under the direct control of the owner/operator.			
3.5.15 Hydrants shall be installed approximately every 250 ft (76 m) apart on the yard main system. A hose house equipped with hose and combination nozzle and other auxiliary equipment specified in NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, shall be provided at intervals of not more than 1000 ft (305 m) along the yard main system. Exception: Mobile means of providing hose and associated equipment, such as hose carts or trucks, shall be permitted in lieu of hose houses. Where provided, such mobile equipment shall be equivalent to the equipment supplied by three hose houses.	**C.6.b <u>Fire Protection Water Supply</u>** **(7)** Outside manual hose installation should be sufficient to provide an effective hose stream to any onsite location where fixed or transient combustibles could jeopardize safety-related equipment. Hydrants should be installed approximately every 250 ft on the yard main system. A hose house equipped with hose and combination nozzle and other auxiliary equipment recommended in NFPA 24, "Outside Protection," should be provided as needed, but at least every 1,000 ft. Alternatively, mobile means of providing hose and associated equipment, such as hose carts or trucks, may be used. When provided, such mobile equipment should be equivalent to the equipment supplied by three hose houses.		
3.5.16*	**C.6.b <u>Fire Protection Water</u>**		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
The fire protection water supply system shall be dedicated for fire protection use only. *Exception No. 1: Fire protection water supply systems shall be permitted to be used to provide backup to nuclear safety systems, provided the fire protection water supply systems are designed and maintained to deliver the combined fire and nuclear safety flow demands for the duration specified by the applicable analysis.* *Exception No. 2: Fire protection water storage can be provided by plant systems serving other functions, provided the storage has a dedicated capacity capable of providing the maximum fire protection demand for the specified duration as determined in this section.*	**Supply** **(4)** fire main system piping should be separate from service or sanitary water system piping, except as described in Position C.5.c.(4). **(10)** Common tanks are permitted for fire and sanitary or service water storage. When this is done, however, minimum fire water storage requirements should be dedicated by passive means, for example, use of a vertical standpipe for other water services. Administrative controls, including locks for tank outlet valves, are unacceptable as the only means to ensure minimum water volume.		
3.6 Standpipe and Hose Stations. **3.6.1**	**C.6.c Water Sprinkler and Hose Standpipe Systems**		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
For all power block buildings, Class III standpipe and hose systems shall be installed in accordance with NFPA 14, Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems.	**(4)** Interior manual hose installation should be able to reach any location that contains, or could present a fire exposure hazard to, safety-related equipment with at least one effective hose stream. To accomplish this, standpipes with hose connections equipped with a maximum of 100 feet of 1-1/2-inch woven-jacket, lined fire hose and suitable nozzles should be provided in all buildings on all floors. Individual standpipes should be at least 4 inches in diameter for multiple hose connections and 2-1/2 inches in diameter for single hose connections. These systems should follow the requirements of NFPA 14, "Standpipe and Hose Systems," for sizing, spacing, and pipe support requirements. Hose stations should be located as dictated by the fire hazard analysis to facilitate access and use for fire fighting operations. Alternative hose stations should be provided for an area if the fire hazard could block access to a single hose station serving that		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	area. Provisions should be made to supply water at least to standpipes and hose connections for manual fire fighting in areas containing equipment required for safe plant shutdown in the event of a safe shutdown earthquake. The piping system serving such hose stations should be analyzed for SSE loading and should be provided with supports to ensure system pressure integrity. The piping and valves for the portion of hose standpipe system affected by this functional requirement should, as a minimum, satisfy ANSI B31.1, "Power Piping." The water supply for this condition may be obtained by manual operator actuation of valves in a connection to the hose standpipe header from a normal seismic Category I water system such as the essential service water system. The cross connection should be (a) capable of providing flow to at least two hose stations (approximately 75 gpm per hose station), and (b) designed to the same standards as the seismic		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	Category I water system; it should not degrade the performance of the seismic Category I water system.		
3.6.2 A capability shall be provided to ensure an adequate water flow rate and nozzle pressure for all hose stations. This capability includes the provision of hose station pressure reducers where necessary for the safety of plant industrial fire brigade members and off-site fire department personnel.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800. May be tacitly covered by the following statement. **C.6.c <u>Water Sprinkler and Hose Standpipe Systems</u>** **(4)** … These systems should follow the requirements of NFPA 14, "Standpipe and Hose Systems," for sizing, spacing, and pipe support requirements.		
3.6.3 The proper type of hose nozzle to be supplied to each power block area shall be based on the area fire hazards. The usual combination spray/straight stream nozzle shall not be used in areas where the straight stream can cause unacceptable damage or present an electrical hazard to fire-fighting personnel.	**C.6.c <u>Water Sprinkler and Hose Standpipe Systems</u>** **(5)** The proper type of hose nozzle to be supplied to each area should be based on the fire hazard analysis. The usual combination spray/straight-stream nozzle should not be used in areas where the straight stream can cause unacceptable mechanical damage. Fixed fog nozzles should be provided at locations where high-voltage		

Chapter 3 Fundamental Fire Protection Program and Design Elements	**Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981**	**Basis Statement**	**Basis Document References**
Listed electrically safe fixed fog nozzles shall be provided at locations where high-voltage shock hazards exist. All hose nozzles shall have shutoff capability and be able to control water flow from full open to full closed.	shock hazards exist. All hose nozzles should have shutoff capability. (Guidance on safe distances for water application to live electrical equipment may be found in the "NFPA Fire Protection Handbook.")		
3.6.4 Provisions shall be made to supply water at least to standpipes and hose stations for manual fire suppression in all areas containing systems and components needed to perform the nuclear safety functions in the event of a safe shutdown earthquake (SSE).	**C.6.c <u>Water Sprinkler and Hose Standpipe Systems</u>** **(4)** Provisions should be made to supply water at least to standpipes and hose connections for manual fire fighting in areas containing equipment required for safe plant shutdown in the event of a safe shutdown earthquake. The piping system serving such hose stations should be analyzed for SSE loading and should be provided with supports to ensure system pressure integrity. The piping and valves for the portion of hose standpipe system affected by this functional requirement should, as a minimum, satisfy ANSI B31.1, "Power Piping." The water supply for this condition may be obtained by manual operator actuation of valves in a connection to the hose standpipe header from a normal seismic		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	Category I water system such as the essential service water system. The cross connection should be (a) capable of providing flow to at least two hose stations (approximately 75 gpm per hose station), and (b) designed to the same standards as the seismic Category I water system; it should not degrade the performance of the seismic Category I water system.		
3.6.5 Where the seismic required hose stations are cross-connected to essential seismic non-fire protection water supply systems, the fire flow shall not degrade the essential water system requirement.	**C.6.c <u>Water Sprinkler and Hose Standpipe Systems</u>** **(4)** Provisions should be made to supply water at least to standpipes and hose connections for manual fire fighting in areas containing equipment required for safe plant shutdown in the event of a safe shutdown earthquake. The piping system serving such hose stations should be analyzed for SSE loading and should be provided with supports to ensure system pressure integrity. The piping and valves for the portion of hose standpipe system affected by this functional requirement should, as a minimum, satisfy ANSI B31.1, "Power Piping." The water supply for this condition		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	may be obtained by manual operator actuation of valves in a connection to the hose standpipe header from a normal seismic Category I water system such as the essential service water system. The cross connection should be (a) capable of providing flow to at least two hose stations (approximately 75 gpm per hose station), and (b) designed to the same standards as the seismic Category I water system; it should not degrade the performance of the seismic Category I water system.		
3.7 Fire Extinguishers. Where provided, fire extinguishers of the appropriate number, size, and type shall be provided in accordance with NFPA 10, Standard for Portable Fire Extinguishers. Extinguishers shall be permitted to be positioned outside of fire areas due to radiological conditions.	**C.6 Portable Extinguishers** **(f)** Fire extinguishers should be provided in areas that contain, or could present a fire exposure hazard to, safety-related equipment in accordance with guidelines of NFPA 10, "Portable Fire Extinguishers, Installation, Maintenance and Use." Dry chemical extinguishers should be installed with due consideration given to possible adverse effects on safety-related equipment installed in the area.		
3.8 Fire Alarm and	**C.6.b Fire Detection**		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
Detection Systems. **3.8.1 Fire Alarm.** Alarm initiating devices shall be installed in accordance with NFPA 72, National Fire Alarm Code®. Alarm annunciation shall allow the proprietary alarm system to transmit fire-related alarms, supervisory signals, and trouble signals to the control room or other constantly attended location from which required notifications and response can be initiated. Personnel assigned to the proprietary alarm station shall be permitted to have other duties. The following fire-related signals shall be transmitted: (1) Actuation of any fire detection device (2) Actuation of any fixed fire suppression system (3) Actuation of any manual fire alarm station (4) Starting of any fire pump (5) Actuation of any fire	**(1)** Detection systems should be provided for all areas that contain or present a fire exposure to safety-related equipment. **(2)** Fire detection systems should comply with the requirements of Class A systems as defined in NFPA 72D, "Standard for the Installation, Maintenance, and Use of Proprietary Protective Signaling Systems," and Class I circuits as defined in NFPA 70, "National Electrical Code." **(3)** Fire detectors should be selected and installed in accordance with NFPA 72E, "Automatic Fire Detectors." Preoperational and periodic testing of pulsed line-type heat detectors should demonstrate that the frequencies used will not affect the actuation of protective relays in other plant systems. **(4)** Fire detection systems should give audible and visual alarm and annunciation in the control room. Where zoned detection systems are used in a given fire area, local means should be provided to identify which detector zone has actuated. Local audible alarms should sound in the fire area.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
protection supervisory device (6) Indication of alarm system trouble condition	**(5)** Fire alarms should be distinctive and unique so they will not be confused with any other plant system alarms. **(6)** Primary and secondary power supplies should be provided for the fire detection system and for electrically operated control valves for automatic suppression systems. Such primary and secondary power supplies should satisfy provisions of Section 2220 of NFPA 72D. This can be accomplished by using normal offsite power as the primary supply with a 4-hour battery supply as secondary supply; and by providing capability for manual connection to the Class 1E emergency power bus within 4 hours of loss of offsite power. Such connection should follow the applicable guidelines in Regulatory Guides 1.6, 1.32, and 1.75.		
3.8.1.1 Means shall be provided to allow a person observing a fire at any location in the plant to quickly and reliably communicate to the control room or other suitable	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
constantly attended location.			
3.8.1.2 Means shall be provided to promptly notify the following of any fire emergency in such a way as to allow them to determine an appropriate course of action: (1) General site population in all occupied areas (2) Members of the industrial fire brigade and other groups supporting fire emergency response (3) Off-site fire emergency response agencies. Two independent means shall be available (e.g., telephone and radio) for notification of off-site emergency services	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.8.2 Detection.	**C.6.b <u>Fire Detection</u>**		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
If automatic fire detection is required to meet the performance or deterministic requirements of Chapter 4, then these devices shall be installed in accordance with NFPA 72, National Fire Alarm Code, and its applicable appendixes.	**(2)** Fire detection systems should comply with the requirements of Class A systems as defined in NFPA 72D, "Standard for the Installation, Maintenance, and Use of Proprietary Protective Signaling Systems," and Class I circuits as defined in NFPA 70, "National Electrical Code." **(3)** Fire detectors should be selected and installed in accordance with NFPA 72E, "Automatic Fire Detectors." Preoperational and periodic testing of pulsed line-type heat detectors should demonstrate that the frequencies used will not affect the actuation of protective relays in other plant systems.		
3.9 Automatic and Manual Water-Based Fire Suppression Systems. **3.9.1*** If an automatic or manual water-based fire suppression system is required to meet the performance or deterministic requirements of Chapter 4, then the system shall be installed in	**C.6.c <u>Water Sprinklers and Hose Standpipe Systems</u>** **(3)** Fixed water extinguishing systems should conform to requirements of appropriate standards such as NFPA 13, "Standard for the Installation of Sprinkler Systems," and NFPA 15, "Standard for Water Spray Fixed Systems." **(7)** Certain fires, such as those		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
accordance with the appropriate NFPA standards including the following: (1) NFPA 13, Standard for the Installation of Sprinkler Systems (2) NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection (3) NFPA 750, Standard on Water Mist Fire Protection Systems (4) NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems	involving flammable liquids, respond well to foam suppression. Consideration should be given to use of mechanical low-expansion foam systems, high-expansion foam generators, or aqueous film-forming foam (AFFF) systems, including the AFFF deluge system. These systems should comply with the requirements of NFPA 11, NFPA 11A, NFPA 11B, and NFPA 16, as applicable.		
3.9.2 Each system shall be equipped with a water flow alarm.	**C.6.c <u>Water Sprinklers and Hose Standpipe Systems</u>** **(1)** …Each sprinkler and standpipe system should be equipped with OS&Y (outside screw and yoke) gate valve or other approved shutoff valve and water flow alarm.		
3.9.3	**B.4 <u>Definitions</u>**		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
All alarms from fire suppression systems shall annunciate in the control room or other suitable constantly attended location.	<u>Sprinkler System</u> - a network of piping connected to a reliable water supply that will distribute the water throughout the area protected and will discharge the water through sprinklers in sufficient quantity either to extinguish the fire entirely or to prevent its spread. The system, usually activated by heat, includes a controlling valve and a device for actuating an alarm when the system is in operation. The following categories of sprinkler systems are defined in NFPA 13, "Standard for the Installation of Sprinkler Systems": • Wet-Pipe System • Dry-Pipe System • Pre-action System • Deluge System • Combined Dry-Pipe and Pre-action System • On-Off System **C.2 <u>Administrative Controls</u>** **(m)** Control actions to be taken by the control room operator to determine the need for brigade assistance upon report of a fire or receipt of alarm on control room		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	annunciator panel, for example, announcing location of fire over PA system, sounding fire alarms, and notifying the shift supervisor and the fire brigade leader of the type, size, and location of the fire. **C. 7. <u>Guidelines for Specific Plant Areas</u>** This section of NUREG 0800 only requires that fire detection systems alarm locally and in the control room. There is no specific reference that automatic and manual water-based fire suppression systems alarm locally and in the control room.		
3.9.4 Diesel-driven fire pumps shall be protected by automatic sprinklers.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.9.5 Each system shall be equipped with an OS&Y gate valve or other approved shutoff valve.	**C.6.c <u>Water Sprinklers and Hose Standpipe Systems</u>** **(1)** …Each sprinkler and standpipe system should be equipped with OS&Y (outside screw and yoke) gate valve or other approved shutoff valve and water flow alarm.		
3.9.6 All valves controlling water-	**C.6.c <u>Water Sprinklers and Hose Standpipe Systems</u>**		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
based fire suppression systems required to meet the performance or deterministic requirements of Chapter 4 shall be supervised as described in 3.5.14.	**(2)** Control and sectionalizing valves in the fire water systems should be electrically supervised or administratively controlled. The electrical supervision signal should indicate in the control room. All valves in the fire protection system should be periodically checked to verify position(see NFPA 26, "Supervision of Valves").		
3.10 Gaseous Fire Suppression Systems. **3.10.1** If an automatic total flooding and local application gaseous fire suppression system is required to meet the performance or deterministic requirements of Chapter 4, then the system shall be designed and installed in accordance with the following applicable NFPA codes: (1) NFPA 12, Standard on Carbon Dioxide Extinguishing Systems (2) NFPA 12A, Standard on Halon 1301 Fire	**C.6.d** **<u>Halon Suppression Systems</u>** Halon fire extinguishing systems should comply with the requirements of NFPA 12A and NFPA 12B, “Halogenated Fire Extinguishing Agent Systems Halon 1301 and Halon 1211.” **C.6.e** **<u>Carbon Dioxide Suppression Systems</u>** Carbon dioxide extinguishing systems should comply with the requirements of NFPA 12, "Carbon Dioxide Extinguishing Systems."		

Chapter 3 Fundamental Fire Protection Program and Design Elements	**Mapped to CMEB BTP 9.5-1, NUREG 0800** **July 1981**	**Basis Statement**	**Basis Document References**
Extinguishing Systems (3) NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems			
3.10.2 Operation of gaseous fire suppression systems shall annunciate and alarm in the control room or other constantly attended location identified.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		
3.10.3 Ventilation system design shall take into account prevention from over-pressurization during agent injection, adequate sealing to prevent loss of agent, and confinement of radioactive contaminants.	**C.5.f <u>Ventilation</u>** Where total flooding gas extinguishing systems are used, area intake and exhaust ventilation dampers should be controlled in accordance with NFPA 12, "Carbon Dioxide Systems," and NFPA 12A, "Halon 1301 Systems," to maintain the necessary gas concentration. **C.6.d <u>Halon Suppression Systems</u>** Particular consideration should also be given to: **(1)** Minimum required Halon concentration, distribution, soak time, and ventilation control. Particular consideration should also be given to:		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	C.6.e <u>Carbon Dioxide Suppression Systems</u> **(1)** Minimum required CO_2 concentration, distribution, soak time, and ventilation control; **(4)** Conflicting requirements for venting during CO_2 injection to prevent overpressurization versus sealing to prevent loss of agent. **7.b <u>Control Room Complex</u>** If a halon flooding system is used for fire suppression, these dampers should be strong enough to support the pressure rise accompanying halon discharge and seal tightly against infiltration of halon into the control room.		
3.10.4* In any area required to be protected by both primary and backup gaseous fire suppression systems, a single active failure or a crack in any pipe in the fire suppression system shall not impair both the primary and backup fire suppression capability.	**III. <u>REVIEW PROCEDURES</u>** CMEB reviews the results of an FPP failure modes and effect analysis (impairment) to assure that the entire fire protection system for one safety-related area cannot be impaired by a single failure. **C.1.c. <u>Fire Suppression System Design Basis</u>** **(2)** A single active failure or a crack in a moderate-energy line (pipe) in the fire suppression		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	system should not impair both the primary and backup fire suppression capability. For example, neither the failure of a fire pump, its power supply or controls, nor a crack in a moderate-energy line in the fire suppression system, should result in loss of function of both sprinkler and hose standpipe systems in an area protected by such primary and backup systems.		
3.10.5 Provisions for locally disarming automatic gaseous suppression systems shall be secured and under strict administrative control.	**C.6.d <u>Halon Suppression Systems</u>** Provisions for locally disarming automatic Halon systems should be key locked and under strict administrative control. Automatic Halon extinguishing systems should not be disarmed unless controls as described in Position C.2.j. are provided. **C.6.e <u>Carbon Dioxide Suppression Systems</u>** Provisions for locally disarming automatic carbon dioxide systems should be key locked and under strict administrative control. Automatic carbon dioxide extinguishing systems should not be disarmed unless controls as		

Chapter 3 Fundamental Fire Protection Program and Design Elements	**Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981**	**Basis Statement**	**Basis Document References**
	described in Position C.2.j. are provided.		
3.10.6* Total flooding carbon dioxide systems shall not be used in normally occupied areas.	**C.7.b <u>Control Room Complex</u>** Carbon dioxide flooding systems are not acceptable for these areas.		
3.10.7 Automatic total flooding carbon dioxide systems shall be equipped with an audible pre-discharge alarm and discharge delay sufficient to permit egress of personnel. The carbon dioxide system shall be provided with an odorizer.	**C.6.e <u>Carbon Dioxide Suppression Systems</u>** Where automatic carbon dioxide systems are used, they should be equipped with a pre-discharge alarm system and a discharge delay to permit personnel egress. No similar requirement in CMEB BTP 9.5-1, NUREG 0800 for an odorizer.		
3.10.8 Positive mechanical means shall be provided to lock out total flooding carbon dioxide systems during work in the protected space.	No similar requirement in CMEB BTP 9.5-1, NUREG 0800 for positive mechanical lockout.		
3.10.9 The possibility of secondary thermal shock (cooling) damage shall be considered during the design of any gaseous fire suppression	**C.6.e <u>Carbon Dioxide Suppression Systems</u>** Particular consideration should also be given to: **(3)** Possibility of secondary thermal shock (cooling) damage.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
system, but particularly with carbon dioxide.			
3.10.10 Particular attention shall be given to corrosive characteristics of agent decomposition products on safety systems.	**C.6.d <u>Halon Suppression Systems</u>** Particular consideration should also be given to: **(3)** Toxicity and corrosive characteristics of the thermal decomposition products of Halon.		
3.11 Passive Fire Protection Features. This section shall be used to determine the design and installation requirements for passive protection features. Passive fire protection features include wall, ceiling, and floor assemblies, fire doors, fire dampers, and through fire barrier penetration seals. Passive fire protection features also include electrical raceway fire barrier systems (ERFBS) that are provided to protect cables and electrical components and equipment from the effects of fire.			
3.11.1 Building Separation. Each major building within	**C. 5.a <u>Building Design</u>** **(1)** Fire barriers with a minimum		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
the power block shall be separated from the others by barriers having a designated fire resistance rating of 3 hours or by open space of at least 50 ft (15.2 m) or space that meets the requirements of NFPA 80A, Recommended Practice for Protection of Buildings from Exterior Fire Exposures. *Exception: Where a performance-based analysis determines the adequacy of building separation, the requirements of 3.11.1 shall not apply.*	fire resistance rating of 3 hours should be provided to: **(c)** Separate individual units on a multiple-unit site unless the requirements of General Design Criterion 5 are met with respect to fires. **(8)** Cable spreading rooms should be separated from each other and from other areas of the plant by barriers having a minimum fire resistance of 3 hours. **(13)** Outdoor oil-filled transformers should have oil spill confinement features or drainage away from the buildings. Such transformers should be located at least 50 feet distant from the building, or by ensuring that such building walls within 50 feet of oil-filled transformers are without openings and have a fire resistance rating of at least 3 hours. **7.h <u>Turbine Building</u>** The turbine building should be separated from adjacent structures containing safety-related equipment by a fire barrier with a minimum rating of 3 hours. The fire barriers should be designed so as to maintain		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
	structural integrity even in the event of a complete collapse of the turbine structure.		
3.11.2 Fire Barriers. Fire barriers required by Chapter 4 shall include a specific fire-resistance rating. Fire barriers shall be designed and installed to meet the specific fire resistance rating using assemblies qualified by fire tests. The qualification fire tests shall be in accordance with NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials, or ASTM E 119, Standard Test Methods for Fire Tests of Building Construction and Materials.	**A.4 Definitions** Fire Resistance Rating - The time that materials or assemblies have withstood a fire exposure as established in accordance with the test procedures of "Standard Methods of Fire Tests of Building Construction and Materials" (NFPA 251).		
3.11.3* Fire Barrier Penetrations. Penetrations in fire barriers shall be provided with listed fire-rated door assemblies or listed rated fire dampers having a fire resistance rating consistent with the designated fire resistance	**C.5.a Building Design** **(4)** Penetration openings for ventilation systems should be protected by fire dampers having a rating equivalent to that required of the barrier (see NFPA-90A, "Air Conditioning and Ventilating Systems"). Flexible air duct coupling in ventilation and filter		

Chapter 3 Fundamental Fire Protection Program and Design Elements	**Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981**	**Basis Statement**	**Basis Document References**
rating of the barrier as determined by the performance requirements established by Chapter 4. (See 3.11.3.4 for penetration seals for through penetration fire stops.) Passive fire protection devices such as doors and dampers shall conform with the following NFPA standards, as applicable: (1) NFPA 80, Standard for Fire Doors and Fire Windows (2) NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems (3) NFPA 101, Life Safety Code Exception: Where fire area boundaries are not wall-to-wall, floor-to-ceiling boundaries with all penetrations sealed to the fire rating required of the boundaries, a performance-based analysis shall be required to assess the	systems should be noncombustible. **(5)** Door openings in fire barriers should be protected with equivalently rated doors, frames, and hardware that have been tested and approved by a nationally recognized laboratory. Such doors should be self-closing or provided with closing mechanisms and should be inspected semiannually to verify that automatic hold-open, release, and closing mechanisms and latches are operable. (See NFPA 80, "Fire Doors and Windows.")		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
adequacy of fire barrier forming the fire boundary to determine if the barrier will withstand the fire effects of the hazards in the area. Openings in fire barriers shall be permitted to be protected by other means as acceptable to the AHJ.			
3.11.4* Through Penetration Fire Stops. Through penetration fire stops for penetrations such as pipes, conduits, bus ducts, cables, wires, pneumatic tubes and ducts, and similar building service equipment that pass through fire barriers shall be protected as follows. (a) The annular space between the penetrating item and the through opening in the fire barrier shall be filled with a qualified fire-resistive penetration seal assembly capable of maintaining the fire resistance of the fire barrier. The assembly	**C.5.a** **<u>Building Design</u>** **(3)** Openings through fire barriers for pipe, conduit, and cable trays which separate fire areas should be sealed or closed to provide a fire resistance rating at least equal to that required of the barrier itself. Openings inside conduit larger than 4 inches in diameter should be sealed at the fire barrier penetration. Openings inside conduit 4 inches or less in diameter should be sealed at the fire barrier unless the conduit extends at least 5 feet on each side of the fire barrier and is sealed either at both ends or at the fire barrier with noncombustible material to prevent the passage of smoke and hot gases. Fire barrier penetrations that must maintain environmental isolation or		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
shall be qualified by tests in accordance with a fire test protocol acceptable to the AHJ or be protected by a listed fire-rated device for the specified fire-resistive period. (b) Conduits shall be provided with an internal fire seal that has an equivalent fire-resistive rating to that of the fire barrier through opening fire stop and shall be permitted to be installed on either side of the barrier in a location that is as close to the barrier as possible. *Exception: Openings inside conduit 4 in. (10.2 cm) or less in diameter shall be sealed at the fire barrier with a fire-rated internal seal unless the conduit extends greater than 5 ft (1.5 m) on each side of the fire barrier. In*	pressure differentials should be qualified by test to maintain the barrier integrity under such conditions. Penetration designs should utilize only noncombustible materials and should be qualified by tests. The penetration qualification tests should use the time-temperature exposure curve specified by ASTM E-119, "Fire Test of Building Construction and Materials." The acceptance criteria for the test should require that: **(a)** The fire barrier penetration has withstood the fire endurance test without passage of flame or ignition of cables on the unexposed side for a period of time equivalent to the fire resistance rating required of the barrier. **(b)** The temperature levels recorded for the unexposed side are analyzed and demonstrate that the maximum temperature does not exceed 325^{o} F. **(c)** The fire barrier penetration remains intact and does not allow		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
this case the conduit opening shall be provided with noncombustible material to prevent the passage of smoke and hot gases. The fill depth of the material packed to a depth of 2 in. (5.1 cm) shall constitute an acceptable smoke and hot gas seal in this application.	projection of water beyond the unexposed surface during the hose stream test. The stream shall be delivered through a 1-1/2 inch nozzle set at a discharge angle of 30% with a nozzle pressure of 75 psi and a minimum discharge of 75 gpm with the tip of the nozzle a maximum of 5 ft from the exposed face; or the-stream shall be delivered through a 1-1/2-inch nozzle set at a discharge angle of 15% with a nozzle pressure of 75 psi and a minimum discharge of 75 gpm with the tip of the nozzle a maximum of 10 ft from the exposed face; or the stream shall be delivered through a 2-1/2-inch national standard playpipe equipped with 1-1/8 inch tip, nozzle pressure of 30 psi, located 20 ft from the exposed face.		
3.11.5* Electrical Raceway Fire Barrier Systems (ERFBS). ERFBS required by Chapter 4 shall be capable of resisting the fire effects of the hazards in the area. ERFBS shall be tested in accordance with and shall	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.		

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
meet the acceptance criteria of NRC Generic Letter 86-10, Supplement 1, "Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Safe Shutdown Trains Within the Same Fire Area." The ERFBS needs to adequately address the design requirements and limitations of supports and intervening items and their impact on the fire barrier system rating. The fire barrier system's ability to maintain the required nuclear safety circuits free of fire damage for a specific thermal exposure, barrier design, raceway size and type, cable size, fill, and type shall be demonstrated. *Exception No. 1: When the temperatures inside the fire barrier system exceed the maximum temperature allowed by the acceptance criteria of Generic Letter 86-10, "Fire Endurance Acceptance Test Criteria for*			

Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to CMEB BTP 9.5-1, NUREG 0800 July 1981	Basis Statement	Basis Document References
Fire Barrier Systems Used to Separate Redundant Safe Shutdown Training Within the Same Fire Area," Supplement 1, functionality of the cable at these elevated temperatures shall be demonstrated. Qualification demonstration of these cables shall be performed in accordance with the electrical testing requirements of Generic Letter 86-10, Supplement 1, Attachment 1, "Attachment Methods for Demonstrating Functionality of Cables Protected by Raceway Fire Barrier Systems During and After Fire Endurance Test Exposure." *Exception No. 2: ERFBS systems employed prior to the issuance of Generic Letter 86-10, Supplement 1, are acceptable providing that the system successfully met the limiting end point temperature requirements as specified by the AHJ at the time of acceptance.*			

Deleted: ¶
¶

REVISION SUMMARY

TBD

EXAMPLE 1- Comply

Chapter 3 Fundamental Fire Protection Program and Design Elements	Compliance Statement	Basis Statement	Basis Document References
3.2.2.4 The policy document shall identify the appropriate AHJ for the various areas of the fire protection program.	Comply	The policy document procedure FPP-001, “Fire Protection Program Manual” identifies the appropriate AHJ for the various areas of the fire protection program • NSPC area-NRC • Non-NSPC areas NEIL / Local Authorities / Site FP Engineer	FPP-001, Rev 29, “Fire Protection Program Manual” Section 3.2

EXAMPLE 2- Complies With Clarification (Simple)

Chapter 3 Fundamental Fire Protection Program and Design Elements	Compliance Statement	Basis Statement	Basis Document References
3.4.2.4 Pre-fire plans shall address coordination with other plant groups during fire emergencies.	Complies with Clarification	FPP-002, Fire Emergency" provides the specific instructions for actions required from key groups at HNP supporting the fire brigade/fire emergency actions. There are detailed response coordination actions specified for Control Room personnel and the Security group. Any other coordination actions would be initiated by Control Room personnel as needed for any plant emergency. The Fire Pre-plans contain guidance to be used by the Site Incident Commander for coordination of control room, security and radiation control personnel activities.	FPP-002, Rev 31, "Fire Emergency" FPP-001, Rev 29, "Fire Protection Program Manual", Section 8.6.5-Fire Response

Key Points- FPP-002 is not by definition a pre-plan it is the control room procedure for fire response

EXAMPLE 3- Complies With Clarification (Detailed)

Chapter 3 Fundamental Fire Protection Program and Design Elements	Compliance Statement	Basis Statement	Basis Document References
3.4.4 Fire-Fighting Equipment. Protective clothing, respiratory protective equipment, radiation monitoring equipment, personal dosimeters, and fire suppression equipment such as hoses, nozzles, fire extinguishers, and other needed equipment shall be provided for the industrial fire brigade. This equipment shall conform with the applicable NFPA standards.	Complies with Clarification	Protective clothing, respiratory protective equipment, radiation monitoring equipment, personal dosimeters, and fire suppression equipment such as hoses, nozzles, and other needed equipment are provided for the fire brigade. Protective clothing is designed and purchased to applicable NFPA codes. Respiratory protective equipment is purchased and maintained per applicable industry codes. Fire suppression equipment such as hoses and nozzles are designed and purchased per the applicable NFPA codes.	SHNPP FSAR, Section 9.5.1, page 9.5.1-26, Amendement 50 SHNPP FSAR, Section 9.5.1, page 9.5.1-25, Amendement 37 HPP-630, Rev 20, “Respiratory Protection Program”.

Key Points- Fire Extinguishers are excluded from the response as they are installed in the plant. The requirement is not clear on expectations on maintenance therefore the response excludes “applicable NFPA standards” regarding maintenance of the clothing and equipment.

EXAMPLE 4- Complies via Previous Approval (Specific Approval)

Chapter 3 Fundamental Fire Protection Program and Design Elements	Compliance Statement	Basis Statement	Basis Document References
3.3.2 Structural. Walls, floors, and components required to maintain structural integrity shall be of noncombustible construction, as defined in NFPA 220, Standard on Types of Building Construction.	Complies Via Previous Approval	NUREG 1038 states in part "Interior walls and structural components, ………are noncombustible or are listed by a nationally recognized testing laboratory, such as Factory Mutual (FM) or UL, or have flame-spread, Smoke, and fuel contribution of 25 or less. The staff finds this in accordance with the guidelines of BTP CMEB 9.5-1 Section C.5.a, and, therefore acceptable."	HNP SER NUREG -1038

Key Points – HNP did not look at NFPA 220 and we will rely on the existing plant construction and licensing basis.

EXAMPLE 5- Complies via Previous Approval (Non-Specific Approval)

Chapter 3 Fundamental Fire Protection Program and Design Elements	Compliance Statement	Basis Statement	Basis Document References
3.9.4 Diesel-driven fire pumps shall be protected by automatic sprinklers.	Complies via Previous Approval	SER section 9.5.1 pg 9-51 states in part “The fire pumps are located in the emergency service-water screening structure. The fire pumps are separated by the intake water structure. A single fire is, therefore, unlikely to cause damage to both pumps. Based on its review, the staff concludes that the fire protection water supply system meets Section C.6.c of BTP CMEB 9.5-l and is, therefore, acceptable.”	HNP SER NUREG-1038

Key Points – The original SER identifies that “A single fire is unlikely to cause damage to both pumps” therefore we believe this bounds the current design and the new requirement for sprinklers is not applicable.

EXAMPLE 6- Further Action Required (Pending FAQ 06-008)

Chapter 3 Fundamental Fire Protection Program and Design Elements	Compliance Statement	Basis Statement	Basis Document References
3.5.3 Fire pumps, designed and installed in accordance with NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, shall be provided to ensure that 100 percent of the required flow rate and pressure are available assuming failure of the largest pump or pump power source.	Complies w/Engineering Equivalency Evaluation (FAQ 06-008)	The Centrifugal Fire Pumps installed at SHNPP conform to the applicable requirements of NFPA 20 – 1972. FSAR states "Fire pumps are installed in accordance with NFPA-20. Water is supplied from the Auxiliary Reservoir by two 100 percent capacity fire pumps. Each fire pump provides the total fire protection water supply requirements to the fire main loop, thus required fire pump discharge capacity and pressure are available with either pump out of service."	SHNPP FSAR Amendment 53, section 9.5.1, page 9.5.1-21 HNP-M/BMRK-0007, Rev 2, "Code Compliance Evaluation NFPA 20 – Centrifugal Fire Pumps"

Key Points- NFPA 20 Code Evaluation has sections that were evaluated as acceptable and flagged as "JC". These are considered acceptable engineering equivalency evaluations.

EXAMPLE 7- License Amendment Request (LAR)

Chapter 3 Fundamental Fire Protection Program and Design Elements	Compliance Statement	Basis Statement	Basis Document References
3.5.16 The fire protection water supply system shall be dedicated for fire protection use only. *Exception No. 1: Fire protection water supply systems shall be permitted to be used to provide backup to nuclear safety systems, provided the fire protection water supply systems are designed and maintained to deliver the combined fire and nuclear safety flow demands for the duration specified by the applicable analysis.* .	LAR	The fire protection system water will not be used for any non-fire-related purposes, except to provide makeup to the Non-Essential Services Chilled Water Expansion Tank. However, under normal conditions there would be no water going into this system as makeup. Other uses are as approved by the Superintendent – Shift Operations.	SHNPP FSAR Amendment 53, section 9.5.1, page 9.5.1-20

Key Points- Need to do formal justification for alternate use of water in non-safety related system.

Chapter 3 Reference	Chapter 3 Requirement	NRC Reference	NRC Requirement
3.2.2.3	3.2.2.3* The policy document shall define the fire protection interfaces with other organizations and assign responsibilities for the coordination of activities. In addition, this policy document shall identify the various plant positions having the authority for implementing the various areas of the fire protection program.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.2.2.4	3.2.2.4* The policy document shall identify the appropriate AHJ for the various areas of the fire protection program.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.3.1.3.4	3.3.1.3.4* Plant administrative procedure shall control the use of portable electrical heaters in the plant. Portable fuel-fired heaters shall not be permitted in plant areas containing equipment important to nuclear safety or where there is a potential for radiological releases resulting from a fire.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.3.7.3	3.3.7.3 Flammable gas storage cylinders not required for normal operation shall be isolated from the system.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.3.9 Transformers.	3.3.9* Transformers. Where provided, transformer oil collection basins and drain paths shall be periodically inspected to ensure that they are free of debris and capable of performing their design function.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.3.11 Electrical Equipment	3.3.11 Electrical Equipment Adequate clearance, free of combustible material, shall be maintained around energized electrical equipment.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.

Chapter 3 Reference	Chapter 3 Requirement	NRC Reference	NRC Requirement
3.4.1 On-Site Fire-Fighting Capability.	3.4.1 On-Site Fire-Fighting Capability. All of the following requirements shall apply. (a) A fully staffed, trained, and equipped fire-fighting force shall be available at all times to control and extinguish all fires on site. This force shall have a minimum complement of five persons on duty and shall conform with the following NFPA standards as applicable: (1) NFPA 600, Standard on Industrial Fire Brigades (interior structural fire fighting) (2) NFPA 1500, Standard on Fire Department Occupational Safety and Health Program (3) NFPA 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians (b) * Industrial fire brigade members shall have no other assigned normal plant duties that would prevent immediate response to a fire or other emergency as required. (c) During every shift, the brigade leader and at least two brigade members shall have sufficient training and knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on nuclear safety performance Exception: Sufficient training and knowledge shall be permitted to be provided by an operations advisor dedicated to industrial fire brigade support criteria. (d) * The industrial fire brigade shall be notified immediately upon verification of a fire. (e) Each industrial fire brigade member shall pass an annual physical examination to determine that he or she can perform the strenuous activity required during manual fire-fighting operations. The physical examination shall determine the ability of each member to use respiratory protection equipment.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.4.2.2	3.4.2.2 Pre-fire plans shall be reviewed and updated as necessary.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.

Chapter 3 Reference	Chapter 3 Requirement	NRC Reference	NRC Requirement
3.4.2.3	3.4.2.3* Pre-fire plans shall be available in the control room and made available to the plant industrial fire brigade.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.4.2.4	3.4.2.4* Pre-fire plans shall address coordination with other plant groups during fire emergencies.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.4.5.1 Mutual Aid Agreement.	3.4.5.1 Mutual Aid Agreement. Off-site fire authorities shall be offered a plan for their interface during fires and related emergencies on site.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.4.5.3 Security and Radiation Protection.	3.4.5.3* Security and Radiation Protection. Plant security and radiation protection plans shall address off-site fire authority response.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.8.1.1	3.8.1.1 Means shall be provided to allow a person observing a fire at any location in the plant to quickly and reliably communicate to the control room or other suitable constantly attended location.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.8.1.2	3.8.1.2 Means shall be provided to promptly notify the following of any fire emergency in such a way as to allow them to determine an appropriate course of action: (1) General site population in all occupied areas (2) Members of the industrial fire brigade and other groups supporting fire emergency response (3) Off-site fire emergency response agencies. Two independent means shall be available (e.g., telephone and radio) for notification of off-site emergency services	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.

Chapter 3 Reference	Chapter 3 Requirement	NRC Reference	NRC Requirement
3.9.4	3.9.4 Diesel-driven fire pumps shall be protected by automatic sprinklers.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.10.2	3.10.2 Operation of gaseous fire suppression systems shall annunciate and alarm in the control room or other constantly attended location identified.	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.
3.11.5 Electrical Raceway Fire Barrier Systems (ERFBS).	3.11.5* Electrical Raceway Fire Barrier Systems (ERFBS). ERFBS required by Chapter 4 shall be capable of resisting the fire effects of the hazards in the area. ERFBS shall be tested in accordance with and shall meet the acceptance criteria of NRC Generic Letter 86-10, Supplement 1, “Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Safe Shutdown Trains Within the Same Fire Area.” The ERFBS needs to adequately address the design requirements and limitations of supports and intervening items and their impact on the fire barrier system rating. The fire barrier system’s ability to maintain the required nuclear safety circuits free of fire damage for a specific thermal exposure, barrier design, raceway size and type, cable size, fill, and type shall be demonstrated. Exception No. 1: When the temperatures inside the fire barrier system exceed the maximum temperature allowed by the acceptance criteria of Generic Letter 86-10, “Fire Endurance Acceptance Test Criteria for Fire Barrier Systems Used to Separate Redundant Safe Shutdown Training Within the Same Fire Area,” Supplement 1, functionality of the cable at these elevated temperatures shall be demonstrated. Qualification demonstration of these cables shall be performed in accordance with the electrical testing requirements of Generic Letter 86-10, Supplement 1, Attachment 1, “Attachment Methods for Demonstrating Functionality of Cables Protected by Raceway	NUREG 0800	No similar requirement in CMEB BTP 9.5-1, NUREG 0800.

Chapter 3 Reference	Chapter 3 Requirement	NRC Reference	NRC Requirement
	Fire Barrier Systems During and After Fire Endurance Test Exposure." Exception No. 2: ERFBS systems employed prior to the issuance of Generic Letter 86-10, Supplement 1, are acceptable providing that the system successfully met the limiting end point temperature requirements as specified by the AHJ at the time of acceptance.		

HNP CHAPTER 3 FURTHER ACTIONS REQUIRED

Chapter 3 Section	Summary Action Required
3.3.1.1 General Fire Prevention Activities (1) Training on fire safety information for all employees and contractors including, as a minimum, familiarization with plant fire prevention procedures, fire reporting, and plant emergency alarms	**FAQ to clarify intent of "familiarization with plant fire prevention procedures, fire reporting, and plant emergency alarms" regarding scope of or depth of the training.**
3.3.1.2 Control of Combustible Materials (1)Wood used within the power block shall be listed pressure-impregnated or coated with a listed fire-retardant application. Exception: Cribbing timbers 6 in. by 6 in. (15.2 cm by 15.2 cm) or larger shall not be required to be fire-retardant treated.	**FAQ to define where used in Chapter 3, "power block" and "plant" are intended to mean "areas in which a fire could jeopardize the ability to meet the performance criteria described in section 1.5."**
3.3.1.2 Control of Combustible Materials (4) Combustible storage or staging areas shall be designated, and limits shall be established on the types and quantities of stored materials.	**Response will provide a methodology to evaluate a storage area.**
(6) Controls on use and storage of flammable gases shall be in accordance with applicable NFPA standards.	**FAQ to identify what "applicable" is.**
3.3.5.2 Only metal tray and metal conduits shall be used for electrical raceways. Thin wall metallic tubing shall not be used for power, instrumentation, or control cables. Flexible	**FAQ required clarifying that air drops are acceptable. HNP has exposed cable drops ~ 3' in length.**

metallic conduits shall only be used in short lengths to connect components.	
3.3.5.3 Electric cable construction shall comply with a flame propagation test as acceptable to the AHJ.	**FAQ to identify a list of typical flame propagation tests which are considered acceptable.**
3.3.8 Bulk Storage of Flammable and Combustible Liquids. Bulk storage of flammable and combustible liquids shall not be permitted inside structures containing systems, equipment, or components important to nuclear safety. As a minimum, storage and use shall comply with NFPA 30, Flammable and Combustible Liquids Code.	**FAQ to grant exception for Diesel Generator Day Tanks located within Diesel Generator Buildings.**
3.3.11 Electrical Equipment Adequate clearance, free of combustible material, shall be maintained around energized electrical equipment.	**FAQ to define what "adequate clearance" is. Could be based on OSHA 3ft requirement.**
3.4 Industrial Fire Brigade. **3.4.2.1** The plans shall detail the fire area configuration and fire hazards to be encountered in the fire area, along with any nuclear safety components and fire protection systems and features that are present.	**FAQ to define minimum acceptable pre-plan scope. Suggest use of existing guidance.**
3.4.4 Fire-Fighting Equipment. Protective clothing, respiratory protective equipment, radiation monitoring equipment, personal dosimeters, and fire suppression equipment such as hoses, nozzles, fire extinguishers, and other needed equipment shall be provided	**FAQ to clarify that intent is for design and purchase of equipment. NFPA code requirements for gear maintenance is not applicable.**

for the industrial fire brigade. This equipment shall conform with the applicable NFPA standards.	
3.5.3 Fire pumps, designed and installed in accordance with NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, shall be provided to ensure that 100 percent of the required flow rate and pressure are available assuming failure of the largest pump or pump power source.	**Need to screen the NFPA 20 calc for deviations that were evaluated as acceptable to ensure they meet any criteria of 805.**
3.7 Fire Extinguishers. Where provided, fire extinguishers of the appropriate number, size, and type shall be provided in accordance with NFPA 10, Standard for Portable Fire Extinguishers. Extinguishers shall be permitted to be positioned outside of fire areas due to radiological conditions.	**FAQ to clarify the "where provided" statement.**

SYSTEM FILE NO.#	6175
CALC. TYPE	DH
CATEGORY CODE	B

CAROLINA POWER & LIGHT COMPANY

HNP-M/BMRK-0007

(CALCULATION #)

Code Compliance Evaluation NFPA 20 – Centrifugal Fire Pumps

(TITLE INCLUDING STRUCTURE/SYSTEM/COMPONENT)

FOR

SHEARON HARRIS NUCLEAR POWER PLANT

NUCLEAR ENGINEERING DEPARTMENT

QUALITY CLASS: ☐ **A** ☐ **B** ☐ **C** ☒ **D** ☐ **E**

REV NO	RESPONSIBLE ENGINEER DATE	☒ DESIGN VERIFIED BY ☐ ENGINEERING REVIEW BY DATE	APPROVED BY RESPONSIBLE SUPERVISORY DATE
0	Ross E. Park	John G. Crowther	
REASON FOR CHANGE:			
REASON FOR CHANGE:			

LIST OF EFFECTIVE PAGES

PAGE	REV	PAGE	REV	PAGE	REV
1	1				
2	1				
3	1				
4	1				
5	1				
6	1				
7	1				
8	1				
				ATTACHMENTS	
				1	1
				2	0
				3	1
				4	0
				5	0
				6	1
				7	1

TABLE OF CONTENTS

PURPOSE

The purpose of this analysis is to assess the NFPA 20 – 1972 compliance level of the Centrifugal Fire Pumps installed at the Shearon Harris Nuclear Power Plant (SHNPP). Centrifugal Fire Pumps are required by FSAR (Reference 1.1) Section 9.5.1.2.1 to conform to NFPA 20 – 1972.

SCOPE

System walkdown, design review, and development of this analysis were conducted in accordance with SHNPP Task Scoping Document WA-00011H, "HNP NFPA Code Evaluations". Minor identified code deviations (items that do not require a design change, procedure change, and/or complex evaluation) are dispositioned within this analysis; others Within Attachment 6. These items are identified by a "JC" (Justified Compliance) entry in the "Compliance" column of Attachment 3 to this calculation, the "Code Compliance Verification Checklist".

Rev. 1: This revision resolves the deviations that were noted in Rev. 0 of this calculation. The resolutions were taken from AR 25060, action item #5, and EC 50147.

REFERENCES

1. Licensing Documents

   1.1 SHNPP FSAR, Section 9.5.1, Fire Protection System.
   1.2 SHNPP FSAR, Appendix 9.5A, Fire Protection Hazards Analysis.
   1.3 NUREG-1038, including Supplements 1-4, Safety Evaluation Report Related to the Operation of SHNPP.
   1.4 DBD-202, Rev. 6, Plant Electrical Distribution System.
   1.5 DBD-317, Rev. 0, Water-Based Fire Suppression System.

2. Fire Protection Procedures

   2.1 FPP-001, Rev. 20, Fire Protection Program Manual.
   2.2 FPP-013, Rev. 33, Fire Protection - Minimum Requirements, Mitigating Actions and Surveillance Requirements.

3. Miscellaneous Procedures

   3.1 CM-M0032, Rev. 5, Johnston Vertical Turbine Pumps (Disassembly and Repair)
   3.2 FPT-3001, Rev. 9, Motor Driven Main Fire Pump Operability Test (Monthly)(All Modes).
   3.3 FPT-3004, Rev. 11, Main Fire Pump Flow Test (Annual)(All Modes).

3.4 FPT-3010, Rev. 9, Engine Driven Main Fire Pump Operability Test (Monthly)(All Modes).

3.5 MPT-E0019, Rev. 4, Diesel Fire Pump Battery Weekly Test.

3.6 MPT-E0020, Rev. 3, Diesel Fire Pump Battery Specific Gravity Verification.

3.7 MPT-E0021, Rev. 4, Diesel Fire Pump Battery 18 Month Inspection.

3.8 MPT-M0036, Rev. 8, Fire Protection Emergency Diesel Engine Operational Inspection (18 Months)(All Modes).

3.9 PIC-I305, Rev. 3, Diesel Driven Fire Pump Over-Speed Switch Calibration.

4. Specifications

4.1 CAR-SH-E-12, Rev. 6, Motors for Station Auxiliary Service Furnished With Driven Equipment Rated up to 460V and 250 HP.

4.2 CAR-SH-M-20, Rev. 2, Firewater Pumps.

4.3 CAR-SH-M-62, Rev. 3, Fire Hose and Accessories.

5. Vendor Manuals

5.1 VM-BCF, Rev. 7, Relief Valves (JE Lonergan).

5.2 VM-BJY, Rev. 6, Valves and Accessories (Crane, Inc.).

5.3 VM-EIZ, Rev. 5, Pumps (Johnston Pump Co.)

5.4 VM-IJX, Rev. 16, Motors (General Electric)

5.5 VM-MJD, Rev. 6, Diesel Engine (Cummins Engine Co.)

5.6 VM-UJL, Rev. 0, Pump Drive, Right Angle (Randolph Mfg. Co.)

6. Plant Drawings and Flow Diagrams

6.1 1364-1675, Rev. 1, Fire Water Pump – Diesel Driven

6.2 1364-1676, Rev. 1, Fire Water Pump – Motor Driven

6.3 1364-1691, Rev. 1, Fire Water Pump – Diesel Driven Right Angle Gear Drive

6.4 1364-1693, Rev. 1, Fire Water Pump – Diesel Driven Engine Detail

6.5 1364-1697, Rev. 3, Fire Water Pump – Diesel Driven 550 Gallon Fuel Tank and Rack

6.6 1364-1698, Rev. 1, Fire Water Pump – Diesel Driven Engine Wiring Diagram

6.7 1364-1719, Rev. 1, Fire Water Jockey Pump

6.8 1364-1741, Rev. 1, Fire Water Jockey Pump Motor

6.9 1364-1742, Rev. 1, Fire Water Pump – Motor Driven Motor O/L

6.10 1364-1812, Rev. 2, Diesel Engine Controller Outline

6.11 1364-1813, Rev. 3, Diesel Engine Controller Wiring Diagram

6.12 1364-1814, Rev. 1, Diesel Engine Controller Data Sheet

6.13 1364-1815, Rev. 1, Diesel Engine Controller Schematic Diagram

6.14 1364-1816, Rev. 4, Diesel Engine Controller External Connections and Selection of Operating Features

6.15 1364-2141, Rev. 3, Fire W Pump – Diesel Driven Disch Fittings

6.16 1364-2142, Rev. 3, Fire W Pump – Motor Driven Disch Fittings

6.17 1364-2156, Rev. 0, Fire Water Pump – Diesel Driven Test Curve.

6.18 1364-2157, Rev. 0, Fire Water Pump – Motor Driven Test Curve.

6.19 SD/C-C-1007, Rev. 0, Site P.O.H - 37838 Jockey Pump Controller Outline And Wiring Diagram.

6.20 SD/C-C-1010, Rev. 0, Site P.O.H - 38698 Motor Control Panel, Wiring And Schem. Diag, Cab Outline.

6.21 CAR-2166-B-041, Sheet 79, Rev. 6, Unit No. 1 Power Distribution & Motor Data 480V General Services Bus 1-4A101.

6.22 CAR-2166-B-041, Sheet 253S01, Rev. 9, Unit No. 1 Power Distribution & Motor Data 480V MCC 1-4A1012.

6.23 CAR-2166-B-401, Sheet 2581, Rev. 9, Unit No. 1 Control Wiring Diagram Motor Driven Fire Pump1-4B-NNS.

6.24 CAR-2166-B-401, Sheet 2582, Rev. 7, Unit No. 1 Control Wiring Diagram Jockey Fire Pump1-4X-NNS.

6.25 CAR-2166-B-401, Sheet 2583, Rev. 6, Unit No. 1 Control Wiring Diagram Diesel Driven Emergency Fire Pump 1-4A-NNS

6.26 CAR-2166-S-0301, Sheet 31, Rev. 3, Low Voltage Relay Settings 480V Power Center 1-4A101

6.27 CAR-2166-G-037S01, Rev. 11, General Service Auxiliary One Line Wiring Diagram Bus 1-4A

6.28 CAR-2165-G-209, Rev. 13, Emergency Service Water Intake Screening Structure Piping.

7. Fire Protection Valve Drawings

7.1 1364-21774, Rev. 0.

7.2 1364-44080, Rev. 4

8. Codes and Standards

8.1 NFPA 20, 1972 Edition, Standard for the Installation of Centrifugal Fire Pumps.

9. Calculations

9.1 E1-001.19, Rev. 0, Analysis for Overcurrent Protection for 460V Motor, Motor Driven Fire Pump 1-4B.

10. Engineering Service Requests

10.1 ESR-94-00257, Rev. 0, 2166-B-401 Sht. 2582 Corrections.

10.2 ESR-95-00467, Rev. 0, NAD Assess. Issue H-FP-95-01-I1 (Eval Fire Pump Performance).

10.3 ESR-96-00128, Rev. 0, Revise Instrument Tags on 2166-B-401 Sht. 2582.

10.4 ESR-95-00532, Rev. 0, Fire Pump Seal Ring Material Evaluation.

10.5 ESR-99-00130, Rev. 0, Fire Protection Jockey Pump Line Leak.

10.6 EC 50147, Rev 0,

11. Miscellaneous / Other Documents

11.1 SD-149, Rev. 12, System Description, Fire Protection / Detection Systems.

11.2 OP-149, Rev. 17, Fire Protection.

11.3 Cummins Diesel Engine NT-380-IF Data Sheets

11.4 Purchase Order NY-435007, including Supplements 1-5, Firewater Pumps and Jockey Pumps

11.5 Line As-Built Master List, Rev. 50, dated 7/23/96.

11.6 FCR-FP-583, Rev. 1, Yard Piping: ESW Screening Structure Valve 8FP-R2-1-4

11.7 FCR-SP-121, Rev. 0, Fire Pump Relief Valve Discharge

11.8 AR 25060

SUMMARY

As part of the fire protection code compliance review for SHNPP, the Centrifugal Fire Pumps were reviewed against the code of record edition of NFPA 20, Standard for the Installation of Centrifugal Fire Pumps. This activity was conducted to identify the present level of compliance with the requirements of the consensus standard.

The methodology applied to the NFPA 20 code compliance review was a three-step process as follows:

- Identify the code of record for the Centrifugal Fire Pumps within the scope of this review.
- Identify the applicable sections of the code requiring verification.
- Perform the verification of the applicable code sections.

First, an NFPA Code of Record Determination was performed. This included a review of the installation documents for the Centrifugal Fire Pumps and modification work associated with system hardware. The code of record determination also included the review of the design and purchase specifications, engineering evaluations and design data on record. The results of this review determined that the code of record for the centrifugal fire pumps is NFPA 20 - 1972. The Code of Record Determination is documented in Attachment 1 to this calculation.

Second, an Applicability Matrix was developed which documents a section-by-section review of NFPA 20 - 1972. The review of each section determined whether a formal verification of compliance with that section would be performed. Where sections were determined "not applicable" for formal verification, a justification for this position was provided. The Applicability Matrix is contained in Attachment 2 to this calculation.

Third, system walkdowns and a documentation review were conducted in order to verify compliance with code sections deemed applicable based on the section-by-section code review. The results of this review are documented in the Code Compliance Verification Checklist, which is included as Attachment 3 to this calculation.

CONCLUSIONS

The Centrifugal Fire Pumps installed at SHNPP conform to the applicable requirements of NFPA 20 – 1972. Refer to the corresponding section in Attachment 3 for the exact NFPA code requirement and a detailed discussion of the SHNPP compliance scenario.

CALCULATION INDEXING TABLE IMPACT

The calculation indexing table is not used in this calculation. There are no impacts to equipment, design documents, licensing documents or plant documents as a result of this calculation.

Attachment 1 – Code of Record Determination – NFPA 20

CODE OF RECORD DETERMINATION

NFPA Code: 20, Centrifugal Fire Pumps

SHNPP System: Centrifugal Fire Pumps

Documents Reviewed:

The documents reviewed in the effort to determine the NFPA 20 code of record were items 1 through 6 and 9-11 identified in the References section of this document. Pertinent code of record information obtained from this review is as follows:

Design/Installation:

- Section 9.5.1.2.1 of the SHNPP FSAR (Reference 1.1) identifies the NFPA 20 code of record as 1972.
- CAR-SH-M-20, the Firewater Pump purchase specification, was originally issued in 1972.
- Purchase Order NY-435007, the Fire Pump purchase contract, specified delivery of all Fire Pumps, controllers, and associated equipment no later than January 1, 1974. NFPA 20 was revised in 1974, but the 1972 edition was still in effect on January 1.
- Each of the following drawings (from Reference Item 6) which include various fire pump, pump driver, and controller components and information, were issued by the vendor in either 1972 or 1973. Since NFPA 20 was revised in 1974, the 1972 edition was still in effect at the time or their issue.

  1364-1675, Rev. 1, Fire Water Pump – Diesel Driven

  1364-1676, Rev. 1, Fire Water Pump – Motor Driven

  1364-1691, Rev. 1, Fire Water Pump – Diesel Driven Right Angle Gear Drive

  1364-1693, Rev. 1, Fire Water Pump – Diesel Driven Engine Detail

  1364-1697, Rev. 3, Fire Water Pump – Diesel Driven 550 Gallon Fuel Tank and Rack

  1364-1698, Rev. 1, Fire Water Pump – Diesel Driven Engine Wiring Diagram

  1364-1719, Rev. 1, Fire Water Jockey Pump

  1364-1741, Rev. 1, Fire Water Jockey Pump Motor

  1364-1742, Rev. 1, Fire Water Pump – Motor Driven Motor O/L

  1364-1813, Rev. 3, Diesel Engine Controller Wiring Diagram

  1364-1816, Rev. 4, Diesel Engine Controller External Connections and Selection of Operating Features

  SD/C-C-1007, Rev. 0, Site P.O.H - 37838 Jockey Pump Controller Outline And Wiring Diagram.

  SD/C-C-1010, Rev. 0, Site P.O.H - 38698 Motor Control Panel, Wiring And Schem. Diag, Cab Outline.

Results

Based on the documents reviewed, the code of record for SHNPP Centrifugal Fire Pump design and installation is NPFA 20 – 1972.

Attachment 2 – Applicability Matrix – NFPA 20, 1972 Edition

NFPA Code Review - Applicability Matrix			
NFPA 20 – Standard for the Installation of Centrifugal Fire Pumps, 1972 Edition			
Code Section	**Title**	**Applicability**	**Basis for Non-Applicability**
---	**General**		
---	Purpose	No	General information not pertaining to fire pump design, installation, operation or maintenance.
---	Approval Prior to Purchase	No	General information not pertaining to fire pump design, installation, operation or maintenance.
---	Unit Assembly Required	No	General information regarding pump purchasing and field acceptance tests that do not pertain to fire pump design, installation, operation or maintenance.
---	Complete Plans and Data Required	No	Pre-installation documentation requirements not pertaining to fire pump design, installation, operation or maintenance.
Part I	**Pump Arrangement, Test, and Installation**		
Chapter 1	**Basic Information**		
10	General	Yes	
20	Water Supplies	Yes	
30	Pumps	Yes	
40	Installation	Yes	
50	Power Supply	Yes	
60	Tests	No	Pre-installation shop test requirements not pertaining to fire pump design, installation, operation or maintenance.
70	Alarms	No	Recommendations, not requirements
Chapter 100	**Horizontal Split-case Pumps**		
110	General	No	Both main fire pumps are vertical shaft turbine-type pumps
120	Water Supplies	No	See above
130	Pump	No	See above
140	Installation	No	See above
Chapter 200	**Vertical Shaft Turbine-Type Pumps**		
210	General	Yes	
220	Water Supply	Yes	
230	Pump	Yes	

NFPA Code Review - Applicability Matrix			
NFPA 20 – Standard for the Installation of Centrifugal Fire Pumps, 1972 Edition			
240	Installation	Yes	
250	Driver	Yes	
260	Tests	Yes	
270	Operation and Maintenance	Yes	
Chapter 300	**Special Fire Service Pumps**		
310	General	No	HNP does not use special fire service pumps.
320	Water Supplies	No	See above.
330	Pump	No	See above.
340	Installation	No	See above.
350	Driver	No	See above.
360	Tests	No	See above.
370	Contracts	No	See above.
Part II	**Drive and Driver Controllers for Pump**		
Chapter 400	**Electrical Drive**		
410	General	Yes	
420	Power Station	Yes	
430	Power Supply Lines	Yes	
440	Transformers	Yes	
450	Motors	Yes	
Chapter 500	**Electric Driver Controllers**		
510	Requirements for all Controllers	Yes	
520	Controllers in Excess of 600 Volts	No	Electric motors are 460 volts. This section is therefore not applicable.
530	Limited Service Controllers	No	The motor of the electric fire pump is in excess of 30 horsepower, which is outside the applicability of this section.
Chapter 600	**Internal Combustion Engine Drive**		
610	General	No	General information not pertaining to fire pump design, installation, operation or maintenance.
620	Engines	Yes	
630	Location	Yes	
640	Fuel Supply Arrangement	Yes	
650	Exhaust Piping	Yes	

NFPA Code Review - Applicability Matrix			
NFPA 20 – Standard for the Installation of Centrifugal Fire Pumps, 1972 Edition			
660	Maintenance	Yes	
Chapter 700	**Engine Drive Controllers**		
710	Requirements for all Controllers	Yes	
Chapter 800	**Steam Turbine Drive**		
810	General Features	No	SHNPP does not use steam turbine drives for their fire pumps.
820	Turbine	No	See above.
830	Installation	No	See above.
Part III	**Acceptance, Operation, and Maintenance**		
Chapter 900	**Tests and Instructions**		
910	Field Acceptance Tests	No	Field acceptance test requirements to be followed after installation; the fire pumps have been installed and acceptance tested.
920	Operating Instructions for Centrifugal Fire Pumps	Yes	
930	Care of Pump	Yes	
Appendix A	**Glossary**	No	This Appendix is not part of NFPA Standard 20. It is included for information purposes only.
Appendix B	**Guide for Diagnosing Defects**	No	This Appendix is not part of NFPA Standard 20. It is included for information purposes only.
Appendix C	**Figures and Diagrams**	No	This Appendix is not part of NFPA Standard 20. It is included for information purposes only.

Attachment 3 – Code Compliance Verification Checklist –

NFPA 20 - 1972

Shearon Harris Nuclear Power Plant

Code Compliance Verification Checklist

Code of Record: NFPA 20 – 1972

Systems Reviewed: Centrifugal Fire Pumps

General Notes applicable to the Code Compliance Verification Checklist:

Verification Method

- DR = Documentation Review
- WD = Walkdown Inspection

Compliance

- Y = Yes
- N = No*
- JC = Justified Compliance. This designates an item deemed acceptable based on an engineering or other type of evaluation.
- N/A = Not Applicable

Abbreviations / Acronyms

AHJ : Authority Having Jurisdiction
gpm : gallons per minute
psi : pounds per square inch

* For Non-compliant items, refer to Table 1 in the "Conclusions" section of this calculation for recommended solutions.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
Part I	**Pump Arrangement, Test, and Installation**				
Chapter 1	**Basic Information**				
10	**General**				
11	Approved Pumps Required – Centrifugal fire pumps shall be specifically approved for fire pump service.	DR	Y	• FSAR Sec. 9.5.1, p. 21	Two fire pumps are provided: A diesel driven fire pump (1-4A-NNS) which is FM approved for fire service, and an electric motor driven fire pump (1-4B-NNS) which is UL listed for fire service.
20	**Water Supplies**				
21	Requirements – Fire pumps should be provided with as large and reliable a supply of water as possible. The adequacy and the dependability of the source of water are of primary importance and must be fully determined at the time of installation, also the prospects for its reliability in the future. The minimum water level with maximum discharge from the pump must be determined. Where a stored supply is the only one available, a reliable method of replenishing the supply should be provided. Representatives of the pump manufacturer shall assist in establishing these facts to the satisfaction of the authority having jurisdiction. Water supplies containing salt and other materials deleterious to the fire protection systems should be avoided whenever possible.	DR	Y	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1 • OP-149, 17, Sec 3.3 • CAR-2165-G-209, Rev. 13	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, which has an area of 317 acres at an approximate depth of 14 feet. The storage capacity greatly exceeds the calculated 2 hour fire protection water supply requirement (including system demand, hose stream, reserve supply, and makeup re-supply) which totals 1,440,000 gallons. The reservoir has been designed with seismic considerations to assure availability of the safety related water supplies (which it provides in addition to fire protection water). The quality of water in the reservoir is suitable for use in fire protection systems. Traveling screens are provided at the intake structure for the removal of larger impurities which may be present in the water. The Auxiliary Reservoir water level is required to be at least 248' (centerline of fire pump discharge pipes is at 257'-8½").

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
30	**Pumps**				
31	**Types and Rated Capacities of Pumps**				
31.a	Positive suction fire pumps of horizontal split-case design for horizontal or vertical mounting having rated capacities of 250, 500, 750, 1,000, 1,500, 2,000 or 2,500 gallons per minute, or larger, and rated at net pressure of 40 pounds per square inch, or more.	DR	N/A	• CAR-SH-M-20, Rev. 2, Sec. 5 • FSAR Sec. 9.5.1, p. 21 • SD-149, Rev. 12, Sec. 3.2	The two main fire pumps are of the vertical shaft turbine, single suction type and are rated for 2500 gpm at 125 psi. The requirements of this code section are therefore not applicable.
31.b	Negative suction fire pumps (these can be used with positive suction) of horizontal split-case design for horizontal or vertical mounting having rated capacities of 500, 750, 1,000, 1,500, 2,000, or 2,500 gallons per minute, or larger, and rated at net pressures of 100 pounds per square inch, or more.	DR	N/A	• CAR-SH-M-20, Rev. 2, Sec. 5 • FSAR Sec. 9.5.1, p. 21 • SD-149, Rev. 12, Sec. 3.2	The two main fire pumps are of the vertical shaft turbine, single suction type and are rated for 2500 gpm at 125 psi. The requirements of this code section are therefore not applicable.
31.c	Vertical shaft turbine type fire pumps intended for submerged installation having rated capacities of 500, 750, 1,000, 1,500, 2,000 or 2,500 gallons per minute, or larger, and rated at net pressures of 100 pounds per square inch, or more.	DR	Y	• CAR-SH-M-20, Rev. 2, Sec. 5 • FSAR Sec. 9.5.1, p. 21 • SD-149, Rev. 12, Sec. 3.2	The two main fire pumps are of the vertical shaft turbine, single suction type and are rated for 2500 gpm at 125 psi.
31.d	Special fire service pumps rated at 200, 300, or 450 gallons per minute limited to 130% capacity maximum, and for various pressures. The maximum power required shall not exceed the limitations of a 30 horsepower electric motor.	DR	N/A	• CAR-SH-M-20, Rev. 2, Sec. 5 • FSAR Sec. 9.5.1, p. 21 • SD-149, Rev. 12, Sec. 3.2	The two main fire pumps are of the vertical shaft turbine, single suction type and are rated for 2500 gpm at 125 psi. Special fire service pumps are not used. The requirements of this code section are therefore not applicable.
31.e	Pressure maintenance pumps (jockey or make-up pumps) are to be used when it is desirable to maintain a uniform or relatively high pressure on the fire protection system. The capacity and pressure rating of the pump shall be sufficient to	DR	Y	• CAR-SH-M-20, Rev. 2, Sec. 5 • FSAR Sec. 9.5.1, p. 22 • SD-149, Rev. 12, Sec. 3.2	A centrifugal vertical turbine, single suction type jockey pump (1-4X-NNS, rated for 125 psi at 50 gpm) is used to maintain a uniform pressure on the fire protection system. The jockey pump maintains system pressure at

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	maintain the desired pressure against the leakage in the system as approved by the authority having jurisdiction. A centrifugal type pump is preferable. Where the discharge pressure at pump shut off of a centrifugal type pump exceeds the working pressure rating of the fire protection equipment, or a turbine vane (peripheral) or a positive displacement type pump is used, a suitable relief valve shall be installed on the pump discharge to prevent damage to the fire system.			• NUREG-1038, p. 9-51 • EC 50147	approximately 115-143 psi. The fire protection water supply system has been approved by the NRC, and has been in continuous service and subjected to ongoing testing and maintenance for over 25 years.
32	Standards on Capacity and Pressure – For requirements on capacity and pressure refer to Standard for the Installation of Sprinkler Systems (NFPA No. 13) and Standard for the Installation of Standpipe and Hose Systems (NFPA No. 14) and for hydrants, Standard for Outside Protection (NFPA No. 24).	DR	Y	• CAR-SH-M-20, Rev. 2, Sec. 5 • FSAR Sec. 9.5.1, p. 21 • 1364-2156, Rev. 0 • 1364-2157, Rev. 0	The main fire pumps are sized such that they can meet the largest firewater flow and pressure demand at SHNPP, which is 2750 gpm at 72 psi at the Turbine Building mezzanine 286' elevation South sprinkler system. Each fire pump is capable of providing the total fire protection water supply to the fire main loop, thus required pump discharge capacity and pressure are available with either pump out of service.
33	Name and Capacity Plate – Pumps shall be provided with a Name and Capacity Plate.	WD	Y	• WD	SHNPP fire pumps feature name and capacity plates.
40	**Installation**				
41	**The Pump Room**				
41.a	The fire pump shall be protected against possible interruption of service through damage caused by fire or water, in a manner satisfactory to the authority having jurisdiction.	WD & DR	Y	• WD • NUREG-1038, p. 9-51 • FSAR Sec. 9.5.1, p. 21 • CAR-2165-G-209, Rev. 13	Both main fire pumps and the jockey pump are located at the Emergency Service Water Intake Screening Structure (ESWISS) which is a concrete building. The pumps are actually installed just outside the building, with the motor driven fire pump and the jockey pump at

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					the North wall and the diesel driven fire pump at the South wall (approx. 104' distance between pumps). As such, the pumps are somewhat protected by the adjacent building on one side. The pumps are mounted on the concrete deck which supports the ESWISS enclosure. Although not fully enclosed, the pumps are not subject to interruption of service caused by fire or water or from damage from falling floors or machinery. A weatherproof motor is provided for the motor driven pump, and the engine for the diesel driven pump is installed in a weatherproof enclosure. The installed fire pump configuration, as part of the fire protection water supply system, was approved by the NRC.
41.b	Except where there are several pumps on the same system, located in buildings which are not all subject to one fire, or where the pump is automatically controlled and supplies automatic sprinklers only, the pump should be in a room so located and constructed as to protect it from falling floors or machinery and from fire which might drive away the operator or damage the pump or driving equipment. NOTE: Where the use of brick or reinforced concrete is not feasible, metal lath and cement plaster is recommended for the construction of the pump room.	WD & DR	Y	• WD • NUREG-1038, p. 9-51 • FSAR Sec. 9.5.1, p. 21 • CAR-2165-G-209, Rev. 13	The pumps are located outside the ESWISS building, as described in item 41.a above. The installed fire pump configuration, as part of the fire protection water supply system, was approved by the NRC.
41.c	The pump room should be of ample size, and the	WD & DR	Y	• WD	The pumps are located outside the ESWISS

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	piping and equipment should be so arranged as to make them readily accessible for operation or repair. The pump room should not be used for storage purposes. NOTE: With vertical type pumps it may be necessary to provide a removable panel in the pump house roof to permit the pump to be lifted out for repairs.			• NUREG-1038, p. 9-51	building, as described in item 41.a above. Although there is not a pump room, the piping and equipment are so arranged that they are readily accessible for operation or repair. The installed fire pump configuration, as part of the fire protection water supply system, was approved by the NRC.
41.d	The location of the pump room should be such as to permit installation of short and direct pipe connections, the suction pipe receiving first consideration.	WD & DR	Y	• WD • 1364-1675, Rev. 1 • 1364-1676, Rev. 1 • NUREG-1038, p. 9-51	The pumps are located outside the ESWISS building, as described in item 41.a above. Although there is not a pump room, the pumps are located directly adjacent to the Auxiliary Reservoir to permit short and direct pipe connections. The suction pipes are routed vertically straight down into the supply water, with an overall column assembly length of 18'-6" from concrete grade elevation. The installed fire pump configuration, as part of the fire protection water supply system, was approved by the NRC.
41.e	Suitable means shall be provided for maintaining the temperature of the pump room above 40^{o}F.	WD & DR	JC	• WD • NUREG-1038, p. 9-51 • FSAR Sec. 9.5.1, p. 21 • CAR-SH-M-20, Rev. 2, Sec. 5.05, 5.06 • CAR-SH-M-62, Rev. 3, Sec. 2.0	The pumps are located outside the ESWISS building, as described in item 41.a above. There is no specific means provided to maintain temperature above 40^{o}F. However, SHNPP winter average temperature is 41.3^{o}F, the installed fire pumps and associated equipment are specified for outdoor use (operating range –2 to 105^{o}F), and piping and components subject to freezing are insulated and heat traced.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					The installed fire pump configuration, as part of the fire protection water supply system, was approved by the NRC.
41.f	Artificial light shall be provided, and provision made for drainage and ventilation of the pump room. A suitable lamp or lantern should be provided for emergency use. Emergency lighting may be provided from the battery circuit of an internal combustion engine.	WD & DR	Y	• WD • NUREG-1038, p. 9-51	The ESWISS building has fixed external lights which provide artificial illumination to the pump areas. Ample ventilation is provided, and the floor adjacent to the pump areas is constructed of steel grating which drains directly to the Auxiliary Reservoir below. The installed fire pump configuration, as part of the fire protection water supply system, was approved by the NRC.
41.g	Pump rooms housing electric and engine driven pumps should be dry and free from condensate. Some heat may be required to accomplish this.	WD & DR	Y	• WD • FSAR Sec. 9.5.1, p. 21 • CAR-SH-M-20, Rev. 2, Sec. 5.05, 5.06 • NUREG-1038, p. 9-51	The pumps are located outside the ESWISS building, as described in item 41.a above. There is no specific means provided to maintain the area dry and free from condensate, however, there is ample ventilation and the installed fire pumps and associated equipment are specified for outdoor use. The installed fire pump configuration, as part of the fire protection water supply system, was approved by the NRC.
42	**Discharge Pipe**				
42.a	The size of discharge pipe shall be as given in the following table unless otherwise specified by the authority having jurisdiction. (See Table in Code – for 2500 gpm Pumps, a 12-inch discharge pipe is required).	DR	Y	• CAR-2165-G-209, Rev. 13	Discharge piping from each main fire pump is of 12-inch diameter, which meets the code requirement for 2500 gpm pumps as installed at SHNPP.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
42.b	An approved check valve shall be installed in the discharged pipe. Large fire protection systems sometimes experience severe water hammer caused by back flow when the automatic control shuts down the fire pump. An approved anti-water hammer check valve should be installed in the discharge line of a fire pump where conditions may be expected to cause objectionable water hammer with the usual swing type check valve.	WD & DR	Y	• WD • CAR-2165-G-209, Rev. 13 • 1364-21774, Rev. 0 • VM-BJY, Rev. 6, pp. 5, 14	An approved 12" check valve (Crane Fig. 147½ XU) is installed in each main fire pump discharge pipe. Observed conditions and reviewed documents did not indicate that the use of an anti-water hammer check valve was warranted.
42.c	Approved indicating gate valves shall be installed in such places as needed to make the pump and check valve accessible for repair. NOTE: This requires a valve on the system side of the check valve and on the supply side of the pump if the supply may at any time be under a head.	WD & DR	JC	• WD • CAR-2165-G-209, Rev. 13 • FSAR Sec. 9.5.1, p. 23 • 1364-44080, Rev. 4 • VM-BJY, Rev. 6, p. 7	An approved Crane Fig. 47½ OS&Y gate valve (with Limitorque operator) is installed immediately on the system side of the check valve in each main fire pump discharge outlet. Although not of the indicating type, the gate valves are considered acceptable because in addition to being normally locked open they are also electrically supervised via limit switches (Namco) installed on the valves. As such, a valve out of position will provide indication at the LFDCP and the MFDIC, as well as in the Control Room. This set of safety features adequately compensates for the non-indicating configuration of the gate valves. No gate is required on the supply side of the pump, since the Auxiliary Reservoir water supply will not be under a head.
43	**Relief Valve**				
43.a	Pumps connected to adjustable-speed drivers shall be equipped with an approved relief valve. Where pumps are driven by constant-speed	WD & DR	Y	• WD • CAR-2165-G-209,	Both the adjustable-speed engine driven fire pump and the constant-speed motor driven fire pump are provided with approved relief valves.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	motors and the shut-off pressure plus the static suction pressure exceeds the pressure for which the system is designed to operate, relief valves are required.			Rev. 13 • 1364-2141, Rev. 3 • 1364-2142, Rev. 3	
43.b	The relief valve should ordinarily be set to prevent pressure on the fire protection system in excess of that pressure at which the system was designed to operate.	DR	Y	• SD-149, Rev. 12, Sec. 3.2 • 1364-2141, Rev. 3 • 1364-2142, Rev. 3 • Line Master List • AR 25060 • EC 50147	The relief valves for the two main fire pumps are set at 150 psi. The fire protection system design working pressure is 125 psig and the maximum design pressure rating is 175 psig. EC 50147 evaluated the impact of the 150 psi setpoint on system design.
43.c	Where provided, relief valves shall be of the size given in the following table. (See Table in Code – For 2500 gpm Pumps, a 6-inch relief valve is required).	WD & DR	Y	• WD • CAR-2165-G-209, Rev. 13 • 1364-2141, Rev. 3 • 1364-2142, Rev. 3 • FCR-FP-583, Rev. 1 • FCR-SP-121, Rev. 0	Relief valves are 6-inch size, which meets the code requirement for 2500 gpm pumps as installed at SHNPP.
43.d	The relief valves should be located between the pump and the pump discharge valve.	WD & DR	Y	• WD • CAR-2165-G-209, Rev. 13 • FCR-FP-583, Rev. 1 • FCR-SP-121, Rev. 0	Relief valves are installed between the pump and the discharge gate valve on both main fire pumps.
43.e	The relief valve should discharge into an open pipe in plain sight near the pump or into a cone or funnel secured to the outlet of the valve. This cone should be so constructed that the pump operator can easily see any water wasting through the relief valve, and it should be so made as to avoid splashing water into the pump room. If a closed type cone is used, it should be	WD	JC	• WD • CAR-2165-G-209, Rev. 13 • 1364-2141, Rev. 3 • 1364-2142, Rev. 3 • FCR-SP-121, Rev. 0 • AR 25060	Relief valves discharge into cones which are of the open port type which can allow the operator to see water wasting through the relief valve. Although the relief valve assemblies are located below grade elevation in concrete pits and are covered by insulation such that relief flow cannot be visibly detected, water flow can be

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	provided with means for detecting motion of water through the cone. The cone should be piped to a point where water can be freely wasted, preferably outside the building.				observed in the pit areas for the excess flow in the discharge cone. This flow provides the operator with sufficient knowledge to verify that the pumps are operating in a normal fashion. Relief valves discharge through fixed 10" piping directly back into the Auxiliary Reservoir. The relief valve discharge-piping configuration is designed per NFPA 13. Insulation is installed on the piping and cone due to freeze protection concerns. Wastewater can be observed in the pits when the pump is running.
43.f	If the relief valve waste pipe is connected to an underground drain, care should be taken that no steam drains enter near enough to work back through the cone and into the pump room. Discharge from the relief valves should not be piped into the suction connection, except with the permission of the authority having jurisdiction.	WD & DR	N/A	• WD • CAR-2165-G-209, Rev. 13 • 1364-2141, Rev. 3 • 1364-2142, Rev. 3 • FCR-SP-121, Rev. 0	Relief valves discharge through fixed 10" piping directly back into the Auxiliary Reservoir. The requirements of this code section are therefore not applicable.
43.g	When the supply of water is taken from a suction reservoir of limited capacity, the waste pipe shall drain into such reservoir, entering as far from the pump suction as is necessary to prevent the pump from drafting air which may be carried down by the discharge from the waste pipe.	DR	Y	• FSAR Sec 9.5.1, p. 21 • CAR-2165-G-209, Rev. 13 • 1364-2141, Rev. 3 • 1364-2142, Rev. 3 • FCR-SP-121, Rev. 0	Relief valve waste piping from both main fire pumps discharges through fixed 10" piping directly back into the Auxiliary Reservoir, and is arranged such that it does not affect pump suction.
43.h	The relief valve waste pipe from an open cone should not be smaller than specified below; if more than one elbow is employed the next size larger pipe should be used to complete the connection. (See Table in Code – for Pumps	DR	JC	• CAR-2165-G-209, Rev. 13 • FCR-SP-121, Rev. 0	The installed 10-inch diameter waste piping, which features 2 elbows, does not meet the code requirement for an open cone configuration for 2500 gpm pumps where more than one elbow as installed at SHNPP. However, the configuration

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	2000-2500 gpm, a 10-inch pipe is required, or a 12-inch pipe if more than one elbow is used).				is considered acceptable based on the modifications per FCR-SP-121, which added deflector shields to the relief cones and bored drainage holes in the bottom of the pits to promote drainage.
43.i	The relief valve waste pipe from a closed cone shall be sized to prevent back pressure in excess of 8 psi.	DR	N/A	• CAR-2165-G-209, Rev. 13 • FCR-SP-121, Rev. 0	Relief valve waste piping is to an open cone. The requirements of this code section are therefore not applicable.
43.j	The relief valve shall be so attached as to permit of its ready removal for repairs without disturbing the waste piping.	WD & DR	Y	• WD • 1364-2141, Rev. 3 • 1364-2142, Rev. 3 • FCR-SP-121, Rev. 0	Relief valves are attached to the piping with standard bolted flanged fittings, and are located such that they may be readily removed. However, the entire relief valve assemblies are covered with insulation which would require removal prior to disassembly of the valves. Since removal of the insulation is possible to enable removal / repair of the relief valves, the intent of the code is met.
44	**Hose Valves**				
44.a	Approved 2½-inch hose valves of the number specified in Paragraph 44b shall be provided for use in testing the pumps. The hose valves should ordinarily be attached to a header or manifold; they shall be connected by suitable piping to the pump discharge piping, preferably at a point between the discharge check valve and the discharge gate valve. The hose valves should be so located as to avoid any possible water damage to the driving motor or engine or their controllers, and should preferably be outside the pump room. Where located outside, or at a distance from the pump, and there is any	WD & DR	Y	• WD • CAR-2165-G-209, Rev. 13	A test manifold featuring eight approved 2½-inch hose valves is located at the ESWISS facility, and is installed in a metal enclosure adjacent to the main motor driven fire pump (the enclosure is situated over the pit which contains the main fire pump discharge piping and valves). The test manifold is connected to both main fire pumps, by suitable 12" piping, at a point between the discharge check valve and the discharge gate valve. The hose valves, since they are in an enclosure separate from the pumps and their controllers, are unlikely to cause water damage upon their discharge. The manifold and

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	danger of freezing, an approved indicating gate valve and drain valve shall be located in the line to the hose valves at a point close to the pump.				supply piping is insulated and supplied with an approved drain valve. The metal enclosure is also provided with a heating unit.
44.b	Unless otherwise specified by the authority having jurisdiction, the number of hose valves shall be as given in the following table, except that for special service fire pumps and for booster pumps, only one hose valve is required for five hundred gallon or smaller pumps. (See Table in Code – For 2500 gpm pumps, 8 hose valves are required)	WD & DR	Y	• WD • CAR-2165-G-209, Rev. 13	Eight hose valves are provided as described in Section 44.a, meeting the code requirement for 2500 gpm fire pumps as installed at SHNPP.
44.c	Where water disposal may be a problem, there should be installed a fixed nozzle(s) or pipe outlet arranged to discharge at an appropriate place, or an approved metering device in a pipe line discharging back into the suction supply, for use in making a flow test to the full capacity of the pump or pumps. (See Section 912.) With such test arrangements, the authority having jurisdiction may permit a reduction in the number of hose valves to the number needed for hose stream use.	DR	N/A	• CAR-2165-G-209, Rev. 13	Water can be readily discharged into the Auxiliary Reservoir, which is located immediately adjacent to the hose valve manifold. The requirements of this code section are therefore not applicable.
44.d	Hose valves shall be threaded to conform to the American (National) Standard B26-1925 for Fire Hose Coupling Screw Threads. Adapter couplings securely attached to each outlet shall be provided if local couplings are not American Standard.	DR	Y	• CAR-2165-G-209, Rev. 13	Hose valves installed in the fire pump test manifold feature National Standard threads.
44.e	When 2 hose valves are required, use 4-inch pipe between the header and the connection to discharge piping; when 3 or 4 are required use 6-inch piping; when 6 or 8 are required use 8-	DR	Y	• CAR-2165-G-209, Rev. 13	Discharge pipe for the test manifold is of 12-inch diameter, which exceeds the 8-inch minimum pipe size required for an eight-valve manifold (the pipe is less than 15 feet long).

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	inch pipe. When this pipe is over 15 feet long increase one pipe size.				
45	**Pressure Gages**				
45.a	A pressure gage having a dial not less than 3½ in. in diameter shall be connected near the discharge casting by a ¼-in. cock with lever handle. The dial shall indicate pressure to at least twice the rated working pressure of the pump but not less than 200 psi. The face of the dial shall read in pounds per square inch with the manufacturer's standard graduations.	WD	Y	• WD	Pressure gages having a diameter of at least 3½ inches in size are installed on the discharge of each pump. The gage dials read to 300 psi which is more than twice the 125 psi working pressure of the pumps. The dials read in units of psi, and are graduated at 10 psi intervals.
45.b	A compound pressure and vacuum gage having a dial not less than 3½ in. in diameter shall be connected to the suction pipe near the pump (except in the case of vertical shaft turbine type pumps). The face of the dial shall read in pounds per square inch for the suction range and have a maximum pressure range not less than twice the rated working pressure of the pump, or a lower pressure range may be furnished if the gage is protected from damage by a gage protector.	WD	N/A	• WD	SHNPP fire pumps are of the vertical shaft turbine type. The requirements of this code section are therefore not applicable.
46	Circulation Relief Valve to Prevent Overheating – Pumps which are automatically controlled shall be provided with a ¾-inch relief valve set slightly below the shut-off pressure and arranged to permit circulation of sufficient water to prevent the pump from overheating when operating with no discharge. A ¾ inch relief valve shall be used for pumps with a rated capacity of 500 to 2500 gpm; a one-inch relief valve shall be use for pumps with a rated	WD & DR	N/A	• WD • CAR-SH-M-20, Rev. 2, Sec. 5 • VM-MJD, Rev. 6, p. 0-20	The main fire pumps are automatic vertical shaft turbine pumps, and are classified as submerged type pumps. The diesel engine for the engine driven fire pump is cooled by raw water which is supplied from the fire pump prior to the pump discharge flange. The requirements of this code section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	capacity of 3000 to 4500 gpm. This is not needed for submerged type pumps nor for engine driven pumps for which engine cooling water is taken from the pump discharge. Pumps which are manually controlled shall be equipped with either such a relief valve or with a test valve as specified in Section 133. Provision should be made for discharge to a drain.				
47	**Summary of Pump Data**		N/A		This section summarizes information from preceding sections designating pump capacities and corresponding required discharge piping sizes, relief valve sizes, relief waste line sizes, and numbers of hose valves.
50	**Power Supply**				
51	Dependability of Power Supply – Careful consideration must be given in each case to the dependability of the power supply not overlooking the possible effect on transmission lines of fire in the property or in adjoining buildings which might threaten the property.	DR	Y	• FSAR Sec. 9.5.1, p. 22 • SD-149, Rev. 12, Sec. 5.1 • CAR-2166-B-041, Sh. 79, Rev. 6	Power for the electric motor driven fire pump is supplied from 480V General Services Bus 1-4A101 (compartment 5A) power center, which is fed from a 6.9kV switchgear that has an alternate feed through a bus tie with another 6.9kV switchgear.
Chapter 200	**Vertical Shaft Turbine-Type Pumps**				
210	**General**				
211	Suitability. The deep well turbine-type pump is particularly suitable for fire pump service when the source of water is located below the surface of the ground and it would be difficult to install any other type of pump below the minimum water level. It is a vertical shaft centrifugal pump with rotating impellers suspended from the pump head by a column or eduction pipe	DR	N/A	FSAR Sec. 9.5.1, p. 22	This section describes vertical-type fire pumps and states that either oil-lubricated or water-lubricated vertical pumps are acceptable. No verification is required. SHNPP uses vertical shaft turbine centrifugal fire pumps.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	which also serves as a support for the shaft and bearings. It was originally designed for installation in bored wells, but may also be used to lift water from lakes, streams, open sumps and other sub-surface sources. Oil-lubricated enclosed line shaft or water-lubricated open line shaft pumps will be acceptable.				
212	Maximum Depth. Wells should not be considered as a source of supply for fire pump service where the water level when pumping at 150 per cent capacity exceeds 200 feet from the surface of the ground. In all applications where the water level is expected to exceed 50 feet the authority having jurisdiction shall be supplied with data on the draw-down characteristics of the well and the pump performance to determine the available discharge pressure at the discharge flange of the vertical pump.	DR	N/A	• FSAR Sec. 9.5.1, p. 22	SHNPP fire protection water is supplied from the Auxiliary Reservoir rather than from a well. The requirements of this code section are therefore not applicable.
213	Acceptable Drive. These pumps may be operated by vertical shaft electric motor or, when equipped with a suitable right angle gear drive, they may be operated by an internal combustion engine or a steam turbine. Careful consideration must be given in each case to the dependability of the source of power.	WD & DR	Y	• WD • FSAR Sec. 9.5.1, p. 22 • CAR-SH-M-20, Rev. 2, Sec. 5	There are two vertical shaft turbine fire pumps installed at SHNPP. One is operated by a vertical shaft electric motor, and the other is equipped with a right angle gear drive and operated by a diesel engine. The electric motor power supply is as discussed in Section 51. The diesel engine fuel is supplied by a 550 gallon No. 2 diesel oil tank located adjacent to the ESWISS.
214	Supervision of Installation. Satisfactory operation of vertical turbine-type pumps is dependent to a large extent upon careful and correct installation of the unit; therefore, it is recommended that this work be done under	DR	JC	• CAR-SH-M-20, Rev. 2, Sec. 13.5 and 15 • VM-EIZ, Rev. 5, Sections 1 and 5	The referenced specification required the pump seller to be responsible for the proper specification of installation and operating procedures for the complete drive equipment and engine assembly, as well all motor and

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	direction of a representative of the pump manufacturer.				engine requirements. It also required submittal by the seller of schedules for fabrication of items, tests, etc. The referenced vendor manual sections contain an installation, operation and maintenance manual which includes detailed step-by-step instructions for installation of the provided fire pumps. Although actual supervision of the installation by the seller was not specified, the reviewed documentation provides reasonable assurance that an adequate level of guidance was provided by the pump supplier. Also, the pump has been in service and subjected to ongoing testing and maintenance for over 25 years.
215	Performance. Pumps shall furnish not less than 150 percent of rated capacity at a total head of not less than 65 per cent of the total rated head. The shut-off total head shall not exceed 140 per cent of total rated head.	DR	Y	• CAR-SH-M-20, Rev. 2, Sec. 6.01 and 6.02 • 1364-2156, Rev. 0 • 1364-2157, Rev. 0	The main fire pumps are rated at 2500 gpm at 294 feet of water (125 psi). At initial tests, the pumps delivered the following: GPM / Head (ft.) / Head (psi) / % of Rated 2500 (100%) / 294 / 127 / 100 3750 (150%) / 253 / 110 / 88[1] 0 (Shutoff) / 387 / 167 / 131[2] [1]Greater than or equal to 65 – per code. [2]Less than or equal to 140 – per code. Pump test results demonstrated that the two main fire pumps are capable of the performance required by this code section.
220	**Water Supply**				
221	**Source**				

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
221.a	The water supply shall be acceptable to the authority having jurisdiction. Stored water supplies from reservoirs or tanks supplying wet pits are preferable. Lakes, streams and ground water supply may be acceptable where investigation shows that they can be expected to provide a suitable and reliable supply.	DR	Y	• NUREG-1038, p. 9-51 • FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1 • OP-149, 17, Sec 3.3 • CAR-2165-G-209, Rev. 13	The fire protection water supply system was approved by the NRC. Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, which has an area of 317 acres at an approximate depth of 14 feet. The storage capacity greatly exceeds the calculated 2 hour fire protection water supply requirement (including system demand, hose stream, reserve supply, and makeup re-supply) which totals 1,440,000 gallons. The reservoir has been designed with seismic considerations to assure availability of the safety related water supplies (which it provides in addition to fire protection water). The quality of water in the reservoir is suitable for use in fire protection systems. Traveling screens are provided at the intake structure for the removal of larger impurities which may be present in the water. The Auxiliary Reservoir water level is required to be at least 248' (centerline of fire pump discharge pipes is at 257'-8½").
221.b	The acceptance of a well as a source of water supply shall be dependent upon satisfactory development of the well. The authority having jurisdiction may require an aquifer performance analysis. The history of the water table should be carefully investigated. The number of wells already in use in the area and the probable number that may be in use should be considered in relation to the total amount of water available.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
222	**Pump Submergence**				
222.a	Proper submergence of the pump must be provided for reliability of operation of the fire pump unit.	DR	Y	• 1364-1675, Rev. 1 • 1364-1676, Rev. 1 • CAR-2165-G-209, Rev. 13 • OP-149, 17, Sec 3.3	The main fire pumps are properly submerged as discussed in Section 222.b, which applies to SHNPP fire pumps.
222.b	Wet Pit Installations. The minimum submergence should be such that the second impeller from the bottom of the pump bowl assembly will be below the lowest standing water level in the open body of water supplying the pit. The minimum submergence shall be increased by one foot for each 1000 feet of elevation above seal level.	DR	Y	• 1364-1675, Rev. 1 • 1364-1676, Rev. 1 • CAR-2165-G-209, Rev. 13 • OP-149, 17, Sec 3.3	For both SHNPP main fire pumps, the top of the pump column assembly (also the elevation of the concrete slab on which the aboveground portion or the pump assemblies rest) is 262’-0” above sea level. The top of the pump bowl assemblies is 14’-6 3/16” inches lower, at 247’-5 13/16” elevation. Since the Auxiliary Reservoir water level is required to be at least 248’-0” above sea level, the entire pump bowl assemblies (including all impellers) will always be submerged. This exceeds the requirements of this code section. Since the elevation of the pump assemblies is less than 1000 feet above sea level, no increase is applied to the minimum required submergence.
222.c	Well Installations. Submergence of the second impeller from the bottom of the pump bowl assembly should be 10 feet below the pumping water level at 150 per cent of rated capacity.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
223	**Well Construction**				
223.a	It shall be the ground water supply contractor's	DR	N/A	• FSAR Sec. 9.5.1, p. 20	Fire protection water for the plant is taken from

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	responsibility to make one or more test holes, if necessary, in search of water-bearing formation, develop a well to meet the required water production necessary for a specific pump, to perform all work and install all equipment in a thorough and workmanlike manner.			• SD-149, Rev. 12, Sec. 3.1	the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
332.b	Each well completed must be of ample diameter and depth and sufficiently straight to receive the pump. The turbine-type pump is designed to operate in a vertical position with all parts in correct alignment; it cannot operate in a crooked well unless the turbine unit hangs freely without being cramped.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
224	**Unconsolidated Formations**				
224.a	All casings shall be steel of such diameter and installed to such depths as the formation may justify and in the contractor's opinion best meet the conditions. Both inner and outer casing shall conform to the thickness and weight in Table 224. (See Table 224).	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
224.b	Outer casing shall extend down to approximately the top of the water-bearing formation. The inner casing of lesser diameter and well screen shall extend into the water-bearing formation as the water-bearing stratum encountered may justify and, in the contractor's opinion, best meet the conditions.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
224.c	It should be emphasized that the well screen is a vital part of the well construction and careful attention should be given to its selection. It shall be the same nominal diameter as the inner	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	casing and of the proper length to provide for the quantity of water to be developed. The screen shall be made of stainless steel material (304) except that Monel metal shall be used where it is anticipated that the chloride content of the well water will exceed 1000 parts per million. The screen shall have adequate strength to resist the external forces that will be supplied after it is installed and to minimize the likelihood of damage during the installation.				requirements of this code Section are therefore not applicable.
224.d	The bottom of the well should be sealed properly with a cement plug or a plate of the same material as the screen. The sides of the outer casing should be sealed by the introduction of neat cement placed under pressure from the bottom to the top.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
224.e	The immediate area surrounding the well screen should be properly prepared with clean and well-rounded gravel of such size and quantity as will create a gravel filter to insure a low velocity and friction loss of water leaving the water-bearing formation and entering the well.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
225	Consolidated Formations. Where wells take their supply from consolidated formations, such as rock, the specifications should be decided upon by the authority having jurisdiction upon consultation with a recognized ground water consultant in the area. In instances where the drilling penetrates unconsolidated formations above the rock, surface casing shall be installed, seated in solid rock and cemented in place.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
226	Developing a Well. Developing a new well and cleaning it of sand (not to exceed five parts per million) shall be the ground water supply contractor's responsibility and should be done with a test pump and not the new fire pump which could be ruined before it is placed in service. Freedom from sand shall be determined when the test pump is operating at 150 per cent of rated capacity of the fire pump for which the well is being prepared.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
227	**Test and Inspection of a Well**				
227.a	A test to determine the water production of the well shall be made with an acceptable typed of water measuring device such as an orifice, a venturi meter or a calibrated pitot tube, and shall be witnessed by a representative of the customer, contractor and authority having jurisdiction, as required. The test shall be continuous for a period of at least eight hours at 150 per cent of the rated capacity of the fire pump, with averaged hourly readings over the test period. The test should be evaluated in the light of the effect of other wells in the vicinity and any possible seasonal variation in the water table at the well site. Test data shall describe the static water level at 100 and 150 percent of the rated capacity of the fire pump for which the well is being prepared.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
227.b	The well work completed by the ground water supply contractor should be carefully examined and it there is some doubt about straightness of well, gaging and plotting is recommended	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	before acceptance of the well.				requirements of this code Section are therefore not applicable.
227.c	Before the permanent pump is ordered, the water in the well should be analyzed for corrosiveness including such items as pH, salts such as chlorides, harmful gases such as carbon dioxide (CO2) or hydrogen sulfide (H2S). If the water is corrosive, the pumps should be constructed of a suitable corrosion -resisting material such as bronze or red brass in accordance with chemical analysis and experience in the area.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	Fire protection water for the plant is taken from the fresh water supply impounded in the Auxiliary Reservoir, as described in Section 221.a above, rather than from a well. The requirements of this code Section are therefore not applicable.
230	**Pump**				
231	Discharge Head. The discharge head should be of the aboveground type. In every case the discharge head shall be designed to support the driver, the pump column and the oil tube tension nut or packing container. The discharge head shall also act as a water passage to direct the water from the column into the discharge fittings.	DR	JC	• 1364-1675, Rev. 1 • 1364-1676, Rev. 1 • VM-EIZ, Rev. 5, pp. S5-45, S5-46	The pump discharge head for both main fire pumps is of the underground type (it is installed below the top of concrete slab elevation within the ESWISS concrete foundation). This arrangement was tested and approved by FM for the SHNPP installations, and is therefore considered to meet the intent of this code section. Although the discharge head is below the concrete slab, the above ground portion of the assembly includes a pedestal which is designed to support the driver, the pump column and the packing container. The discharge head acts as a water passage to direct the water from the column into the discharge fittings.
232	**Pump Column**				
232.a	The column shall be furnished in sections not exceeding a nominal length of 10 feet, shall be of minimum weight conforming to specifications in Table 232, and shall be	DR	Y	• VM-EIZ, Rev. 5, pp. S1-4, S1-5, S1-16 • FSAR Sec. 9.5.1, p. 21	Columns for the main fire pumps were furnished in standard ten-foot sections and are connected by threaded sleeve type couplings, with column pipes machined for straight thread, butt joint

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	connected by threaded sleeve type or flange type couplings. The ends of each section of threaded pipe shall be faced parallel and machined with threads to permit the ends to butt so as to form accurate alignment of pump column. All column flange faces shall be parallel and machined for rabbet fit to permit accurate alignment.				construction. Although no reviewed documents specified column weight, it can be reasonably concluded to meet the requirements of this code section based on the approval/listing of both pumps for fire service.
232.b	Open line shaft water-lubricated columns shall not be used where the distance from the pump head to the static water level exceeds 50 feet.	DR	N/A	• CAR-SH-M-20, Rev. 2, Sec. 7.2 • VM-EIZ, Rev. 5, p. S1-5 • 1364-1675, Rev. 1 • 1364-1676, Rev. 1 • CAR-2165-G-209, Rev. 13 • OP-149, 17, Sec 3.3	The main fire pumps feature open line shaft water-lubricated columns. However, since the distance from the main pump heads to the Auxiliary Reservoir minimum static water level is 12'-0" (262'-0" minus 248'-0"), the requirements of this code section are not applicable.
232.c	If the pump is to be of the enclosed line shaft oil lubricated type the shaft enclosing tube shall be furnished in interchangeable sections not over 10 feet in length, of extra strong pipe. An automatic sight feed oiler shall be provided on a suitable mounting bracket with connection to the shaft tube for oil lubricated pumps.	DR	N/A	• CAR-SH-M-20, Rev. 2, Sec. 7.2	The main fire pumps feature water-lubricated columns. The requirements of this code section are therefore not applicable.
233	**Bowl Assembly**				
233.a	The pump bowl shall be of close-grained cast iron or bronze, and provided with bronze wearing rings or other suitable material in accordance with the chemical analysis of the water and experience in the area, as per Paragraph 224b.	DR	Y	• VM-EIZ, Rev. 5, p. S1-16	The pump bowl for both main pumps is of close-grained cast iron. The bowl bearings are dual high lead bronze and rubber.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
233.b	Impellers shall be of bronze of the enclosed or semi-open type.	DR	Y	• VM-EIZ, Rev. 5, pp. S1-16, S6a-8	Both main fire pumps feature enclosed type bronze impellers.
234	**Suction Strainer**				
234.a	A cast or heavy fabricated type of non-ferrous cone or basket type strainer shall be attached to the suction manifold of the pump. The suction strainer shall have a free area of at least four times the area of the suction connections and the openings shall be of such size to restrict the passage of a 1/2 inch sphere.	WD & DR	Y	• WD • VM-EIZ, Rev. 5, pp. S1-16, S6a-8 • 1364-1675, Rev. 1 • 1364-1676, Rev. 1	A bronze basket type strainer is attached at the suction inlet for each pump. Based on assembly drawing dimensions, the suction strainer free area is four times the area of the suction opening for each pump. Field inspection verified that the strainer openings are less than ½- inch in size.
234.b	This suction strainer shall be required in addition to intake screen, specified under Paragraph 143m.	DR	Y	• VM-EIZ, Rev. 5, pp. S1-16, S6a-8 • 1364-1675, Rev. 1 • 1364-1676, Rev. 1	Suction strainers are provided for both main fire pumps.
235	**Fittings**				
235.a	The following fittings to be furnished by the pump manufacturer shall be required for attachment to the pump: Discharge tee or elbow. Hose valve head (separable type), Section 44. Hose valves, Section 44. Automatic air release valve and fittings, Paragraph 235b. Discharge gage conforming to Section 45. Relief valve and discharge cone, when required by Section 43. Water level testing device, Paragraph 235c.	DR	Y	• 1364-1675, Rev. 1 • 1364-1676, Rev. 1 • CAR-2165-G-209, Rev. 13	All applicable fittings designated by this code section were provided by the pump vendor for attachment to the main fire pumps. (For each referenced code Section, see the corresponding section of this checklist for applicability and detailed SHNPP compliance discussion).
235.b	A 1 1/2-inch or larger automatic air release valve is required to vent air from the column and discharge head upon starting the pump and also to serve to admit air to the column to dissipate	WD & DR	Y	• WD • CAR-2165-G-209, Rev. 13 • 1364-2141, Rev. 3	Both main fire pumps are provided with a 2-inch automatic air & vacuum release valve, located in the horizontal discharge line between the pump and the discharge check valve

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	the vacuum when the pump is stopped. This valve shall be located at the highest point in the discharge line between the fire pump and the discharge check valve.			• 1364-2142, Rev. 3	
235.c	Each pump installed in a well must be equipped with a suitable water level detector. The air line method (Section 236) is considered as a satisfactory method of determining depth of water level. This device should be permanently installed.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	SHNPP fire pumps are not installed in wells. The requirements of this code Section are therefore not applicable.
236	**Air Line Method of Water Level Detection**				
236.a	A satisfactory method of determining the water level involves the use of an air line of small pipe or tubing and of known vertical length, a pressure or depth gage, and an ordinary bicycle or automobile pump installed as shown by Fig. 236. The air line pipe should be of known length and extend beyond the lowest anticipated water level in the well in order to assure more reliable gage readings and should be properly installed. As noted in Fig. 236 an air pressure gage is used to indicate the pressure in the air line.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	SHNPP fire pumps are not installed in wells. The requirements of this code Section are therefore not applicable.
236.b	The air line pipe is lowered into the well, a tee is placed in the line above the ground, and a pressure gage is screwed into one connection and the other is fitted with an ordinary bicycle valve to which a bicycle pump is attached. All joints must be made carefully and must be air tight to obtain correct information. When air is forced into the line by means of the bicycle pump the gage pressure increases until all the water has been expelled. When this point is	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	SHNPP fire pumps are not installed in wells. The requirements of this code Section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	reached the gage reading becomes constant. The maximum maintained air pressure recorded by the gage is equivalent to that necessary to support a column of water of the same height as that forced out of the air line. The length of this water column is equal to the amount of air line submerged.				
236.c	Deducting this pressure converted to feet (psi pressure x 2.31 = feet) from the known length of the air line will give the amount of submergence.	DR	N/A	• FSAR Sec. 9.5.1, p. 20 • SD-149, Rev. 12, Sec. 3.1	SHNPP fire pumps are not installed in wells. The requirements of this code Section are therefore not applicable.
240	**Installation**				
241	Pump House. The pump house should be of such character as will offer the minimum obstruction to the convenient handling and hoisting of vertical pump parts. Otherwise the requirements of Section 41 and Section 666 should apply.	WD & DR	N/A	• WD • CAR-2165-G-209, Rev. 13	SHNPP fire pumps are not located in a pump house. The requirements of this code section are therefore not applicable. Reference Sections 41 and 666 for discussion of applicability and associated compliance.
242	Outdoor Setting. If in special cases the authority having jurisdiction does not require a pump room and the unit motor is installed outdoors the motor shall be screened, and adequately protected against tampering. The screen should be easily removable and provision made for ample ventilation. A sheet metal on iron frame is better than wood.	WD & DR	JC	• WD • CAR-SH-M-20, Rev. 2, Sec. 5.05, 5.06, 13.5 • VM-EIZ, Rev. 5, p. S4-4 • NUREG-1038, p. 9-51 • NAS Fire Protection Audit H-FP-00-01 • AR 25060	SHNPP fire pumps, which are suitable for outdoor service, are not located in a pump house. The installed fire pump configuration, as part of the fire protection water supply system, was approved by the NRC. Sheet metal screening, which provides ample ventilation and can be easily removed, is provided around the electric driven fire pump motor. Also, the diesel driven fire pump engine, drive shaft, and right angle drive are similarly protected by metal screening or metal enclosures. However, access to the HNP fire pump motor is not limited due to the open gate at the ESWISS. For justification

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					of the acceptability of this condition, see Attachment 6.
243	**Foundation**				
243.a	The pump foundation for vertical type pumps should be substantially built to carry the weight of the entire pump full of water and the driver. It should be rigid enough to withstand and prevent any vibration. Area of the base of foundation should extend at least 3 inches beyond the pump head base plate on all sides and be of sufficient area strength so that the load per square foot on concrete does not exceed the ordinary foundation standards, or two I-beams of sufficient length and weight may be used on either side of well.	DR	Y	• CAR-2165-G-209, Rev. 13	Both main fire pumps have as their foundation the concrete structure which is also the foundation for the ESWISS building. As such, the pump foundation far exceeds the requirements of this code section in terms of adequate size, strength and rigidity.
243.b	Certified prints can be obtained from the pump manufacturer giving the necessary dimensions.	DR	N/A	• CAR-2165-G-209, Rev. 13	As described in section 243.a above, the pump foundation size far exceeds that required by the code. The recommendation of this code section is therefore not applicable.
243.c	Top of the foundation shall be carefully leveled to permit the pump to hang free in the well.	DR	Y	• CAR-2165-G-209, Rev. 13	Both main fire pumps have as their foundation the concrete structure which is also the foundation for the ESWISS building. It can therefore be reasonably assumed that the top of the pump foundations was properly leveled per the requirements of this code section.
243.d	Where pump is mounted on I-beam over a pit the right angle gear housing and driver should always be installed parallel to beams, never at right angle.	DR	N/A	• CAR-2165-G-209, Rev. 13	Both main fire pumps are mounted on concrete. The requirements of this code section are therefore not applicable.
244	**Method of Erecting**				

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
244.a	Several methods of installing a vertical pump may be followed, depending upon the location of the well and facilities available. Since most of the pump unit is underground, extreme care must be used in assembling and installing it and thoroughly checking the work as it progresses. The installation should be made under supervision of a representative of the pump manufacturer.	DR	JC	• VM-EIZ, Rev. 5, Sections 1 and 5	The referenced vendor manual sections contain an installation, operation and maintenance manual which includes detailed instructions for installation of the provided fire pumps. Although actual supervision of the installation by the seller was not specified, the reviewed documentation provides reasonable assurance that an adequate level of guidance was provided by the pump supplier. Also, this code section does not specify a strict requirement, rather, it provides guidance and recommendations. Additionally, the pumps have been in service and functioning properly for over 25 years.
244.b	The following simple method is the most common. 1. Construct a tripod or portable derrick and use two sets of installing clamps over open well or pump house. After the derrick is in place the alignment should be checked carefully with the well or suction pit to avoid any trouble when setting the pump. 2. Attach set of clamps to the suction pipe on which strainer has already been placed and lower into the well until clamps rest on block beside well casing or on pump foundation. 3. Attach clamps to pump stage assembly and bring over well and install pump stages to suction pipe, etc., until each piece has been installed in accordance with manufacturer's instructions.	DR	JC	• VM-EIZ, Rev. 5, Sections 1 and 5	The referenced vendor manual sections contain an installation, operation and maintenance manual which includes detailed instructions for installation of the provided fire pumps. Although the method described in this code section was not specified, the information contained in the vendor manual provides reasonable assurance that the installations were performed in accordance with the manufacturer's specifications. Also, this code section does not specify a strict requirement, rather, it provides guidance and recommendations. Additionally, the pumps have been in service and functioning properly for over 25 years.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
245	Setting Impellers. The setting of the impellers should only be undertaken by a representative of the pump manufacturer. Improper setting will develop excessive friction loss by rubbing of impellers on pump seals with resultant increase in power demand. If adjusted too high there will be a loss in capacity; full capacity is vital for fire pump service. The top shaft nut should be locked or pinned after proper setting.	DR	JC	• VM-EIZ, Rev. 5, Sections 1 and 5	The referenced vendor manual sections contain an installation, operation and maintenance manual which includes detailed instructions for installation of the provided fire pumps, including impeller adjustment. Although actual supervision of the installation by the seller was not specified, the information contained in the vendor manual provides reasonable assurance that the installations were performed in accordance with the manufacturer's specifications. Also, this code section does not specify a strict requirement, rather, it provides guidance and recommendations. Additionally, the pumps have been in service and functioning properly for over 25 years.
250	**Driver**				
251	**Method of Drive**				
251.a	The pump may be driven by a vertical hollow shaft electric motor or right angle gear drive or dual drive with internal combustion engine or steam turbine. The driver provided must be so constructed that the total thrust of the pump, which includes the weight of the shaft, impellers, and the hydraulic thrust, can be carried on a thrust bearing of ample capacity so that it will have an average life rating of five-year continuous operation. All drivers must be so constructed that axial adjustment of impellers can be made to permit proper installation and operation of the equipment.	DR	Y	• VM-IJX, Rev. 16, p. S2-7 • 1364-1742, Rev. 1 • VM-UJL, Rev. 0 • CAR-SH-M-20, Rev. 2, Sec.12A.10, 12B.11, 13.5	One of the two SHNPP main vertical turbine fire pumps is driven by a vertical hollow shaft electric motor having a minimum bearing life of 12½ years at 7675 lbs. downthrust. The other fire pump is driven by a right angle gear drive with internal combustion (diesel) engine, having a minimum bearing life well over five years. Additionally, the referenced specification required that the engines shall be specifically approved by UL or FM for fire pump service, providing reasonable assurance that the requirements of this code section are fulfilled.
251.b	Motors shall be direct connected, of the vertical, hollow shaft type, drip proof, normal starting	DR	Y	• VM-IJX, Rev. 16, p.	The electric driven fire pump motor is direct connected, of the vertical, hollow shaft type,

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	torque, low starting current, squirrel cage induction type. The motor shall be equipped with an antireverse ratchet.			S2-7 • 1364-1742, Rev. 1	shielded (drip-proof), normal starting torque, squirrel cage induction type, equipped with a non-reverse coupling.
251.c	Gear drives must be acceptable to the authority having jurisdiction. Gear drives shall be of the hollow shaft type, permitting adjustment of the impellers for proper installation and operation of the equipment. The gear drive shall be equipped with an antireverse ratchet.	DR	Y	• VM-UJL, Rev. 0 • NUREG-1038, p. 9-51	The right angle gear drive is of the hollow shaft type and is equipped with non-reverse dowel pins. The gear drive, as part of the fire pump assembly and fire water supply system, was approved by the NRC.
251.d	Where internal combustion engines under manual control are used, it shall be the pump manufacturer's responsibility to furnish a coupling of suitable design which will prevent undue strain on either the engine or pump by reverse operation. Automatic starters are equipped with an antidieseling device which serves to prevent reverse operation from self ignition during compression.	DR	N/A	• FSAR Sec. 9.5.1, p. 22	The SHNPP diesel driven main fire pump is designed for automatic starting. The requirements of this code section are therefore not applicable.
251.e	If dual drive is used, all equipment shall be of approved type and shall include approved free-wheeling clutches (see Paragraph 623.b)	DR	N/A	• CAR-2165-G-209, Rev. 13	Dual drive is not used for SHNPP fire pumps. The requirements of this code section are therefore not applicable.
252	Controls. The controls for the motor, steam turbine or internal combustion engine shall comply with the sections of this standard which cover these controls.	DR	N/A	• FSAR Sec. 9.5.1, p. 22	Compliance assessment for motor and diesel engine controllers is documented in the applicable sections of this checklist. Steam turbine engines are not used for fire pumps at SHNPP.
260	**Tests**				
261	**Field Acceptance and Subsequent Tests**				
261.a	When the installation is completed, with wells and pumping equipment all in place, and necessary adjustments and connections made, an	DR	JC	• P.O. NY-435007 • FPP-013, Rev. 33, Sec. 8.1.3	The referenced purchase order included an option for the seller's supervising and/or start-up field service engineer if requested by the

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	operating test shall be made in the presence of the customer, pump manufacturer and representative of the authority having jurisdiction. Requirements regarding field acceptance test in Article 910 should be followed insofar as they apply, excepting that for well installations the test shall include a continuous run long enough to satisfy the authority having jurisdiction that the permanent pump performs as required, but in no event shall the test be for less than one hour.			• FPT-3001, Rev. 9 • FPT-3004, Rev. 11 • FPT-3010, Rev. 9 • MPT-M0036, Rev. 8 • CM-M0032, Rev. 5	purchaser. This may have occurred, although no reviewed documents confirmed whether this option was requested or whether the requirements of this code section were specifically fulfilled. However, the fire pumps and associated equipment have been in continuous service since their initial installation and are subject to ongoing testing and maintenance as delineated by the referenced procedures. Initial installation acceptance tests are therefore essentially meaningless.
261.b	A yearly inspection and test at 150 per cent rated capacity to determine water level and condition of pump should be made.	DR	Y	• FPP-013, Rev. 33, Sec. 8.1.3 • FPT-3004, Rev. 11	The referenced procedures combine to implement the required testing at yearly intervals for the two main fire pumps (diesel driven and motor driven).
270	**Operation and Maintenance.**				
271	**Operation**				
271.a	In starting the unit for the first time after installation it is advisable to check over all electrical connections to the motor and also the discharge piping from the pump. Then momentarily operate the motor to see that the pump shaft rotates in a counter-clockwise direction when viewed from above.		N/A		This code section provides recommended checkpoints for initial starting of newly installed pumps. No verification is required.
271.b	With these precautions taken the pump may be started and allowed to run. Observe the operation for vibration while running and also any heating of the motor.		N/A		This code section provides recommended procedures initial starting of newly installed pumps. No verification is required.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
272	**Vibration**				
272.a	Pumping units are checked at the factory for smoothness of running and performance and should operate satisfactorily on the job. If excessive vibration is present several conditions may cause the trouble - a bent pump or column shaft, impellers not properly set within the pump bowls, pump not hanging freely in the well, or strain transmitted through the discharge piping.		N/A		This code section provides information on the possible causes of vibration in pumping units. No verification is required.
272.b	If vibration develops later the unit should not be continued in operation. The pump manufacturer should be requested to service the installation and to place it in proper running condition.	DR	Y	• FPP-013, Rev. 33, Sec. 8.1.3 • FPT-3001, Rev. 9 • FPT-3010, Rev. 9 • CM-M0032, Rev. 5 • VM-EIZ, Rev. 5	The referenced FPP and FPT procedures implement monthly verification of main fire pump operability, which includes running the motor driven fire pump for at least 15 minutes and the diesel engine driven fire pump for at least 30 minutes. The pumps are shutdown if any unusual noises or vibration are observed during these tests and the Control Room is notified. The procedures require documentation of any corrective actions to be taken. The referenced CM procedure provides instructions for corrective maintenance disassembly and repair of Johnston Vertical Turbine Pumps, and also references the corresponding Vendor Manual.
273	Excessive Motor Temperature. This condition is generally caused either by a maintained low voltage of the electric service, or when the impellers are not properly set within the pump bowls.		N/A		This code section provides information on the possible causes of excessive motor temperature. No verification is required.
274	**Repair**				
274.a	Manufacturer's instructions must be carefully	DR	Y	• CM-M0032, Rev. 5	The referenced CM procedure provides

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	followed in making repairs, taking apart and reassembling the pumps. This work should only be undertaken by someone familiar with their design.			• VM-EIZ, Rev. 5	instructions for corrective maintenance disassembly and repair of Johnston Vertical Turbine Pumps, and also references the corresponding Vendor Manual. These documents constitute the manufacturer's instructions for proper repair of the fire pumps. Fire pump repairs are performed by mechanics and craftsman trained to the procedures as required by the SHNPP Quality Assurance Program.
274.b	In ordering spare or replacement parts use the pump serial number stamped on the name plate fastened to the pump head.	DR	Y	• CM-M0032, Rev. 5 • VM-EIZ, Rev. 5	The referenced procedure includes a list of replacement parts which corresponds to those specified in the referenced Vendor Manual. Each of the items has been assigned a CP&L Part Number.
Part II	**Drive and Driver Controllers for Pump**				
Chapter 400	**Electric Drive**				
410	**General**				
411	Electrical Equipment – Electrical equipment shall comply with the National Electrical Code (NFPA No. 70), except as modified or provided herein. NOTE: See Par. 2421 of the NFPA Standard for Installation of Sprinkler Systems (NFPA No. 13) regarding supervision of centrifugal fire pumps constituting the sole sprinkler supply.		N/A		This section of the code requires electrical equipment to comply with the National Electrical Code, NFPA-70, except as modified by NFPA 20. Verification of compliance with NFPA 70 is outside the scope of this assessment.
420	**Power Station**				
421	Single Power Station – When current is taken from a single power station, the station should	DR	N/A	• FSAR Sec. 9.5.1, p. 22 • SD-149, Rev. 12, Sec.	Power for the pumps is provided from the SHNPP plant electrical distribution system. The

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	be of noncombustible construction, so located or protected as to be free from chances of serious damage by exposure from fire, and the design and arrangement of apparatus within it such that there will be but little chance of interruption of service.			3.2 • CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • DBD-202, Rev. 6, Section 2.1	power supply for the main pump electric motor is from the 480V power center 1-4A101 (compartment 5A), which is fed from a 6.9kV switchgear that has an alternate feed through a bus tie with another 6.9kV switchgear. The jockey pump power is supplied from 480V MCC-1-4A1012 (compartment 1BR). The requirements of this code section are not applicable.
422	From a Sub-Station – Where current is taken through a sub-station this sub-station should also meet the requirement of Section 421 and in addition the number and arrangement of cables between the station and the sub-station should be such as to practically guarantee continuous power at the sub-station.	DR	Y	• FSAR Sec. 9.5.1, p. 22 • SD-149, Rev. 12, Sec. 3.2 • CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • DBD-202, Rev. 6, Section 2.1	Power for the pumps is provided from the SHNPP plant electrical distribution system. The power supply for the main pump electric motor is from the 480V power center 1-4A101 (compartment 5A), which is fed from a 6.9kV switchgear that has an alternate feed through a bus tie with another 6.9kV switchgear. The jockey pump power is supplied from 480V MCC-1-4A1012 (compartment 1BR).
423	**Other Sources**				
423.a	Where service cannot be obtained from a power station or sub-station meeting these requirements, it should be obtained from two or more stations or sub-stations so located and equipped that an accident or fire at one will not cause an interruption of the service supplied by the others.	DR	Y	• FSAR Sec. 9.5.1, p. 22 • SD-149, Rev. 12, Sec. 3.2 • CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • CAR-2166-G-037S01, Rev. 11 • DBD-202, Rev. 6, Section 2.1	Power for the pumps is provided from the SHNPP plant electrical distribution system. The power supply for the main pump electric motor is from the 480V power center 1-4A101 (compartment 5A), which is fed from a 6.9kV switchgear that has an alternate feed through a bus tie with another 6.9kV switchgear. The jockey pump power is supplied from 480V MCC-1-4A1012 (compartment 1BR).
423.b	A private generating plant located on the	DR	N/A	• FSAR Sec. 9.5.1, p. 22	Power for the pumps is provided from the

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	premises served by the fire pump, if in a separate power house or cut off from main buildings, will be considered as a power station, and may be used as one source of current supply.			• SD-149, Rev. 12, Sec. 3.2 • CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • CAR-2166-G-037S01, Rev. 11 • DBD-202, Rev. 6, Section 2.1	SHNPP plant electrical distribution system, rather than from a private generating plant. The power supply for the main pump electric motor is from the 480V power center 1-4A101 (compartment 5A), which is fed from a 6.9kV switchgear that has an alternate feed through a bus tie with another 6.9kV switchgear. The jockey pump power is supplied from 480V MCC-1-4A1012 (compartment 1BR). The requirements of this code section are not applicable.
430	**Power Supply Lines** (See Fig. 430, Appendix C, for illustrative Diagrams.)				
431	**Types of Lines**				
431.a	The lines between the power plants and the pump room should be of such number, so arranged and so located that there will be small chance of an interruption of service to the motor, due to accident to the lines.	DR	JC	• CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • DBD-202, Rev. 6, Section 2.1.1.f, 2.1.3.2.7	The cables between the pump and power supply are installed underground. The multiple power sources available through the plant electrical distribution system provide sufficient assurance to preclude the chance of an interruption of service to the motor due to accidents to the lines.
431.b	All wiring in the pump room shall be in approved rigid metal conduit, electrical metallic tubing or liquid-tight flexible metal conduit, or for 600 volts or less may be approved mineral insulated metal-sheathed cable (type MI). NOTE: Where the monetary values involved are large and the crippling of this pump service would seriously affect the protection of the	WD & DR	Y	• WD • CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • DBD-202, Rev. 6, Section 2.1.1.f, 2.1.3.2.7	The pumps are installed outdoors. However, all wiring is enclosed in conduit. The cables from the power supply to the pump are installed underground.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	property, at least two separate lines from the power plant or plants to the pump installation should be provided. The lines should be run by separate routes or in such a manner that a failure of both at the same time will by only a remote possibility. Where current is taken from an underground Edison 3-wire system it will be considered that two independent lines have been provided if connections are brought into the pump room from two street mains or feeders not terminating directly in the same junction box. A complete underground circuit from generating station to pump is strongly recommended and should be obtained when practicable. When such construction is not available, an overhead circuit may be allowed, but that part of the circuit adjacent to the plant or exposing plants should be run with special reference to damage in case of fire. Where the pump room is a part of, or in close proximity to, the plant which the pump is designed to protect, the wires for some distance from the pump room should be underground.				
432	**Capacity of Lines**				
432.a	Each line between the power plant and pump room shall be of such size that its carrying capacity, as given by the National Electrical Code (NFPA NO. 70), will not be exceeded.	DR	Y	• CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9	The power cables from 480V General Services Bus 1-4A101 to the electric motor driven pump are sized such that their carrying capacity will not be exceeded.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
				• CAR-2166-G-037S01, Rev. 11 • DBD-202, Rev. 6, Sec. 2.1.3.2.7	
432.b	The voltage at the motors should not drop more than 5 percent below the voltage rating of the motors when the pumps are being driven at rated output, pressure, and speed, and the lines between motors and power stations are carrying their peak loads.	DR	Y	• DBD-202, Rev. 6, Sec. 2.1.3.2.4	The power available from the plant electrical distribution system is such that there will be voltage drop of no greater than 2% at the motors under the described conditions.
432.c	Where squirrel-cage motors are used, the capacity of the generating station, the connecting lines and the transformers should be ample and such as not to cause the voltage to drop sufficiently to prevent the motor starting (not more than 10 percent below normal voltage).	DR	Y	• DBD-202, Rev. 6, Sec. 2.1.3.2.3	The voltage available from the generation stations and from the distribution system is sufficient to permit the motors to start with a voltage no less than 90 percent of the normal voltage.
432.d	When 208-220 (or 208-220/440) volt motors are used on 208-volt nominal lines, the 5 percent voltage drop allowed in 432b shall be figured from the 220-volt rating.	DR	N/A	• CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • DBD-202, Rev. 6	Pump motors are designed for 460V service and are supplied from 480V power sources. The requirements of this code section are therefore not applicable.
433	**Power Supply Protective Devices** (Fuses or Circuit Breakers)				
433.a	Such devices when installed in the power supply circuits at utility plants, sub-stations, or plant load distribution centers ahead of the fire pump feeder circuits shall hold indefinitely stalled rotor current conditions of the fire pump motor(s) under maximum plant load.	DR	JC	• CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • CAR-2166-G-037S01, Rev. 11 • DBD-202, Rev. 6, Sec.	Circuit breakers installed in the power supply circuits are rated for 1600 amps / 50000 amps interrupting current or more. Although evidence of precise compliance with this code section could not be found in the reviewed documents, credit is taken for the adequacy of the plant electrical distribution system, and on that basis

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
				2.1.3.2.7	it is concluded that the requirements of this code section are satisfied.
433.b	Such devices (fuses not recommended) when installed in the fire pump feeder circuit shall hold indefinitely stalled rotor current of the fire pump motor(s) and other necessary associated fire pump installation electrical accessories. NOTE: Each ungrounded conductor shall be protected. See also 514b.	DR	JC	• CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • CAR-2166-G-037S01, Rev. 11 • DBD-202, Rev. 6, Sec. 2.1.3.2.7	Circuit breakers installed in the fire pump feeder circuits are rated for 1600 amps / 50000 amps interrupting current or more. Although evidence of precise compliance with this code section could not be found in the reviewed documents, credit is taken for the adequacy of the plant electrical distribution system, and on that basis it is concluded that the requirements of this code section are satisfied.
440	**Transformers**				
441	Installation – Transformers shall be installed in accordance with the requirements of the National Electric Code (NFPA No. 70). If in the transformer room, there should be access from the outside of the building.		NA		Verification of transformer installation per the requirements of NFPA 70 is outside the scope of this assessment.
442	Isolation – Transformers supplying current to the lights and motors in the building served by the fire pump may also supply the pump motor, provided all load except the pump motor load can be quickly cut off when necessary. Switches for doing this must be in the pump room unless transformer room is near pump room, in which case they may be in transformer room.	DR	JC	• CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • CAR-2166-G-037S01, Rev. 11 • DBD-202, Rev. 6, Sec. 2.1.3.2.7	Station Service Transformer 1-4A101 supplies current to the fire pump and other equipment located at the ESWISS. Although evidence of precise compliance with this code section could not be found in the reviewed documents, credit is taken for the adequacy of the plant electrical distribution system, and on that basis it is concluded that the requirements of this code section are satisfied.
443	Location – Room containing transformers installed solely to supply current to the pump motor must be dry and heated in cold weather, or else the transformers must be normally left connected to the supply lines.	WD & DR	N/A	• CAR-2166-B-041, Sh. 79, Rev. 6 • CAR-2166-B-041, Sh. 253S01, Rev. 9 • CAR-2166-G-037S01,	Station Service Transformer 1-4A101 supplies current to the fire pump and other equipment located at the ESWISS. The requirements of this code section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
				Rev. 11	
450	**Motors**				
451	Types–600 Volts or Less – Electric motors are an accepted dependable source of power for operation of centrifugal fire pumps. All fire pump motors shall be rated for continuous duty and shall not be used at voltages in excess of 110 percent of rated voltage. It is the pump manufacturer's responsibility to provide a motor of ample size as specified in Section 453. Only motors wound for 208 volts shall be used for 208-volt services when the voltage may be less than that determined in accordance with 432d. Direct- or alternating-current motors may be used in accordance with the following requirements: a. Direct-current motors shall be either of the stabilized shunt type, or cumulative compound-wound type. The speed of the motor at no load hot shall not exceed the speed at full load hot by more than 10 percent. b. Alternating-current motors may be of the squirrel-cage induction type with across-the-line type starting equipment unless their starting characteristics would be objectionable to the company furnishing the power, in which case primary resistance primary reactor or auto-transformer type starting may be employed, or a wound rotor type of motor with appropriate starting	DR	Y	• VM-IJX, Rev. 16, Sec. 2A, 2B • CAR-SH-M-20, Rev. 2, Sec. 12A • 1364-1676, Rev. 1 • 1364-1719, Rev. 1 • 1364-1741, Rev. 1 • 1364-1742, Rev. 1 • CAR-2166-B-401, Sh. 2581, Rev. 9 • CAR-2166-B-401, Sh. 2582, Rev. 7	The main fire pump motor is 300 horsepower, 3 Phase, 60 Cycle, 460V, 1800 RPM, of the direct-current, squirrel-cage induction weatherproof type. The motor is designed for starting under full voltage and is also designed for starting under normal torque and at low starting current. The locked-rotor current is 2200 amps, which is per the code Table for this motor. The pump controller is configured for across-the-line starting of the motor. The jockey pump motor is 7.5 horsepower, 3 Phase, 60 Cycle, 460V, 3600 RPM, of the direct-current, squirrel-cage induction weatherproof type. The motor is designed for starting under full voltage and is also designed for starting under normal torque and at low starting current. The locked-rotor current is 63.5 amps, which is per the code table for this motor. The pump controller is configured for across-the-line starting of the motor.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	equipment may be substituted. c. Squirrel-cage induction motors should have normal starting and breakdown torque. The locked-rotor current of three-phase, constant-speed, induction motors, measured with rated voltage and frequency impressed with rotor locked shall not exceed the following values: (See Code for values and Notes that follow.)				
452	Types-In Excess of 600 Volts – All fire pump motors shall be rated for continuous duty and shall not be used at voltages in excess of 110 percent of rated voltage. Voltages above 600 are not recommended for fire pump service, but where it is impracticable to use low voltage, higher voltages may be accepted by the authority having jurisdiction, for motor ratings of approximately 75 horsepower and larger at 2,300 volts and for motor ratings of approximately 100 horsepower and larger at 4,000 volts.	DR	N/A	• VM-IJX, Rev. 16, Sec. 2A, 2B • CAR-SH-M-20, Rev. 2, Sec. 12A • 1364-1676, Rev. 1 • 1364-1719, Rev. 1 • 1364-1741, Rev. 1 • 1364-1742, Rev. 1	Motors for the main motor driven fire pump and the jockey pump are of the 460V type. The requirements of this code section are therefore not applicable.
453	**Current Limits**				
453.a	All motors shall be of such capacity that at rated voltage (and on a.c. motors at rated frequency) their full load ampere rating will not be exceeded (except as allowed by the service factor stamped on the name plate) under any conditions of pump load.	DR	Y	• VM-IJX, Rev. 16, Sec. 2A, 2B • CAR-SH-M-20, Rev. 2, Sec. 12A • 1364-1676, Rev. 1 • 1364-1719, Rev. 1 • 1364-1741, Rev. 1 • 1364-1742, Rev. 1	The main motor driven fire pump and jockey pump motors are of adequate capacity such that at rated voltage and frequency the full load ampere rating of the motors will not be exceeded.
453.b	Motors used at altitudes above 3300 feet shall be	WD & DR	N/A	• WD	Motors for the main motor driven fire pump and

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	operated or derated according to NEMA Standard MG1-14.14 (1963).			• CAR-2165-G-209, Rev. 13	the jockey pump are installed at approximately 262'-0" elevation. The requirements of this code section are therefore not applicable.
454	**Marking**				
454.a	Marking of motor terminals shall be in accordance with the current NEMA Standard MG1-Part 2.	DR	Y	• CAR-SH-E-12, Rev. 6, p. 4	The referenced specification required compliance with NEMA Standard MG1.
454.b	A name plate shall be provided showing the following information:	WD & DR	Y	• WD • 1364-1741, Rev. 1 • 1364-1742, Rev. 1	A name plate is attached to each of the two motors.
	Direct-Current Motors Manufacturer's type and frame designation. Rated horsepower output. Time rating. Voltage. Temperature rise or class of insulation. Ambient temperature. RPM at full load. Full load amperes. Shunt or compound wound.	DR	N/A	• VM-IJX, Rev. 16, Sec. 2A, 2B • CAR-SH-M-20, Rev. 2, Sec. 12A • 1364-1676, Rev. 1 • 1364-1719, Rev. 1 • 1364-1741, Rev. 1 • 1364-1742, Rev. 1	Alternating current type motors are installed for the main motor driven fire pump and the jockey pump. The requirements of this code section are not applicable.
	Alternating-Current Motors *Squirrel-cage Motors* Manufacturer's type and frame designation. Rated horsepower output. Time rating. RPM at full load. Frequency. Number of phases. Voltage. Full load amperes. Code letter.	WD & DR	Y	• WD • 1364-1741, Rev. 1 • 1364-1742, Rev. 1	The motor name plates contain the information required by this code section.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	Service factor, if other than 1.0. Temperature rise or class of insulation and ambient temperature. *Wound Rotor Induction Motor* In addition to information required in previous paragraph, also show secondary amperes at full load and secondary voltage.		N/A		Wound rotor induction motors are not used for the main motor driven fire pump or jockey pump. This portion of the code section is therefore not applicable.
455	**Water Protection**				
455.a	Open motors which are subject to possible splash of water from hose connections close to the pump, shall be protected against such splashing by some means such as a noncombustible, moisture-resisting partition, furnished by the pump manufacturer, installed between the pump and the motor.	WD & DR	N/A	• WD • 1364-1741, Rev. 1 • 1364-1742, Rev. 1 • VM-IJX, Rev. 16, p. S2d-27	Motors for the main fire pump and jockey pump are drip-proof (shielded) with NEMA WP-I (weather-protected) enclosures. The requirements of this code section are therefore not applicable.
455.b	Drip-proof motors shall be arranged as described above unless the hose valves are located outside the pump room.	WD & DR	Y	• WD • 1364-1741, Rev. 1 • 1364-1742, Rev. 1 • VM-IJX, Rev. 16, p. S2d-27	Motors for the main fire pump and jockey pump are drip-proof (shielded) with NEMA WP-I (weather-protected) enclosures. However, the hose connections are located within a metal enclosure and are oriented such that hose discharge would be directly into the Auxiliary Reservoir and not directed toward the pump motors. The motors are therefore considered adequately protected against splashing, satisfying the intent of this code section.
455.c	Splash-proof motors shall be acceptable without splash partition as described above, providing the ventilating inlet and discharge are located so as to prevent impact of dripping or splashing water on windings or other energized mechanisms.	WD & DR	N/A	• WD • 1364-1741, Rev. 1 • 1364-1742, Rev. 1 • VM-IJX, Rev. 16, p. S2d-27	Motors for the main fire pump and jockey pump are drip-proof (shielded) with NEMA WP-I (weather-protected) enclosures. The requirements of this code section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
455.d	Motors of totally enclosed, fan-cooled type shall be acceptable without splash partition. They shall be sealed at the joints and have conduit fittings arranged to prevent the entrance of water. NOTE: See item 19 in Appendix A-Glossary for a description of the various types of electric motors.	WD & DR	N/A	• WD • 1364-1741, Rev. 1 • 1364-1742, Rev. 1 • VM-IJX, Rev. 16, p. S2d-27	Motors for the main fire pump and jockey pump are drip-proof (shielded) with NEMA WP-I (weather-protected) enclosures. The requirements of this code section are therefore not applicable.
455.e	Current-carrying parts of electric motors shall be at least 12 inches above the floor.	WD & DR	Y	• WD • 1364-1741, Rev. 1 • 1364-1742, Rev. 1	Both pump motors are installed such that the entire motor enclosure is at least 12 inches above the concrete deck at the ESWISS.
456	**Other Features**				
456.a	Motors shall be equipped with anti-friction ball or roller-type bearings mounted so as to be effectively sealed against dirt and moisture.	DR	Y	• VM-IJX, Rev. 16, p. S2c-16, 20 • 1364-1741, Rev. 1 • 1364-1742, Rev. 1	Pump motors feature grease-lubricated ball bearings (jockey pump) and oil-lubricated angular contact ball bearings (main pump).
456.b	Instructions as to lubrication and care of motor bearings shall accompany each motor.	DR	Y	• VM-IJX, Rev. 16, p. S2c-16, 20	The referenced vendor manual provides instructions on the lubrication and care of the motors.
456.c	The terminal box shall be of a type which can be arranged for attaching conduit at sides, top or bottom. A totally-enclosed fan-cooled motor shall be provided with a watertight conduit box.	WD & DR	Y	• WD • VM-IJX, Rev. 16, p. S2d-27 • 1364-1741, Rev. 1 • 1364-1742, Rev. 1	The terminal box for the jockey pump motor allows for conduit connection per this code section. The terminal box for the main fire pump motor, although it is not specified as such, appears to allow for installation in any orientation.
456.d	Where unusual moisture or abrasive dust conditions are anticipated, motors shall be of special type or specially insulated to withstand such conditions. Under such conditions high voltage motors shall be totally enclosed.	WD	N/A	• WD	The fire pump motors are not located in an area subject to unusual abrasive dust conditions. The requirements of this code section are therefore not applicable. However, the motors are of the vertical, squirrel-cage, and weatherproof type

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					that provides for protection from moisture.
457	Conformance – Motors furnished for centrifugal fire pump use shall be guaranteed to conform with these specifications.	DR	Y	• P.O. NY-435007	The referenced purchase order required the seller to provide motors that were in conformance with latest issue of NPFA 20.
Chapter 500	**Electric Drive Controllers**				
510	**Requirements for all Controllers**				
511	**General**				
511.a	The following specifications cover controlling equipment of the nonautomatic and automatic types for electric motors driving centrifugal fire pumps. Chapter 400 dealing with the electric motor drive also applies insofar as it is appropriate.		N/A		This code section provides general information on the scope of Section 511. No verification is required.
511.b	Automatic-type controllers are recommended for use only where the fire pump takes its water under positive pressure and their use is not recommended where a suction lift is involved.	DR	Y	• P.O. NY-435007 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	A UL listed / FM approved Automatic controller is provided for the electric motor driven main pump (GTE/Sylvania C10630). An approved controller (GTE/Sylvania 10661 TM-1) is provided for the jockey pump. These pumps take suction under a positive head.
511.c	All controllers shall be specifically approved for fire pump service.	DR	Y	• P.O. NY-435007 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	Automatic controllers are provided for the electric motor driven main pump (GTE/Sylvania C10630) and jockey pump (GTE/Sylvania 10661 TM-1). The motor driven main fire pump controller is UL listed / FM approved for fire pump service. Although the jockey pump controller is not approved for fire pump service, this is acceptable since the jockey pump is a pressure maintenance pump rather than a fire pump (ref. Section 31.e).

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
511.d	The control panel shall be completely assembled, wired, and tested by the manufacturer before shipment from the factory.	DR	JC	• P.O. NY-435007 • CAR-SH-M-20, Rev. 2 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0 • VM-EIZ	The reviewed documents did not specify precise adherence to the requirements of this section. However, the specified equipment was provided by the seller, accepted by CP&L, installed, and has been functioning continuously as a part of the SHNPP fire protection water supply system since that time. It can be reasonably concluded that the intent of this code section has been fulfilled.
511.e	Voltages above 600 v are not recommended for fire pump service, but where it is impracticable to use a low voltage, higher voltages may be accepted by the authority having jurisdiction. High voltage controllers shall be rated at not more than 5000 v. (See Article 520).	DR	N/A	• 1364-1741, Rev. 1 • 1364-1742, Rev. 1 • VM-EIZ	Motors for the electric motor driven fire pump and the jockey pump are of the 460V type. The requirements of this code section are therefore not applicable.
511.f	Controllers conforming to this Standard shall be marked “Fire Pump Controller” and shall show plainly the name of the manufacturer, the identifying designation and the complete electrical rating.	WD	Y	• WD	The controller for the main motor driven fire pump is marked as required by this code section. The jockey pump controller is labeled as a “Jockey Fire Pump Controller”.
512	**Location**				
512.a	The controller shall be located as close to as is practical and within sight of the motor.	WD	Y	• WD	Controllers for the main motor driven fire pump and jockey pump are each located in sight of, and within a 15-foot distance from, the associated motor.
512.b	The controller shall be so located or protected that it will not be injured by water escaping from the pump or connections. Current carrying parts of the controller shall be not less that 12 inches above the floor level.	WD & DR	Y	• WD • P.O. NY-435007 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0 • VM-EIZ	Controllers for the main motor driven fire pump and jockey pump are protected by NEMA III weather resistant enclosures. The entire jockey pump controller enclosure and all current-carrying parts of the motor driven fire pump controller are at least 12 inches above the

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					ESWISS concrete floor deck.
512.c	A clearance of not less that 3½ feet shall be provided at the rear of enclosures designed to be inspected and serviced from the rear.	WD & DR	N/A	• WD • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0 • VM-EIZ	The controller enclosures, which are mounted against the outside wall of the ESWISS, are not designed for rear access. The requirements of this code section are therefore not applicable.
513	**General Construction**				
513.a	Equipment – All equipment shall be suitable for use in locations subject to a moderate degree of moisture such as a damp basement.	DR	Y	• P.O. NY-435007 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	Equipment is suitable for use in a moderately damp location and is installed in NEMA III) weather resistant enclosures.
513.b	Mounting - All equipment shall be mounted in a substantial manner on a single, noncombustible supporting structure.	WD	Y	• WD	Equipment is mounted in NEMA III weather resistant steel enclosures which rest on a concrete slab and are secured to a concrete building wall.
513.c	Enclosure – The structure or panel shall be securely mounted in an enclosure(s) which will protect the equipment against mechanical injury and falling drops of water striking the enclosure from the downward vertical.	WD & DR	Y	• WD • P.O. NY-435007 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0 • VM-EIZ	Controllers for the main motor driven fire pump and jockey pump are protected by NEMA III weather resistant enclosures. The panels adequately protect the enclosed equipment from mechanical injury and falling drops of water.
513.d	Connections and Wiring				
513.d.1	All bus bars and connections shall be readily accessible for maintenance work after installation of the controller without disconnecting the external circuit conductors.	WD & DR	Y	• WD • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0 • VM-EIZ	All connections are accessible for maintenance without disconnecting the external circuit connectors.
513.d.2	Test connections. Provision shall be made to allow the use of test meters by one of the methods outlined in the following paragraphs (a) or (b). a) Terminal shall be so located and arranged that a clamp-or such type meter can be safely and conveniently used, or	WD & DR	Y	• WD • CAR-2166-B-401, Sh. 2582, Rev. 7 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	The main motor driven fire pump controller features specific test connections which satisfy paragraphs a) and b) as described in this code section. The jockey pump controller provides capability for testing per paragraph a), although the test points are not clearly identified as such.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	b) There shall be provided, as part of the controller, a readily accessible test link or equivalent means for connecting a current measuring instrument in one of the motor circuit conductors without the necessity for disconnecting any conductor which runs outside the equipment enclosures. The test link shall be connected between the isolating switch and the circuit breaker.				
513.d.3	Bus bars and other wiring elements of the controller shall be designed on a continuous basis, except that conductors which are in a circuit only during the motor starting period may be designed accordingly.	DR	JC	• CAR-2166-B-401, Sh. 2582, Rev. 7 • P.O. NY-435007 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	No reviewed documents verified compliance with this section. However, the motor driven pump controller (GTE/Sylvania C10630) is UL listed / FM approved for fire service, providing reasonable assurance of compliance with these requirements.
513.e	Protection of Auxiliary Circuits. Circuits which are depended upon for proper operation of the controller shall not have over-current protective devices connected in them.	DR	JC	• CAR-2166-B-401, Sh. 2582, Rev. 7 • P.O. NY-435007 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	No reviewed documents verified compliance with this section. However, the motor driven pump controller (GTE/Sylvania C10630) is UL listed / FM approved for fire service, providing reasonable assurance of compliance with these requirements.
513.f	External Operation. All switching equipment for manual use in connecting or disconnecting, or starting or stopping the motor shall be externally operable as defined in the National Electrical Code (NFPA No. 70). The isolation switch shall meet the requirements of Section 514.	WD & DR	Y	• WD • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	Controllers for the main motor driven fire pump and jockey pump are each equipped with externally operable stopping / disconnection switches for manual use. See section 514 for compliance with individual subsections, as applicable.
513.g	Wiring Diagrams and Instructions. 1) A wiring diagram shall be provided and permanently attached to the inside of the	WD &DR	JC	• WD • CAR-2166-B-401, Sh. 2581, Rev. 7	The inside of the control panels could not be accessed for verification of compliance with this code section. However, the referenced

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	enclosure. 2) All the field wiring terminals shall be plainly marked to correspond with the wiring diagram furnished.			• CAR-2166-B-401, Sh. 2582, Rev. 7 • P.O. NY-435007 • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	documents, which are wiring diagrams for the main motor driven fire pump and jockey pump controllers, are maintained by the SHNPP document control system and are readily retrievable. Therefore, although diagrams were not verified as permanently attached to the inside of each enclosure, the intent of this code requirement is fulfilled. Additionally, since the motor driven pump controller is UL listed / FM approved for fire service, there is reasonable assurance that field wiring terminals are marked to correspond to the applicable wiring diagrams.
513.h	Marking. Each motor control device and each switch and circuit breaker shall be marked to plainly indicate the name of the manufacturer, his designated identifying number and the electrical rating in volts, horsepower, amperes, frequency, phases, etc., as to be visible after installation.	WD & DR	JC	• WD • P.O. NY-435007	The inside of the control panel could not be accessed for verification of compliance with this code section. However, the motor driven pump controller (GTE/Sylvania C10630) is UL listed / FM approved for fire service, providing reasonable assurance of compliance with these requirements.
513.i	Instructions. Complete instructions covering the operation of the controller shall be provided and conspicuously mounted on the controller. Pump operators should be familiar with these instructions and should observe in detail all of their provisions.	WD & DR	Y	• WD • FPP-001, Rev. 26	Start and stop instructions are provided on the front of the main motor driven fire pump controller, and a pre-start checklist is also mounted to the junction box on the front of the motor itself. Operations personnel responsible for inspection, testing & maintenance, and operation of the pumps are trained in the operation of this equipment as required by the SHNPP fire protection program.
514	**Components**				
514.a	Isolating Switch. Except as noted in Paragraph 531.b for limited service controllers, a manually operated isolating switch shall be provided	DR	Y	• CAR-2166-B-401, Sh. 2581, Rev. 9	The non-automatic isolation switch is located on the front of the control panel, is externally operable, and is of the two-hand interlock type.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	within the enclosure, connected on the supply side of the circuit breaker with one pole for each branch circuit connector.			• SD/C-C-1010, Rev. 0	It is connected on the supply side of the circuit breaker and has one pole for each of the 3 branch circuit connectors.
514.a.1	The switch shall be externally operable (see 513f) and the operating handle shall be provided with a spring latch which will not interfere with the closing of the switch, but shall be so arranged that it requires the use of the other hand to hold the latch released in order to permit the opening of the isolating switch.	WD & DR	Y	• WD • SD/C-C-1010, Rev. 0	The non-automatic isolation switch is located on the front of the control panel, is externally operable, and is of the two-hand interlock type, in which the switch and the release latch (button) cannot be operated with one hand.
514.a.2	The ampere rating of the switch shall be at least 115 per cent of the nameplate current rating of the motor.	DR	JC	• CAR-2166-B-401, Sh. 2581, Rev. 9 • P.O. NY-435007 • SD/C-C-1010, Rev. 0	The reviewed documents did not provide the ampere rating of the isolation switch. However, the motor driven pump controller (GTE/Sylvania C10630) is UL listed / FM approved for fire service, providing reasonable assurance of compliance with this requirement.
514.a.3	The following warning shall appear on or immediately adjacent to the isolating switch: WARNING – DO NOT OPEN OR CLOSE THIS SWITCH WHILE THE CIRCUIT BREAKER (DISCONNETING MEANS) IS IN CLOSED POSITION.	WD	Y	• WD	The required warning is located on the instruction label mounted on the front of the cabinet.
514.b	<u>Circuit Breaker (Disconnecting Means)</u>. Except as noted in Section 532 for limited service controllers, the motor branch circuit breaker shall be protected by a suitable magnetic trip-type circuit breaker, connected directly to the load side of the isolating switch and conforming with the following requirements:	DR	Y	• SD/C-C-1010, Rev. 0	The main motor driven fire pump controller is equipped with the required type circuit breaker which is connected to the load side of the isolating device.
514.b.1	No other over-current protective devices shall be in the motor circuit on the load side of the circuit	DR	Y	• CAR-2166-B-401, Sh. 2581, Rev. 9	No over-current protective devices other than the circuit breaker are installed in the motor

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	breaker. Note: See Article 433 for rating and setting of over-current devices in the circuit on the line side of the circuit breaker. See NFPA 70 for the number of over-current units required for circuit protection devices.				circuit on the load side of the breaker.
514.b.2	It shall have one pole for each ungrounded branch circuit conductor.	DR	Y	• SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	The circuit breaker is a 3-pole type, which is as required for the 3-conductor branch circuit.
514.b.3	It shall be externally operable. (See 513f)	WD & DR	Y	• WD • SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	The circuit breaker is externally operable using the handle mounted on the left-front of the cabinet.
514.b.4	It shall trip free of the handle.	DR	Y	• SD/C-C-1007, Rev. 0 • SD/C-C-1010, Rev. 0	The breaker will trip free of the handle.
514.b.5	Its rating shall not be less than 115% of the rated full load current of the motor.	DR	Y	• E1-001.19, Rev. 0 • CPL-2166-S-0301, Sh. 31, Rev. 3	The breaker rating is 800 amps, which is greater than 115% of the full load current of the motor (345 amps).
514.b.6	It shall permit normal starting of the motor without tripping.	DR	Y	• E1-001.19, Rev. 0 • SD/C-C-1010, Rev. 0	The circuit breaker, which has a time delay over-current feature, will allow normal starting of the motor without tripping.
514.b.7	It shall provide stalled rotor and instantaneous short circuit protection. (a) For a squirrel cage induction motor, it shall be of the time delay type and have a time delay of not over 20 seconds at locked rotor current (this is 600% of rated full load motor current for squirrel cage induction motors), and shall be calibrated up to and set at 300% of the motor full load current. (b) For a direct-current motor and wound rotor alternating-current motor, it shall be of the	DR	Y	• E1-001.19, Rev. 0 • SD/C-C-1010, Rev. 0	The referenced calculation documents that the circuit breaker is in compliance with item a) requirements, which are appropriate for a squirrel cage induction motor as used to drive the motor driven fire pump.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	instantaneous type calibrated and set at 400% of the motor full load current.				
514.b.8	Its interrupting rating shall be adequate for the circuit in which it is used, and in no case be less than 14,000 amps (symmetrical). Were the available short circuit current of the power supply exceeds the interrupting capacity of the breaker, the breaker shall be protected with current limiting fuses coordinated with the breaker, The current limiting fuses shall be mounted in the control panel and connected between the isolating switch and the circuit breaker.	DR	Y	• CAR-2166-B-041, Sh. 79, Rev. 6 • E1-001.19, Rev. 0 • SD/C-C-1010, Rev. 0	The circuit breaker is rated for 50,000 amperes interrupting current.
514.b.9	The required interrupting ratings should be obtained by the purchaser based upon the maximum possible short-circuit current at the pump room. The values, which are approximate, show in Table 514 may be used as a guide.	DR	Y	• CAR-2166-B-041, Sh. 79, Rev. 6 • E1-001.19, Rev. 0 • SD/C-C-1010, Rev. 0	The circuit breaker is rated for 50,000 amperes interrupting current, which is greater than any of the values specified in Table 514. The referenced calculation is an analysis performed to determine the proper settings for the over-current protection circuit breaker. It is reasonable to assume that is adequate for the circuit in which it is used, including consideration of the maximum possible short-circuit current at the controller.
514.b.10	A nameplate with the legend CIRCUIT BREAKER – DISCONNECTING MEANS in letters not less than 3/8 inch high shall be located on the outside of the enclosure adjacent to the means for tripping the circuit breaker.	WD	Y	• WD	The controller for the main motor driven fire pump features a nameplate meeting the requirements of this code section.
514.c	MOTOR STARTER – The motor starter shall be of the magnetic type with a contact in each conductor.	DR	Y	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2581, Rev. 9	The motor starter is of the across-the-line type, which features a contact in each conductor.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
514.c.1	For electrical operation of reduced voltage starters, timed automatic acceleration of the motor shall be provided and the period of motor acceleration shall not exceed 10 seconds.	DR	JC	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2581, Rev. 9	The reviewed documents did not provide the required starter data. However, the motor driven pump controller (GTE/Sylvania C10630) is UL listed / FM approved for fire service, providing reasonable assurance of that the included motor starter is in compliance with this requirement.
514.c.2	Starting resistors shall be designed to permit one 5-second starting operation in each 80 seconds for a period of not less than 1-hour.	DR	JC	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2581, Rev. 9	The reviewed documents did not provide the required starter data. However, the motor driven pump controller (GTE/Sylvania C10630) is UL listed / FM approved for fire service, providing reasonable assurance of that the included motor starter is in compliance with this requirement.
514.c.3	The operating coil for the main contactor shall be supplied directly from the main power voltage and not through a transformer for controllers of 600 volts or less.	DR	JC	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2581, Rev. 9	The reviewed documents did not provide the required starter data. However, the motor driven pump controller (GTE/Sylvania C10630) is UL listed / FM approved for fire service, providing reasonable assurance of that the included motor starter is in compliance with this requirement.
514.d	ALARMS AND SIGNAL DEVICES (ON CONTROLLER) – A 6w or 7w candelabra base 115-125 v. pilot lamp shall be connected to a pair of power supply conductors directly on the line side of the motor starter (load side of the circuit breaker) to indicate that the circuit breaker and test link are closed and that power is available at the controller for starting. The lamp shall be accessible for replacement. Note: It is recommended that the lamp operating voltage be less than the rated voltage of the lamp to insure long operating life. When necessary, suitable resistors or potential transformers should be used to reduce the	DR	Y	• CAR-2166-B-401, Sh. 2581, Rev. 9 • SD/C-C-1010, Rev. 0	A 6w, 120V lamp with resistor and amber lens is connected per the requirements of this code section to indicate "power available". This lamp is accessible for replacement.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	voltage for operating the lamp.				
514.e	ALARM AND SIGNAL DEVICES (REMOTE). Where the pump room is not constantly attended, the controller shall be equipped with contacts to operate circuits, not exceeding 125 volts, for audible or visual alarms at a point constant attendance indicating the following:	DR	Y	• CAR-2166-B-401, Sh. 2581, Rev. 9 • SD/C-C-1010, Rev. 0	Since there is no pump room, remote indication is provided in the Control Room at annunciator cabinet 2, ALB-30. Power source is 125V or less.
514.e.1	Controller has operated into a pump running condition.	DR	Y	• CAR-2166-B-401, Sh. 2581, Rev. 9 • SD/C-C-1010, Rev. 0	Remote panel has an annunciator that indicates "Fire Pump B Operating".
514.e.2	Loss of line power on line side of motor starter in any phase. This may be accomplished through use of drop out type relays controlling an alarm circuit energized by a reliable source of power supply. The relay contacts should close on failure of voltage. Unless the power to this alarm circuit is electrically supervised, the controller shall be arranged to start upon failure of this alarm circuit power.	DR	Y	• CAR-2166-B-401, Sh. 2581, Rev. 9 • SD/C-C-1010, Rev. 0	Power availability is indicated in the control room per the requirements of this code section.
515	**Starting and Control**				
515.a	The following definitions are from the National Electrical Code (1971)		N/A		General information. No verification required.
515.a.1	Nonautomatic: Nonautomatic means that the implied action requires personal intervention for its control. As applied to an electric controller, nonautomatic control does not necessarily imply a manual controller, but only that personal intervention is necessary.		N/A		Definition. No verification is required.
515.a.2	Automatic: Automatic means self-acting,		N/A		Definition. No verification is required.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	operating by its own mechanism when actuated by some impersonal influence, as for example, a change in current strength, pressure, temperature, or mechanical configuration.				
515.b	NFPA No. 20 contemplates that:				
515.b.1	Non-automatic controller shall be actuated by electrical manual and mechanical manual means.	DR	N/A	• P.O. NY-435007 • SD-149, Sec. 4.2.1	The fire pump controller is designed for automatic starting of the motor driven fire pump on pressure drop. The requirements of this code section are therefore not applicable.
515.b.2	Automatic controller shall be operable as a nonautomatic controller and also by other non-personal means such as: low water pressure, tripping of deluge and dry pipe valves, etc.	DR	Y	• P.O. NY-435007 • SD-149, Sec. 4.2.1	The fire pump controller is designed for automatic starting of the motor driven fire pump on pressure drop. The controller can also be manually operated.
515.c	Nonautomatic				
515.c.1	Manual Electric Control at Controller: There shall be a manually operated switch on the control panel so arranged that when the pumping unit is started manually, its operation cannot be affected by the pressure switch, and so that the unit will remain in operation until manually shut down, except that an auto-transformer reduced-voltage type of starter need not have electrical control means for starting the motor.	DR	Y	• SD/C-C-1010, Rev. 0	The control panel at the motor driven fire pump is equipped with a pushbutton switch and also an emergency latch lever for manual actuation of the pump. The manual fire pump start sequence will cause the fire pump to start and run until manually shut down.
515.c.2	Manual Electric Control at Remote Station – Additional control stations for causing nonautomatic continuous operation of the pumping unit independent of the pressure actuated control switch may be provided at locations remote from the controller, but such stations shall not be operable to stop the unit.	DR	N/A	• SD-149, Sec. 4.2.1 • SD/C-C-1010, Rev. 0	No reviewed documents indicated that the motor driven fire pump can be manually started from a remote location. The requirements of this code section are therefore not applicable.
515.c.3	Manual Mechanical Control at Controller:	DR	Y	• OP-149, Rev. 17, p. 9	A Motor Driven Fire Pump Emergency Latch

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	(a) The controller shall be equipped with a handle or lever which operates to close the motor-circuit switching mechanism mechanically for nonautomatic continuous running operation of the motors independent of any electric control circuits or magnets (or equivalent devices) and independent of the pressure-activated control switch. Means shall be incorporated for mechanically latching or holding of the handle or lever for manual operation in the actuated position. The mechanical latching shall not be automatic, but at the option of the operator. (b) The handle or lever shall be arranged to move in one direction only from off to final position with the exception of the auto-transformer reduced-voltage type starter. (c) The motor starter shall return automatically to the "off" position in case the operator releases the starter handle in any but the full running position.			• SD/C-C-1010, Rev. 0	Lever, located at the lower right side of the controller cabinet, will manually start the pump if it is pulled down and latched. The handle moves in one direction only and will return to its original "off" position if not latched.
515.d	Automatic				
515.d.1	Water Pressure Control: An acceptable type pressure switch having independent high and low calibrated adjustments, and which is responsive to water pressure in the fire system shall be provided in the control circuit. Note: Test Device – Suitable provision shall be made for relieving pressure to the pressure	DR	Y	• SD/C-C-1010, Rev. 0 • SD-149, Sec. 4.2.1 • FPT-3001, Rev. 9	A Mercoid pressure switch which is responsive to water pressure in the fire protection water supply system is provided in the control circuit. This switch is set to start the motor driven fire pump when system water pressure falls below 100 psig.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	switch to test the operation of the controller and the pump.				The referenced procedure operates the motor driven pump monthly, using the pressure switch and the controller to test automatic starting of the unit.
515.d.2	Fire Protection Equipment Control: When the pump supplies special water control equipment (deluge, dry pipe valves, etc.) and it is desired to start the pump before the pressure control(s) would do so, the AHJ may require the controller to be equipped to start the pump upon operation of the fire protection equipment. The controller shall be equipped with a relay of the drop-out type to start the pump when the fire protection equipment operates. The relay shall be actuated from a normally closed contact on the fire protection equipment. Note: Deluge System Operation: see code for more details.	DR	N/A	• P.O. NY-435007 • SD-149, Sec. 4.2.1	The fire pump controller is designed for automatic starting of the motor driven fire pump on pressure drop, rather than on the operation of fire protection equipment. The requirements of this code section are therefore not applicable.
515.d.3	Sequence Starting: Controllers for multiple pump units shall incorporate a sequential timing device to prevent any one pump starting simultaneously with any other pump. If the water requirements are such that more than one pump operates, the units shall start in intervals of five to ten seconds. Failure of a leading pump to start shall not prevent subsequent pumps from starting.	DR	Y	• SD-149, Sec. 4.2.1 • AR 25060 • EC 50147	Two main fire pumps are provided and are designed to sequentially start as follows: • The electric motor driven pump starts automatically when pressure in the fire protection water system drops to 100 psig. • The diesel engine driven pump automatically starts when pressure in the system drops to 83 psig. Each pump has a separate controller, and there is a sequential timing device to prevent both pumps from running simultaneously. An 8

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					second time delay in the starting sequence for the DDFP prevents simultaneous starting of the fire pumps.
515.d.4	For sprinkler systems and standpipe systems where an automatically controlled pump constitutes the sole supply or where required by the AHJ, the controller shall be wired for automatic start and manual shutdown.	DR	Y	• SD-149, Sec. 4.2.1	The motor driven fire pump controller is designed for automatic starting upon pressure drop to 100 psig and for manual shutdown at the pump controller.
515.e	METHODS OF STOPPING: Shutdown may be accomplished by either one or both of the following:				
515.e.1	Manual – the control panel shall have means for electrical operation for stopping the motor which in case of automatic controllers will return the controller to full automatic position.	DR	Y	• SD/C-C-1010, Rev. 0	The pump controller features a pushbutton switch for manual shutdown.
515.e.2	Automatic – after starting causes have returned to normal and the pumping unit has operated for the time fixed by the running period timer. Note: Whenever the controller is arranged for automatic shutdown, a running period timer set for one minute for each ten horsepower of motor rating, but not to exceed 7 minutes, shall be installed.	DR	N/A	• SD/C-C-1010, Rev. 0	Motor driven fire pump is arranged for manual shutdown. The automatic shutdown feature is not provided. This code section is not applicable, since Section 515.e requires only one of the shutdown methods to be provided.
Chapter 600	**Internal Combustion Engine Drive**				
620	**Engines**				
621	Approval. – Engines shall be specifically approved for fire pump service.	DR	Y	• Cummins Diesel Engine NT-380-IF Data Sheets • CAR-SH-M-20, Rev. 2, Sec. 13.4	The main diesel driven fire pump engine is UL listed and FM approved for fire service.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
622	**Ratings**				
622.a	The engine shall have a bare engine brake horsepower rating at least 20% greater than the maximum brake horsepower required to drive the fire pump at rated revolutions per minute of the pump unit. Note: The 20 per cent excess power takes account of the fact that new production engines are permitted to run as low as 5 per cent under the official bare engine horsepower curve and that up to 5 per cent may be needed for operation of accessories, allowing at least 10 percent reserve power for reliability of performance and for normal depreciation of the engine with age and use.	DR	JC	• CAR-SH-M-20, Rev. 2, Sec. 6, 12B • AR 25060	The diesel engine is rated at 303 horsepower at 1900 rpm, which is approximately 14% greater than the 265 required fire pump brake horsepower for design conditions of 2500 gpm at 125 psi, and rated rpm of 1760. Note: Reference Section 622.d for increased horsepower requirements due to the use of a right angle gear drive. For justification of the acceptability of this condition, see Attachment 6.
622.b	A deduction of 5% for spark ignition engines and 3 percent for diesel engines for each 1000 ft rise in altitude above sea level shall be made to the engine horsepower rating as corrected to sea level conditions.	DR	N/A	• CAR-2165-G-209, Rev. 13	The diesel engine is installed at approximately 262’-0” above sea level. As such, the requirements of this code section are not applicable.
622.c	A deduction of 1 percent for every 10°F above 60°F shall be made to the engine horsepower rating as corrected to sea level conditions.	DR	N/A	• Cummins Diesel Engine NT-380-IF Data Sheets • CAR-SH-M-62, Rev. 3, Sec. 2.01	The average outside temperature at SHNPP is 79°F (summer) and 41.3°F (winter), from which it can be estimated that the average daily temperature is approximately 60°F. It is therefore reasonable to conclude that no horsepower rating deduction per the requirements of this section is applicable.
622.d	When the authority having jurisdiction permits the use of gear drives between the pump and its driver, (see 623a) the horsepower requirement of the pump should be increased to allow for power losses.	DR	JC	• CAR-SH-M-20, Rev. 2, Sec. 13.2 • NUREG-1038, p. 9-51 • 1364-1675, Rev. 1	A Randolph 300 HP capacity right angle gear drive is used between the pump and the diesel engine, as approved by the NRC for HNP as part of the fire protection water supply system. The horsepower requirement of the pump should,

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
				• AR 25060	therefore, be increased to allow for power losses. The right angle gear drive has a gear ratio of 11:10, which translates to 1956 driver rpm required to achieve the rated pump rpm of 1760. Note: Since the bare engine brake horsepower rating of the diesel engine does not comply with the 20% code requirement stated in Section 622.a, the increased horsepower requirement due to the right angle gear drive must be factored into any evaluation of the acceptability of the installed diesel engine. For justification for the acceptability of this condition, see Attachment 6.
622.e	Engines listed for fire pump service by a nationally recognized testing laboratory may be accepted for horsepower ratings established by the laboratories.	DR	Y	• Cummins Diesel Engine NT-380-IF Data Sheets	The diesel engine was manufactured by Cummins Engine Co., Inc. and is UL listed and FM approved for fire service applications.
623	**Connection To Pump**				
623.a	Except where otherwise permitted by the AHJ the engine shall be directly connected to a horizontal shaft pump by means of a flexible coupling of suitable design. Vertical shaft pumps shall have the engine connected to the right angle drive with suitable universal joints.	WD & DR	Y	• WD • VM-UJL, Rev. 0 • 1364-1691, Rev. 1	The diesel driven fire pump is a vertical shaft turbine. The diesel engine is properly connected to the right angle gear drive.
623.b	Dual drive units are not recommended. The use of separate pumps provides greater flexibility and reliability. Where dual drive is used, the coupling should be of an automatic type acceptable to the AHJ and the engine drive shall	DR	N/A	• CAR-2165-G-209, Rev. 13	Dual drive units are not installed at SHNPP. The requirements of this code section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	be equipped with an approved free-wheeling clutch. If the other drive is an electric motor, it too shall be equipped with an approved free-wheeling clutch.				
624	**Instrumentation And Control**				
624.a	GOVERNOR: – An adjustable governor shall be provided for the engine to regulate the speed within a range of 10% between shutoff and maximum load conditions of the pump. It shall be set to maintain rated pump speed at maximum pump load.	DR	JC	• Cummins Diesel Engine NT-380-IF Data Sheets	The diesel engine is provided with a mechanical flyball, mechanical variable speed type governor to regulate engine speed. Although no reviewed documents indicated the governor settings, the referenced data sheets stated that the engine would be furnished with safety engine switches in compliance with NFPA Bulletin 20.
624.b	EMERGENCY GOVERNOR: – An emergency governor shall be provided for a diesel engine. It should be arranged to shut down the engine at a speed approximately 20% above rated engine speed. The emergency governor shall be arranged for manual reset. The position of the emergency shutdown device shall be supervised so that the automatic engine controller will continue to show an overspeed trouble signal until the device is reset to normal operating position.	DR	Y	• PIC-I305, Rev. 3, p. 5 • CAR-2166-B-401, Sh. 2583, Rev. 6 • Cummins Diesel Engine NT-380-IF Data Sheets	The diesel engine is equipped with a Syncrostart Model CO-2M 210314 Over-Speed switch which is set to shut down the engine at 2200 rpm, approximately 15% above the rated engine speed of 1900 rpm. The device is arranged for manual reset, and is supervised such that shutdown is annunciated at the controller panel as well as at ALB-30.
624.c	TACHOMETER – A tachometer shall be provided to indicate rpm of the engine. It shall be the totalizing type or an hour meter shall be provided to record total time of engine operation.	WD & DR	Y	• WD • 1364-1693, Rev. 1	The diesel engine features an hour meter type tachometer which indicates engine rpm as well as total engine operation time.
624.d	OIL PRESSURE GAGE – An oil pressure gage shall be provided to indicate engine lubricating oil pressure.	WD & DR	Y	• WD • 1364-1693, Rev. 1	The diesel engine features an oil pressure gage which indicates engine lubricating oil pressure.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
624.e	TEMPERATURE GAGE – A temperature gage shall be provided to indicate engine cooling water temperature.	WD & DR	Y	• WD • 1364-1693, Rev. 1	The diesel engine features a temperature gage which indicates engine cooling water temperature.
624.f	CONTROL PANEL – All instruments of control such as gages, switches, indicators and coils should be placed on a suitable board secured to the unit at a suitable point.	WD & DR	Y	• WD • 1364-1693, Rev. 1	The circuit breaker, water temperature gage, ammeter, lube oil pressure gage, tachometer-hour meter, 24 vdc junction box, and vernier throttle are located on an instrument panel that is attached to the engine.
624.g	FACTORY WIRING – AUTOMATIC CONTROLLER – All connecting wires for the automatic controller shall be harnessed or flexibly enclosed, mounted on the engine and connected in an engine junction box to terminals numbered to correspond with numbered terminals in the automatic controller, for ready wiring in the field between the two sets of terminals.	DR	Y	• P.O. NY-435007	The referenced Purchase Order required that all switches shall be prewired to an enclosed, labeled terminal strip mounted on the engine, and that terminals shall be labeled to correspond to those of the Auto Control panel.
624.h	MAIN BATTERY CONTACTORS – Main battery contactors shall be manually operable in case of control circuit failure.	WD	Y	• WD	Diesel Engine main battery contactors are manually operable.
625	**Starting Methods**				
625.a	Compression ignition diesel engines should preferably be equipped with an electric starting device taking current from a storage battery, but may be started by other reliable means.	WD & DR	Y	• WD • CAR-2166-B-401, Sh. 2583, Rev. 6	The diesel engine is started by a 24 vdc electric starting motor taking current from four 12V batteries.
625.b	If air starting of diesel engines is used with air pressure in excess of 100 pounds gage pressure, the air tanks shall be so located or guarded as not to be subject to mechanical injury. For air starting there shall be at least two containers each sufficient for six consecutive starts without	WD & DR	N/A	• WD • CAR-2166-B-401, Sh. 2583, Rev. 6	The diesel engine is started by a 24 vdc electric starting motor taking current from four 12V batteries, rather than by air pressure. The requirements of this code section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	recharging. There shall be a separate air compressor, suitably powered, or means of obtaining air from some other system shall be installed, independent of any compressor driven by the engine operating the fire pump. Automatic maintenance of air pressure is preferable, but in all cases suitable supervisory service shall be maintained to indicate high and low pressure conditions.				
625.c	If a gasoline starting engine is used to crank the diesel engine, or gasoline is used in connection with electric ignition, the handling and storage of gasoline shall be as required for gasoline engine driving of centrifugal fire pumps. Note: Electric current for ignition may be taken from the storage battery or from a high tension magneto.	WD & DR	N/A	• WD • CAR-2166-B-401, Sh. 2583, Rev. 6	The diesel engine is started by a 24 vdc electric starting motor taking current from four 12V batteries, rather than by a gasoline starting engine. The requirements of this code section are therefore not applicable.
625.d	Gasoline engines shall be equipped with an electric starting device taking current from the storage battery.	WD & DR	N/A	• WD • CAR-2166-B-401, Sh. 2583, Rev. 6	The diesel engine is started by a 24 vdc electric starting motor taking current from four 12V batteries, rather than by a gasoline starting engine. The requirements of this code section are therefore not applicable.
626	**Storage Battery**				
626.a	The battery shall have sufficient capacity, at 40°F, to maintain the engine manufacturers recommended cranking speed during the following 6 minute cycle (15 seconds crank and 15 second rest in 12 consecutive cycles). The fire pump manufacturer shall provide a certification that the battery which was furnished complies with this requirement.	WD & DR	JC	• WD • Cummins Diesel Engine NT-380-IF Data Sheets • FPT-3010, Rev. 9 • MPT-E0019, Rev. 4	Four 12V batteries, maintained at a temperature of between 60°F and 80°F by heater pads, are provided for starting the diesel engine. Although no reviewed documents identified recommended cranking speed or documented compliance based on the specified 6 minute cycle, the supplied batteries are considered acceptable since their engine starting capability

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					is verified monthly by the referenced FPT procedure and the batteries are inspected and tested weekly by the referenced MPT procedure.
626.b	Lead Acid – Batteries shall be furnished in a dry charge condition with electrolyte liquid in separate container. Electrolyte should be added at the time the unit is put into service. The battery shall then be given a conditioning charge to bring the electrolyte up to its designated specific gravity.	DR	Y	• P.O. NY-435007 • MPT-E0020, Rev. 3	The referenced purchase order indicated that the seller furnished Lead Acid batteries in a dry charged condition, and that electrolyte was provided. Reviewed documents did not describe initial conditioning of batteries, however, the referenced MPT procedure verifies diesel fire pump engine battery specific gravity (i.e., electrolyte level) on a quarterly basis, ensuring compliance with the intent of this code section.
626.c	Nickel Cadmium – A nickel cadmium alkaline type battery may be used where desired in place of the lead acid battery described above.	DR	N/A	• P.O. NY-435007	Lead acid batteries are used to start the diesel engine rather than Nickel Cadmium. The requirements of this code section are therefore not applicable.
626.d	Recharging – Two ways of recharging storage batteries shall be provided. One shall be the generator furnished with the engine. The other shall be an automatically controlled charger taking power from an alternating power source. (Other charging methods must be specified if a reliable alternating power source is not available)	DR	Y	• CAR-2166-B-401, Sh. 2583, Rev. 6	Two ways of recharging storage batteries are provided. The batteries are maintained automatically charged by the battery charger installed as part of the engine control panel, and they can also be charged by the engine alternator.
626.e	Chargers				
626.e.1	All chargers shall be specifically approved for fire pump service.	WD & DR	Y	• WD • P.O. NY-435007 • CAR-2166-B-401, Sh. 2583, Rev. 6	The battery charger was supplied as part of the fire pump controller (Lexington Standard Model LX-1000), which is UL listed and FM approved for fire service.
626.e.2	The rectifier shall be of the semiconductor type.	DR	JC	• P.O. NY-435007 • CAR-2166-B-401, Sh.	Reviewed documents did not indicate whether the rectifier is of the semiconductor type.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
				2583, Rev. 6	However, the battery charger was supplied as part of the UL listed / FM approved fire pump controller, providing reasonable assurance that the requirement of this code section was fulfilled.
626.e.3	The charger for a lead acid battery shall be of a type which automatically reduces the charging rate to less than 500 milliamperes when the battery reaches a full charge condition.	DR	Y	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2583, Rev. 6	Reviewed documents did not indicate whether the battery charger automatically reduces the charging rate per this code section. However, the battery charger was supplied as part of the UL listed / FM approved fire pump controller, providing reasonable assurance that the requirements of this code section were fulfilled.
626.e.4	The control equipment incorporated in an "off-on" type of charger for a lead acid battery shall start the rectifier hourly and automatically shut off when the battery has been fully charged.	DR	Y	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2583, Rev. 6	Reviewed documents did not indicate whether the battery charger control equipment functions per this code section. However, the battery charger was supplied as part of the UL listed / FM approved fire pump controller, providing reasonable assurance that the requirements of this code section were fulfilled.
626.e.5	The battery charger shall be capable of delivering energy into a fully discharged battery in such a manner that it will not damage the battery and will restore to the battery 100% of the battery's ampere hour rating within 24 hours.	DR	Y	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2583, Rev. 6	Reviewed documents did not indicate whether the battery charger can fully charge batteries within 24 hours per this code section. However, the battery charger was supplied as part of the UL listed / FM approved fire pump controller, providing reasonable assurance that the requirements of this code section were fulfilled.
626.e.6	An ammeter of an accuracy of 5% of the normal charging rate shall be furnished to indicate the operation of the charger.	DR	Y	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2583, Rev. 6	Reviewed documents did not indicate whether an ammeter of the type required was provided. However, the battery charger was supplied as part of the UL listed / FM approved fire pump controller, providing reasonable assurance that the requirements of this code section were

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					fulfilled.
626.e.7	The charger shall be so designed that it will not be damaged or blow fuses during the cranking cycle of the engine when operated by an automatic or manual controller.	DR	Y	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2583, Rev. 6	Reviewed documents did not indicate whether charger was designed per this code section. However, the battery charger was supplied as part of the UL listed / FM approved fire pump controller, providing reasonable assurance that the requirements of this code section were fulfilled.
626.e.8	A single charger that automatically alternates from one battery to another on an hourly cycle may be used on two battery installations.	DR	Y	• P.O. NY-435007 • CAR-2166-B-401, Sh. 2583, Rev. 6	The installed unit is used to charge all four 12V batteries. Reviewed documents did not indicate whether the charger alternates among batteries per this code section. However, the battery charger was supplied as part of the UL listed / FM approved fire pump controller, providing reasonable assurance that the requirements of this code section were fulfilled.
626.e.9	A manual charge switch with indicator light shall be provided or in lieu thereof, the charge shall automatically charge at the maximum rate when required by the state of charge of the battery.	WD & DR	Y	• WD • P.O. NY-435007 • CAR-2166-B-401, Sh. 2583, Rev. 6	The battery charger provided with the diesel driven fire pump is of the automatic type.
626.f	Location: – Storage batteries shall be substantially supported, secured against displacement, and located where they will not be subject to excessive temperature, vibration, mechanical injury, or flooding with water, and are readily accessible for servicing. Location at the side of and level with the engine is recommended to minimize battery to starter lead length.	WD	Y	• WD	Batteries are located on the ESWISS concrete slab adjacent to, and at essentially the same elevation as, the engine controller and the diesel engine. The batteries are contained in weatherproof steel enclosures which are easily accessible but are not subject to excessive temperature, mechanical injury or flooding.
627	**Cooling**				

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
627.a	The engine cooling system shall be of the closed circuit type including a circulating pump drive by the engine, a heat exchanger and a reliable engine jacket temperature regulating device (“Fail Safe” type of thermostat). An opening shall be provided in this circuit for filling the system, checking coolant level, and adding make-up water when required.	WD & DR	Y	• WD • VM-MJD, Rev. 6, p. S1-28 • Cummins Diesel Engine NT-380-IF Data Sheets	The engine cooling system is of the closed circuit type including a heat exchanger and an engine jacket temperature thermostat (120-140°F). Water is circulated by fire pump pressure. An opening is provided in the heat exchanger to add liquid and check the coolant level.
627.b	The cooling water supply for the heat exchanger shall be from the discharge of the fire pump taken off prior to the pump discharge valve. Threaded rigid piping shall be used. The pipe connection shall include a manual shutoff valve, a strainer, a pressure regulating valve, an automatic electric solenoid valve (when required) and a second manual shut-off valve. Provision should be made for a pressure gage to be installed in the cooling water supply system on the engine side of the last control valve.	WD & DR	Y	• WD • VM-MJD, Rev. 6, p. S1-28 • Cummins Diesel Engine NT-380-IF Data Sheets	The cooling supply for the heat exchanger is taken from the discharge side of the fire pump, is of threaded, galvanized schedule 40 piping, and contains the valves, regulator and accessories required by this code section.
627.c	A by-pass line with a manual valve shall be installed around the manual shut-off valve, strainer, pressure regulating valve, automatic solenoid valve (when required) and second manual shut-off valve.	WD & DR	Y	• WD • VM-MJD, Rev. 6, p. S1-28 • Cummins Diesel Engine NT-380-IF Data Sheets	A by-pass line is provided per the requirements of this code section.
627.d	An outlet shall be provided for the waste water line from the heat exchanger and the line shall be at least one size larger than the inlet line. The outlet line shall be short, with the discharge into a visible open waste cone, and no valves shall be used in this line.	WD &DR	Y	• WD • 1364-1693, Rev. 1 • VM-MJD, Rev. 6, p. S1-28	The waste pipe outlet line from the heat exchanger is of 1½” diameter, larger than the 1” diameter inlet piping. Waste discharge is into an open cone, with no valves installed in the waste line.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
627.e	A water jacketed (cooled) exhaust manifold shall be used since no fan is available to dissipate heat and to avoid hazard to operators or flammable material adjacent to the engine. This exhaust manifold should be cooled by raw water discharging from the heat exchanger.	WD & DR	Y	• WD • Cummins Diesel Engine NT-380-IF Data Sheets	The diesel engine features a water cooled exhaust manifold.
628	**Carburetion**				
628.a	If a down-draft carburetor is used, suitable provision shall be made in addition to the carburetor float valve to prevent delivery of liquid gasoline to the engine cylinders. Note: This is usually accomplished by a drain from the intake manifold. This should be piped to a safe location.	DR	N/A	• 1364-1693, Rev. 1 • VM-MJD, Rev. 6, p. S3-66	The diesel engine is fuel-injected and does not feature a carburetor. The requirements of this code section are therefore not applicable.
628.b	The carburetor drip cup drain should be piped at its lower end to a safe location.	DR	N/A	• 1364-1693, Rev. 1 • VM-MJD, Rev. 6, p. S3-66	The diesel engine is fuel-injected and does not feature a carburetor. The requirements of this code section are therefore not applicable.
629	**Anti-Dieseling Devices**				
629.a	Anti-dieseling devices. A reliable and effective anti-dieseling device shall be provided on automatically controlled spark-ignited gasoline engines with a displacement of 350 cubic inches and larger to insure positive shutdown without dieseling. Control for the device shall be provided by the automatic engine controller or supplemental accessories to the controlled engines.	DR	N/A	• 1364-1693, Rev. 1 • Cummins Diesel Engine NT-380-IF Data Sheets	The diesel engine runs on No. 2 diesel fuel rather than gasoline. The requirements of this code section are therefore not applicable.
629.b	Less than 350 cubic inch displacement engines shall also be equipped with this device unless approval tests show that it is unnecessary.	DR	N/A	• 1364-1693, Rev. 1 • Cummins Diesel Engine NT-380-IF Data Sheets	The diesel engine runs on No. 2 diesel fuel rather than gasoline. The requirements of this code section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
630	**Location**				
631	**Construction**				
631.a	While it may not always be possible to locate a fire pump driven by an internal combustion engine in a separate pump house it is in every case highly important that the pump room be wholly cut off by noncombustible construction of a heavy character.	WD	Y	• WD	The diesel engine driven fire pump is located outside of and directly adjacent to the South wall of the ESWISS. The building is of solid concrete construction and has no openings of any kind on the South wall. The Auxiliary Reservoir is directly to the East of the engine, and the areas directly to the North and West consist of open ground with no equipment or building. The engine itself is fully protected by a sheet steel enclosure. Additionally, the diesel engine is separated from the motor driven fire pump and the jockey pump by the ESWISS building and a distance of approximately 104 feet.
631.b	Floors should be pitched for adequate drainage of escaping water or fuel away from critical equipment such as pump, driver, controller, fuel tank, etc.	WD	Y	• WD	The concrete slab in the vicinity of the equipment is pitched to promote drainage, which is further enhanced by the presence of grating and the Auxiliary Reservoir within 10 to 15 feet of the equipment. Note: A curb is provided around the Diesel Fuel Oil tank to contain spilled fuel and prevent it from spreading in case of a fire.
631.c	Where fire pumps constitute the entire water supply or where they constitute the major water supply, gasoline engine driven fire pumps located in the same room with fire pumps driven by other methods should, because of their possible fire hazard, have a heat resistant barrier	WD	N/A	• WD	Gasoline engine driven fire pumps are not used as SHNPP. The requirements of this code section are therefore not applicable.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	wall to isolate the gasoline engine from other pumping units.				
632	**Ventilation**				
632.a	Means for thorough ventilation shall be provided, adequate for engine air supply and for remove of hazardous vapors.	WD	Y	• WD	Ample ventilation is available for the diesel engine, which is located outside and has louvered panels built into the sheet steel cabinet in which it is enclosed..
632.b	Gasoline engine driven fire pump units should not be installed in depressed pump rooms. Installation shall be such that escaping gasoline vapors cannot accumulate in e pump room or vicinity.	WD	N/A	• WD	Gasoline engine driven fire pumps are not used as SHNPP.
640	**Fuel Supply Arrangement**				
641	Review Of Plan: – Before any system is installed the AHJ should be consulted as to the system proposed to the end that the suitability of the system for conditions be determined.	DR	Y	• NUREG-1038, p. 9-51 • FSAR Sec. 9.5.1, p. 20	The fuel supply arrangement for the diesel engine, as part of the fire protection water supply system, was approved by the NRC.
642	Guards: – A guard or protecting pipe shall be provided for all exposed fuel lines.	WD	Y	• WD	Exposed fuel lines from the Diesel Fuel Oil tank and near the Diesel engine are protected by steel instrument tube raceways.
643	**Diesel**				
643.a	Capacity Diesel Fuel Supply:– The capacity of the main diesel fuel supply tank shall be determined by conditions and subject to special consideration in each case by the AHJ; minimum storage capacity shall be sufficient to operate the engine for at least eight hours, and greater capacity should be provided in places where prompt replenishment of supply is unlikely. There shall be a separate fuel line and fuel tank for each engine. Where multiple	DR	Y	• FSAR, Sec. 9.5.1, p. 22 • Cummins Diesel Engine NT-380-IF Data Sheets • FPP-013, Rev. 33, Sec. 8.1.3 • NUREG-1038, p. 9-51	The diesel engine fuel supply, as part of the fire protection water supply system, was approved by the NRC. Fuel tank capacity is 550 gallons, which will provide sufficient fuel to operate the diesel engine for more than 34 hours at the estimated fuel consumption rate of 15.75 gallons per hour (295 hp @ 1900 rpm). The minimum allowable fuel level of 130 gallons will operate the diesel engine for more than 8 hours. There is only one diesel engine and one fuel tank.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	engine drive pumps are used , the fuel lines shall be interconnected and valved so that all engines may continue to operate even though one or more fuel tanks may be out of service.				
643.b	Location Diesel Fuel Supply: – The tank shall be located in accordance with municipal ordinances, and requirements of the AHJ. Means shall be provided for determining the amount of fuel in the storage tank. The tank should have suitable filling and vent connections.	WD & DR	Y	• WD • FSAR, Sec. 9.5.1, p. 22 • Cummins Diesel Engine NT-380-IF Data Sheets • 1364-1697, Rev. 3 • NUREG-1038, p. 9-51	The diesel engine fuel supply location, as part of the fire protection water supply system, was approved by the NRC. The tank is UL listed, and is equipped with suitable filling and vent connections. The tank features a gage which measures inches of water, and an adjacent sign provides conversion to gallons of fuel.
643.c	Diesel Fuel Piping: – NFPA 31 may be used as a guide. A suitable flexible connection of approved metallic type shall be provided in the fuel line where it connects to the engine fuel piping. No shutoff valve shall be installed in the fuel return line to the tank.	WD & DR	Y	• WD. • 1364-1697, Rev. 3 • CAR-2165-G-209, Rev. 13	A flexible connection is used to connect the fuel line to the engine fuel piping system. No shutoff valves are installed in the return line to the fuel tank.
644	**Natural Gas**	DR	N/A	• FSAR Sec. 9.5.1, p. 22	No. 2 Diesel fuel oil is used for the diesel engine. The requirements of this code section are therefore not applicable.
645	**Gasoline**	DR	N/A	• FSAR Sec. 9.5.1, p. 22	No. 2 Diesel fuel oil is used for the diesel engine. The requirements of this code section are therefore not applicable.
646	**Gasoline Piping**	DR	N/A	• FSAR Sec. 9.5.1, p. 22	No. 2 Diesel fuel oil is used for the diesel engine. The requirements of this code section are therefore not applicable.
650	**Exhaust Piping**				
651	Exhaust Piping – Exhaust from the engine shall be piped to a safe point outside the pump room and arranged to exclude water. A seamless or	WD & DR	Y	• WD • 1364-1693, Rev. 1 • Cummins Diesel	The diesel engine, since it is installed outdoors, exhausts directly to the outside air. The exhaust pipe is short (less than 3 feet) and is attached to

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	welded corrugated (not interlocked) flexible connection shall be made between the engine exhaust outlet and the exhaust pipe. The exhaust pipe shall be as short as possible and not over 15 feet unless the size of exhaust pipe is increased at least one pipe size, and shall be properly insulated from combustible material. Muffler, receiving vessel or other attachments which may accumulate unburned gases are not recommended, but if used shall not be located in the pump room. Exhaust gases should not be discharged where they will affect persons or endanger buildings, flues or stacks. A free and independent exhaust is essential to the reliability of the equipment.			Engine NT-380-IF Data Sheets	a horizontally mounted silencer (muffler) with a seamless bellows-type flexible connector. The exhaust outlet of the silencer is provided with a rain cap. The exhaust assembly is insulated from combustible material by the sheet steel of the diesel engine enclosure and heat resistant aluminum paint applied to the silencer. The use of a silencer (muffler) is acceptable due to its outdoor location.
660	**Maintenance**				
661	General – Internal combustion engines necessarily embody moving parts of such design and in such number that the engines cannot give reliable service unless given intelligent care. The manufacturer's instruction book covering care and operation should be preserved and pump operators should be familiar with its contents and should observe in detail all of its provisions.	DR	Y	• VM-MJD, Rev. 6 • FPP-013, Rev.33, Sec. 8.1.3 • MPT-M0036, Rev. 8	The referenced procedures implement comprehensive inspection and preventive maintenance activities which are performed on the diesel engine every 18 months. The referenced Vendor Manual (VM) contains the maintenance information on the diesel engine. Personnel assigned to operate, inspect, test and maintain the pump are provided with training.
662	Weekly Run: The engine shall be started at least once a week and run for at least thirty minutes to bring it up to normal running temperature and to make sure that it is running smoothly at rated speed.	DR	JC	• FPP-013, Rev.33, Sec. 8.1.3 • FPT-3010, Rev. 9, Sec. 1, 6 • AR 25060	The diesel engine driven fire pump is started and operated each month for a minimum of 30 minutes. The referenced procedures require the pump to be operated monthly for 30 minutes. This frequency meets the requirements of Nuclear

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					Electric Insurance Limited (NEIL) and of FPP-013, Section 8.1.3. However, this does not meet the requirement of this code section. For a discussion of the acceptability of this condition, see Attachment 6.
663	Fuel Tank:– The fuel storage tank shall be kept well supplied. This tank should always be filled through strainer funnel designed to withhold any water or other foreign matter that may be present. Any service tank shall also be kept full. Note: Gasoline deteriorates with age. It is therefore desirable that gasoline storage tanks be drained and refilled with fresh supply at least once each year. The occasional use of an upper lubricant is desirable for smooth operation of the engine and preventing sticking valves	DR	Y	• FPP-013, Rev. 33, Sec. 8.1.3 • OP-149, Rev. 17, p. 6	The diesel fuel oil tank minimum operable fuel level is 130 gallons, and a level of less than 225 gallons will trigger a low fuel level alarm. Requirements for service tanks and gasoline storage tanks are not applicable to SHNPP.
664	Engine Upkeep:– The engine should be kept clean, dry and well lubricated, and the proper oil level should be maintained in the crankcase. Oil should be changed in accordance with engine manufacturer's recommendations, but at least annually.	DR	Y	• FPT-3010, Rev. 9, Sec. 7.1 • MPT-M0036, Rev. 8 • FPP-013, Rev. 33, Sec 8.1.3	The engine oil level is checked monthly prior to the operability test. Oil is changed at least once every 18 months per the referenced MPT procedure, which was prepared in conjunction with the engine manufacturer's recommendations for the class of service. This interval meets the frequency requirements of FPP-013, Sec. 8.1.3.
665	**Storage Batteries**				
665.a	Storage batteries should be kept charged at all times and tested frequently with a hydrometer to ascertain the condition of the cells and the amount of charge in the battery.	DR	Y	• FPP-013, Rev. 33, Sec 8.1.3 • MPT-E0019, Rev. 4	The referenced procedures require that he batteries are inspected monthly to verify that the electrolyte level of each battery is above the plates and the overall voltage is greater than or equal to 24 volts.

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
665.b	Distilled water only should be used in storage battery cells and the plates should be kept submerged at all times.	DR	Y	• MPT-E0019, Rev. 4	Distilled or demineralized water is used to raise the water level to the required level.
665.c	An automatic battery charger is not a substitute for proper maintenance of the battery and charger. Periodic inspection of the battery and the charger shall be made. This inspection should determine that the charger is operating correctly, the water level in the battery is correct, and the battery shall be checked by means of a hydrometer to show it is maintaining its proper charge.	DR	Y	• MPT-E0020, Rev. 3 • MPT-E0021, Rev. 4	Quarterly, the electrolyte temperature and specific gravity are checked for adequacy. Every 18-months, the batteries, cell plates, battery boxes, jumpers and connecting cables are inspected for any indication of damage or abnormal deterioration.
666	**Temperature**				
666.a	Pump room temperatures must be maintained above 40°F.	WD & DR	JC	• WD • NUREG-1038, p. 9-51	No pump room is provided at SHNPP. The engine driven fire pump diesel engine is installed outdoors at the location of the ESWISS. This arrangement, as part of the fire protection water supply system, was approved by the NRC.
666.b	Diesel engines, at temperatures below 70°F, may require some form of starting aid as recommended by the engine manufacturer.	DR	Y	• P.O. NY-435007 • Cummins Diesel Engine NT-380-IF Data Sheets	The diesel engine is provided, by the manufacturer, with an electric jacket water heater and lube oil heater, with thermostat control (on at 120°F – off at 140°F) as a starting aid.
666.c	Automatically started engines should be installed in enclosed pump rooms where a minimum of temperature of 60°F for gasoline engines and 70°F for diesel engines is maintained.	DR	Y	• P.O. NY-435007 • Cummins Diesel Engine NT-380-IF Data Sheets • NUREG-1038, p. 9-51	The diesel engine, installed outdoors and equipped with the starting aid described in section 666.b, has been approved, as part of the fire protection water supply, by the NRC. Also, this code section delineates a recommendation rather than a mandatory requirement.
666.d	Since fire pump engines must carry full load as	WD & DR	Y	• WD	The diesel engine is provided, by the

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	soon as started, automatic heaters should be employed to maintain jacket water temperatures of liquid cooled engines at (a minimum of 120F) or near operating temperature. This may be accomplished through the circulation of hot water through the jacket or through heating of engine water by electric elements inserted into the block. The benefits to be gained are (1) quick starting, (2) reduction in engine wear, (3) reduced drain on batteries, (4) reduced oil dilution, (5) reduction in carbon deposits, and (6) with gasoline fueled engines it becomes possible to adjust the automatic choke so that the engine is far more likely to start every time.			• P.O. NY-435007 • Cummins Diesel Engine NT-380-IF Data Sheets	manufacturer, with an electric jacket water heater with thermostat control (on at 120°F – off at 140°F) as a starting aid.
667	Parts: – Spare parts of such portions of the machine as may be expected to give trouble should be kept on hand.	DR	Y	• MPT-M0036, Rev. 8	The referenced procedure identifies commonly used spare parts and corresponding assigned CP&L part numbers. These parts are maintained on site or can be requisitioned for receipt in a timely manner.
Chapter 700	**Engine Drive Controllers**				
710	**Requirements for All Controllers**				
711	**General**				
711.a	The following specifications cover controlling equipment of the combined non-automatic and automatic types for internal combustion engines driving centrifugal fire pumps. Chapter 600 dealing with the internal combustion engine drive also applies where appropriate.		N/A		General design information. No verification is required.
711.b	Automatic type controllers are recommended for use only where the fire pump takes its water		N/A		General design information. No verification is required.

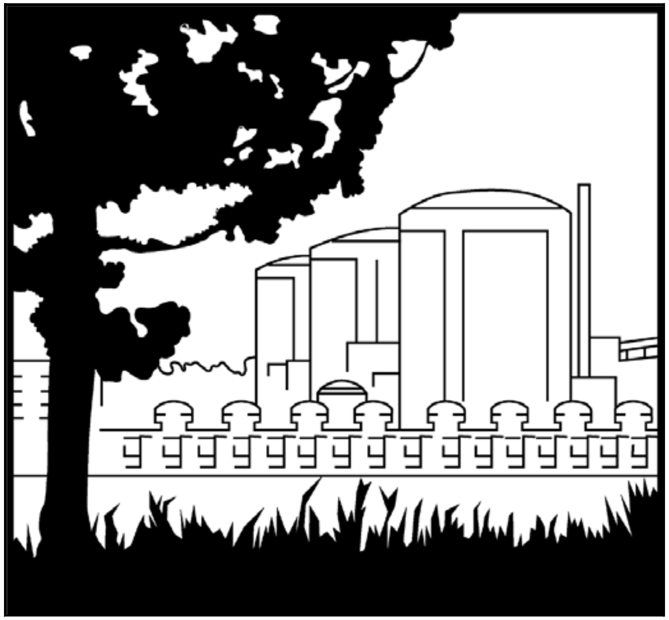
Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	under positive pressure and their use is not recommended where a suction lift is involved.				
711.c	All controllers shall be specifically approved for fire pump service.	DR	Y	• P.O. NY-435007	The diesel driven fire pump is provided with an automatic fire pump controller (Lexington Standard Model LX-1000), which is UL listed and FM approved for fire service.
711.d	The control panel shall be completely assembled, wired and tested by the manufacturer before shipment from the factory.	DR	Y	• P.O. NY-435007	The reviewed documents did not specify precise adherence to the requirements of this section. However, the specified equipment was provided by the seller, accepted by CP&L, installed, and has been functioning continuously as a part of the SHNPP fire protection water supply system since that time. It can be reasonably concluded that the intent of this code section has been fulfilled.
711.e	Controllers conforming to this Standard shall be marked "Fire Pump Controller" and shall show plainly the name of the manufacturer, the identifying designation and the complete electrical rating.	WD	Y	• WD	The diesel driven fire pump controller bears a label marked "Automatic Fire Pump Controller" and containing the information required by this code section.
711.f	The services of a representative of the manufacturer may be required for installation and adjustment of the equipment. It shall be the responsibility of the installing contractor to make the necessary arrangements for this service.	DR	JC	• P.O. NY-435007	The referenced purchase order included an option for the seller's supervising and/or start-up field service engineer if requested by the purchaser. This may have occurred, although no reviewed documents confirmed whether this option was requested or whether the requirements of this code section were specifically fulfilled. However, the fire pumps, controllers, and associated equipment have been in continuous service since their initial installation and are

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
					subject to ongoing testing and maintenance as delineated by SHNPP procedures. Verification of initial installation and adjustment is therefore essentially meaningless.
712	**Location**				
712.a	The controller shall be located as close to as is practical and within sight of the engine.	WD	Y	• WD	The engine driven fire pump controller is located approximately 10 feet from, and within sight of, the diesel engine.
712.b	The controller shall be so located or protected that it will not be injured by water escaping from the pump or connections.	WD	Y	• WD	The engine driven fire pump controller (fully enclosed in a metal cabinet) is located approximately 6 feet from the pump and further from pump connections, all of which are located below the slab upon which the controller rests. As such, the controller is not subject to injury from escaping water.
712.c	A clearance of not less than 2-1/2 feet shall be provided at the rear of enclosures designed to be inspected and serviced from the rear.	WD	N/A	• WD	The controller enclosure, which is mounted flush to the ESWISS South wall, is not designed for inspection and service from the rear. The requirements of this code section are therefore not applicable.
713	**General Construction**				
713.a	Equipment. All equipment shall be suitable for use in locations subject to a moderate degree of moisture such as a damp basement. Reliability of operation shall not be adversely affected by normal dust accumulations. Note: In areas affected by excessive moisture, heat may be useful in reducing the dampness.	WD & DR	Y	• WD • P.O. NY-435007 • 1364-1812, Rev. 2 • 1364-1814, Rev. 1	The controller is contained in a NEMA III floor mounted, dust and moisture resistant enclosure.
713.b	Mounting. All equipment except engine mounted shall be mounted in a substantial manner on a single, noncombustible supporting	WD & DR	Y	• WD • P.O. NY-435007 • 1364-1812, Rev. 2	The controller, and all equipment that is not engine mounted, is contained in a NEMA III floor mounted, dust and moisture resistant

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	structure.				enclosure. The enclosure rests on the ESWISS concrete slab.
713.c	Enclosure. The structure or panel shall be securely mounted in an enclosure(s) which will protect the equipment against mechanical injury and falling drops of water striking the enclosure from the downward vertical.	WD & DR	Y	• WD • P.O. NY-435007 • 1364-1812, Rev. 2	The panel is contained in a NEMA III floor mounted, dust and moisture resistant enclosure. The enclosure provides adequate protection against mechanical injury and falling water.
713.d	Locks: All switches required to keep the controller in the "automatic" position shall be within locked cabinets having break glass panels.	WD & DR	JC	• WD • 1364-1812, Rev. 2 • AR 25060 • NAS Fire Protection Audit H-FP-00-01	The controller panel is provided with a cabinet lock. A break glass panel covers switches required to keep the controller in the "automatic" position. However, the cabinet is not kept locked. For a discussion of the acceptability of this condition, see Attachment 6.
713.e	Wiring Diagrams				
713.e.1	A wiring diagram shall be provided and permanently attached to the inside of the enclosure showing exact wiring for this controller including a legend of identifying numbers of individual components.	DR	JC	• 1364-1812, Rev. 2 • 1364-1813, Rev. 3 • 1364-1814, Rev. 1 • 1364-1815, Rev. 1 • 1364-1816, Rev. 4	The referenced documents, which are wiring, schematic, and other electrical diagrams for the diesel driven fire pump controller, are maintained by the SHNPP document control system and are readily retrievable. Therefore, although diagrams were not verified as permanently attached to the inside of each enclosure, the intent of this code section is fulfilled. Field wiring terminals are marked to correspond to the applicable wiring diagrams.
713.e.2	All wiring terminals shall be plainly marked to correspond with the wiring diagram furnished.	DR	Y	• 1364-1812, Rev. 2 • 1364-1813, Rev. 3 • 1364-1814, Rev. 1 • 1364-1815, Rev. 1 • 1364-1816, Rev. 4	Field wiring terminals are marked to correspond to the referenced wiring diagrams.
713.f	Connections and Wiring:				

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
713.f.1	Wiring elements of the controller shall be designed on a continuous duty basis, except that conductors which are in a circuit only during the engine starting period may be designed accordingly.	DR	JC	• P.O. NY-435007	The reviewed documents did not confirm compliance with the requirements of this code section. However, the diesel driven fire pump controller and all associated equipment are UL listed / FM approved for fire pump service, thus providing reasonable assurance that the requirements of this code section are fulfilled.
713.f.2	Field Wiring. All wiring leading from the panel to the engine and batteries shall have adequate carrying capacity and shall be protected against mechanical injury. Controller manufacturer's specifications regarding distance and wire size shall be followed.	WD & DR	JC	• P.O. NY-435007	The reviewed documents did not confirm compliance with the requirements of this code section. However, the diesel driven fire pump controller and all associated equipment are UL listed / FM approved for fire pump service, thus providing reasonable assurance that the requirements of this code section are fulfilled.
713.g	Marking. Each operating component of the controller shall be marked to plainly indicate an identifying number referenced to the wiring diagram. The markings shall be located so as to be visible after installation.	DR	JC	• P.O. NY-435007	The reviewed documents did not confirm compliance with the requirements of this code section. However, the diesel driven fire pump controller and all associated equipment are UL listed / FM approved for fire pump service, thus providing reasonable assurance that the requirements of this code section are fulfilled.
713.h	Instructions. Complete instructions covering the operation of the controller shall be provided and conspicuously mounted on the controller. Pump operators should be familiar with these instructions and should observe in detail all of their provisions.	WD & DR	JC	• WD • OP-149, Rev. 17, pp. 10, 132 • FPP-001, Rev. 20	Operating instructions are not provided on the controller, however, OP-149 provides instructions for operation of the pump. Personnel assigned to operate the pumps have been provided with training as required by the SHNPP fire protection program.
714	**Components**				
714.a	Alarm and Signal Devices (On Controller)				
714.a.1	A pilot lamp(s) shall be provided in the line side of the starting equipment circuit to indicate that	WD & DR	Y	• WD • 1364-1813, Rev. 3	A pilot lamp are provided to indicate the controller is in the "automatic" position with

Code Section	Verification Requirements	Verification Method	Comply (Y, N, JC or N/A)	Reference	Summary of Results
	the controller is in the "automatic" position with power available for starting. The lamp shall be accessible for replacement. (See also Note in code re: lamp operating voltage)			• 1364-1815, Rev. 1	power available for starting the engine. The lamp is accessible for replacement.
714.a.2	A pilot lamp shall be provided in each battery supply to indicate that batteries are connected to the controller and are at least partially charged when the controller is set in the automatic position.	WD & DR	Y	• WD • 1364-1813, Rev. 3 • 1364-1815, Rev. 1	Pilot lamps are provided for each battery bank to indicate "power available".
714.a.3	Pilot lamps and a common bell shall be provided to indicate trouble caused by: a) Low oil pressure in the lubrication system. The controller shall provide means for testing the position of the pressure switch contacts without causing trouble alarms. b) High engine jacket water temperature. c) Failure of engine to start automatically. d) Shutdown from over-speed (diesel only).	WD & DR	Y	• WD • 1364-1813, Rev. 3 • 1364-1815, Rev. 1 • 1364-1816, Rev. 4 • CAR-2166-B-401, Sh. 2583, Rev. 6	Pilot lamps and a common bell are provided to indicate: a) Low Lube Oil Pressure b) High Cooling Water Temperature c) Engine Failed to Start d) Engine Over-speed
714.b	Alarm and Signal Devices (Remote). Where the pump room is not constantly attended, the controller shall be equipped with contacts (open or closed) to operate circuits powered by a source other than engine starting batteries, not exceeding 125 volts, for audible or visual alarms at a point of constant attendance indicating the following:	DR	Y	• CAR-2166-B-401, Sh. 2583, Rev. 6 • 1364-1813, Rev. 3 • 1364-1815, Rev. 1 • 1364-1816, Rev. 4	Since there is no pump room, the pump controller is equipped to operate circuits, powered by 115V 60 Hz AC, for audible and visual alarms in the Control Room (which is constantly attended) at annunciator cabinet 2, ALB-30, and visual alarms at the MFDIC in the Communications Room. Visual alarm annunciation in the Control Room consists of a single lamp indicator for a common "off station" signal. Visual alarm indication at the MFDIC is provided for pump running, pump controller switch turned to MANUAL or OFF, and trouble



Oconee NFPA-805 Project Chapter 3 Initiative

November 08, 2006

Discussion Outline

- Present Scope Overview of Project Task
- Discuss Project Deliverables
- Depict process to document compliance
- Present Duke Chapter 3 task 1.1 & 1.2 process
- Discuss future state Fire Protection Program bases document
- Explain interpretation of interim documentation.
- Conclusion

Scope of Project

- Use NFPA-805 Chapter 3 as a roadmap to help define the ONS fire protection classical fire protection program properties.
- Chapter 3 is a combination/enhancement of the qualities that are required to create an effective program as derived through a merger of the GDC-3, 10CFR50.48(a), NUREG 0800, and applicable sections of Appendix R (excluding the subsections pertaining to Safe Shutdown Equipment SSEL).
- Clearly define the “safe today” fire protection features in a database as licensed in the current license bases as defined by SERs and letters to the NRC since ONS has a pre-’79 license and an shutdown protection methodology.
- Evaluate FP features that were evaluated for equivalency with requirements through the past process of 86-10 in a documented control process versus memos to file or left in CAPs.
- Create a draft document to be used in the interim to maintain configuration control.

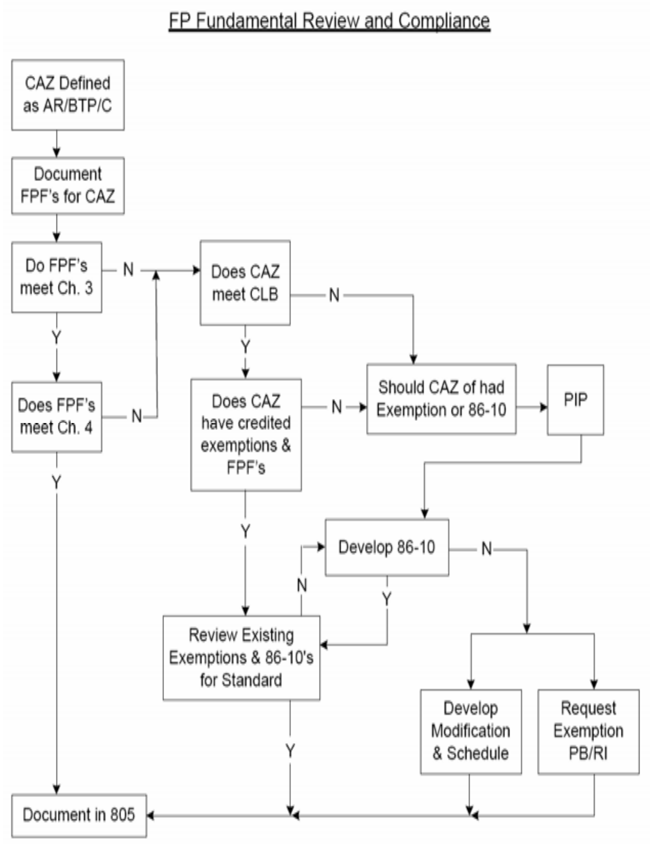
Project Deliverables

- Complete a NEI-04-02 Table B-1 that confirms compliance with each NFPA-805 Chapter 3 line item.
- Deliver a report that includes supporting details and references that document compliance with each line item in Table B-1.
- Perform a walk down of each FIRE ZONE in the plant to create a current FHA with additional items of interest.
- Create a list of potential ignition sources per NUREG-6850 defined “bin” list descriptions. Any future fire modeling will still require target to source spatial walk downs

Determination of Compliance

CAZ: Compartment/Area/zone

This process was developed to aid our decision process on how to manage those elements required by NFPA-805 that may not obviously meet the intent of the requirement.



Project Tasks 1.1 & 1.2

- Task 1.1 - populate Table B-1 with available and applicable approved licensing information (presented by Nexus)
- Task 1.2 - physically walk down and verify all classical fire protection features and 6850 ignition sources in each fire zone. Relate any fire protection program elements in that zone to prior licensing commitments. (presented by Nexus)

Fire Protection Program Document Development

- Place the information from Task 1.1 and 1.2 in an interim site draft deliverable document to ensure future plant changes take this new information into consideration.
- Expect to modify/enhance this interim document as the NFPA 805 Chapter-4 effort evolves and clarifies the needs for classical fire protection elements/features based on the reconstituted safe shutdown and 6850 analysis outputs.
- Move forward to analyze and validate any fire protection elements deviation or degradation equivalency.

Summary

- Publish an interim site guidance document for to ensure information is maintained current while the Chapter 4 analysis is finalized
- Ensure that a maintainable site fire protection licensing roadmap is produced.
- Ensure future success in audit traceability of compliance.
- Ensure that future configuration control of the data can be achieved
- Use the deliverable document to support the information required for the license submittal/ transition report.

Oconee Nuclear Station
NFPA 805 Chapter 3 Transition
NEI 04-02 Table B-1

By: Corey Kinsman

Nexus Technical Services Corporation

Engineering for Success

Topic Outline

- ✓ NEI 04-02 Requirements
- ✓ Information Gathering (Procedure & Results)
- ✓ Table B-1 Limitations
- ✓ Table B-1 Enhancements
- ✓ Lessons Learned

Engineering for Success

NEI 04-02 Table B-1 Requirements

- Columns to include:
  - NFPA 805 Chapter 3 requirements
  - Mapped to current licensing (similar BTP sections)
  - Compliance Statement
  - Current Licensing Basis Documents

NFPA 805 Chapter 3 Fundamental Fire Protection Program and Design Elements	Mapped to BTP 9.5-1 APCSB 5/1/76 Application Docketed but Construction Permit Not Received as of 7/1/76	Compliance Statement	Current Licensing Basis Document Identification
3.5 Water Supply. 3.5.1 A fire protection water supply of adequate reliability, quantity, and duration shall be provided by one of the two following methods.			
(a) Provide a fire protection water supply of not less than two separate 300,000-gal (1,135,500-L) supplies.	IV.C.2. (d) Two separate reliable water supplies should be provided. If tanks are used, two 100% (minimum of 300,000 gallons each) system capacity tanks should be installed.	The fire water storage system consists of two dedicated fire water storage tanks sized at 350,000 gallons each.	UFSAR Volume 9, Fire Hazards Analysis, Section 9.5-1, page 34. NRC Safety Evaluation Report, page 44-45.

Information Gathering

- Procedure
  - Searched Fire Protection historical files and electronic database (NEDL)
  - Used information from applicable documents to populate compliance statements
- Findings
  - Electronic searches are limited
    - No global search & requires correct sub-section
  - Out-of-date documents, requiring alternate references
    - BTP comparisons, commitment matrices, etc.

Table B-1 Limitations

- Large amounts of supporting information are not conducive to table format
- Lengths of information for a single section sometimes stretched over multiple pages
- Difficult to navigate and to read

NEXUS Engineering for Success

Sample Original Table B-1 (Draft)

(2) " Compensatory actions implemented when fire protection systems and other systems credited by the fire protection program and this	**Fire Dampers** Only 10% of the NRC committed fire dampers are expected to be inspected every 18 months per a recent revision to the SLC. However due to database constraints the fire dampers are still under a 100% every 18 month inspection. When the 10% program is initiated, it will need to ensure that each fire damper is inspected at least once in 15 years. The electrically controlled fire dampers in the cable and equipment rooms get an annual periodic check per IP/0/A/0250/005J.	IP/0/A/0250/005J

Chapter 3 Fundamental Fire Protection Program and Design Elements	Compliance Statement	Current Licensing Basis Document Identification
standard cannot perform their intended function and limits on impairment duration	(2) Compensatory actions implemented when fire protection systems and other systems credited by the fire protection program and this standard cannot perform their intended function and limits on impairment duration **Nuclear System Directive NSD - 316,** "Fire Protection Impairment and Surveillance" provides the requirements and responsibilities for reporting fire protection feature impairments and insures proper compensatory actions are satisfied for licensing, insurance and good fire protection practices. Impairments include any action or condition, which inhibits any fire protection feature to function as designed. Compensatory actions are the steps taken to minimize the fire risk potential due to a fire protection feature impairment such as staging backup suppression, temporary fire detection, fire watch tours, etc. This directive provides the directions and requirements to notify the fire brigade of any fire impairment to ensures restoration of impaired features occur in a timely manner. This directive applies to all fire protection features in the owner control area, and to all work groups that impair fire protection features.	Nuclear System Directive NSD - 316, "Fire Protection Impairment and Surveillance"
	Selected Licensing Conditions	
	The Fire Suppression Water Supply Systems shall be OPERABLE	SLC- 16.9.1
	Sprinkler and Spray Systems	SLC- 16.9.2
	The automatic CO_2 system provided for the generators at Keowee Hydro Station shall be OPERABLE	
	Fire Hose Stations listed in Table 16.9.4-1 shall be OPERABLE	SLC- 16.9.3
	All Fire Barriers (including mechanical and electrical penetrations, fire doors, fire dampers, walls, ceilings and floors) boundaries, as shown on the O-310-K and O-310-L series drawings, shall be OPERABLE.	SLC- 16.9.4
	The provided Fire Detection Instrumentation for each equipment/location shall be OPERABLE as listed in Table 16.9.6-1.	SLC- 16.9.5

Table B-1 Enhancements

- Table completed with high-level summaries
  - NFPA 805 section heading
  - Method of Compliance
    - Comply, Not Applicable, Comply with Previous Approval, Does Not Comply, etc.
  - Brief Compliance Statement
  - Mapped to existing licensing

Sample Table B-1 (Draft)

NFPA 805 Chapter 3 Section	Method of Compliance	Compliance Statement	Mapped to CMEB BTP 9.5-1
		supply fire water is acceptable	
3.5.6	Comply-Previous Approval	The use of the High Pressure Service Water (HPSW) pumps that cycle on elevated storage tank level was found to be acceptable.	Section C.6.b, Fire Protection Water Supply, (6)
3.5.7	Comply	There are separate connections from the HPSW pumps to the fire loops.	Section C.6.b, Fire Protection Water Supply, (6)
3.5.8	Comply	The pressure in the system is maintained by the Jockey Pump.	Section C.6.b, Fire Protection Water Supply, (6)
3.5.9	Comply	The level of the elevated storage tank and operation of the HPSW pumps are indicated in Control Room.	Section C.6.b, Fire Protection Water Supply, (6)
3.5.10	Comply-Previous Approval	The underground fire loop was found acceptable by the NRC.	Section C.6.b, Fire Protection Water Supply, (1)
3.5.11	Comply	Valves are provided to isolate portions of the system.	Section C.6.b, Fire Protection Water Supply, (3)
3.5.12	Comply	Compatible threads are provided.	Section C.6.b, Fire Protection Water Supply, (3)
3.5.13	Comply-Previous Approval	Each header has a separate connection with shutoff valve to the fire water system.	Section C.6.c, Water Sprinkler and Hose Standpipe Systems, (1)
*3.5.14**	Comply	The position of the sealed and locked valves is periodically verified.	Section C.6.c, Water Sprinkler and Hose Standpipe Systems, (2)
3.5.15	Comply-Previous Approval	The NRC determined that having the hydrants installed approximately every 300 feet was acceptable.	Section C.6.b, Fire Protection Water Supply, (7)
*3.5.16**	Comply-Previous	The fire water system was found	Section C.6.b, Fire Protection

Table B-1 Enhancements (cont.)

- Table linked to a back-up report that provides the in-depth details and references included in the original Table B-1 format

Duke Energy

Sample Table B-1 Report (Draft)

An underground fire loop (16 inch cement-lined, ductile iron pipe) is provided around the perimeter of the plant site. Post indicator valves are provided and are sealed or locked open to prevent inadvertent closing of valves required open for fire protection. Post indicator valves are arranged to provide isolation to portions of the main for maintenance or repair without shutting off the complete system. Valves will allow other service water systems to be removed from the HPSW system without compromising the fire protection system.

The Keowee Fire Water System does not have an underground loop. The system does supply two fire hydrants. Appropriate isolation valves are provided for that portion of the system. The Keowee flow diagram - Drawing KFD-109A-1.1 provides details on the piping arrangement.

These arrangements were found acceptable by the NRC in meeting the provisions of Appendix A to BTP 9.5-1 in Section 4.3.1.3 of their SER dated August 11, 1978.

Reference(s): UFSAR Section 9.5.1
NRC SER dated August 11, 1978
UFSAR Figure 9-10
Drawing KFD-109A-1.1

3.5.11

Means shall be provided to isolate portions of the yard fire main loop for maintenance or repair without simultaneously shutting off the supply to both fixed fire suppression systems and fire hose stations provided for manual backup. Sprinkler systems and manual hose station standpipes shall be connected to the plant fire protection water main so that a single active failure or a crack to the water supply piping to these systems can be isolated so as not to impair both the primary and backup fire suppression systems.

A 16 inch loop is provided around the perimeter of the plant. Connections from this header to the units are redundant. Auxiliary Building headers are fed from a 16 inch line coming from the yard and a four inch line from the Turbine Building. The 16 inch line that cross connects the yard loop with the Turbine Building through the Auxiliary Building is normally isolated to reduce the potential consequences of an Auxiliary Building flood event. The isolation valves can be manually opened with the appropriate compensatory measures in place any time the cross connect is required to be placed in service. A 4 inch line from the Turbine Building will remain in service during normal operation in order to supply normal Auxiliary Building HPSW header requirements. The 4 inch line is capable of providing adequate initial HPSW flow and pressure and for fire mitigation and service water demands in all areas of the Auxiliary Building.

The Keowee fire protection system incorporates isolation valves for the various service water and fire system components.

The piping arrangement for the nuclear plant is shown schematically on UFSAR Figure 9-10; the piping for the Keowee system is shown on Drawing KFD-109A-1.1.

These arrangements were found acceptable by the NRC in meeting the provisions of Appendix A to BTP 9.5-1 in their SER dated August 11, 1978. Facility operational restrictions based on HPSW Pump and Keowee Fire Protection Pump Operability are contained in SLC 16.9.1 "Fire Suppression Water Supply Systems."

Reference(s): UFSAR Section 9.5.1
NRC SER dated August 11, 1978
UFSAR Figure 9-10

3.5.12

Threads compatible with those used by local fire departments shall be provided on all

NEXUS Engineering for Success

Table B-1 Enhancements (cont.)

- Designed with simplification, usefulness, and maintenance in mind
  - Simplification: All references in one location (NEDL), One-line summaries for quick answers, Reading logic
  - Usefulness: Format allows for the Transition Report integration into a new DBD/Licensing document
  - Maintenance: Updating information, Navigation to specific sections, No electronic links to references/ Doc's in doc. control system

Lessons Learned

- Keep documents in one place – Doc. Control with better indices
- Don't create new configuration management headaches – integrate with existing systems

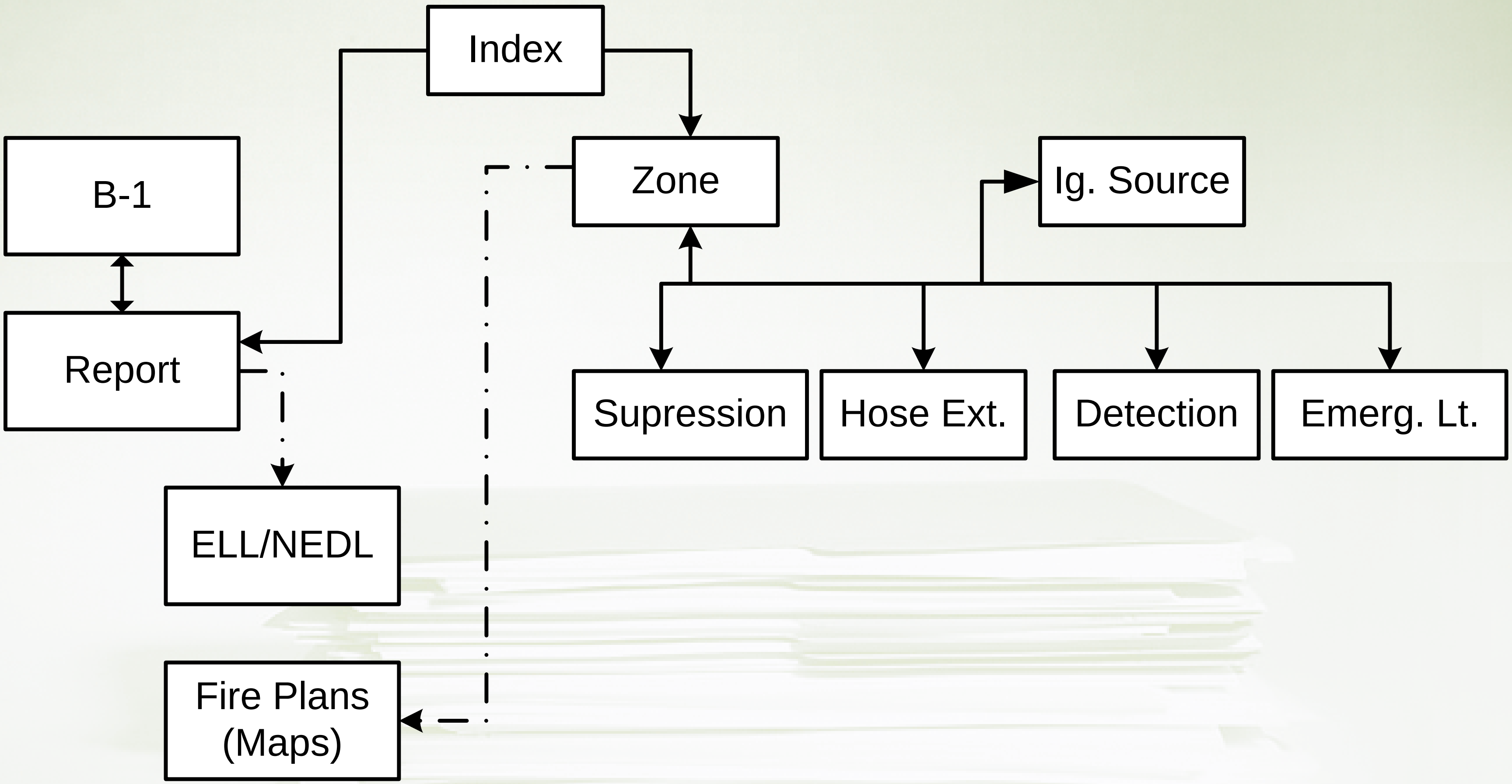
NFPA 805 Chapter 3 Transition Fire Hazards Analysis Verification Oconee Nuclear Station

By: Robert A. Jackson, PE
Senior Engineer
Nexus Technical Services Corporation

Chapter 3 Goal

- Generate a fire protection feature basis document suitable for transition of NFPA 805 fire-area specific requirements

Chapter 3 Interfaces



Background

- Due to potential incomplete documentation of fire protection features, revalidation was required
- Oconee may be an outlier in the industry

Methodology

- Project Instruction
  - Standard approach for team implementation
  - Documentation of assumptions
  - Definitions of data to be gathered
  - Checklist for field data
- Inaccessible zones
  - Done from "table-top" look using general arrangement and electrical layout drawings and output from the EDB (electrical equipment and motors)

Methodology

- Drawing Mark-up
  - Include location fire protection features and configuration corrections
- Review
  - Senior FPE review of fire zones to check data gathered (FP features and ignition sources)
  - Major hazards protected
  - FP feature discrepancies

Bin Definitions

Bin #	Item	Criteria Notes
1	Batteries (Battery Room)	Interconnected batteries = 1 set
2	Reactor Coolant Pump (Containment)	
4	Main Control Board (Control Room)	U1/U2 Control Room = 3 control boards each for unit (Switchyard mimic board counts as bin 15); U3 Control Room = 2 control boards and 1 Switchyard mimic board
8	Diesel Generators	All subsystems included as 1 count.
9	Air Compressors	Includes control panel; compressors with motors less than 5-hp excluded; Note all portable compressors
10	Battery Chargers	Typically find these with DC buses
13	Dryers	Clothes dryers
14	Electric Motors	Greater than 5-hp; not associated with other bins; Do not count motor operated valves
15	Electrical Cabinets	UPS (Power supplies), SWGR, MCC, Load Centers, DC Dist Cab, relay cab, control & switch panel that are not part of other bins. Free standing electrical cabinets (SWGR/MCC/Load Centers) counted by vertical segments. Terminal boxes (labeled TB) or unlabeled electrical cabinets with any dimension greater than 6'. (Most TB's are low voltage, typically they are labeled as High Voltage if they have voltage greater than 440 VAC. If labeled as high voltage, they should be counted). Count wall mounted panels not excluded by the rules below. Exclusions: - Well sealed, secured doors, less than 440V and less than 4 switches or lights - Welding receptacles (i.e. 600VAC cabinet w/connector) - Cabinet less than 1'x1'x1' unless labeled as High voltage (labeled with the words "High Voltage" or indication of voltage at least 440 VAC) - Abandoned and de-energized panels

NEXUS Engineering for Success

Bin Definitions (cont.)

Bin #	Item	Criteria Notes
16	High-Energy Arcing Faults	-Regular bus duct (not iso phase bus duct) -Load Centers and Switchgear (in addition to Bin 15) • If greater than 440 VAC but less than 1000 VAC, count entire load center or switchgear as one HEAF • If greater than 1000VAC, count each vertical segment of the load center or switchgear as a HEAF
17	Hydrogen Tanks	Multi-tank trailers = 1
19	Misc. Hydrogen Fires	Other that storage, generator cooling and battery rooms
21	Pumps & Large Hydraulic Valves	Pumps above 5-hp; include large hydraulic valves if any
23	Transformers	Include those not integral part of larger component; Include low-voltage regulators; - Include all those over rating 45 kVA
26	Ventilation Subsystems	Count air handling units (AHUs), and chillers
27	Yard Transformer (catastrophic)	Include isolation phase bus duct
28	Yard Transformer (non-catastrophic)	Include anything that was in Bin 27 except for isolation phase bus ducts
29	Yard Transformer (other)	Assume 1 count of Bin 29 for each component that was previously assigned to both Bins 27 and 28.
30	Boiler (TB)	Ancillary items included except electrical cabinets if installed separate
32	Main Feedwater Pumps (TB)	Include ancillary items
33	T/G Exciter (TB)	
34	T/G Hydrogen	Entire unit = 1 (include piping, valves, heat exchangers, oil separators, etc.)
35	T/G Oil	Entire unit = 1 (include storage tanks, pumps, heat exchangers, valves, control devices etc.)

Data Gathering Checklist - Field Walkdown

Oconee Nuclear Station 805 Transition
Chapter 3 Walkdown Checklist

Fire Zone: ________ Date: ________

Team Member 1: ___________________ Team Member 2: ________________
Senior FPE Review: _________________ Date: ________

Ignition Sources (use attached Sheet)

Equipment subject to water, smoke and heat damage (use attached Sheet)

Suppression in Zone: Yes / No
Type: _____________________ automatic / manual
If Yes: partial / complete
System ID: _________________

Detection in Zone: Yes / No
Type: _____________________
If Yes: partial / complete
System ID: _________________

Fire Hose Stations: Yes / No (If Yes, confirm location(s) on drawing)

Fire Extinguishers: Yes / No (If Yes, confirm location(s) on drawing)

Floor Drainage: Yes / No drains / open penetrations

Storage Areas: Note on drawing(s) location of combustible, noncombustible, chemical, and flammable storage areas; also note location oil rag cans and trash bins

Radiological Hazards: Note on drawing(s) (contaminated areas/radiation areas/hot spots)

Seismic Concerns: Note on drawing(s) (hydrogen piping/gas bottles/unrestrained cabinets)

Fire Protection: Note below any abnormal or unexpected observations of fire suppression or fire detection systems. Note if equipment described as significant in the pre-fire plan is not protected by suppression or detection.

Notes:

Data Gathering Checklist – Ignition Source

Oconee Nuclear Station 805 Transition
Chapter 3 Walkdown Equipment List

Fire Zone: ________ Date: _______
Team Member 1: ________________ Team Member 2: ______________
Senior FPE Review: ______________ Date: _______

#	Equipment Name/Description	Equipment EDM	Ignition Source (Bin #)	Count	Subject to damage:		
					Water	Smoke	Heat
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
15							
17							
18							
19							
20							
21							

Notes:
___
___
___

Field Walkdown Results

- Data Recorded
  - Ignition Sources
  - Suppression
  - Detection
  - Manual Fire Protection (Fire Extinguishers/Hose Stations
  - Storage Areas
  - Other: floor drainage, concerns
- Observed discrepancies
  - Drawings to field equipment
  - Fire protection feature/hazard protection

NEXUS Engineering for Success

Database

- Data
  - Field Walkdown
  - Table top – Emergency Lights, fire barriers, adjacent zones, zone information (fire area, building, elevation, etc)
  - Input into spreadsheet for simplicity
- Imported into database for control, query and report functions
- Reports
  - Fire Protection Feature (Zone basis)
  - Ignition Sources
  - Multiple other report options limited by the amount data entered

Database Output – FP Features

Oconee Nuclear Station
Fire Protection Features

OSS-0254.00-00-4008
Revision 00
Attachment 3.XX1

Unit _______ Building _______________ Fire Area _______

Fire Zone _______ {Fire Zone Description} Elevation _______

Appendix R Section _______ Fire Protection Plan Drawing No. _______________

Suppression System Name	Suppression Type	Suppression Complete / Partial / Hazard	Commitment				
			BTP	App R			Comm.
				G.1	G.2	G.3	

Detection Complete / Partial / Hazard	Detector Type	Detector #	Commitment				
			BTP	App R			Comm.
				G.1	G.2	G.3	

Fire Hose Station # _______ Fire Hose Station Location _______ Commitment _______

Fire Extinguisher # _______ Fire Extinguisher Type _______ Fire Extinguisher Location _______ Commitment _______

Emergency Light # _______ Emergency Light Drawing _______ Commitment _______

Floor Drainage {Y/N} Floor Drainage Type _______

Database Output – FP Features

Oconee Nuclear Station
Fire Protection Features

OSS-0254.00-00-4008
Revision 00
Attachment 3.XX1

Storage Type ______ Storage Location ______

Fire Barrier — Commitment ______

Fire Barrier	
North	{Y/N}
South	{Y/N}
East	{Y/N}
West	{Y/N}
Above	{Y/N}
Below	{Y/N}

Adjacent Fire Zone(s)

Adjacent Fire Zone(s)	
North	______
South	______
East	______
West	______
Above	______
Below	______

Comments:

Exemptions:
____
____
____

Equivalencies:
____
____
____

General:
____
____
____

Duke Energy

Database Output – Ignition Source

Oconee Nuclear Station
Fire Ignition Sources

OSS-0254.00.00-4008
Revision 00
Attachment 3.XXX
Fire Area BOP
Fire Zone 19

Equipment Description	EDM Equipment No.	Ignition Source Bin	Bin Count
1B MFDWP Emer. Bearing Oil Pump		21	1
1A CST Pump	1CPU0008	21	1
1A FDWP Aux Oil Pump		21	1
1A FDW Pump		32	1
MCC	1EL MX 1MVC3	15	1
Terminal Box	1TBFPT	15	0.5
1A Seal Injection Sump Pump		21	1
MCC	1EL MX 1XC	15	14
1B Seal Injection Sump Pump		21	1
1B FDWP Aux Oil Pump		21	1
1B FDW Pump		32	1
1B FDWPT Motor Control Unit		15	0.5
1A FDWPT Seal Injection Pump		21	1
1B FDWPT Seal Injection Pump		21	1
1B CST Pump	1CPU0009	21	1
SG FDW Panel	1SGFP	15	1
1C1-Condenser Tube Cleaning Ameritap Control		15	1
1C1 Waterbox Discharge Valve	1CCW VA 0024	21	1
1C1-B Ameritap Pump	1CCW PU 0014	21	1
1C1-A Ameritap Pump	1CCW PU 0013	21	1
MCC	1EL MX 1MVC2	15	2
TK Pump B Condenser Return Switch		15	0.5
1A MFDWP Emer. Bearing Oil Pump		21	1
1C2-Condenser Tube Cleaning Ameritap Control		15	1
1C2 Waterbox Discharge Valve	1CCW VA 0025	21	1
1A FDWPT Motor Control Unit		15	0.5
1C2-B Ameritap Pump	1CCW PU 0016	21	1

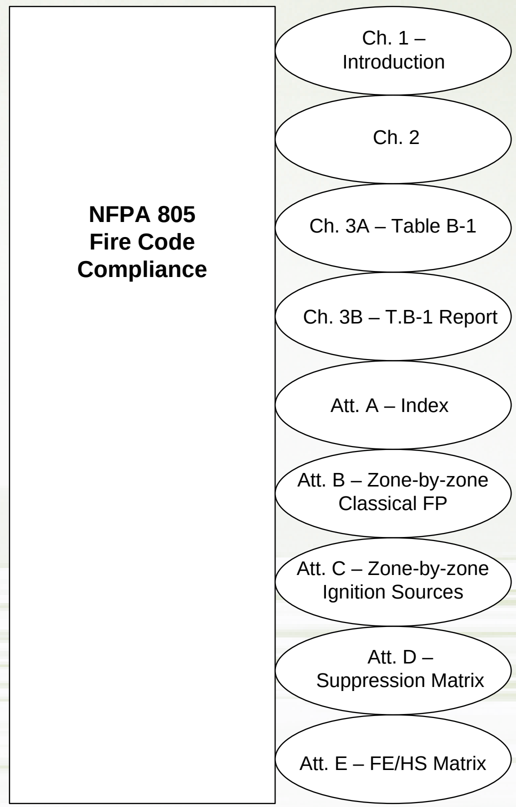
Walkdown Team BG/JM
Data Entry Review: BG 8/24
Zone Review: RAJ **Review Date:** Oct 1, 2006

Page 1 of 2

NEXUS Engineering for Success

Conceptual Document Content

Conceptual Document Outline



Lessons Learned/Good Practices

- Define scope/definitions at beginning
- Schedule around outage
- Define a date-stamp for data collection
- Routine team meetings
- Prompt review of fire zones

Where Do We Go From Here?

- Equivalency Evaluations (86-10's)
- Support Iterations between Chapter 3 and 4
- PRA/Fire Scenario Support – Evaluate target and spatial separation of fire hazards

NFPA 805 Pilot Observations Meeting
Fire PRA Ignition Source Counting

November 8, 2006

Dave Miskiewicz
Kiang Zee

FAQs

- 06-0016
  Electrical Cabinets (Bin 15)
- 06-0017
  HEAF Counting (Bin 16)
- 06-00XX
  MCB Counting (Bin 4)
- 06-00XX
  Misc Counting Items (valves, transformers, etc.

Bin 15

- When does size matter?
- Define outlier criteria
- Provide a basis for outliers
- Examples

Bin 16

- Energy
- Only count switchgear and load centers (MCCs not counted)
- Count Bus Duct as 1 HEAF (more discussion needed)
- Count load centers as 1 HEAF

Bin 4

- Use NUREG/CR-6850 App. L

FAQ Number	06-0016, Revision 0a

(DRAFT – pre-NEI NFPA-805 task Force)

Plant:	Harris Nuclear Plant (HNP)	FAQ # 06-0016	
Submittal Date:	11-6-06		
Licensee Contact:	David Miskiewicz	Tele/email 919-546-7588	
NRC Contact:		Tele/email	

Distribution: Check all that apply *(NEI Internal Use)*

□ FPWG □ RIRWG □ NSSS OG □ NFPA 805 TF □

Subject: Clarification/enhancement of Ignition Source counting guidance for Electrical Cabinets in NUREG/CR-6850, supporting NFPA-805 Fire PRA application.

Interpretation of guidance? Yes

Proposed new guidance not in NEI 04-02? Yes

Details:

NEI 04-02 Guidance needing interpretation (include section, paragraph number, and line number):

New attachment on interpretation issues

Circumstances requiring guidance interpretation or new guidance:

The guidance provided in NUREG/CR-6850 for Task 6, Fire Ignition Frequency (Section 6.5.6, Bin 15), states:

> *Bin 15 – Electrical Cabinets (Plant-Wide Components):* Electrical cabinets represent such items as switchgears, motor control centers, DC distribution panels, relay cabinets, control and switch panels (excluding panels that are part of machinery), fire protection panels, etc. Electrical cabinets in a nuclear power plant vary significantly in size, configuration, and voltage. Size variation range from small-wall mounted units to large walk-through vertical control cabinets, which can be 20' to 30' long. The configuration can vary based on number of components that contribute to ignition, such as relays and circuit cards, and combustible loading, which also affects the fire frequency. Voltages in electrical cabinets vary from low voltage (120 V) panels to 6.9 kV switchgears. Even though it is expected that these features affect the likelihood of fire ignition, from a simple analysis of the event data involving the electrical cabinets, it was determined that the variation by cabinet type did not warrant separate frequency evaluation. Therefore, one fire frequency was estimated for the electrical cabinets.

This guidance infers that cabinet size is not a factor for ignition source counting. However, additional guidance states that electrical cabinets "… should be counted by their vertical segments ...". During the presentation of Pilot Project results it was determined that differences related to the definition of 'segments' could result in notable inconsistency between individual users of NUREG/CR-6850.

The discussion of this issue found that this issue affects only general electrical cabinets and panels. In the case of switchgears, load centers, unit substations, and motor control centers the term 'segment' was uniformly interpreted to be equal to the individual vertical sections that define these types of components. As applied to general electrical cabinets and panels, the term 'segments' could be interpreted to mean different metrics.

- A segment could be defined as an enclosed element that is generally independent of size or volume (also referred to as a vertical section).
- A segment could be defined as an individual section of an enclosure regardless of whether it was fully enclosed.
- A segment could be defined based on a 'standard' or reference sample panel size.

Depending on the metric being used, the counting of electrical cabinets would result in varying results and consequently, different fire ignition frequency values. While NUREG/CR-6850 allows the establishment of plant specific criteria for counting of electrical cabinets, additional guidance is required to achieve a consistent basis for determining the ignition frequencies.

Detail contentious points if licensee and NRC have not reached agreement

This topic has impact on the NFPA-805 pilots, non-pilots and other users of NUREG/CR-6850.

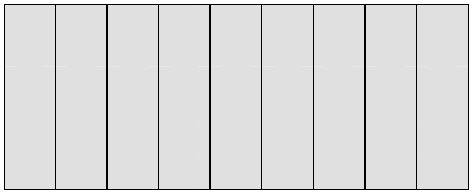
Potentially relevant existing FAQ numbers:

This guidance is specific to the characterization of electrical cabinets for Bin 15 ignition frequency determination. The characterization of switchgear and load center segments for the purposes of high energy arcing faults is addressed by FAQ 06-0017.

<u>Response Section</u>

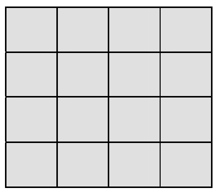
A generalized counting criterion for general electrical cabinets and panels is proposed. This proposed criterion would involve two elements.

For switchgears, load centers, unit substations, and motor control centers the counting for the purposes of NUREG/CR-6850, Task 6, Bin 15 would be based on vertical section. This counting is illustrated in the following examples.



Medium Voltage Switchgear

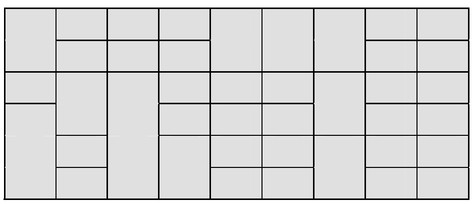
9 Breakers and Sections
Count = 9 for Bin 15



Load Center or Unit Substation

16 Breakers in 4 Sections

Count = 4 for Bin 15



Motor Control Center

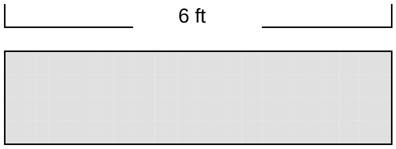
41 Breakers/Starters in 9 Sections

Count = 9 for Bin 15

For general electrical cabinets and panels, it is proposed that the counting be based on a physically enclosed element. A physically enclosed element means that that the cabinet or panel is fully enclosed by 6 solid elements with the provision that a non-combustible floor or ceiling may represent the bottom or top. The term ‘solid’ element is not intended to mean that the element is substantially continuous. Consequently, breeches or unsealed penetrations could still be treated as ‘solid’. The term ‘solid’ is intended to prevent a panel that is divided by an element that is substantially open from being treated as two separate panels.

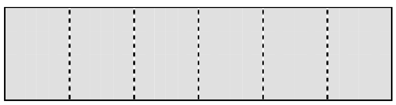
This proposed counting for electrical cabinets and panels is to be applied for a wide range of panel sizes. However, recognizing that the ignition frequency is more a function of the cabinet contents than the cabinet size, a basis is needed to address outlier conditions. It is proposed that each user be required to establish criteria for identifying the outliers and the basis for counting them. As an example, they can be counted by establishing a nominal ‘standard’ or reference cabinet size. The count could also be based on evaluating the cabinet internals relative to a defined ‘standard’ or reference configuration.

For example, a particular user may define a cabinet with any horizontal dimension more than 8 feet as an outlier, and a ‘standard’ cabinet as being nominally 4 feet in length x 3 feet deep. (cabinet height is not generally an issue based on the use of vertical sections). Using this example, the following cabinet and panel examples would be counted as follows:

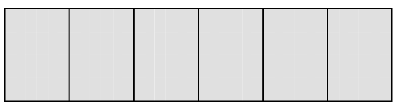


Cabinet is not an outlier –
Count = 1

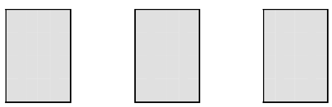
Cabinet is same as standard
Count = 1



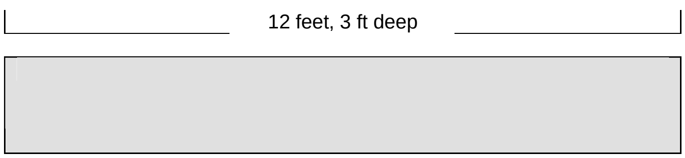
Internal dividers are not solid
Count = 1



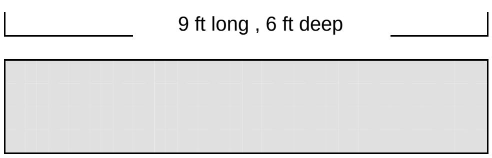
Internal dividers are solid
Count = 6



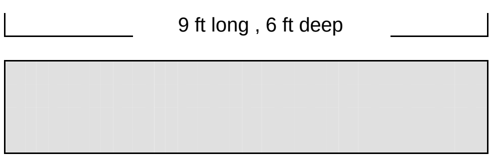
Three independent cabinets
Count = 3



Panel is an outlier, using a 4’ standard cabinet -
Count = 3



Cabinet is an outlier, evaluation of contents shows low cable loading typical of the standard cabinet -
Count = 1.



Cabinet is an outlier, no evaluation of contents, based on reference cabinet
Count = 3 – due to both variation from the standard length and width.

The intent is that a basis for the counting of outliers is required. A volumetric comparison is not required. Also, to prevent any appearance that this treatment is intended to be based on physical measurements, the proposed approach allows only integer counting. The assignment of fractional values would not be allowed. In addition, the proposed methodology retains the option for screening small cabinets resulting in a count of zero for them (as discussed in NUREG/CR-6850). As applied in this case, the user would be allowed to screen cabinets or panels based on defined criteria and exclude them from the overall population count.

Deleted: on a defined criteria

Basis:

The existing guidance in NUREG/CR-6850 is based on industry data which has only been provided with fidelity adequate to support plant level ignition frequencies for electrical cabinets. Although the guidance does address the broad applicability of the data, it leaves room for variability that can create issues with PRA quality. It is important that the ignition frequency results be of sufficient quality to support not only NFPA-805 transition but also the more broad scope of regulatory inspection and enforcement issues.

The guidance proposed will provide more consistency when determining plant specific electrical cabinet ignition frequencies while working within the bounds of the exiting data provided by the NUREG. This should facilitate the review and acceptability of the results.

FAQ Number 06-0017, Revision 0a

Formatted: Left: 82.8 pt, Right: 66.95 pt, Top: 69.85 pt, Footer distance from edge: 21.6 pt

(DRAFT – pre-NEI NFPA-805 task Force)

Deleted: FAQ

Plant: Oconee FAQ # 06-0017

Deleted: Harris Nuclear Plant (HNP)

Submittal Date: 11-6-06

Licensee Contact: Kiang Zee Tele/email

Deleted: David Miskiewicz

Deleted: 919-546-7588

NRC Contact: Tele/email

Distribution: Check all that apply *(NEI Internal Use)*

Formatted: Centered

Formatted: Left: 72 pt, Right: 54 pt, Top: 36 pt, Bottom: 36 pt, Header distance from edge: 21.6 pt, Footer distance from edge: 21.6 pt

□ FPWG □ RIRWG □ NSSS OG □ NFPA 805 TF □

Subject: Clarification/enhancement of Ignition Source counting guidance for High Energy Arcing Faults (HEAF) in NUREG/CR-6850, supporting NFPA-805 Fire PRA application.

Interpretation of guidance? Yes

Proposed new guidance not in NEI 04-02? Yes

Details:
NEI 04-02 Guidance needing interpretation (include section, paragraph number, and line number):

New attachment on interpretation issues

Circumstances requiring guidance interpretation or new guidance:

The guidance provided in NUREG/CR-6850 for Task 6, Fire Ignition Frequency (Section 6.5.6, Bin 16), states:

> Bin 16 – High-Energy Arcing Faults (Plant-Wide Components): High-energy arcing faults are associated with switchgear and load centers. Switchyard transformers and isolation phase buses are not part of this bin. For this bin, similar to electrical cabinets, the vertical segments of the switchgear and load centers should be counted. Additionally, to cover potential explosive failure of oil filled transformers (those transformers that are associated with 4.16 or 6.9kV switchgear and lower voltage load centers) may be included in vertical segment counts of the switchgear.

Pilot discussions and benchmarking of NUREG/CR-6850 for Task 6, Fire Ignition Frequency, has shown inconsistency in the treatment of High Energy Arcing Faults (Bin 16). Strict interpretation of the guidance is that the HEAF count should mimic the electrical cabinet counts for switchgear and load centers. The application of such a counting method is expected to result in reported High Energy Arcing Fault (HEAF) frequency values for an individual plant being inconsistent with industry experience. The industry experience and consequently the HEAF frequency is based on 3 events occurring on medium voltage switchgears and ½ event occurring on a 480 VAC Load Center. Because of the relative numbers of switchgears and load centers at an individual plant, it is expected that the resultant frequency may be inappropriately skewed. There is a concern that the occurrence of a HEAF frequency distribution that departs significantly from the 3 to ½ ratio would cause results to be challenged. There is also a question of counting Bus Ducts. There is a need to resolve this issue to prevent future rework and to reduce burden associated with uncertainty treatment.

Deleted: o

Detail contentious points if licensee and NRC have not reached agreement

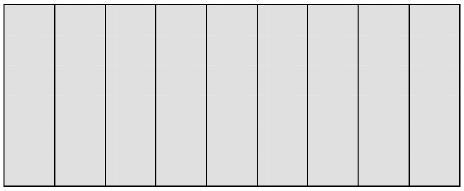
This topic has impact on the NFPA-805 pilots, non-pilots and other users of NUREG/CR-6850.

Potentially relevant existing FAQ numbers:

This guidance is specific to the characterization of electrical cabinets for Bin 16 HEAF determination. The characterization and counting of electrical cabinets for Bin 15 determination is addressed by FAQ 06-0016.

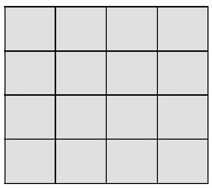
Response Section

It is proposed that the existing guidance in NUREG/CR-6850 that recommends counting based on segments be modified. Since industry experience shows that the medium voltage switchgears are most likely to experience this event, it is proposed that each load center or unit substation be counted as a single unit regardless of the number of vertical sections or segments. This treatment would ensure that the majority of the HEAF frequency is allocated to the medium voltage switchgears.



Medium Voltage Switchgear

9 Breakers and Sections
Count = 9 for Bin 16



Load Center or Unit Substation

16 Breakers in 4 Sections

Count = 1 for Bin 16

Bus ducts are recommended to be counted as an equivalent to an individual section, regardless of length. Since the termination point of the bus duct is the likely location for the HEAF, and each individual bus duct is terminated at both ends, the likelihood of a shorter bus duct having a HEAF is not significantly different than a longer bus duct. When a grouping of bus ducts route between a two electrical sources or cabinets, each individual bus duct is counted.

Comment [K1]: Kiang – bus ducts have many bolted connections. The number of connections is a function of length. The argument that HEAF are most likely to occur at the terminal ends would be interpreted to mean at each bolted connection. Therefore, length might become an issue.

Also, it is unclear how the bus ducts are to be counted. If a single bus duct passes through 6 compartments, is it counted as 1/6 per room or 1 in each room.

I would propose that bus ducts be ignored. The only instance that I know of if the Waterford event and that occurred near the switchgear. The HEAF for the switchgear should bound the consequences.

Formatted: Centered

Basis:

The existing guidance in NUREG/CR-6850 is based on industry data which has only been provided with fidelity adequate to support plant level ignition frequencies for HEAFs. Although the guidance does address the data, it leaves room for variability that can create issues with PRA quality. It is important that the ignition frequency results be of sufficient quality to support not only NFPA-805 transition but also the more broad scope of regulatory inspection and enforcement issues.

The guidance proposed will provide more consistency when determining plant specific electrical cabinet ignition frequencies while working within the bounds of the exiting data provided by the NUREG. This should facilitate the review and acceptability of the results.

FAQ Number 06-0018x, Revision 0a

(DRAFT – pre-NEI NFPA-805 task Force)

Formatted: Left: 82.8 pt, Right: 66.95 pt, Top: 69.85 pt, Footer distance from edge: 21.6 pt

Deleted: FAQ

Plant:	Harris Nuclear Plant (HNP)	FAQ # 06-0018?	
Submittal Date:	11-6-06		
Licensee Contact:	David Miskiewicz	Tele/email 919-546-7588	
NRC Contact:		Tele/email	

Deleted: 0017

Distribution: Check all that apply *(NEI Internal Use)*

Formatted: Centered

□ FPWG □ RIRWG □ NSSS OG □ NFPA 805 TF □

Subject: Clarification/enhancement of Ignition Source counting guidance for Main Control Board (MCB) in NUREG/CR-6850, supporting NFPA-805 Fire PRA application.

Interpretation of guidance? Yes

Proposed new guidance not in NEI 04-02? Yes

Details:
NEI 04-02 Guidance needing interpretation (include section, paragraph number, and line number):
New attachment on interpretation issues

Circumstances requiring guidance interpretation or new guidance:

NUREG/CR-6850, Section 6.5.6

The guidance provided in NUREG/CR-6850 for Task 6, Fire Ignition Frequency, is subject to application inconsistency in the treatment of Main Control Board (Bin 4). The guidance for Task 6 does not provide any specific definition or characterization of what constitutes a Main Control Board (MCB) other than a reference to it being the central element of the room. A discussion amongst the Pilot Plants that included consideration of other plants in their respective fleets found wide variability in the configuration of the main control room. There was a concern that inconsistent treatment of this bin would unnecessarily challenge the completion and review of the Fire PRA. This challenge would be manifested by a notable change in the fire frequency assigned to an individual panel depending on whether it was counted as Bin 4 or Bin 15.

Further review of NUREG/CR-6850 found that a definition of MCB is provided in Appendix L. However, this Appendix develops a fire modeling treatment of fire behavior within a panel enclosure. There was a concern that absent documented agreement, there could be a future challenge to the use of the definition in Appendix L for the purposes of Task 6, Bin 4 counting.

Detail contentious points if licensee and NRC have not reached agreement
This topic has impact on the NFPA-805 pilots, non-pilots and other users of NUREG/CR-6850.

Potentially relevant existing FAQ numbers:
This guidance is specific to the characterization of Main Control Board for Bin 4 determination. The characterization and counting of electrical cabinets for Bin 15 determination is addressed by FAQ 06-0016.

Response Section

It is proposed that the definition of Main Control Board provided in NUREG/CR-6850, Appendix L be accepted as also being applicable for Task 6, Bin 4 counting.

Basis:

The guidance proposed will provide more consistency when determining plant specific control room ignition frequencies while working within the bounds of the exiting data provided by the NUREG. This should facilitate the review and acceptability of the results.

Formatted: Left: 72 pt, Right: 54 pt, Top: 36 pt, Bottom: 36 pt, Header distance from edge: 21.6 pt, Footer distance from edge: 21.6 pt

Deleted: High Energy Arcing Faults (HEAF)

Deleted: The guidance provided in NUREG/CR-6850 for Task 6, Fire Ignition Frequency (Section 6.5.6, Bin 16), states:¶
¶
Bin 16 – High-Energy Arcing Faults (Plant-Wide Components): High-energy arcing faults are associated with switchgear and load centers. Switchyard transformers and isolation phase buses are not part of this bin. For this bin, similar to electrical cabinets, the vertical segments of the switchgear and load centers should be counted. Additionally, to cover potential explosive failure of oil filled transformers (those transformers that are associated with 4.16 or 6.9kV switchgear and lower voltage load centers) may be included in vertical segment counts of the switchgear.¶
¶

Deleted: Pilot discussions and benchmarking of NUREG/CR-6850 for Task 6, Fire Ignition Frequency, has shown inconsistency in the treatment of High Energy Arcing Faults (Bin 16). Strict interpretation of the guidance is that the HEAF count should mimic the electrical cabinet counts for switchgear and load centers. The application of such a counting method is expected to result in reported High Energy Arcing Fault (HEAF) frequency values for an individual plant being inconsistent with industry experience. The industry experience and consequently the HEAF frequency is based on 3 events occurring on medium voltage switchgears and ½ event occurring on a 480 VAC Load Center. Because of the relative numbers of switchgears and load centers at an individual plant, it is expected that the resultant frequency may be ... [1]

Deleted: electrical cabinets

Deleted: 16

Deleted: HEAF

Comment [K1]: Kiang – bus ducts have many bolted connections. The number of connections is a function of length. The argument that HEAF are most likely to occur at the termina ... [2]

Deleted: It is proposed that the existing guidance in NUREG/CR-6850 that recommends counting based on segments be modified. Since industry experience shows that the medium voltage ... [3]

Deleted: The existing guidance in NUREG/CR-6850 is based on industry data which has only been provided with fidelity adequate to support plant level ignition frequencies for HEAFs. ... [4]

Formatted: Normal, Indent: Left: 18 pt

Deleted: electrical cabinet

Page 2: [1] Deleted **dnm** **11/7/2006 1:23:00 PM**

Pilot discussions and benchmarking of NUREG/CR-6850 for Task 6, Fire Ignition Frequency, has shown inconsistency in the treatment of High Energy Arcing Faults (Bin 16). Strict interpretation of the guidance is that the HEAF count should mimic the electrical cabinet counts for switchgear and load centers. The application of such a counting method is expected to result in reported High Energy Arcing Fault (HEAF) frequency values for an individual plant being inconsistent with industry experience. The industry experience and consequently the HEAF frequency is based on 3 events occurring on medium voltage switchgears and ½ event occurring on a 480 VAC Load Center. Because of the relative numbers of switchgears and load centers at an individual plant, it is expected that the resultant frequency may be inappropriately skewed. There is a concern that the occurrence of a HEAF frequency distribution that departs significantly from the 3 to ½ ratio would cause results to be challenged. There is also a question of counting Bus Ducts. There is a need to resolve this issue to prevent future rework and to reduce burden associated with uncertainty treatment.

Page 2: [2] Comment [K1] **KLZ** **11/4/2006 4:03:00 AM**

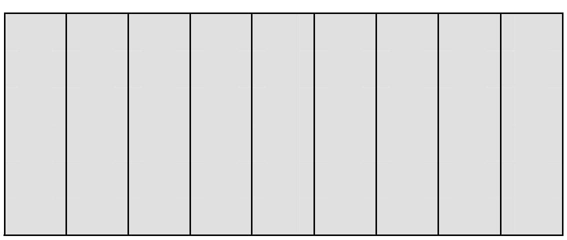
Kiang – bus ducts have many bolted connections. The number of connections is a function of length. The argument that HEAF are most likely to occur at the terminal ends would be interpreted to mean at each bolted connection. Therefore, length might become an issue.

Also, it is unclear how the bus ducts are to be counted. If a single bus duct passes through 6 compartments, is it counted as 1/6 per room or 1 in each room.

I would propose that bus ducts be ignored. The only instance that I know of if the Waterford event and that occurred near the switchgear. The HEAF for the switchgear should bound the consequences.

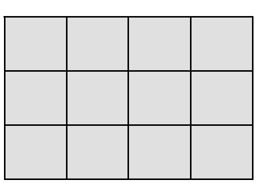
Page 2: [3] Deleted **dnm** **11/7/2006 1:25:00 PM**

It is proposed that the existing guidance in NUREG/CR-6850 that recommends counting based on segments be modified. Since industry experience shows that the medium voltage switchgears are most likely to experience this event, it is proposed that each load center or unit substation be counted as a single unit regardless of the number of vertical sections or segments. This treatment would ensure that the majority of the HEAF frequency is allocated to the medium voltage switchgears.



Medium Voltage Switchgear

9 Breakers and Sections
Count = 9 for Bin 16



Load Center or Unit Substation

16 Breakers in 4 Sections

Count = 1 for Bin 16

Bus ducts are recommended to be counted as an equivalent to an individual section, regardless of length. Since the termination point of the bus duct is the likely location for the HEAF, and each individual bus duct is terminated at both ends, the likelihood of a shorter bus duct having a HEAF is not significantly different than a longer bus duct. When a grouping of bus ducts route between a two electrical sources or cabinets, each individual bus duct is counted.

Page Break

Page 2: [4] Deleted **dnm** **11/7/2006 1:26:00 PM**

The existing guidance in NUREG/CR-6850 is based on industry data which has only been provided with fidelity adequate to support plant level ignition frequencies for HEAFs. Although the guidance does address the data, it leaves room for variability that can create issues with PRA quality. It is important that the ignition frequency results be of sufficient quality to support not only NFPA-805 transition but also the more broad scope of regulatory inspection and enforcement issues.

NFPA 805 Transition

Harris Nuclear Plant (HNP) Nuclear Safety Performance Criteria Transition

HNP Pilot Meeting
Nov. 6-9, 2006
Raleigh, NC

Keith Began
Bob Rhodes
11/08/06

Nuclear Generation Group

Progress Energy

Introduction

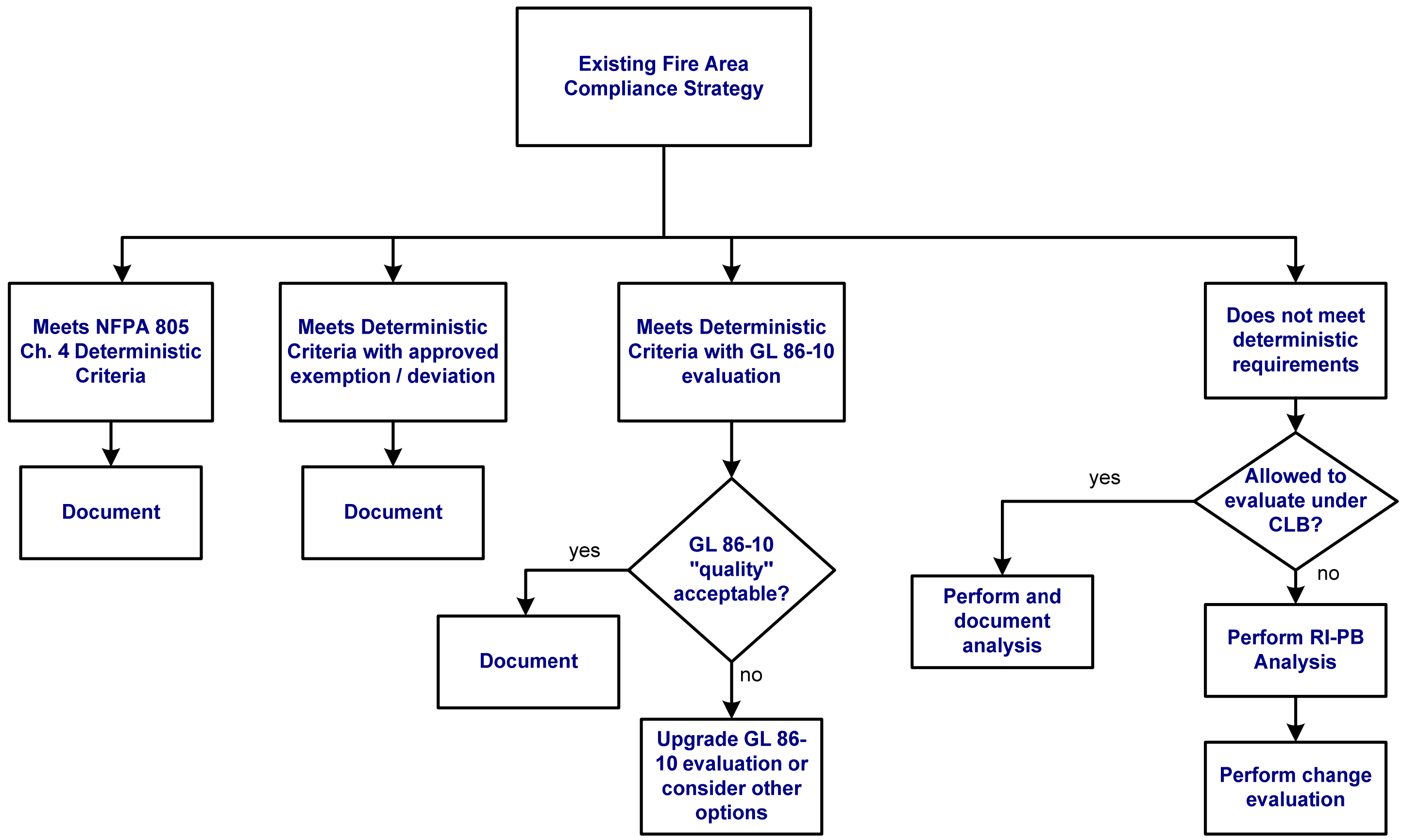
- Nuclear Safety Performance Criteria transition review consists of:
  - Review of safe shutdown methodology for basic attributes (NFPA 805, Chapters 1 and 2)
  - Fire area by fire area review (NFPA 805, Chapter 4 **[Focus of Presentation]**

NEI 04-02 Guidance

- Section 4.3.2 provides guidance
- Appendix B.2 provides clarification
  - Section B.2.1 - Methodology Review
  - Section B.2.2 – Fire Area by Fire Area Transition
- Sample Tables B-2 and B-3

NEI 04-02 Guidance (cont'd)

Note: Iterative process performed for each compliance strategy (i.e., there can be multiple approaches for each fire area)



NEI 04-02 Figure 4-3

NEI 04-02 Guidance (cont'd)

Table B-3

NFPA 805 Chapter 2 – Nuclear Safety Transition - Fire Area Assessment Worksheet Example

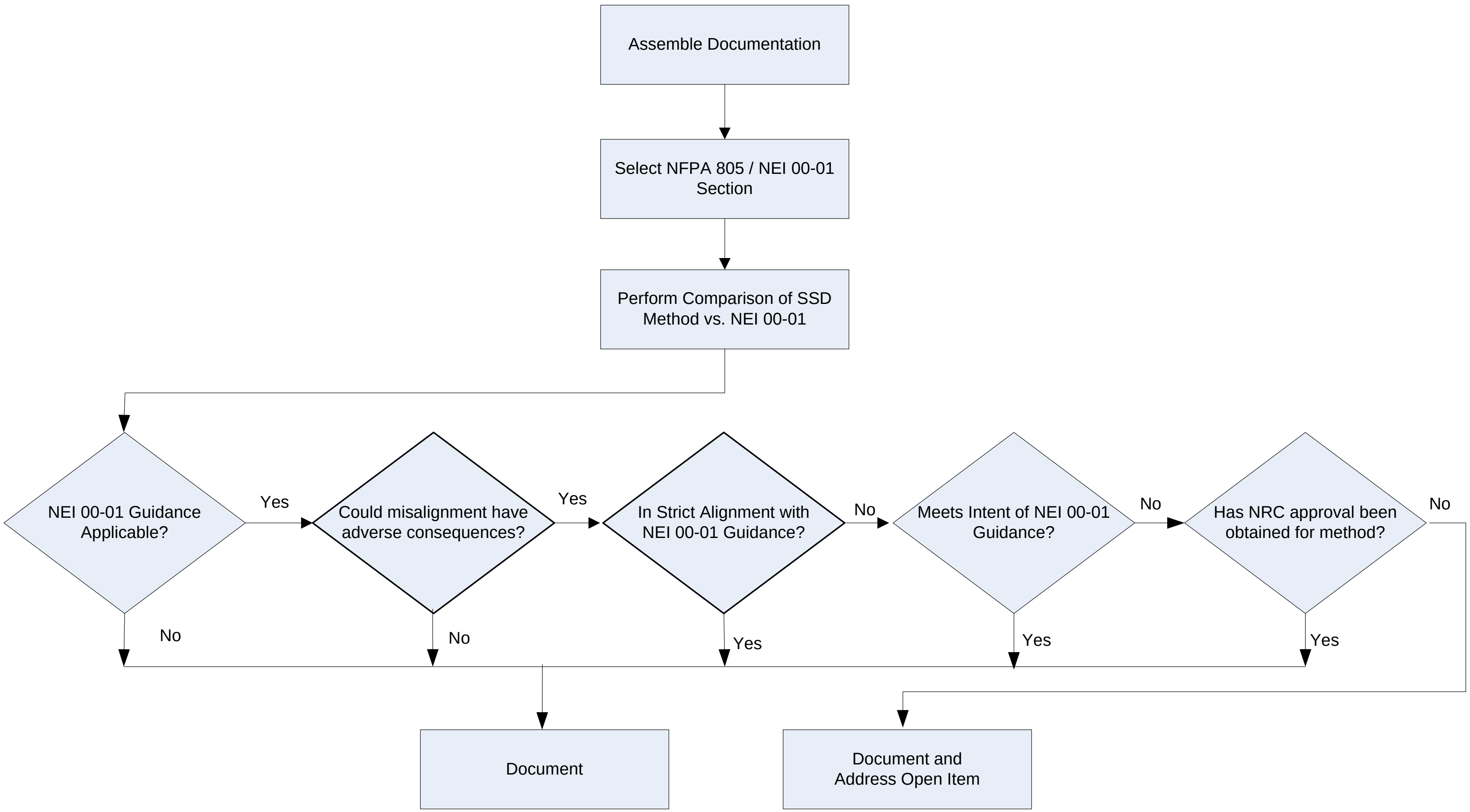
Fire Area	Fire Area Description	Appendix R Compliance Methods	Exemption / Deviation	Nuclear Safety Performance Criteria	Evaluations	Outstanding CLB Issues
1	Containment	III.G.1, III.G.2.	Exemption 7, RCP Lube Oil Bases for Acceptability: ▪ Type of oil ▪ Seismic zone ▪ Deluge system ▪ Detection Exemption 14, intervening combustibles Bases for Acceptability: ▪ Detection ▪ Admin. Controls. ▪ Fire stops. ▪ Deluge system for RCPs.	The nuclear Safety Criteria are met as follows: ▪ Reactivity control – Charging (Tr. A & B) ▪ Inventory and pressure control – Charging (Tr. A & B), Aux. Spray or PORV B ▪ Decay heat removal (AFW A, B, or C, RHR A & B) ▪ Vital auxiliaries (CCW A&B), (SW A&B) ▪ Process monitoring (dependant on location)	▪ Eval 89-05, Unrated containment penetrations ▪ Eval. 88-05, Manual Action Acceptability	▪ RCPLOC CR 02-0221 ▪ Radiant energy shield rating CR 99-0233 ▪ NRC IR 02-01 URI 02-01-04
2	Aux. Bldg. 50' Elev.	III.G.2	Exemption 4, Lack of automatic suppression. Bases for Acceptability: ▪ Detection in pump rooms ▪ Low combustible loading ▪ Separation of redundant circuitry (> 50 ft.)	The nuclear Safety Criteria are met as follows: ▪ Reactivity control – Charging (Tr. A) ▪ Inventory and pressure control – Charging (Tr. A), Aux. Spray ▪ Decay heat removal (AFW A, B, RHR A) ▪ Vital auxiliaries (CCW A), (SW A) ▪ Process monitoring (Channels I, III)	▪ Eval 89-07, unrated hatch ▪ Eval 95-07, fire dampers fire area 2 – fire area 14 ▪ Eval 92-13, partial detection evaluation ▪ Eval 84-3, NFPA 72 code deviations ▪ Eval. 88-05, Manual Action Acceptability	None

Note: Example only – Not HNP data

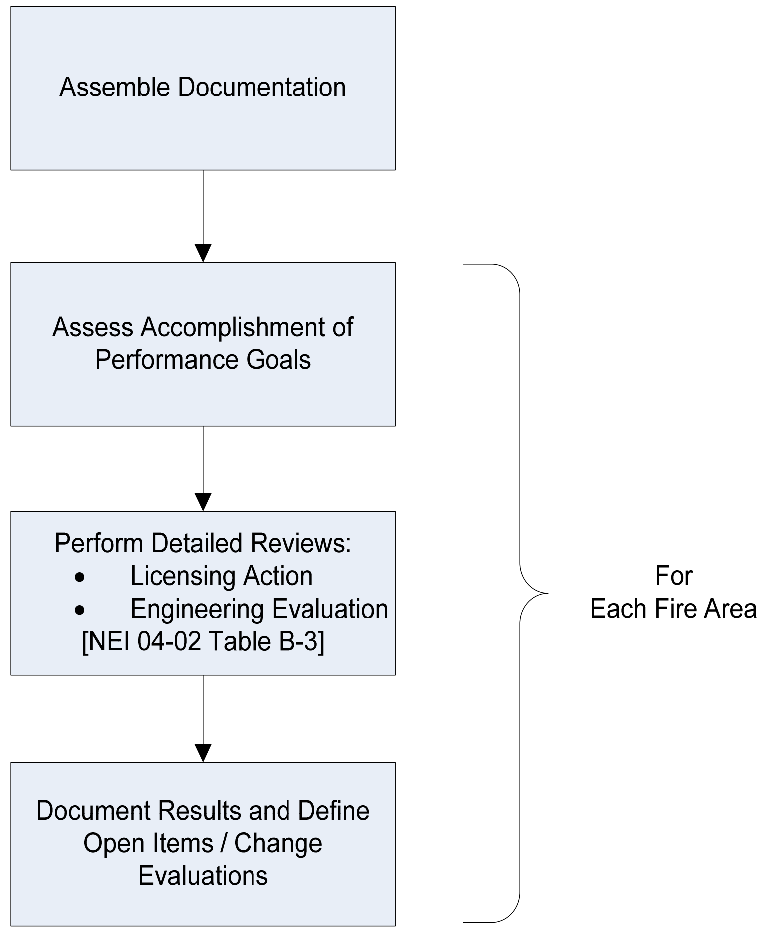
HNP Background

- Post-1979 Plant (NUREG-0800)
- Issues Related to Hemyc and MT Fire Barriers
- Safe Shutdown Re-Analysis (2003-2006)
- Nuclear Safety Performance Criteria Transition:
  - Started October 2006
  - Drafted Project Instruction
  - Piloted Process for 2 Fire Areas

Methodology Transition



Fire Area Review



Fire Area Review – Assemble Documentation

- Industry Documentation:
  - NEI 04-02, Revision 1
  - Outstanding Frequently Asked Questions (FAQs) related to the Fire Area-by-Fire Area Transition
  - Guidance on Resolution of Industry Issues (e.g., operator manual actions, Hemyc/MT, circuit failures)

Fire Area Review – Assemble Documentation

FAQ ID	Topic
06-0004	Clarify NFPA 805 Chapter 4 and 3 relationship for 'required' FP systems/features
06-0006	High-low pressure interface definition and NEI 00-01/NFPA 805 discrepancies
06-0008	Alternate method for Engineering Evaluations
06-0011	Clarify III.G.3 Compliance Transition
06-0012	Clarify Manual Action Transition in Appendix B

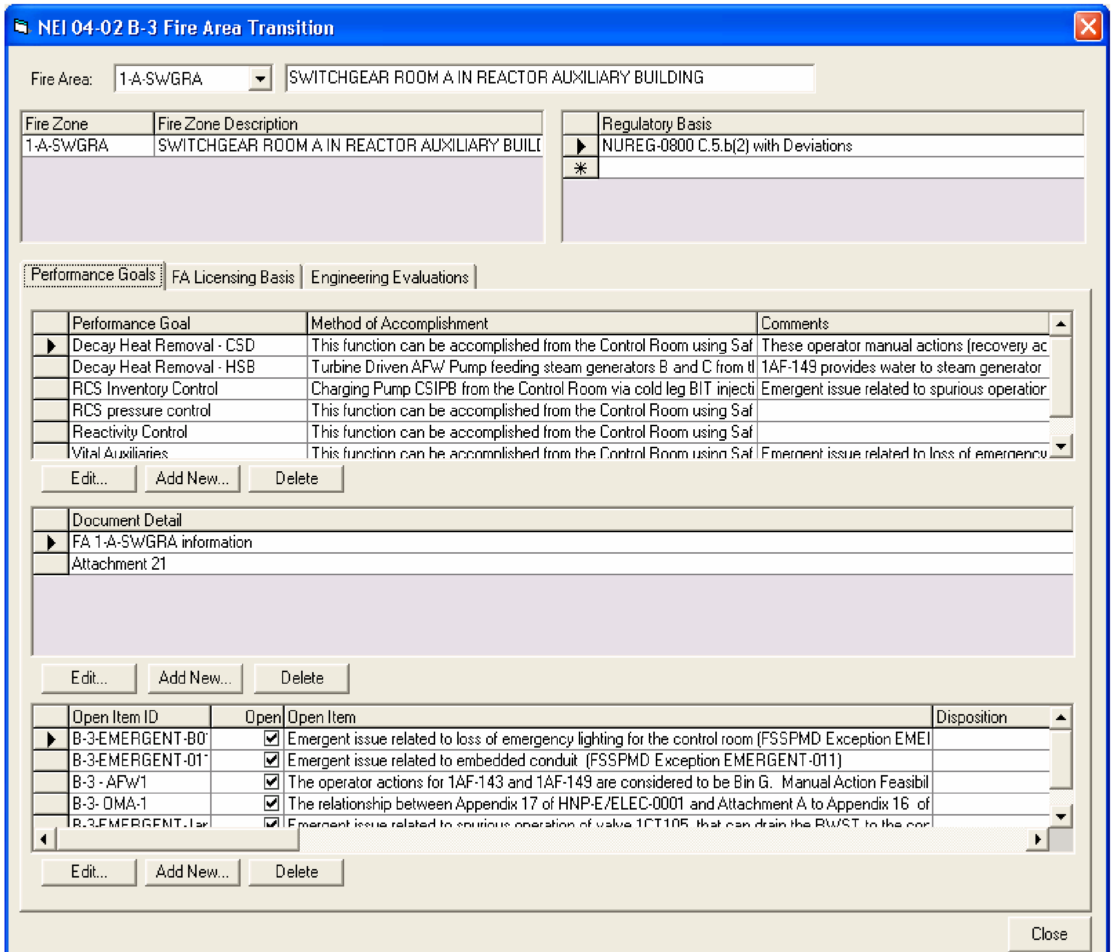
Fire Area Review – Assemble Documentation

- Plant specific calculations/analyses for:
  - Fire area assessment and supporting analyses
    - Operator manual action feasibility assessments
    - Engineering evaluations (e.g., GL 86-10 evaluations)
    - Assessment of spurious component actuations
  - Licensing basis/regulatory documents
    - Exemptions, Exemption requests (or Deviations, Deviation Requests) and supporting correspondence
    - Safety evaluation reports
    - Inspection reports
    - Response to generic letters, etc.

Fire Area Review – Performance Goals

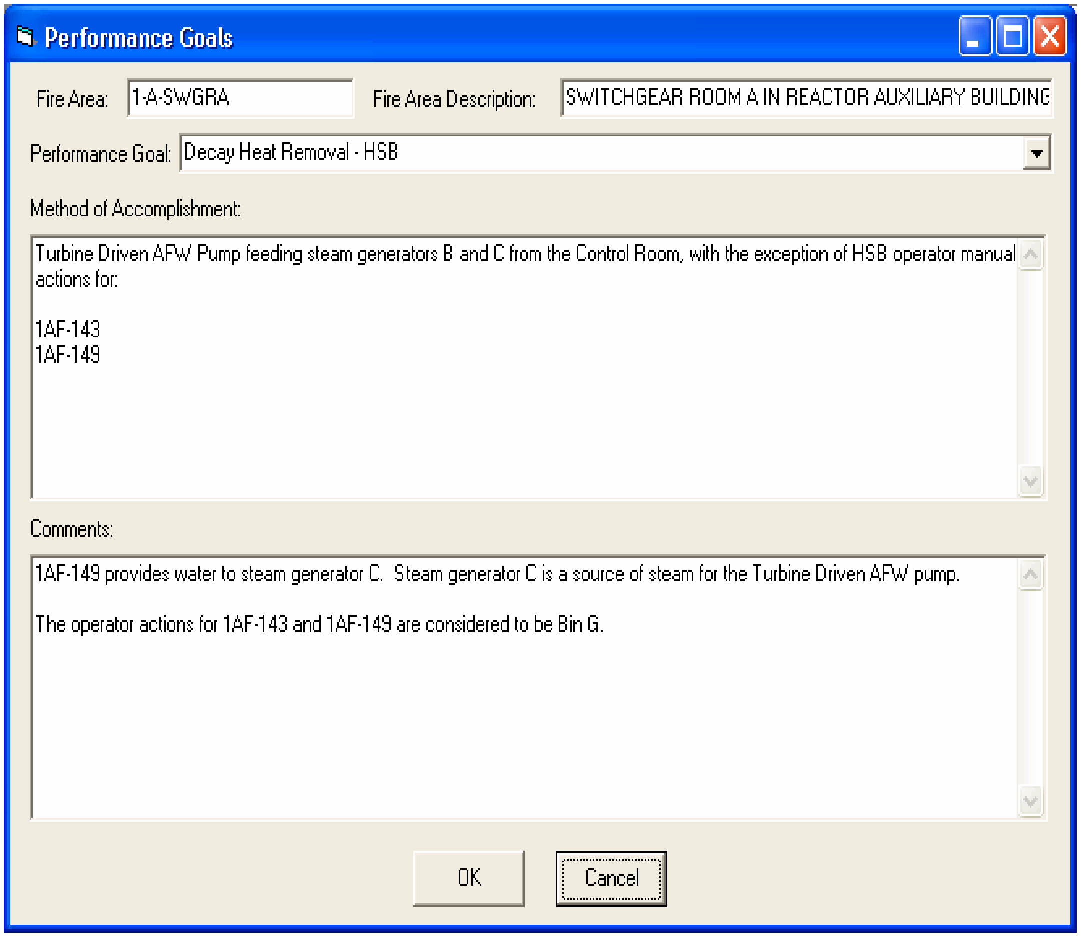
- Document accomplishment of NFPA 805 performance goals for the selected fire area.
- Document the "Method of Accomplishment" in summary level form.
- Document comments/additional information.
- Provide specific reference/basis documents
- Capture existing non-compliances related to post-fire safe shutdown
  - Perform or review existing operator manual action information
  - Issues already in CAP as part of SSD Re-Analysis
  - Multiple Spurious Operations/GL 2006-XX issues

Fire Area Review – Performance Goals



Progress Energy

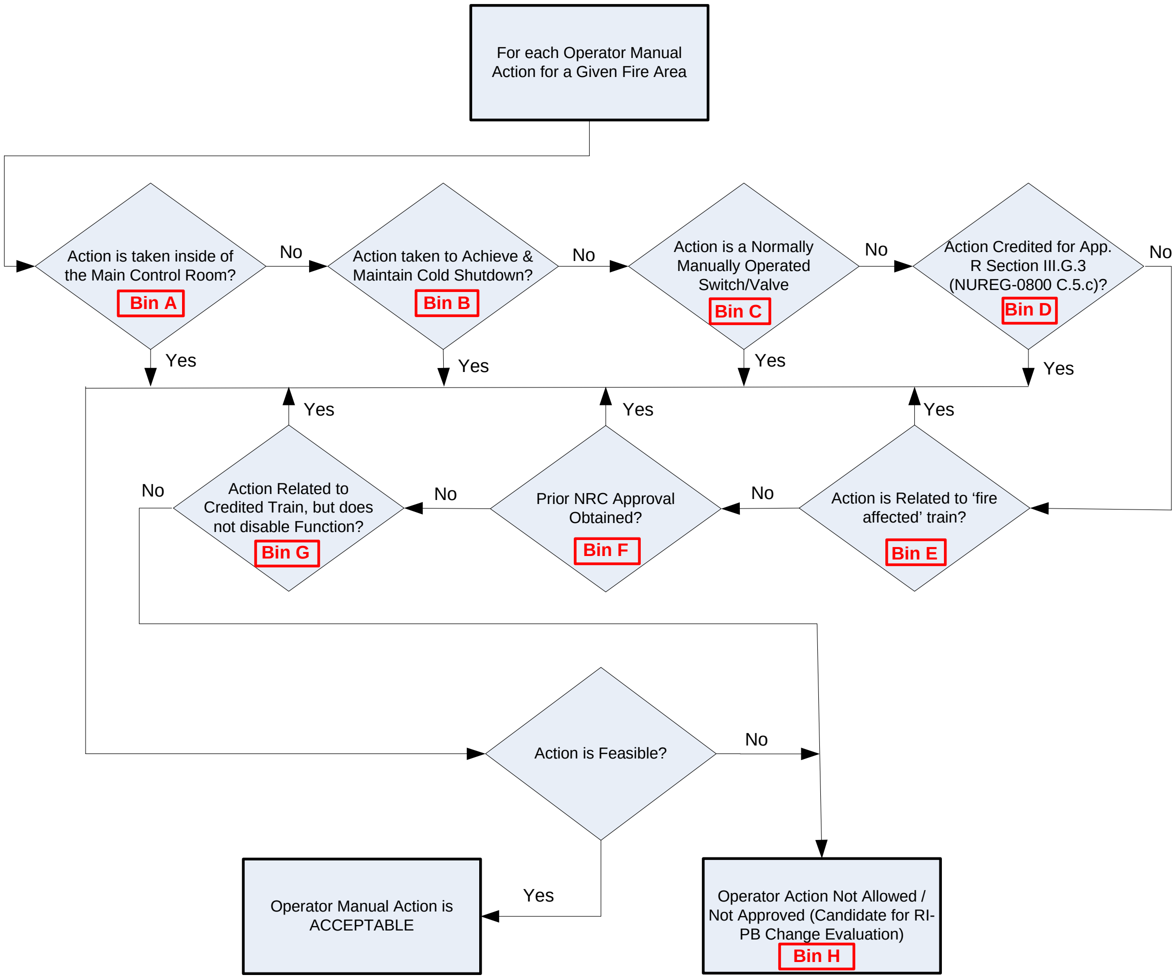
Fire Area Review – Performance Goals



Fire Area Review – Performance Goals (Operator Manual Actions)

- Key Industry issue is determining which Operator Manual Actions (Recovery Actions) are Allowed/Approved
- This is a key part of defining scope of the transition change evaluation
- NEI 04-02 App. B, Section B.2.2
- FAQ 06-0012 provides proposed clarification based on recent industry activity
- Process was piloted for selected fire areas
- Binned Actions based upon FAQ 06-0012 guidance

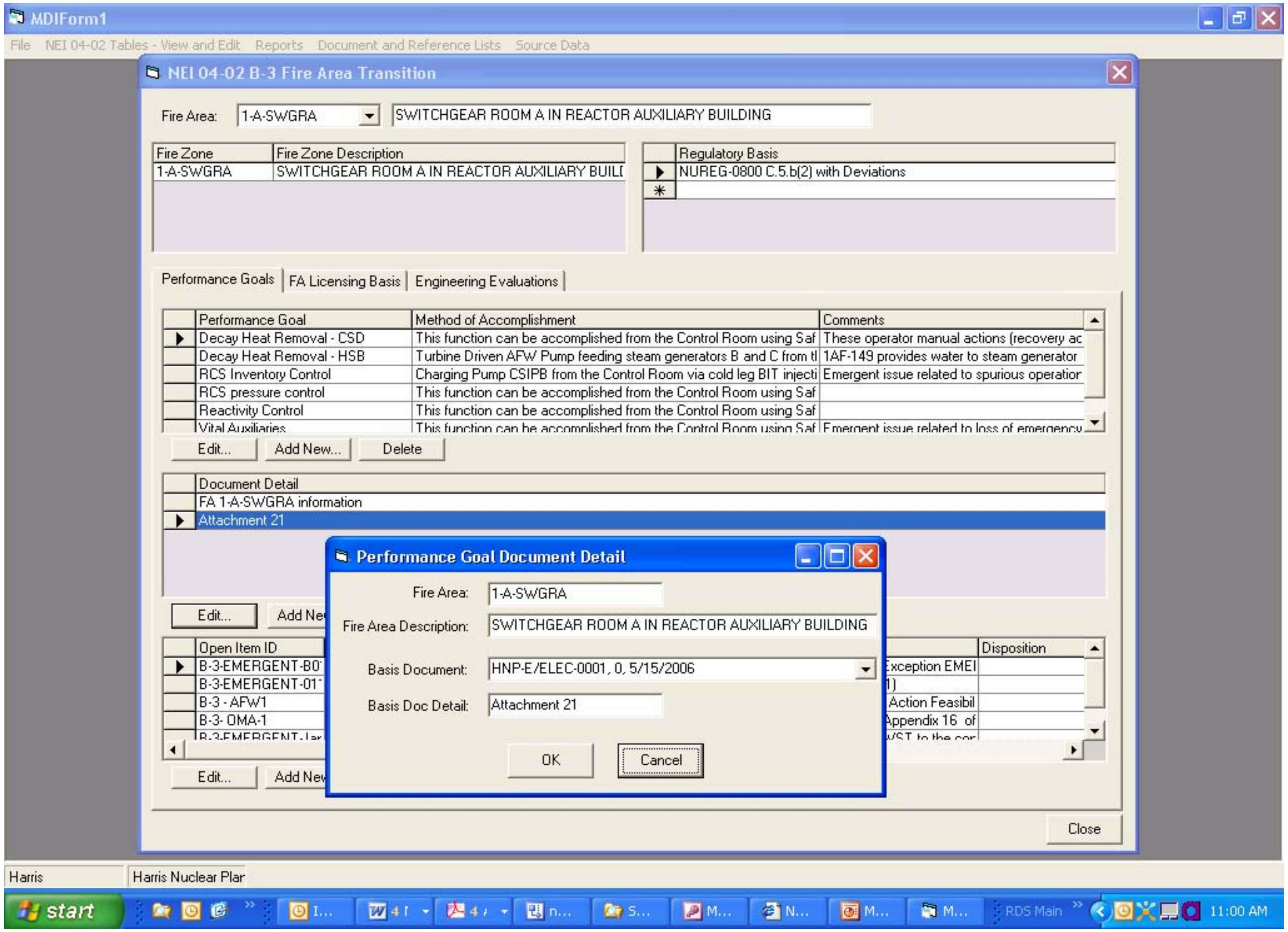
Fire Area Review – Performance Goals
(Operator Manual Actions)



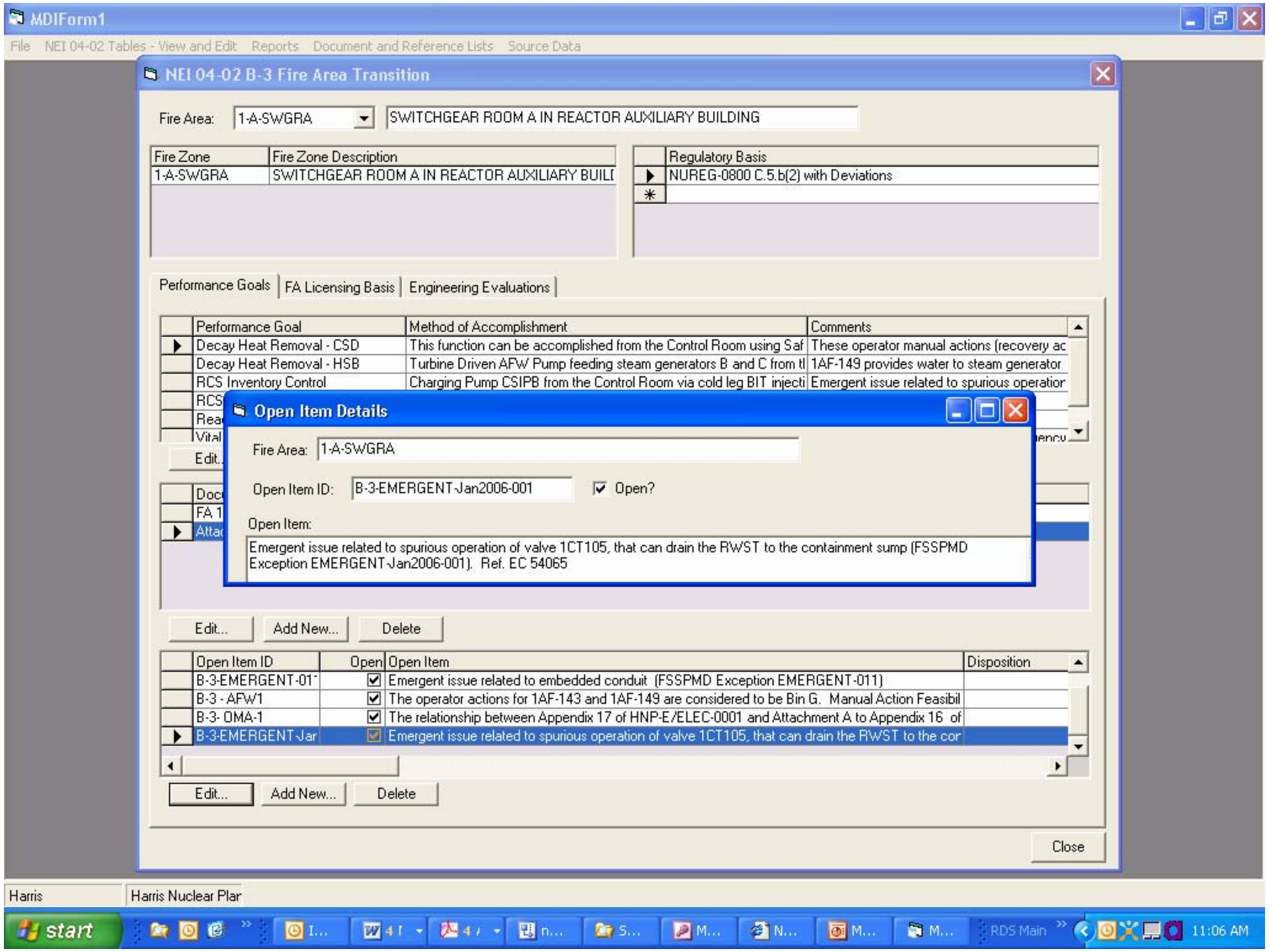
NGG

Progress Energy

Fire Area Review – Performance Goals (Basis Docs)



Fire Area Review – Performance Goals (Open Items)



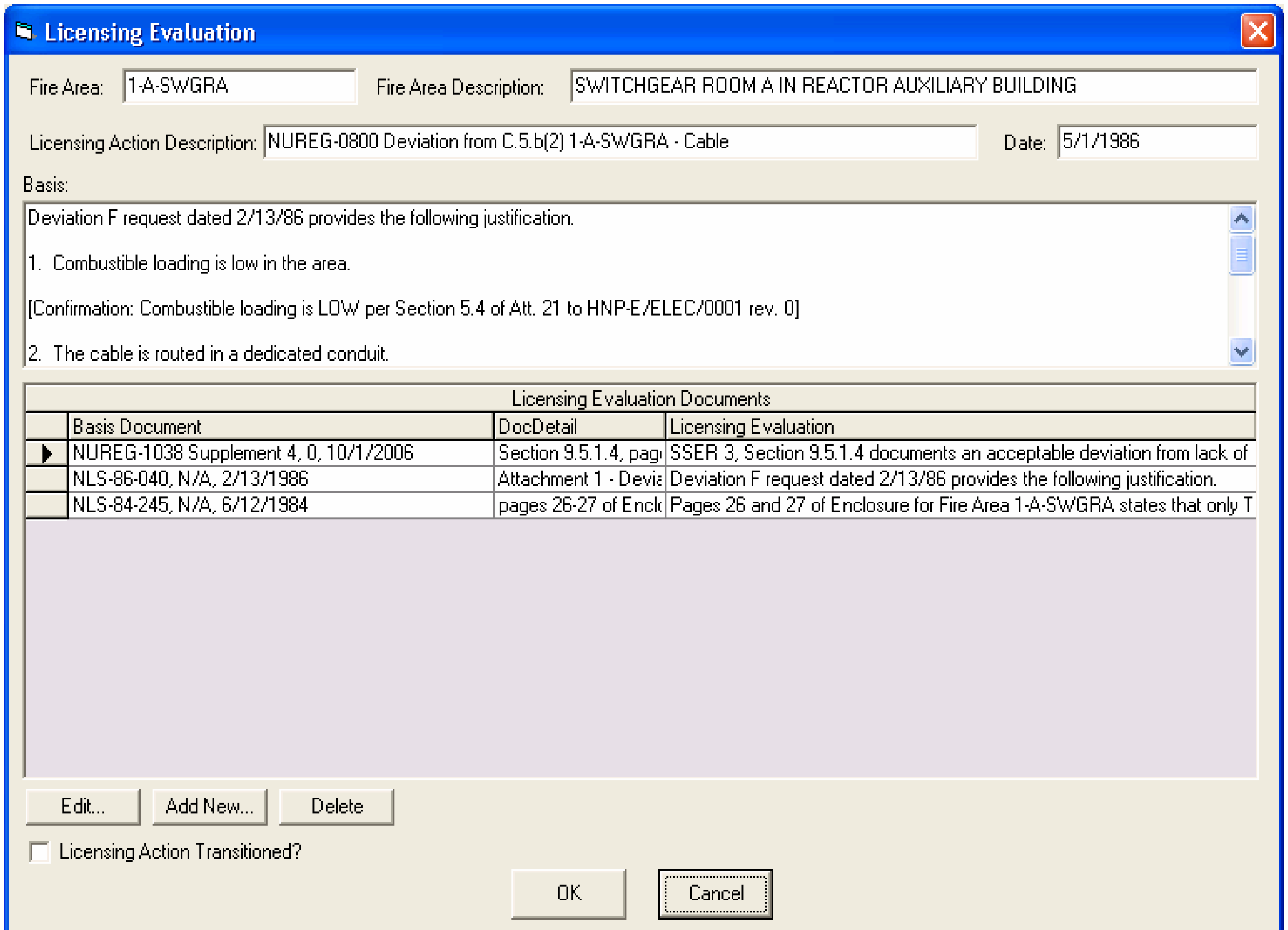
NGG

Progress Energy

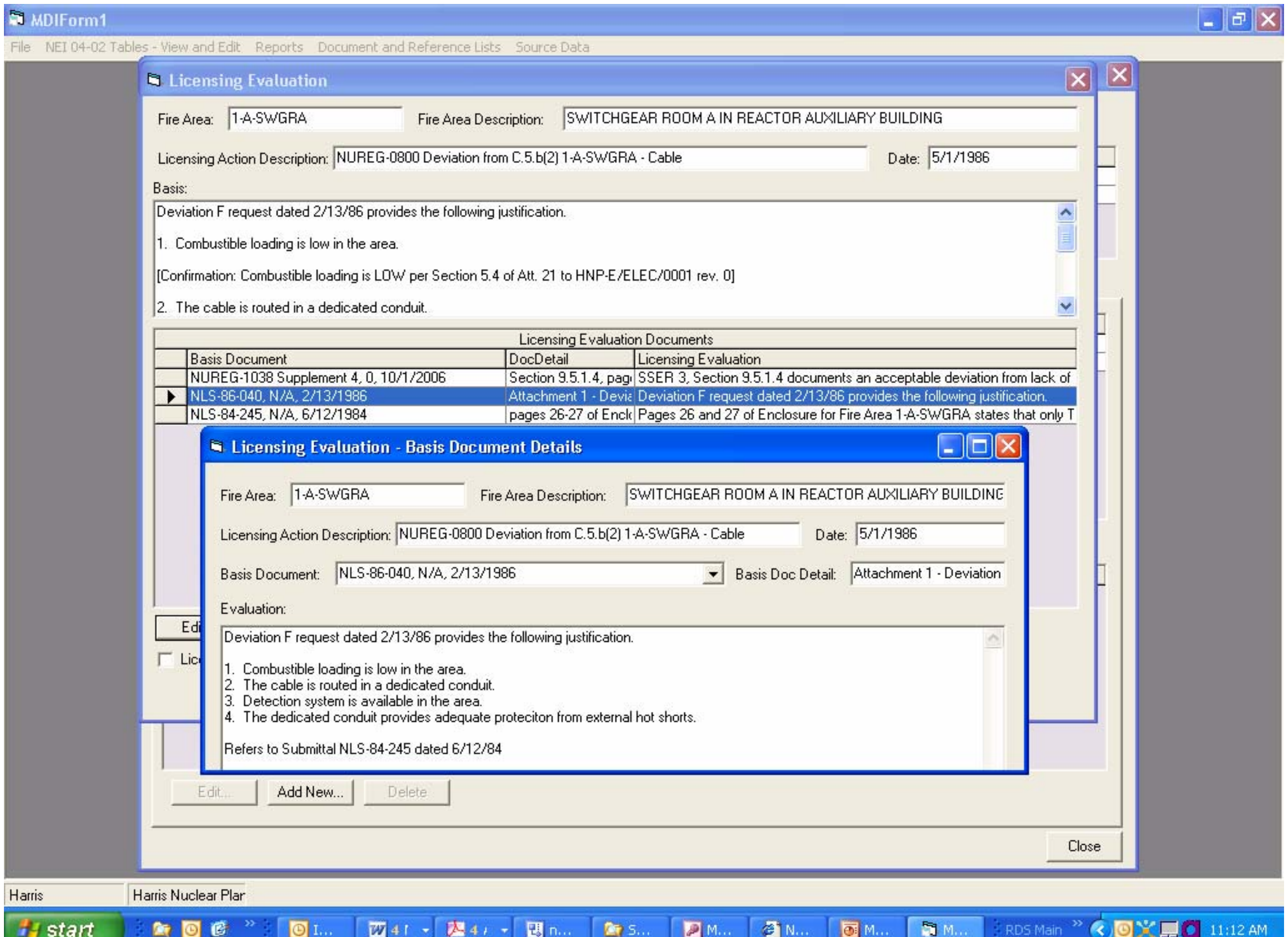
Fire Area Review – FA Licensing Basis

- Licensing Basis Documents (exemptions/deviations/SERs) reviewed to ensure bases remain valid
- Approving documents (e.g., SER) as well as submittals were reviewed
- Interfaces between NFPA 805 Chapters 4 and 3 (e.g., barriers, detection, and suppression systems)

Fire Area Review – FA Licensing Basis



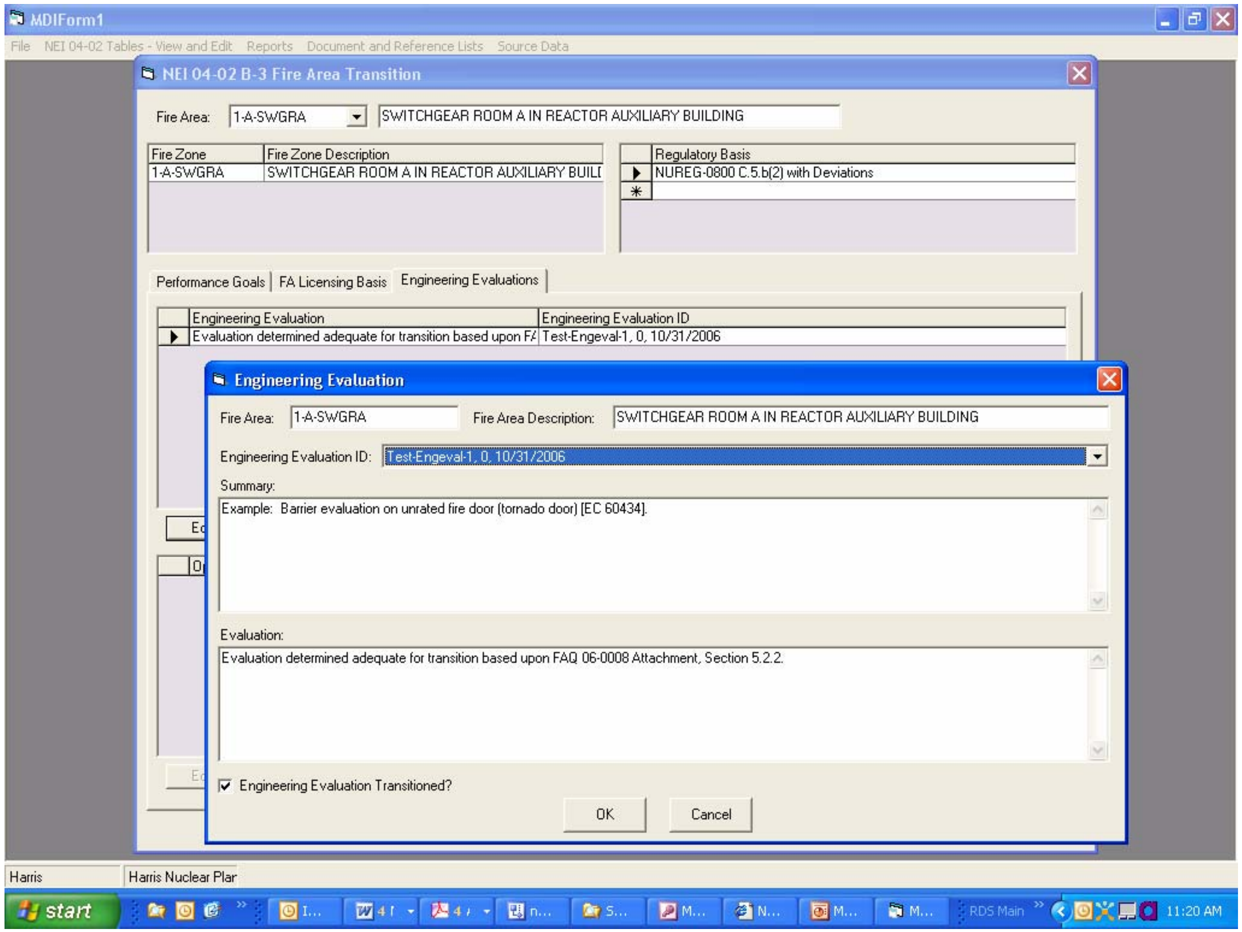
Fire Area Review – FA Licensing Basis
(Basis Document Details)



Fire Area Review – Engineering Evaluations

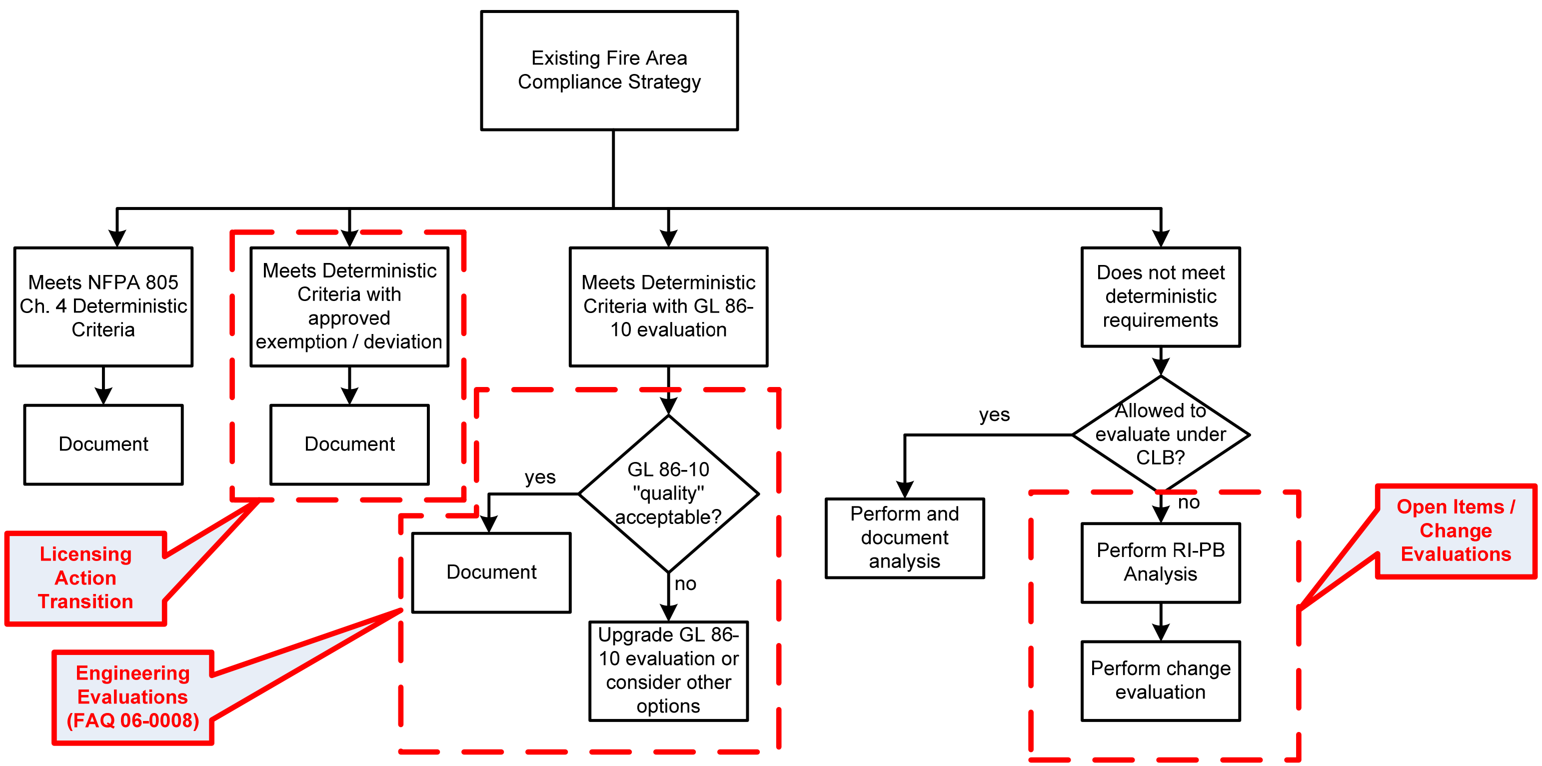
- Engineering Evaluations to be reviewed to ensure bases remain valid
- Interfaces between NFPA 805 Chapters 4 and 3 (e.g., barriers, detection, and suppression systems)
- FAQ 06-0008 provides guidance on adequacy determination
- Not yet tested during HNP Pilot Process

Fire Area Review – Engineering Evaluations (Reference FAQ 06-0008)



NEI 04-02 Fig. 4-3 Alignment

Note: Iterative process performed for each compliance strategy (i.e., there can be multiple approaches for each fire area)



Alternative Shutdown Considerations (FAQ 06-0011)

- Safe today safe tomorrow
- Consistent with NFPA 805 Figure 2-2 “Deterministic Approach”
- ASD fire areas addressed in Fire PRA
- Perform change evaluations for any ‘noncompliances’ (e.g., failure to meet III.G.3/NUREG-0800 C.5.c)
  - Consistent with NEI 04-02 table 4-3
  - Specifically discussed in NEI 04-02 Appendix B.2.
- Operator manual actions for ASD fire areas must be feasible.
- Feasible operator manual actions for ASD fire areas are acceptable & do not require change evaluations (based on previous approval)

Overall Observations and Insights

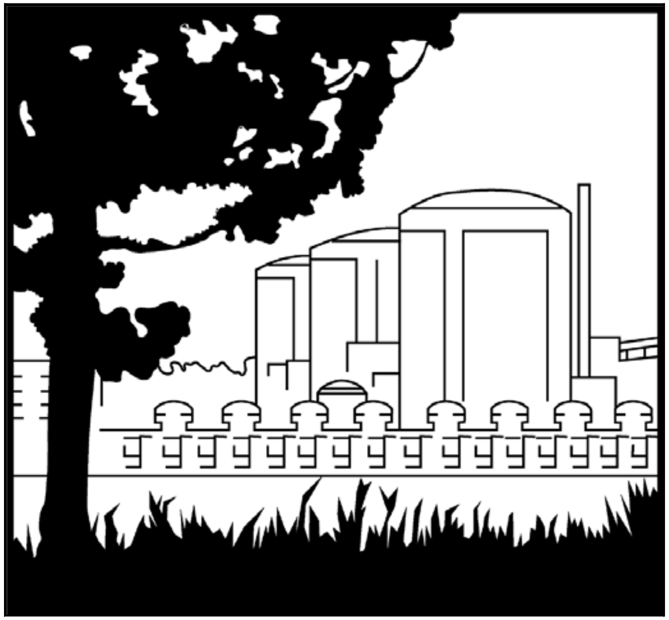
- Reviews are not intended to be reconstitution/revalidation efforts (“safe today, safe tomorrow”)
- Prep work for reviews is key:
  - Readily available licensing documentation
  - Correlation of licensing correspondence to fire areas
  - Correlation of engineering evaluations to fire areas
- Efficient reviews require plant-specific knowledge
- Effective summary level documentation facilitates efficient documentation of performance goals
- Recent revalidation efforts provide good starting point for open item/change evaluation scope

Overall Observations and Insights (cont'd)

- Relationship between NFPA 805 Chapters 4 and 3 important to process
  - e.g., Document fire barriers as part of Table B-1 or B-3?
- NUREG-0800 plant has more classical FP information in SER than an App. R plant (barrier deviations)
- Deviations contain the type of info found in App. R plant's GL 86-10 evaluations.
- Categorization of allowed/approved operator manual actions prior to transition efforts will expedite nuclear safety transition.

Potential Challenges

- Integration of multiple spurious operation ‘compliance issues’ depending upon GL 2006-XX scope/content.
- Decisions on transitioning deviations / exemptions with large amounts of detail:
  - What level of confirmation.



Duke Power NFPA 805 Ch 4 Transition

Oconee (ONS)

November 08, 2006

Discussion Topics

- Nuclear Safety Goals, Objectives and Performance Criteria
- Deterministic Approach
  - Methodology
  - Fire-Area-by-Fire-Area
- Performance-Based Approach
- Issues

NFPA-805 Section 1.3.1, Nuclear Safety Goal

- "The nuclear safety goal is to provide reasonable assurance that a fire during any operational mode and plant configuration will not prevent the plant from achieving and maintaining the fuel in a safe and stable condition."

NFPA-805 Section 1.4.1, Nuclear Safety Objectives

- “In the event of a fire during any operational mode and plant configuration, the plant shall be as follows:
  - *Reactivity Control*. Capable of rapidly achieving and maintaining subcritical conditions
  - *Fuel Cooling.* Capable of achieving and maintaining decay heat removal and inventory control functions
  - *Fission Product Boundary.* Capable of preventing fuel clad damage so that the primary containment boundary is not challenged.”

NFPA-805, Section 1.5.1, Nuclear Safety Performance Criteria

- Fire Protection features shall be capable of providing reasonable assurance that, in the event of a fire, the plant is not placed in an unrecoverable condition. To demonstrate this, the following performance criteria shall be met.
  - (a) *Reactivity Control.* Reactivity control shall be capable of inserting negative reactivity to achieve and maintain subcritical conditions. Negative reactivity inserting shall occur rapidly enough such that fuel design limits are not exceeded.
  - (b) *Inventory and Pressure Control.* With fuel in the reactor vessel, head on and tensioned, inventory and pressure control shall be capable of controlling coolant level such that subcooling is maintained for a PWR and shall be capable of maintaining or rapidly restoring reactor water level above top of active fuel for a BWR such that fuel clad damage as a result of a fire is prevented.
  - (c) *Decay Heat Removal* Decay heat removal shall be capable of removing sufficient heat from the reactor core or spent fuel such that fuel is maintained in a safe stable condition.
  - (d) *Vital Auxiliaries* Vital auxiliaries shall be capable of providing the necessary auxiliary support equipment and systems to assure that the systems required under (a), (b), (c) and (e) are capable of performing their required nuclear safety function.
  - (e) *Process Monitoring* Process monitoring shall be capable of providing the necessary indication to assure the criteria addressed in (a) through (d) have been achieved and are being maintained.

NSPA Documentation

- Analysis Documentation broken up into two main themes
  - Methodology (NFPA-805 Chapters 1 and 2)
  - Fire Area by Fire Area (NFPA-805 Chapter 4)
- NEI 04-02 recommends documenting this in two different tables:
  - Methodology Review Worksheet – Table B-2
  - Fire Area Assessment Worksheet – Table B-3

Methodology Review

- Duke presented information on Table B-2 in previous Pilot Observation Meetings
- Use of Table B-2 in its original intended layout was judged to be too confusing and hard to read
- We propose an alternate approach that presents information in a more concise manner yet still references detailed backup information

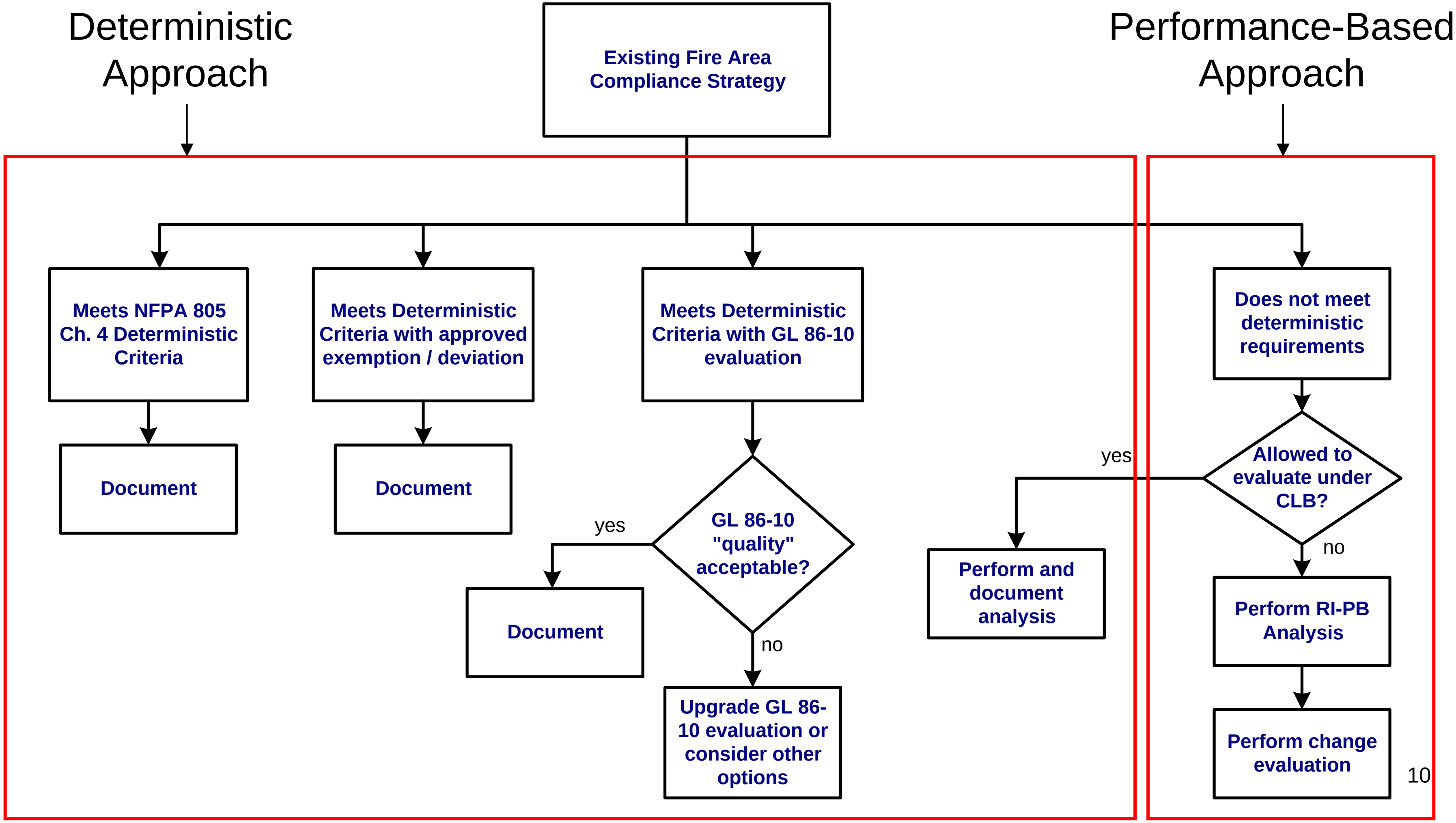
Alternate Table B-2 Format

Table B-2 NFPA 805 Chapter 2 – Nuclear Safety Transition – Methodology Review Worksheet	
NFPA 805 Requirement	**Implementing Guidance**
2.4.2.1 Nuclear Safety Capability System and Equipment Selection A comprehensive list of systems and equipment and their interrelationships to be analyzed for a fire event shall be developed. The equipment list shall contain an inventory of those critical components required to achieve the nuclear safety performance criteria of Section 1.5. Components required to achieve and maintain the nuclear safety functions and components whose fire-induced failure could prevent the operation or result in the maloperation of those components needed to meet the nuclear safety criteria shall be included. Availability and reliability of equipment selected shall be evaluated. *(See NFPA 805 Appendix B[1] for methods used to identify equipment)*	The ONS methodology for Nuclear Safety Capability System and Equipment Selection is generally consistent with the methodology for Safe shutdown Systems and Path Development and the Safe Shutdown Equipment Selection discussed in Sections 3.1 and 3.2 of NEI 00-01, Revision 1. Reference: Duke EDM XYZ, Revision 0, Sections 6.1.1, A.2

Fire Area Assessment

- On a Fire-Area by Fire-Area basis, must select using either the Deterministic or the Performance-Based Approach.
  - Deterministic Approach has been “deemed to satisfy” the performance criteria
  - Performance-Based Approach
    - “Use of Fire Modeling”
    - “Use of Risk Evaluation”
    - Required when using Recovery Actions

Fire Area Assessment



Approach
Selection Process

- Selection of Deterministic vs. Performance-Based will likely have to be performed on a functional basis (or even on a component basis)
  - Some fire areas have multiple compliance strategies, affecting two or more functions (reactivity control, pressure control, inventory control, etc.)
  - One function may credit separation, another operator manual actions

Approach
Selection Process

- Process will have to be performed for each different function/compliance strategy (must decide if it meets Deterministic Requirements or if Performance-Based approach will be needed)

NFPA-805 Ch 4 Methodology

- Use of both Deterministic and Performance-Based approaches are documented in a similar fashion on a fire area basis
- Fire Areas that fully meet deterministic requirements are documented in the fire area assessment worksheet
- Fire Areas that do not meet one or more attributes of the deterministic requirements will reference one or more Change Evaluations

Fire Area Assessment Worksheet, Table B-3

Table B-3

NFPA 805 Chapter 2 – Nuclear Safety Transition - Fire Area Assessment Worksheet Example

Fire Area	Fire Area Description	Appendix R Compliance Methods	Exemption / Deviation	Nuclear Safety Performance Criteria	Evaluations	Outstanding CLB Issues
1	Containment	III.G.1, III.G.2.	Exemption 7, RCP Lube Oil Bases for Acceptability: ▪ Type of oil ▪ Seismic zone ▪ Deluge system ▪ Detection Exemption 14, intervening combustibles Bases for Acceptability: ▪ Detection ▪ Admin. Controls. ▪ Fire stops. ▪ Deluge system for RCPs.	The nuclear Safety Criteria are met as follows: ▪ Reactivity control – Charging (Tr. A & B) ▪ Inventory and pressure control – Charging (Tr. A & B), Aux. Spray or PORV B ▪ Decay heat removal (AFW A, B, or C, RHR A & B) ▪ Vital auxiliaries (CCW A&B), (SW A&B) ▪ Process monitoring (dependant on location)	▪ Eval 89-05, Unrated containment penetrations ▪ Eval. 88-05, Manual Action Acceptability	▪ RCPLOC CR 02-0221 ▪ Radiant energy shield rating CR 99-0233 ▪ NRC IR 02-01 URI 02-01-04
2	Aux. Bldg. 50' Elev.	III.G2	Exemption 4, Lack of automatic suppression. Bases for Acceptability: ▪ Detection in pump rooms ▪ Low combustible loading ▪ Separation of redundant circuitry (> 50 ft.)	The nuclear Safety Criteria are met as follows: ▪ Reactivity control – Charging (Tr. A) ▪ Inventory and pressure control – Charging (Tr. A), Aux. Spray ▪ Decay heat removal (AFW A, B, RHR A) ▪ Vital auxiliaries (CCW A), (SW A) ▪ Process monitoring (Channels I, III)	▪ Eval 89-07, unrated hatch ▪ Eval 95-07, fire dampers fire area 2 – fire area 14 ▪ Eval 92-13, partial detection evaluation ▪ Eval 84-3, NFPA 72 code deviations ▪ Eval. 88-05, Manual Action Acceptability	None

NSPA Information Organization

- NSPA information is being documented in a relational database
- Database structure designed for multiple uses
  - NFPA-805 Transition
    - Transition Report
  - Post-Transition
    - Design Basis Document

NSPA Information Organization - continued

- Database documents several major topics in one convenient location
  - Fire Area by Fire Area compliance
  - Nonpower Operational considerations
  - Radiological Release
  - Life Safety Code
  - Plant Damage/Business Interruption

NSPA Database Report Table Format

<table>
<tr><td>FIRE AREA</td><td colspan="2">NUCLEAR SAFETY PERFORMANCE CRITERIA</td><td>[ ] III.G.1/.2 COMPLIANCE
[ ] III.G.3/ III.L COMPLIANCE</td><td>EXEMPTIONS/ DEVIATIONS/ EVALUATIONS</td><td>NEI 00-01 CONFORMANCE</td><td>RECOVERY ACTIONS</td></tr>
<tr><td rowspan="8">POWER OPERATIONS
Modes 1 and 2</td><td colspan="2">REACTIVITY CONTROL</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">INVENTORY AND PRESSURE CONTROL</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">DECAY HEAT REMOVAL</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">PROCESS MONITORING</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">SUPPORT FUNCTIONS</td><td>POWER</td><td></td><td></td><td></td><td></td></tr>
<tr><td>COOLING WATER</td><td></td><td></td><td></td><td></td></tr>
<tr><td>HVAC</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">NON-POWER OPERATIONS
Modes 3 through 6</td><td colspan="5"></td><td></td></tr>
<tr><td>HIGH RISK EVOLUTION(S)</td><td colspan="2"></td><td>KEY SAFETY FUNCTION(S)</td><td></td><td></td></tr>
<tr><td>SUPPRESSION/DETECTION</td><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td>RADIOACTIVE RELEASE</td><td colspan="5"></td><td></td></tr>
<tr><td rowspan="5">LIFE SAFETY
Lights/Access/Egress/Tenability for Recovery Actions</td><td>EMERGENCY LIGHTING</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>ACCESS/EGRESS</td><td colspan="5"></td></tr>
<tr><td>TENABILITY</td><td colspan="5"></td></tr>
<tr><td>PPE REQUIRED</td><td colspan="5"></td></tr>
<tr><td>OTHER</td><td colspan="5"></td></tr>
<tr><td>PLANT DAMAGE/BUSINESS INTERRUPTION
To Be Filled in After LAR</td><td colspan="6"></td></tr>
</table>

COMMENTS	Clarifying information only, no issues	**MONITORING METHOD**
OPEN ITEMS	AKA Outstanding CLB Issues from table B-3	How Change Evaluation parameters monitored

NSPA Database Report Table Format - Example

FIRE AREA BH-12	NUCLEAR SAFETY PERFORMANCE CRITERIA	[ ] III.G.1/.2 COMPLIANCE [X] III.G.3/ III.L COMPLIANCE	EXEMPTIONS/ DEVIATIONS	NEI 00-01 CONFORMANCE	RECOVERY ACTIONS *Need to include procedure references*
POWER OPERATIONS Modes 1 and 2	**REACTIVITY CONTROL**	The safe shutdown performance and design Requirements for the reactivity control function are satisfied by manually scramming/tripping the reactor from the Control Room prior to Control Room evacuation and activation of the SSF. After reactor scram, adequate shutdown margin is maintained by ensuring an adequate concentration of borated water is utilized during RCS makeup/charging. The credited path for Chemical and Volume Control for hot shutdown is the SSF RC Makeup Pump (HPI System) supplied from the Spent Fuel Pool (SF System) with Letdown back to the Spent Fuel Pool. For cool down, boron injection is accomplished by a bleed and feed operation using the A HPI pump in conjunction with letdown and the BWST as a source of borated water. The credited RCS letdown paths are: Through the Pressurizer PORV to the Quench Tank, or Via the HPI and SF systems to the spent fuel pool. To borate the Pressurizer, charging flow must be diverted to the Pressurizer auxiliary spray line, which causes mixing in the Pressurizer as well as depressurization of the Pressurizer steam bubble. In order to prevent boron dilution, RCS sampling is performed prior to and during cool down to Mode 5.	NONE	Development of the SSEL, Component and Cable Selection, Circuit analysis, and Cable routing were performed in accordance with the guidance of NEI 00-01. Treatment of Spurious Operations was performed in accordance with RIS 2004-003. Multiple spurious operations were reviewed for this area utilizing the expert panel methodology of NEI 04-002. ***Any issues are discussed in the Open Items section below***	.A. HPI pump (repair necessary) The actions required to restore Mode 5 capability are contained in the Oconee Nuclear Station Response Procedure RP/0/A/1000/22, Procedure for Site Fire Damage Assessment and Repair. Pressurizer PORV (repair necessary) The actions required to restore Mode 5 capability are contained in the Oconee Nuclear Station Response Procedure RP/0/A/1000/22, Procedure for Site Fire Damage Assessment and Repair. RCS sampling is performed prior to and during cool down to Mode 5.
	INVENTORY AND PRESSURE CONTROL	The reactor coolant makeup control function must be capable of ensuring that sufficient make-up inventory is provided to compensate for reactor coolant system fluid shrinkage during cool down and to replace any coolant that may escape due to leakage from the system. Maintenance of adequate inventory prevents overheating of the reactor fuel, which could lead to core damage Systems performing this function must be capable of maintaining reactor coolant level within the level indication of the pressurizer. Reactor Coolant Makeup Control is maintained by isolating the RCS; and providing RCS charging and RCP seal injection. RCS Charging and RCP seal injection are provided by the SSF Reactor Coolant Makeup Pump supplied from the Spent Fuel Pool		Development of the SSEL, Component and Cable Selection, Circuit analysis, and Cable routing were performed in accordance with the guidance of NEI 00-01. Treatment of Spurious Operations	A HPI pump (repair & manual actions necessary) The actions required to restore Mode 5 capability are contained in the Oconee Nuclear Station Response Procedure RP/0/A/1000/22, Procedure for Site Fire Damage Assessment and Repair.

NSPA Database
- continued

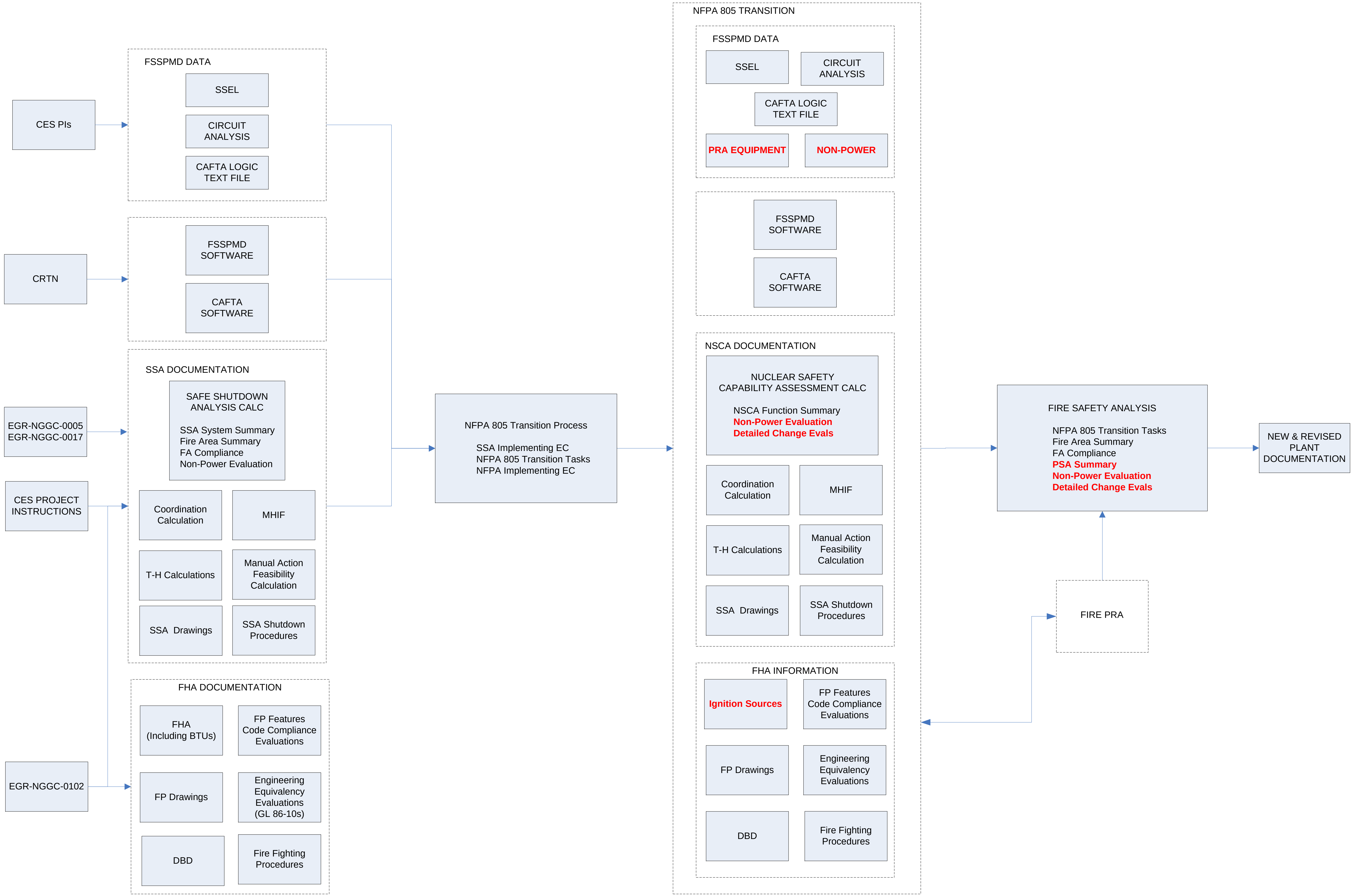
- Database links to a text document that provides additional detail when needed
- Text document used to provide a detailed description of fire area attributes for use in Design Basis Document post-transition

Oconee Observations

- Establishing uses and final resting place of fire area transition information led to use of database to help manage information
- Database has extensive flexibility to allow different report formats to present the same information for different purposes (Table B-3 information can be used for Transition Report as well as post-transition DBD)

Oconee Observations

- Plant utilizes III.G.3 Alternate Shutdown for vast majority of plant areas
- Final resolution of FAQ 06-011 may have significant impact on level of effort for Oconee transition
  - If Alternate shutdown areas are not transitioned deterministically, significant number of Performance-Based, Risk-Informed evaluations will be needed
  - Using Performance-Based, Risk-Informed approach begins to look the same as Change Evaluation, which should not be required if you are in compliance with III.G.3


CES PIs
CRTN
EGR-NGGC-0005
EGR-NGGC-0017
CES PROJECT INSTRUCTIONS
EGR-NGGC-0102
FSSPMD DATA
SSEL
CIRCUIT ANALYSIS
CAFTA LOGIC TEXT FILE
FSSPMD SOFTWARE
CAFTA SOFTWARE
SSA DOCUMENTATION
SAFE SHUTDOWN ANALYSIS CALC
SSA System Summary
Fire Area Summary
FA Compliance
Non-Power Evaluation
Coordination Calculation
MHIF
T-H Calculations
Manual Action Feasibility Calculation
SSA Drawings
SSA Shutdown Procedures
FHA DOCUMENTATION
FHA (Including BTUs)
FP Features Code Compliance Evaluations
FP Drawings
Engineering Equivalency Evaluations (GL 86-10s)
DBD
Fire Fighting Procedures
NFPA 805 Transition Process
SSA Implementing EC
NFPA 805 Transition Tasks
NFPA Implementing EC
NFPA 805 TRANSITION
FSSPMD DATA
SSEL
CIRCUIT ANALYSIS
CAFTA LOGIC TEXT FILE
PRA EQUIPMENT
NON-POWER
FSSPMD SOFTWARE
CAFTA SOFTWARE
NSCA DOCUMENTATION
NUCLEAR SAFETY CAPABILITY ASSESSMENT CALC
NSCA Function Summary
Non-Power Evaluation
Detailed Change Evals
Coordination Calculation
MHIF
T-H Calculations
Manual Action Feasibility Calculation
SSA Drawings
SSA Shutdown Procedures
FHA INFORMATION
Ignition Sources
FP Features Code Compliance Evaluations
FP Drawings
Engineering Equivalency Evaluations
DBD
Fire Fighting Procedures
FIRE SAFETY ANALYSIS
NFPA 805 Transition Tasks
Fire Area Summary
FA Compliance
PSA Summary
Non-Power Evaluation
Detailed Change Evals
FIRE PRA
NEW & REVISED PLANT DOCUMENTATION

NRC Perspective of Pilot Plant Transition

Paul W. Lain, P.E.
NFPA 805 Program Manager
NRC/NRR/DRA/AFPB
November 9, 2006

Purpose

Provide feedback on what’s “on track” or “off track”

NRC Interactions w/ Pilots

- 08/05 – Pilot Kick-Off Mtg @ RII
- 11/05 – Observation Visit @ Duke HQ
- 03/06 – Public Workshop @ NRC HQ
- 03/06 – Observation Visit @ Progress HQ
- 07/06 – FAQ Kick-Off Mtg @ NRC HQ
- 07/06 – Pubic Workshop @ AEP
- 08/06 – FAQ Public Conference Call
- 08/06 – NEI FPIF / 805 Information Exchange
- 09/06 – FAQ Public Mtg @ Winston & Strawn
- 10/06 – Observation Visit @ Oconee
- 10/06 – FAQ Public Conference Call
- 11/06 – Observation Visit @ Harris/PE HQ
- 11/06 – FAQ Public Mtg @ NEI

Programmatic Issues

- Process: Information Dissemination
  - Parking Lot Issues
  - NRC Trip Reports w/ Lessons Learned
  - Industry Information Meetings
  - NEI Task Force
  - FAQ Process
  - Working Level Reviews

Programmatic Issues

- Process: Timing
  - RG 1.205 Approval Endorsing NEI 04-02
  - Enforcement Discretion Extension
  - NRC Trip Reports w/ Lessons Learned
  - FAQ Process
  - NEI Peer Review Guide
  - ANS Standard

Future Programmatic Issues

- Visits
  - Periodicity
  - Observation vs Working Level
- Duke LAR Date
- Topical Reports vs FAQ Approval
  - Multiple Spurious Methodology
  - Additions to NUREG/CR-6850 Methodology
  - Alternatives to 50.48(c) Methodology

NEI NFPA 805 Task Force

- **Mission**
- **Communication**
- **Solutions**
- **Going Forward**

Mission

- Successfully implement Regulatory Guide 1.205 based on the industry guidance document, NEI 04-02

- Provide support to plants transitioning to 10 CFR 50.48 (c)

- Work under the auspices of the Fire Protection Working Group and coordinate with the Risk-Informed Regulation Working Group

Communication

- Representation from Risk Applications Task Force & Fire Protection Working Group
- Monthly meetings w/Task Force and NRC
- Sharing of information
  - Pilot updates
  - Transition issues
  - FAQs
- Web Board

Solutions

- FAQs
  - Issues captured from transitioning plants
  - Solutions developed and vetted through Industry group (s)
  - Approval by joint effort from Industry/NRC
- NEI 04-02
  - Approved FAQs incorporated to document
  - Periodic & future revisions endorsed by NRC

Going Forward…

- Status and lessons learned from pilots will be communicated
- Overall coordination is essential: pilots must be given the highest priority to baseline the transition and LAR process
  - Expectation: Expedited review
  - Goal: 0 RAIs
- Need to resolve the 3 year enforcement discretion question

Going Forward…

The NEI NFPA 805 Task Force is the pathway for resolution of technical issues and communication hub for successful transition to 10 CFR 50.48 (c).

Questions?