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1CAN011401

January 29, 2014

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

SUBJECT: License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants (2001 Edition)
Arkansas Nuclear One – Unit 1
Docket No. 50-313
License No. DPR-51

Dear Sir or Madam:

In accordance with 10 CFR 50.90, Entergy Operations, Inc. (Entergy) proposes to amend Renewed Facility Operating License No. NPF-6 for Arkansas Nuclear One, Unit 1 (ANO-1). This License Amendment Request (LAR) requests Nuclear Regulatory Commission (NRC) review and approval for adoption of a new fire protection licensing basis which complies with the requirements in 10 CFR 50.48(a), 10 CFR 50.48(c), and the guidance in Regulatory Guide (RG) 1.205, "Risk-Informed Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants." The LAR follows Nuclear Energy Institute (NEI) 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program under 10 CFR 50.48(c)." This submittal describes the methodology used to demonstrate compliance with, and transition to, National Fire Protection Association (NFPA) 805, and includes regulatory evaluations, probabilistic risk assessment (PRA), change evaluations, proposed modifications for non-compliances, and supporting attachments.

The transition includes the following high level activities: 1) a new fire safe shutdown analysis, 2) a new fire PRA, and 3) completion of activities required to transition the licensing basis to 10 CFR 50.48(c).

A series of reviews and observation meetings occurred as part of the transition process. These served to increase communication between the NRC and transitioning licensees, develop transition lesson learned reports from observation visits, improve the NFPA 805 Regulatory Guide and Inspection Procedures, gain insights on the Enforcement Discretion Policy, and develop a LAR template.

In addition to the Pilot Plant Process, NEI established the NFPA 805 Task Force, to ensure successful implementation of RG 1.205. The NFPA 805 Task force provided the interface between the pilot plants, the nuclear industry, and the NRC. The NFPA 805 Task Force, working with the NRC, developed a Frequently Asked Questions (FAQ) process for obtaining clarifications to RG 1.205, NEI 04-02, and NFPA 805. This process is discussed in the enclosed NFPA 805 Transition Report for ANO-1, Section 3.4. Attachment H of the report provides the FAQs that ANO-1 used to support transition to NFPA 805.

Enclosure 1 contains the ANO-1 NFPA 805 Transition Report with supporting attachments. The report provides the required technical and regulatory assessments to enable the NRC to begin the review and approval of the new licensing basis.

Enclosures 2 and 3 contain the marked-up and re-typed pages, respectively, of the Operating License and Technical Specifications (TS).

Section 5.4 of Enclosure 1 contains the ANO-1 proposed implementation schedule for transitioning to the new fire protection licensing basis. The proposed modifications and implementation actions in Tables S-1 and S-2 of Attachment S provide Entergy's commitments in support of the NFPA 805 transitioning process. Enclosure 4 contains the summary of the new commitments associated with this request.

An update to the ANO-1 Safety Analysis Report (SAR) will be performed and submitted in accordance with 10 CFR 50.71(e). The station Fire Hazards Analysis (FHA), which is considered part of the SAR and common to both ANO units, will be revised as necessary and submitted consistent with the submittal of the ANO -1 SAR, in accordance with 10 CFR 50.71(e). Because these submittals are controlled by regulation, no new commitment related to these submittals is proposed in this letter.

Should you have any questions concerning this letter, or require additional information, please contact Stephenie Pyle at 479-858-4704.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on January 29, 2014.

Sincerely,

ORIGINAL SIGNED BY JEREMY G. BROWNING

JGB/dbb

Enclosures:
1. NFPA 805 Transition Report
2. Proposed Operating License and Technical Specification Changes (mark-up)
3. Revised Operating License and Technical Specification Pages
4. List of Regulatory Commitments

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Entergy Operations, Inc.
Arkansas Nuclear One – Unit 1

Enclosure 1 to
1CAN011401

Transition to 10 CFR 50.48(c) - NFPA 805

Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition

Transition Report

January 27, 2014

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Executive Summary

Entergy Operations, Inc. (Entergy) will transition the Arkansas Nuclear One, Unit 1 (ANO-1) fire protection program to a new Risk-Informed, Performance-Based (RI-PB) alternative per 10 CFR 50.48(c), which incorporates by reference NFPA 805. The licensing basis per 10 CFR 50, Appendix R, will be superseded.

In letter dated November 2, 2005 (0CAN110502), Entergy informed the NRC of the intent to transition ANO -1 and ANO, Unit 2 (ANO-2) to the 2001 Edition of NFPA 805.

The transition process consisted of a review and update of ANO-1 documentation, including the development of a Fire Probabilistic Risk Assessment (PRA) using NUREG/CR-6850 as guidance. This Transition Report summarizes the transition process and results. This Transition Report contains information:

- Required by 10 CFR 50.48(c).
- Recommended by guidance document Nuclear Energy Institute (NEI) 04-02, Revision 2, and appropriate Frequently Asked Questions (FAQs).
- Recommended by guidance document Regulatory Guide 1.205, Revision 1.

Section 4 of the Transition Report provides a summary of compliance with the following NFPA 805 requirements:

- Fundamental Fire Protection Program Elements and Minimum Design Requirements
- Nuclear Safety Performance Criteria, including:
  - Non-Power Operational Modes
  - Fire Risk Evaluations
- Radioactive Release Performance Criteria
- Monitoring Program
- Program Documentation, Configuration Control, and Quality Assurance

Section 5 of the Transition Report provides regulatory evaluations and associated attachments, including:

- Changes to License Condition
- Changes to Technical Specifications, Orders, and Exemptions,
- Determination of No Significant Hazards and evaluation of Environmental Considerations.

The attachments to the Transition Report include detail to support the transition process and results.

Attachment H contains the approved FAQs not yet incorporated into the endorsed revision of NEI 04-02 that were utilized by ANO-1 in the preparation of the License Amendment Request. These FAQs have been used to clarify the guidance in RG 1.205, NEI 04-02, and the requirements of NFPA 805. The methodologies associated with these FAQs have been included in the Transition Report for Nuclear Regulatory Commission approval.

Acronym List

ANO-1	Arkansas Nuclear One, Unit 1
ANO-2	Arkansas Nuclear One, Unit 2
AHJ	Authority Having Jurisdiction
APCSB	Auxiliary & Power Conversion Systems Branch
AP&L	Arkansas Power and Light
ANS	American Nuclear Society
ASME	American Society of Mechanical Engineers
CCDP	Conditional Core Damage Probability
CDF	Core Damage Frequency
CLB	Current Licensing Basis
DID	Defense-in-Depth
DBA	Design Basis Accident
DBD	Design Basis Document
EDG	Emergency Diesel Generator
EEEE	Existing Engineering Equivalency Evaluation
F&O	Findings and Observations
FA	Fire Analysis
FAQ	Frequently Asked Question
FP	Fire Protection
FPP	Fire Protection Plan
FPRA	Fire Probabilistic Risk Assessment
FR	Federal Register
GDC	General Design Criterion
HELB	High Energy Line Break
HPI	High Pressure Injection
HRA	Human Reliability Analysis
ICM	Interim Compensatory Measures
IF	Ignition Frequency
KSF	Key Safety Functions
LA	Licensing Action
LAR	Licensing Amendment Request
LERF	Large Early Release Frequency
LFS	Limiting Fire Scenario
LPI	Low Pressure Injection
MEFS	Maximum Expected Fire Scenario
MOU	Memorandum of Understanding
MSO	Multiple Spurious Operation
NEC	National Electric Code
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NPO	Non-Power Operational
NRC	Nuclear Regulatory Commission
NSCA	Nuclear Safety Capability Assessment
NSEL	Nuclear Safety Equipment List
OMA	Operator Manual Action
OOS	Out of Service
PCS	Primary Control Station
PDMS	Plant Data Monitoring System
PORV	Power-Operated Relief Valve
POS	Plant Operational State
PRA	Probabilistic Risk Assessment
PWR	Pressurized Water Reactor
QA	Quality Assurance
QCST	Quality Condensate Storage Tank
RA	Radiation Area
RAI	Request for Additional Information
RCA	Radiological Controlled Area
RCP	Reactor Coolant Pump
RCZ	Radiological Controlled Zone
RG	Regulatory Guide
RI-PB	Risk-Informed, Performance-Based
RIS	Regulatory Issue Summary
RHR	Residual Heat Removal
SAR	Safety Analysis Report
SER	Safety Evaluation Report
SM	Safety Margin
SSA	Safe Shutdown Analysis
SSC	Structure, System, or Component
SSD	Safe Shutdown
SSE	Safe Shutdown Earthquake
SW	Service Water
SWGR	Switchgear
T-H	Thermal-Hydraulic
TR	Transition Report
TS	Technical Specification
V&V	Verification and Validation
VFDR	Variances From Deterministic Requirements

1.0 INTRODUCTION

The Nuclear Regulatory Commission (NRC) has promulgated an alternative rule for fire protection requirements at nuclear power plants, 10 CFR 50.48(c), National Fire Protection Association (NFPA) Standard 805 (NFPA 805). Entergy Operations, Inc. (Entergy) is implementing the Nuclear Energy Institute methodology NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," to transition Arkansas Nuclear One, Unit 1 (ANO-1) from its current fire protection licensing basis to the new requirements as outlined in NFPA 805. This report describes the transition methodology utilized and documents how ANO-1 complies with the new requirements.

1.1 Background

1.1.1 NFPA 805 – Requirements and Guidance

On July 16, 2004 the NRC amended 10 CFR 50.48, "Fire Protection," to add a new subsection, 10 CFR 50.48(c), which establishes new Risk-Informed, Performance-Based (RI-PB) fire protection requirements. 10 CFR 50.48(c) incorporates by reference, with exceptions, the National Fire Protection Association's NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants – 2001 Edition," as a voluntary alternative to 10 CFR 50.48 Section (b), Appendix R, and Section (f), Decommissioning.

As stated in 10 CFR 50.48(c)(3)(i), any licensee's adoption of a RI-PB program that complies with the rule is voluntary. This rule may be adopted as an acceptable alternative method for complying with either 10 CFR 50.48(b) for plants licensed to operate before January 1, 1979, or the fire protection license conditions for plants licensed to operate after January 1, 1979, or 10 CFR 50.48(f) for plants shutdown in accordance with 10 CFR 50.82(a)(1).

NEI developed NEI 04-02 to assist licensees in adopting NFPA 805 and making the transition from their current fire protection licensing basis to one based on NFPA 805. The NRC issued Regulatory Guide (RG) 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light Water Nuclear Power Plants," which endorses NEI 04-02, with exceptions, in December 2009.[1]

[1] Where referred to in this document NEI 04-02 is Revision 2 and RG 1.205 is Revision 1.

A depiction of the primary document relationships is shown in Figure 1-1:

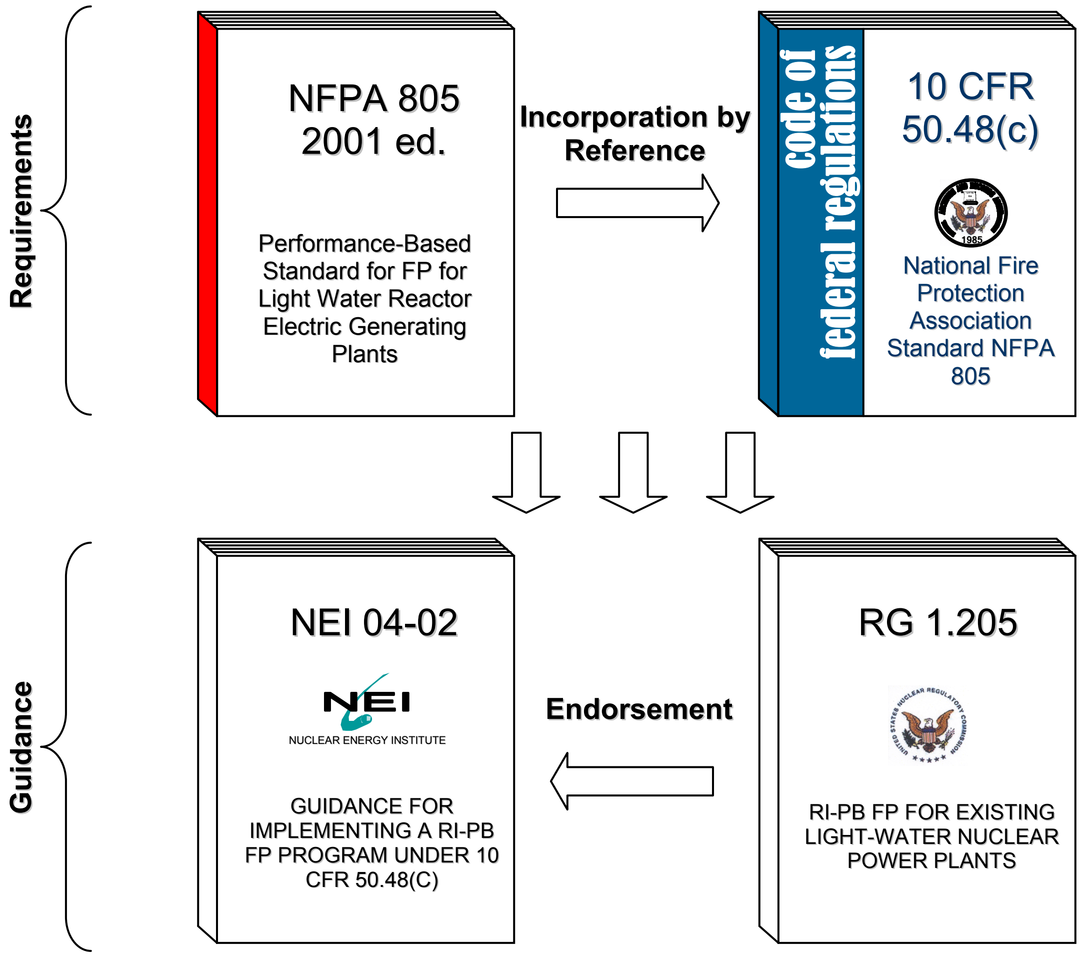


Figure 1-1

NFPA 805 Transition – Implementation Requirements/Guidance

1.1.2 Transition to 10 CFR 50.48(c)

1.1.2.1 Start of Transition

Entergy submitted a letter of intent to the NRC on November 2, 2005 (0CAN110502, ML053140128), for ANO-1 to adopt NFPA 805 in accordance with 10 CFR 50.48(c).

By letter dated December 22, 2008 (0CNA120805, ML083500404), the NRC granted an enforcement discretion period based, in part, on the date in which pilot plant submittals were approved by the NRC. By letter dated July 28, 2011 (0CNA071107, ML112030193), the NRC extended the enforcement discretion period for ANO-1 based on a commitment by Entergy to submit the letter of transition to NFPA 805 no later than August 31, 2012. This was revised by letter dated January 24, 2013 (1CNA011301, ML13009A292), where the NRC extended the enforcement discretion period for ANO-1 based on a commitment by Entergy to submit the letter of transition to NFPA 805 no later than January 31, 2014. In accordance with NRC Enforcement Policy, the enforcement discretion period will continue until the NRC approval of the license amendment request (LAR) is completed.

1.1.2.2 Transition Process

The transition to NFPA 805 includes the following high level activities:

- A new Nuclear Safety Capability Assessment (NSCA);
- A new Fire Probabilistic Risk Assessment (PRA) using NUREG/CR-6850, “EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities,” as guidance;
- Completion of activities required to transition the pre-transition Licensing Basis to 10 CFR 50.48(c) as specified in NEI 04-02 and RG 1.205.

1.2 Purpose

The purpose of the Transition Report is as follows:

1) Describe the process implemented to transition the current fire protection program to comply with the additional requirements of 10 CFR 50.48(c)
2) Summarize the results of the transition process
3) Explain the bases for conclusions that the fire protection program complies with 10 CFR 50.48(c) requirements
4) Describe the new fire protection licensing basis
5) Describe the configuration management processes used to manage post-transition changes to the station and the Fire Protection Program, and resulting impact on the licensing basis.

2.0 OVERVIEW OF EXISTING FIRE PROTECTION PROGRAM

2.1 Current Fire Protection Licensing Basis

Arkansas Nuclear One, Unit 1 (ANO-1) was licensed to operate on May 21, 1974. The fire protection program at ANO-1 is based on the Nuclear Regulatory Commission (NRC) requirements, as well as the requirements of state and other federal agencies, and insurance carriers. With regard to NRC criteria, the ANO-1 fire protection program addresses the guidelines of Appendix A to the Auxiliary and Power Conversion Systems Branch (APCSB) Technical Position 9.5-1 (APCSB 9.5-1). Various aspects of the fire protection program are detailed, as required, to show conformance with the guidelines or to demonstrate the equivalency of alternative approaches, and the following license condition:

ANO-1 license condition 2.C(8), as approved by letter dated March 31, 1992 (0CNA039215), states (note that Item 1 was not discussed in the March 31, 1992, Safety Evaluation, but was part of original commitments related to fire protection modifications from 1978 correspondence referenced and discussed in Section 2.2 below):

(8) *Fire Protection*

EOI shall implement and maintain in effect all provisions of the approved Fire Protection Program as described in Appendix 9A to the SAR and as approved in the Safety Evaluation dated March 31, 1992, subject to the following provision:

1. *AP&L[1] may proceed with and is required to complete the modifications identified in Paragraphs 3.1 through 3.19 of the NRC's Fire Protection Safety Evaluation on the facility dated August 22, 1978, and supplements thereto. These modifications shall be completed as specified in Table 3.1 of the Safety Evaluation Report or supplements thereto. In addition, the licensee may proceed with and is required to complete the modifications identified in Supplement 1 to the Fire Protection Safety Evaluation Report, and any future supplements. These modifications shall be completed by the dates identified in the supplement.*

2. *The licensee may make changes to the approved Fire Protection Program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.*

[1] The Original licensee authorized to possess, use, and operate the facility was AP&L. Consequently, certain historical references to AP&L remain in the license conditions.

See Attachment M and Enclosures 2 and 3 for proposed changes to license condition 2.C(8).

By letter dated July 18, 2007, new license condition 2.C(9) was added to address Section B.5.b. of the February 25, 2002, Interim Compensatory Measures (ICM) Order (EA-02-026) and related NRC guidance, associated with loss of large areas of the plant due to explosions or fire, including those that an aircraft impact might create. This license condition will be maintained with the ANO-1 transition to NFPA 805.

(9) Mitigation Strategies

The licensee shall develop and maintain strategies for addressing large fires and explosions that include the following key areas:

1. Fire fighting response strategy with the following elements:
   - *(a) Pre-defined coordinated fire response strategy and guidance*
   - *(b) Assessment of mutual aid fire fighting assets*
   - *(c) Designated staging areas for equipment and materials*
   - *(d) Command and control*
   - *(e) Training of response personnel*

2. Operations to mitigate fuel damage considering the following:
   - *(a) Protection and use of personnel assets*
   - *(b) Communications*
   - *(c) Minimizing fire spread*
   - *(d) Procedures for implementing integrated fire response strategy*
   - *(e) Identification of readily-available pre-staged equipment*
   - *(f) Training on integrated fire response strategy*
   - *(g) Spent fuel pool mitigation measures*

3. Actions to minimize release to include consideration of:
   - *(a) Water spray scrubbing*
   - *(b) Dose to onsite responders*

In addition to the above, ANO-1 Technical Specifications (TSs) require the following:

5.4.1 Written procedures shall be established, implemented, and maintained covering the following activities:

c. Fire Protection Program implementation

See Attachment N and Enclosures 2 and 3 for proposed changes to TS 5.4.1.c.

2.2 NRC Acceptance of the ANO-1 Fire Protection Licensing Basis

In 1977-78, Arkansas Power and Light Company (AP&L), hereafter to be referred to as Entergy Operations, Inc. (Entergy), which manages Arkansas Nuclear One (ANO), conducted a fire hazards analysis study to meet the criteria of APCSB 9.5-1 for ANO-1. The results of this study were submitted to the NRC on February 28, 1978 (0CAN027802), and subsequently, the ANO-1 fire protection program was documented in the NRC's ANO-1 Fire Protection Safety Evaluation Report (SER) dated August 22, 1978 (1CNA087810).

The first license condition listed in Section 2.1 above refers to commitments to perform certain modifications or otherwise meet specific NRC requirements as denoted in the August 22, 1978, SER. These commitments have long been completed (or exemptions received) and, therefore, this license condition will not be carried forward with the transition to NFPA 805. Below is a list of commitments denoted in the August 22, 1978, SER along with how each was dispositioned. The related fire zone (where applicable) is listed immediately following the SER excerpt. The zone numbers were obtained from Table 3.1 of the SER. The bullet numbers are the same as those in the SER.

In the cover letter, the NRC requested revised Technical Specifications (TS) be proposed, as necessary, in relation to the following commitments. TS changes were proposed via letter dated February 23, 1979 (1CAN027914), and approved by the NRC in Amendment 43 to the ANO-1 TSs by letter dated May 23, 1979 (1CNA057918).

3.1 "Portable radio communication equipment will be provided and available for fire brigade use."

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"The NRC inspectors found that portable radios were stored on the first floor of the licensee's administrative building. The portable radios were in a locker which included built-in electrical charging outlets. The portable radios had separate microphones which could be clipped to the user's collar and throat microphones for use under respiratory equipment. Licensee representatives stated that all members of the fire brigade received instructions in the use of the portable radios as part of "Emergency Response" training and that the portable radios were used on some of the drills. The portable radio frequency assigned for fire brigade use was monitored in the control rooms. There were no violations or deviations identified."*

3.2 "Redundant power cables for service water pumps and fuel transfer pumps will be separated by a barrier where redundant cables are in a common manhole in the yard area."

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"Manholes were not inspected by the NRC inspector because the licensee did not consider that they should be entered during mode 1 (power) operation, which both units were in. From records, it was established that Unit 2 barriers were installed, but for Unit 1 the work had not been done. For Unit 1, correspondence from R. W. Reid, Chief, Operating Reactors Branch No. 4, Division of Licensing, dated October 24, 1980, stated that Item 3.2 of the SER remained unresolved and that this item should be resolved in a manner that would meet the requirements of the (at that time) proposed Appendix R (to 10 CFR 50). The issue of protection of redundant equipment cables in yard manholes is being reviewed by the licensee as discussed in paragraph 2 of this report. Within the context of paragraph 2, no violations or deviations were identified."*

At the time, the open issue related to the fuel transfer pumps for Emergency Diesel Generators (EDGs) was that the redundant power cables for the pumps were routed together. This did not meet the concern addressed in Item 3.2, nor did it meet Appendix R requirements, which were issued later. To address this concern, Entergy modified the fuel transfer system to allow cross-connect capability between units such that an EDG could be supplied with fuel oil from any available fuel transfer pump. This emergency capability is addressed in station procedures to this day.

With regard to service water (SW) pump cable separation in common manholes, an exemption was granted by the NRC in letter dated March 22, 1983 (0CNA038328). This exemption letter is discussed in further detail following the discussion of Item 3.19 of this section.

3.3 "To protect redundant safe shutdown cables in the auxiliary building hallway – elevation 372 feet, either a deluge system actuated by heat and smoke detectors and coating of cables where redundant cables are in proximity will be provided, or all cables will be coated and smoke detectors and a wet pipe sprinkler system installed." (98-J corridor adjacent to Cable Spreading Room)

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203):

"The NRC inspectors found that the licensee had installed heat and smoke detectors which actuated a deluge system and had coated redundant cables. Although the hallways are separate spaces, licensee action was similar for both. The installed deluge system appeared to meet National Fire Code requirements. The licensee was reviewing the adequacy of action taken as described in paragraph 2 of this report. Pending completion of the licensee's review, the NRC inspectors noted the following:

a. The barrier material used was not yet accepted as a "3-hour barrier."

b. There were several terminal boxes that were not covered by barrier material, although the conduits on both sides of them were covered. Examples are terminal boxes 561, 346, and 345.

c. Conduit above door 57 (Unit 1) appeared to be covered with barrier material over only half of its length.

Resolution of these specific items is considered to be an open item pending completion of the licensee's review under 10 CFR 50, Appendix R, Item III.G (50-313/8215-04; 50-368/8212-03). No violations or deviations were identified."

In letter dated July 25, 1985 (0CNA078522), the NRC stated: *"Specific item resolution was inspected and it was found that the installation of the barrier material had been significantly redefined. The separation criteria requires only a "1-hour barrier" and this has been installed on conduits with cables of concern and is the Hemyc Barrier System. Terminal boxes in the conduit runs were covered. The conduit above Door 57 was determined not to contain any cables of concern. Adequacy of the review and determination of the cables of concern will be addressed and inspected during the inspection for Appendix R compliance. This item is closed."*

3.4 "Cables which are from the opposite division to the cables in each switchgear room will be separated by a fire retardant board or blanket where redundant cables are in proximity to each other." (99-M North Switchgear Room, 100-N South Switchgear Room)

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"The NRC inspectors found that cables from opposite trains were wrapped in blanket material in the switchgear rooms.*

It was also noted that some cable trays have been sprayed with a fire retardant coating. This item is under review by the licensee; paragraph 2 of this report is applicable. No violations or deviations were identified."

These zones contain redundant cabling for RCS makeup and SW pumps. In addition to the above, Entergy determined that additional modifications would be required to ensure at least one makeup pump and one SW pump would remain available post-fire, assuming the opposite train pump was concurrently removed from service for maintenance. The modification provided electrical power capability from both the red and green train power sources to the swing makeup and SW pump (there are three makeup and three SW pumps, on each being a "swing" pump; only two of each are required to be operable in accordance with TSs). This modification was completed as documented in Entergy letter dated August 30, 1985 (0CAN088508), which states: *"Modifications were completed to ensure the "swing" makeup and service water pumps may be powered from the "green" switchgear…"* Prior to the modification, the swing pumps could only be powered from the red train power source.

3.5 "An existing wet pipe sprinkler system will be extended to protect redundant safe shutdown cables." (73-W Condensate Demineralizer Room)

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"The NRC inspector viewed the extension of the sprinkler system in the condensate demineralizer area. The licensee is also conducting a review of this item; paragraph 2 of this report is applicable. No violations or deviations were identified."*

By letter dated October 20, 1986, (0CAN108608), Entergy provided the following conclusion of Appendix R compliance to the NRC: *"The evaluation to verify adequacy of partial suppression in Fire Zones 73-W, 79-U and 149-E (ANO-1) and Fire Zone 2006-LL (ANO-2), has been completed. Based on the location of the redundancies in these zones, existing 1-hour wraps on one train of the redundant safe shutdown cabling where the redundancies are within twenty feet of each other, and existing fire hazards in the zones, these systems have been judged to provide adequate protection for the hazards in the area."*

3.6 "The Halon system in the control room false ceiling and floor will be modified to be actuated by smoke detectors. All exposed cables in the false floor space will be coated with a flame retardant coating." (129-F Control Room)

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"The NRC inspectors found that smoke detectors were installed. These actuated the control room halon system. Several false floor panels were pulled, and the cables underneath were found to be coated with flame retardant"*

3.7 "To protect redundant cables, either a deluge system actuated by heat and smoke detectors will be provided, or all exposed cables in cable trays will be coated with flame retardant coating." (97-R Cable Spreading Room)

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"The NRC inspectors found that an extensive deluge system was installed in the cable spreading room. The system* *was activated by smoke and heat detectors. It was noted that review of the licensee's action in this area had not been considered acceptable (R. Reid letter, dated October 24, 1980). This item is under review by the licensee as described in paragraph 2 of this report. There were no violations or deviations identified."*

The acceptability concerns were noted from NRC letter dated October 24, 1980 (1CNA108085), which stated: *"To meet Section III, Paragraph G of the proposed Appendix R to 10 CFR Part 50, the licensee should provide an alternate shutdown capability independent of this area. The alternate shutdown system should meet the requirements of Section L, Paragraph III of proposed Appendix R to 10 CFR Part 50."*

In SER dated May 13, 1983 (0CNA058316), the NRC concluded that ANO-1 and ANO-2 met Appendix R, Items III.G.3 and III.L, except where an exemption had previously been granted related to the 72-hour shutdown requirement for ANO-1. In addition, the NRC requested both units install a source range neutron flux monitor indication on the SPDS computer electrically independent of the control room displays. This requirement was documented as satisfied in NRC Inspection Report 50-313/87-14 50-368/87-14 dated September 30, 1987 (0CNA098716):

"The following process monitoring instrumentation is available in the control room and on the SPDS "Alternate Shutdown" display:

…Source Range Flux…

The safety parameter display system (SPDS) at ANO is a computer-based system used for monitoring and display of plant safety parameters developed in accordance with the requirements of NUREG-0737. The SPDS configuration at ANO is designed to provide redundant isolated data acquisition, processing, and display devices. Two redundant display terminals are available in the control room and also in the TSC for alternate shutdown. Software has been developed to display the above parameters as well as provide trending data on an "Alternate Shutdown" display screen."

3.8 "Where redundant diesel generator cables are in proximity, a barrier will be provided between the cables, and the manual sprinkler system will be converted to automatic operation." (149-E Upper North Electrical Penetration Room)

This requirement was documented as partially satisfied in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"Fire barriers were found to be installed. It was noted that the deluge system had sprinkler heads installed so that each one covered approximately 100 square feet of area. This item is under licensee review; paragraph 2 of this report is applicable. No violations or deviations were identified."*

By letter dated October 20, 1986 (0CAN108608), Entergy informed the NRC of completed compliance: *"The evaluation to verify adequacy of partial suppression in Fire Zones 73-W, 79-U and 149-E (ANO-1) and Fire Zone 2006-LL (ANO-2), has been completed. Based on the location of the redundancies in these zones, existing 1-hour wraps on one train of the redundant safe shutdown cabling where the redundancies are within twenty feet of each other, and existing fire hazards in the zones, these systems have been judged to provide adequate protection for the hazards in the area."*

In letter dated October 26, 1988 (1CNA108806), the NRC stated in regard to this fire zone contained within Fire Area B: *“The licensee's fire hazards evaluation concerning the absence of area-wide fire detectors and a fire suppression system in Fire Area B conforms with the guidance in GL 86-10. No exemption for this condition is therefore required.”*

3.9 “A portable water or halon extinguisher will be provided in or adjacent to the control room.” (129-F Control Room)

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *“The NRC inspectors found that a small (10 pound) halon (1211) fire extinguisher was permanently mounted in each control room. No violations or deviations were identified.”*

3.10 “Smoke detectors will be provided in each control room cabinet which contains safe shutdown equipment. Additional smoke detectors will be provided such that detectors are provided in all safety-related areas containing significant combustibles. Smoke detectors will be provided in various safety-related areas which contain no combustibles but which contain redundant safe shutdown cabling in conduit. Power supplies for fire detectors will be modified so that all fire detectors will be powered from an emergency power source.”

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *“The NRC inspectors found smoke detectors installed in every area checked and identified as an area where they were required by the SER. Smoke detector coverage was also checked with licensee representatives who provided marked up plan view drawings by level to indicate detector coverage. Design change packages which addressed smoke detector installation and power supplies were also reviewed. There were no violations or deviations identified.”*

3.11 “Manual hose stations accessible to all safety-related equipment on elevation 317 feet of the auxiliary building will be provided. Manual hose stations will be provided in the reactor building.”

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82 dated August 6, 1982 (0CNA088203): *“HR-49 had been installed in elevation 317' of the auxiliary building. Because Unit 1 was at power, hose reel stations in the containment could not be checked, but hose reel station HR-49 was visually inspected. It was noted that there were two licensee procedures which affected surveillance of hose reel stations.”*

3.12 “The cable penetration firestop design will be tested, and existing firestops upgraded where required by the testing.”

In letter dated June 2, 1982 (1CAN068201), Entergy provided the NRC the remaining fire seal test results. The tests were conducted using the test plan approved by the NRC by letter (R. W. Reid), dated April 5, 1979 (1CNA047909), and results met applicable criteria (e.g., 3-hour rating in accordance with the criteria specified in IEEE 634).

3.13 "Portable smoke exhaust units with flexible ductwork will be provided so that three units are available for each ANO-1 and ANO-2."

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"The NRC inspectors checked three fire carts, one located for Unit 1, one for Unit 2, and one on the turbine deck between the two units. Each of the unit fire carts had two 110 volt portable blowers and flexible ductwork sections. The fire cart, which was common to the two units, had three of the blowers and flexible ductwork pieces. No violations or deviations were identified."*

3.14 "Fixed emergency lights will be provided in the control room independent of existing normal and emergency lighting. Portable hand held sealed beam lanterns will be provided for fire brigade use."

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"The NRC inspectors found that the licensee had installed emergency lighting as specified. Licensee representatives stated that this lighting was part of the installation made to meet the requirements of 10 CFR 50, Appendix R, Item III.J. The NRC inspectors had noted similar lighting installations in other plant areas. The fire carts described in paragraph 7 of this report were also found to contain portable hand held, sealed beam lanterns. No violations or deviations were identified."*

3.15 "The reactor coolant pump oil collection system will be upgraded to provide collection capability at all potential leakage points."

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"Neither oil collection system was actually viewed, because both units were in mode 1. The NRC inspectors did review drawings and photographs of the installation made. It was noted that the design for both units had been reviewed by NRR. R. W. Reid letter of May 11, 1980, and R. A. Clark letter of November 5, 1980, are applicable to Units 1 and 2, respectively. The NRC inspectors had no questions in this area of the inspection. No violations or deviations were identified."*

In addition, on July 1, 1982 (0CAN078202), Entergy submitted the results of its ANO-1 and ANO-2 Appendix R review. On August 15, 1984 (0CAN088404), Entergy requested an exemption from the requirements that an RCP oil collection system be seismically qualified and capable of containing the oil from all RCP motors. This exemption was approved in NRC letter dated October 26, 1988 (1CNA108806):

"On the basis that the lube oil system at ANO-1 is capable of withstanding the SSE without rupture and that the existing oil collection system will channel random leaks to a vented and closed container, the existing design conforms with the above staff guidance. Based on the above evaluation, the licensee's alternate design of the oil collection system provides an equivalent level of safety to that achieved by compliance with Section III.0 of Appendix R. Therefore, the licensee's request for exemption is approved."

3.16 “The effects of fires involving associated circuits (circuits which are connected to safety systems but perform non-safety functions) are being evaluated by the licensee. Results of the evaluation will be provided by January 15, 1979. Where a fire involving associated circuits may affect operation of safe shutdown equipment, modifications such as rerouting of cables or installation of relay contacts will be made to preclude disabling of safe shutdown equipment.”

Entergy provide the results of modifications and reanalysis associated with the above circuits in letters dated August 15, 1984 (0CAN088404), and August 30, 1985 (0CAN088508), “Results of Reanalysis Against NRC Clarification/Interpretation of Appendix R to 10CFR50.” Due the amount of information provided in these documents and the extensive review performed, excerpts are not provided. Likewise, the NRC’s acceptance of the review is not specific to one fire-related component. However, the NRC did conclude that the ANO-1 analysis was adequate, in addition to granting several exemptions, in letter dated October 26, 1988 (1CNA108806):

“Based on our evaluation of the AP&L submittals, we conclude that AP&L's proposed fire protection configuration provides an equivalent level of safety to that achieved by compliance with Appendix R.”

As stated in the October 26, 1988 letter, this conclusion was a result of NRC review of the two Entergy letters listed above and supplemental Entergy letters dated October 20, 1986 (0CAN108608), April 22, 1987 (1CAN048708), June 24, 1987 (1CAN068706), and April 25, 1988 (1CAN048808).

3.17 “The manually actuated sprinkler systems in the diesel generator rooms will be modified to automatic actuation.” (149-E, 86-G, 87-H)

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *“The NRC inspectors checked the diesel generator rooms. It was found that they were equipped with deluge systems actuated by a combination of smoke and flame detectors. There were no violations or deviations identified.”*

3.18 “Fire doors which separate redundant safe shutdown equipment or which separate safe shutdown equipment from large oil hazards will either be locked or provided with electrical supervision to alarm if opened.”

This requirement was discussed in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *“The NRC inspectors found that many fire doors had installed electrical supervision, but, except in those cases wherein the fire door also happened to be a security door, the electrical supervision was not activated; i.e., the alarm did not work. It was also found that the only fire doors that were locked were those that were also security doors. Specifically, the fire doors that separated the diesel generator rooms for both Unit 1 and Unit 2 (doors 39 and 259, respectively) were neither locked nor did the installed alarms operate. Since the Table 3 SER requirements are incorporated into the licenses for both units, failure either to have doors 39 and 259 locked or to have operating supervisory alarms on them is an apparent violation.”*

In letter dated May 6, 1983 (0CNA058307), the NRC stated: *"(Closed) Violation (50-313/8215-01; 50-368/8212-01). This violation was the result of the failure to have fire doors between spaces with redundant safe shutdown equipment either locked or electrically supervised. The NRC inspector found that these fire doors were now electrically supervised and would cause an alarm if left in an open position."*

3.19 "Procedures are being developed or changed to incorporate controls over combustible materials and ignition sources, fire brigade staffing and training, fire fighting procedures, quality assurance provisions, and definition of fire protection duties and responsibilities."

This requirement was documented in NRC Inspection Report 50-313/82-15 50-368/82-12 dated August 6, 1982 (0CNA088203): *"The NRC inspectors reviewed the licensee procedures listed below. These procedures addressed the requirements for administrative procedures related to fire protection and prevention.*

1015.07, "Fire Brigade Organization and Responsibilities," Rev 2, November 30, 1981.

1023.20, "Fire Plan/Fire Brigade Training," Revision 2, February 23, 1982

1053.01, "Control of Combustibles," Revision 1, January 15, 1982

1053.02, "Control of Ignition Sources," Revision 1, February 21, 1981

1053.03, "Safety and Fire Prevention Inspection," Revision 1, May 13, 1981

1903.22, "Fire or Explosion," (from Emergency Plan), Revision 3, April 28, 1982

1903.41, "Duties of the Emergency Fire Team," Revision 3, December 8, 1981

There were no violations or deviations identified."

On November 19, 1980, the NRC published the Fire Protection Rule, 10 CFR 50.48 and its guidance for implementation of that rule, Appendix R to 10 CFR 50. The effective date of the regulation was February 19, 1981. On July 1, 1982, Entergy submitted the results of its Appendix R compliance review and specific exemption requests (0CAN078202). Supplemental information and clarification of exemption requests were submitted on November 11, 1982 (0CAN118210). The following exemptions were approved in the staff's SER (0CNA038328) dated March 22, 1983. The NRC basis for acceptability of each exemption is also included below.

<u>ANO-1</u>

- An exemption from 10 CFR 50, Appendix R, Section III.G.2, Intake Structure, Below El. 354': Exemption to requirement for automatic fire suppression.

  "This zone consists of the service water pump intake bays; therefore, the water level in the intake bays precludes the possible accumulation of transient combustible materials as anticipated in other plant areas. Because the likelihood of an exposure fire is low, these alternative features compensate for the required suppression system and provide a level of fire protection equivalent to that required by Section III.G of Appendix R. Therefore, the exemption is granted."

- An exemption from 10 CFR 50, Appendix R, Section III.G.2, Intake Structure, El. 354': Exemption to requirement for 20-foot separation and automatic fire suppression system.

  "Because of the low in-situ fire load, separation between cables, large room volumes, and detection system, there is reasonable assurance that one train of service water pumps will be maintained free of fire damage in the time interval required for fire brigade response to extinguish a fire. The level of protection which will be provided in this area in conjunction with the one-hour barriers provides a level of fire protection equivalent to Section III.G of Appendix R. Therefore, the exemption is granted."

- An exemption from 10 CFR 50, Appendix R, Section III.G.2, Intake Structure, El. 366': Exemption to requirement for 20-foot separation and automatic fire suppression system.

  "Because of the low in-situ fire load, large room volumes and the partial width missile barriers installed between each pump, and the ceiling height above the pumps, there is reasonable assurance that one train of service water pumps will be maintained free of fire damage in the time interval required for fire brigade response to extinguish an exposure fire. Although the pump discharge valves are separated by approximately five feet, they are effectively shielded from an exposure fire by the intervening missile barrier. These alternative features compensate for the automatic fire suppression system required by Section III.G and provide a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R. Therefore, the exemption is granted."

- An exemption from 10 CFR 50, Appendix R, Section III.G.2, Yard Area Manholes 1MH04 and 1MH06: Exemption to requirements for 20-foot separation, one-hour fire barrier, detection, and automatic fire suppression system.

  "Filling the manholes with sand or vermiculite will prevent a fire from occurring in the manholes and, therefore, an adequate level of fire protection will be provided equivalent to Section III.G of Appendix R. Therefore, the exemption is granted."

  In letter dated August 15, 1984 (0CAN088404), Entergy provide the NRC with the following information: *"These manholes are filled with sand to prevent propagation of fire from damaging redundant trains of service water cabling. During the fourth refueling outage (2R4), which is scheduled to commence in mid-1985, the "swing" service water pumps will be provided with a separate cable leading to the redundant switchgear of the opposite division, i.e., for ANO-1, power for the "swing" pump will be directly available from the "green" 4160V bus independent of 1MH04 and 1MH06, and for ANO-2, power for the "swing" pump will be available from the "red" 4160V bus independent of 2MH01E, 2MH02E, and 2MH03E. With the completion of those modifications, this area will meet Appendix R, and the sand will no longer be needed."*

- An exemption from 10 CFR 50, Appendix R, Section III.G.2, Radwaste Processing Area, Waste Monitor Tank Room, Fire Zone 20Y: Exemption to requirement for full coverage automatic fire suppression system.

  "Because there are no in-situ combustibles in this room, an exposure fire would involve transient combustibles. Due to the limited personnel access to this area for health physics reasons, it is unlikely that a large quantity of transient combustible materials could accumulate. Therefore, any potential fires in this area would be of limited severity and duration. Due to the considerable heat sink provided by the concrete floor, walls, and steel tanks in the area, there is slight possibility that a fire could damage both redundant BWST valves before actuation of the detection and automatic suppression systems. The one-hour rated barrier between redundant conduits will provide an added

margin of safety against premature fire damage. The alternative protective features provided for the BWST dropline valves provide a level of fire protection equivalent to Section III.G of Appendix R. Therefore, the exemption is granted."

- An exemption from 10 CFR 50, Appendix R, Section III.G.2, Radwaste Processing Area, Make-up Pump Rooms and Adjacent Corridor, Fire Zone 20Y: Exemption to requirement for automatic fire suppression system.

  "Access to these areas is restricted for health physics reasons and partial height walls are provided between the pumps. One-hour fire barriers will be provided for the trays and conduits associated with power for the pump and suction valve of the swing and one other pump within each individual pump room. Portable fire extinguishers, manual hose stations and a smoke detection system are provided in the area. These features, in conjunction with one-hour barriers, will mitigate the onset of cable damage for a sufficient time period to enable the fire brigade to respond and extinguish a fire prior to damage of both trains. The resulting protection for the make-up pump rooms and the adjacent corridor will provide a level of fire protection equivalent to Section III.G of Appendix R. Therefore, the exemption is granted."

  In letter dated October 22, 1997 (1CAN109704), Entergy provide the NRC with the following information: *"Therefore, per the March 22, 1983, safety evaluation (0CNA038328), one-hour fire barriers have been installed on the conduits associated with P36A and P36B. The conduits providing power to the auxiliary lube oil pumps are below the hot gas layer as are the MU/auxiliary lube oil pumps themselves. The partial height walls will effectively shield these components from the radiant heat generated by a fire in an adjacent pump cubicle. Therefore, the cables routed from the floor to the auxiliary lube oil pump are not subject to damage induced by a fire in an adjoining compartment. Consequently, the existing one-hour fire barrier material on the MU pump power conduits is not required on the portion of the routing less than four feet above the floor (i.e., elevation 335 to elevation 339)."*

- An exemption from 10 CFR 50, Appendix R, Section III.G.2, Containment Building, Fire Zones 32K and 33K: Exemption to requirement for 20-foot separation with no intervening combustibles or fire hazards.

  "Because the amount of in-situ combustibles is low in this area and early warning detection is provided, the probability of a fire which could damage both RHR valve conduits is low. We believe that the probability that this damage would occur in such a specific manner is also low. This combination of conditions provided reasonable assurance that a spurious operation of both valves in the RHR system is not likely to occur. Based on the above, the NRC staff concluded that the existing level of protection inside the containment provides fire protection equivalent to the technical requirements of Section III.G of Appendix R. Therefore, the exemption is granted."

- An exemption from 10 CFR 50, Appendix R, Section III.G.2, Pipe Area, Fire Zone 34Y: Exemption to requirement for automatic fire suppression system.

  "The in-situ combustible loading in this fire area is negligible, therefore, any postulated fire would involve transient combustible materials. Such a fire would most likely be of limited severity in a corridor area where little maintenance activities are performed. The installed early warning detection system, in conjunction with the one-hour fire barrier for the protection of two service water pump cables, and the greater than 20 feet separation of the decay heat pump cables provides reasonable assurance that one train of

components needed for safe shutdown will be maintained free of fire damage. Based on the above, the NRC staff concludes that the level of protection in this area is equivalent to that required by Section III.G of Appendix R. Therefore, the exemption is granted."

- An exemption from 10 CFR 50, Appendix R, Section III.G.2, Pipe Area, Fire Zone 40Y: Exemption to requirement for automatic fire suppression system.

  "Because there are no in-situ combustibles in this area, any postulated fire would involve transient combustible materials. Restricted access to this area via a vertical ladder makes the probability of a significant quantity of combustible transient materials accumulating low. A fire in this area would therefore be of limited severity and duration. The installed early warning detection system would be able to promptly detect incipient fire conditions, and the one-hour barrier will maintain the integrity of the cables until the fire brigade is able to respond and extinguish the fire. Although access to this area is restricted, the fire brigade should be capable of reaching this area within a few minutes after an alarm is received in the control room. This combination of alternative protective features provides reasonable assurance that one train of equipment necessary for safe shutdown will be maintained free of fire damage. The level of existing protection for this pipe area, in conjunction with the one-hour barrier, will provided a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R. Therefore, the exemption is granted."

- An exemption from 10 CFR 50, Appendix R, Section III.G.3, Lower North Piping Penetration Area, Fire Zone 53Y: Exemption to requirements for fixed fire suppression system and detection.

  "These fire zones represent a similar configuration, i.e., combustible loading is light, there is alternate shutdown capability, and manual fire suppression equipment is available. The low combustible loading in these areas ensures that safety related equipment in adjacent areas will not be threatened. The installation of a fixed fire suppression system will not significantly increase the level of fire protection in these areas. The existing fire protection, in conjunction with alternate shutdown capability in these areas, provides a level of fire protection equivalent to the technical requirements of Section III.G.3 of Appendix R. Therefore, the exemptions are granted."

- An exemption from 10 CFR 50, Appendix R, Section III.G.3, Yard Area Manholes 1MH09 and 1MH10: Exemption to requirements for fixed fire suppression system and detection.

  "These fire zones represent a similar configuration, i.e., combustible loading is light, there is alternate shutdown capability, and manual fire suppression equipment is available. The low combustible loading in these areas ensures that safety related equipment in adjacent areas will not be threatened. The installation of a fixed fire suppression system will not significantly increase the level of fire protection in these areas. The existing fire protection, in conjunction with alternate shutdown capability in these areas, provides a level of fire protection equivalent to the technical requirements of Section III.G.3 of Appendix R. Therefore, the exemptions are granted."

By letter dated May 11, 1983 (1CNA058303), the NRC also approved an exemption from 10 CFR 50, Appendix R, Section III.L, which requires a plant to be capable of reaching cold shutdown within 72 hours during a fire event coincident with a loss of offsite power. While the ANO-1 design can support this requirement, it is preferred to cool down the Reactor Coolant System slowly to prevent reactor vessel head void formation. This exemption permitted the ANO-1 plant 140 hours to achieve cold shutdown with respect to the aforementioned event. From the aforementioned SER:

"Without offsite power, the reactor coolant pumps cannot be operated and, therefore, the auxiliary pressurizer spray capability is lost. The licensee has indicated that the facility is unable to achieve cold shutdown within 72 hours because of the additional time required to cool and depressurize the reactor coolant system (RCS) without auxiliary pressurizer spray. The licensee provided a summary of a very conservative analysis which assumes no steam void formation in the upper reactor vessel (RV) head. This analysis, which was performed by Babcock and Wilcox (B&W), concludes that a minimum of 135 hours is needed to reach the decay heat removal system cut-in point of 291 psig and 280 °F. Void formation in the upper RV head is permitted by emergency procedures under controlled conditions that would sustain natural circulation in the primary system. Additionally, it is estimated that it will take approximately five hours to reduce the RCS temperature from 280 °F to 200 °F (cold shutdown) with the decay heat removal system in operation. Therefore, a total of approximately 140 hours will be required to reach cold shutdown without voiding the RV head. This cold shutdown condition can be achieved without the use of offsite power. If necessary, cold shutdown can be achieved in 72 hours; however, this procedure would permit flashing in the RV head. The licensee chose not to take credit for this procedure, but instead to provide a more conservative analysis based upon no flashing in the upper head."

"These scenarios are listed in their probability of occurrence. Only the last two would be considerations for this exemption request. Both of these cases can be accommodated; however, the option of reaching cold shutdown in 140 hours with no voiding formation in the upper head is preferable for overall plant safety.

Based upon this conservative approach of the licensee, together with the unlikeliness of the events that would require both cold shutdown and the inability to return offsite power within 72 hours as well as the availability of a less preferred method of controlled cooldown in less than 72 hours, if needed, we conclude that an approximate time of 140 hours is acceptable to achieve cold shutdown without offsite power. We therefore conclude that an exemption from the requirements of Section III.L to the extent that it requires that capability to achieve cold shutdown within 72 hours without offsite power should be granted."

By letter dated May 13, 1983 (0CNA058316), the NRC accepted the alternate shutdown capability and methods for ANO-1 and ANO-2 in the event of a fire in the control room, cable spreading room, or other critical area. From the aforementioned SER:

"The goals of reactivity control, inventory control, decay heat removal, and pressure control are met. The goal of process monitoring is only partially met in that no means of monitoring source range radioactive flux is provided. The goal of adequate support systems has been met. Based on our review, we conclude that the design proposed for Arkansas Nuclear Plant, Units 1 and 2 meets the requirements of Appendix R to 10 CFR Part 50 Items III.G.3 and III.L with respect to safe shutdown in the event of a fire, except where an exemption to the 72 hour shutdown requirement has been granted to ANO-1 and with the following exception:

1. *A source range flux monitoring capability electrically independent of the control room should be provided at the safety parameter display system for both units."*

This requirement was documented in NRC Inspection Report 50-313/87-14 50-368/87-14 dated September 30, 1987 (0CNA098716): *"Areas examined during the inspection included implementation of and compliance to the safe shutdown requirements of*

10 CFR 50, Appendix R.” “The following process monitoring instrumentation is available in the control room and on the safety parameter display system (SPDS) "Alternate Shutdown" display: Source Range Flux.”

During the period following the initial Appendix R submittal date, requirements continued to evolve, resulting in further Appendix R reanalysis. Based on this reanalysis, additional exemptions were requested in letters dated August 15, 1984 (0CAN088404), August 30, 1985 (0CAN088508), and October 29, 1987 (0CAN108710). The following exemptions were approved in the staff's SER (1CNA108806) dated October 26, 1988. The NRC basis for acceptability of each exemption is also included below.

- An exemption from 10 CFR 50, Appendix R, Section III.G.2.b due to a lack of 20 feet of separation free of intervening combustible materials between redundant shutdown-related systems in the diesel generator room exhaust fan outlets area (Fire Area B, Zones 1-E and 2-E).

  “The special circumstances of 10 CFR 50.12 apply in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. In this case the low fire loading, the absence of intervening combustibles, and the installation of the 3-hour rated fire doors between redundant trains, minimize the possibility of a fire in one train spreading and causing damage to the redundant train equipment. Thus the underlying purpose of the rule would be satisfied without requiring the 20 foot minimum separation distance free of intervening combustible material between the diesel generator room exhaust fan outlets.”

- An exemption from 10 CFR 50, Appendix R, Section III.G.2.b due to a lack of 20 feet of separation free of intervening combustible materials between redundant shutdown-related systems, the borated water storage tank (BWST) outlet valves in the radwaste processing area (Fire Area C, Zone 20-Y).

  “The special circumstances of 10 CFR 50.12 apply in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. In this case the low fire loading, the fire brigade response to the fire detection system control room alarm, and the 1-hour rated barrier on the cables for one of the two valves provides reasonable assurance that the redundant valve would be adequately protected. Additionally, local manual operation of the valves would be possible despite fire damage to electrical circuits. Thus the underlying purpose of the rule would be satisfied without requiring equipment separation.”

- An exemption from 10 CFR 50, Appendix R, Section III.G.2.b due to a lack of 20 feet of separation free of intervening combustible materials between redundant shutdown-related systems in the emergency feedwater (EFW) pump room (Fire Area C, Zone 38-Y).

  “The special circumstances of IC CFR 50.12 apply in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. In this case, the low fire loading, the automatic fire detection system combined with the timely response of the fire brigade, and the proposed installation of automatic fire suppression and fire wrapping committed to by the licensee, all provide assurance that the redundant safe shutdown equipment will be adequately protected. Thus, the underlying purpose of the rule would be satisfied without requiring the minimum of 20 feet of separation between redundant equipment.”

Although the above modifications were completed, in letter dated May 5, 2006 (0CNA050603), NRC Inspection Report 05000313/2006002 and 05000368/2006002 and Exercise of Enforcement Discretion, the NRC questioned the acceptability of the automatic fire suppression system around the turbine-driven EFW pump, in that a fusible head type system was installed. The NRC believed this was contrary to the requirements of NFPA 15 (1985 Edition). This non-cited violation was entered into the ANO Corrective Action Program (CR ANO-1-2005-0954). Entergy concluded that the arrangement was acceptable. The NRC closed Unresolved Issue (URI) 05000313/ 2005004-01 in letter dated May 5, 2006 (0CNA050603), based on ANO's intent to transition to NFPA 805 (enforcement discretion exercised). This issue is currently being tracked under CR-ANO-C-2006-00048, Corrective Action 18.

- An exemption from 10 CFR 50, Appendix R, Section III.G.2.c due to a lack of an automatic fire suppression system to protect redundant shutdown-related systems separated by a 1-hour fire barrier and protected by a fire detection system in the pipe area (Fire Area C, Zone 34-Y).

  "The special circumstances of 10 CFR 50.12 apply in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. In this case the low fire loading, the existing fire detection system combined with the timely response of the fire brigade, and the 1-hour rated barrier around the power cables for the B-train makeup pump, all provide assurance that the redundant safe shutdown equipment will be adequately protected. Thus the underlying purpose of the rule would be satisfied without requiring automatic fire suppression in this area."

- An exemption from 10 CFR 50, Appendix R, Section III.J due to a lack of 8-hour battery powered emergency lighting units on Elevation 317 feet and portions of the access paths to the steam pipe area on Elevation 404 feet, the intake structure, and diesel fuel storage vaults, all of which are areas required to be manned for safe shutdown.

  "The special circumstances of 10 CFR 50.12 apply in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. In this case the existing lighting is adequate. Thus the underlying purpose of the rule would be satisfied without requiring installation of emergency lighting."

- An exemption from 10 CFR 50, Appendix R, Section III.G.2 due to a lack of a complete three-hour fire-rated barrier between redundant level transmitters for the safety grade condensate storage tank (QCST) (Yard Area).

  "The special circumstances of 10 CFR 50.12 apply in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. In this case the absence of significant in-situ fire hazards, and the physical location and arrangement of the equipment provide assurance that the redundant level indication equipment would be adequately protected until the fire was brought under control by the fire brigade. Thus the underlying purpose of the rule would be satisfied without requiring a 3-hour fire-rated barrier between the redundant QCST level transmitters."

- An exemption from 10 CFR 50, Appendix R, Section III.O due to a lack of a reactor coolant pump oil collection system that is designed to withstand a safe shutdown earthquake (SSE) and sized to hold the oil from all reactor coolant pumps (RCPs).

  "The special circumstances of 10 CFR 50.12 apply in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. In this case the design of the reactor coolant pump lubricating systems and the oil collection systems meets certain criteria previously determined by the staff to be

acceptable for assuring adequate fire safety. Thus the underlying purpose of the rule would be satisfied without requiring the oil collection system to be seismically qualified and capable of holding the oil contained in all of the reactor coolant pumps."

- An exemption from 10 CFR 50, Appendix R, Section III.G.2.b due to a lack of an automatic fire suppression system to protect redundant emergency feedwater (EFW) pump cables (Fire Area C, Zones 20-Y and 34-Y).

  "The special circumstances of 10 CFR 50.12 apply in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. In this case the low fire loading, the spatial separation between redundant cable trains, and the automatic smoke detection system combined with the timely response of the fire brigade to the control room alarm, all provide assurance that the redundant safe shutdown equipment would be adequately protected until the fire is brought under control. Thus the underlying purpose of the rule would be satisfied without requiring an automatic fire suppression system."

3.0 TRANSITION PROCESS

3.1 Background

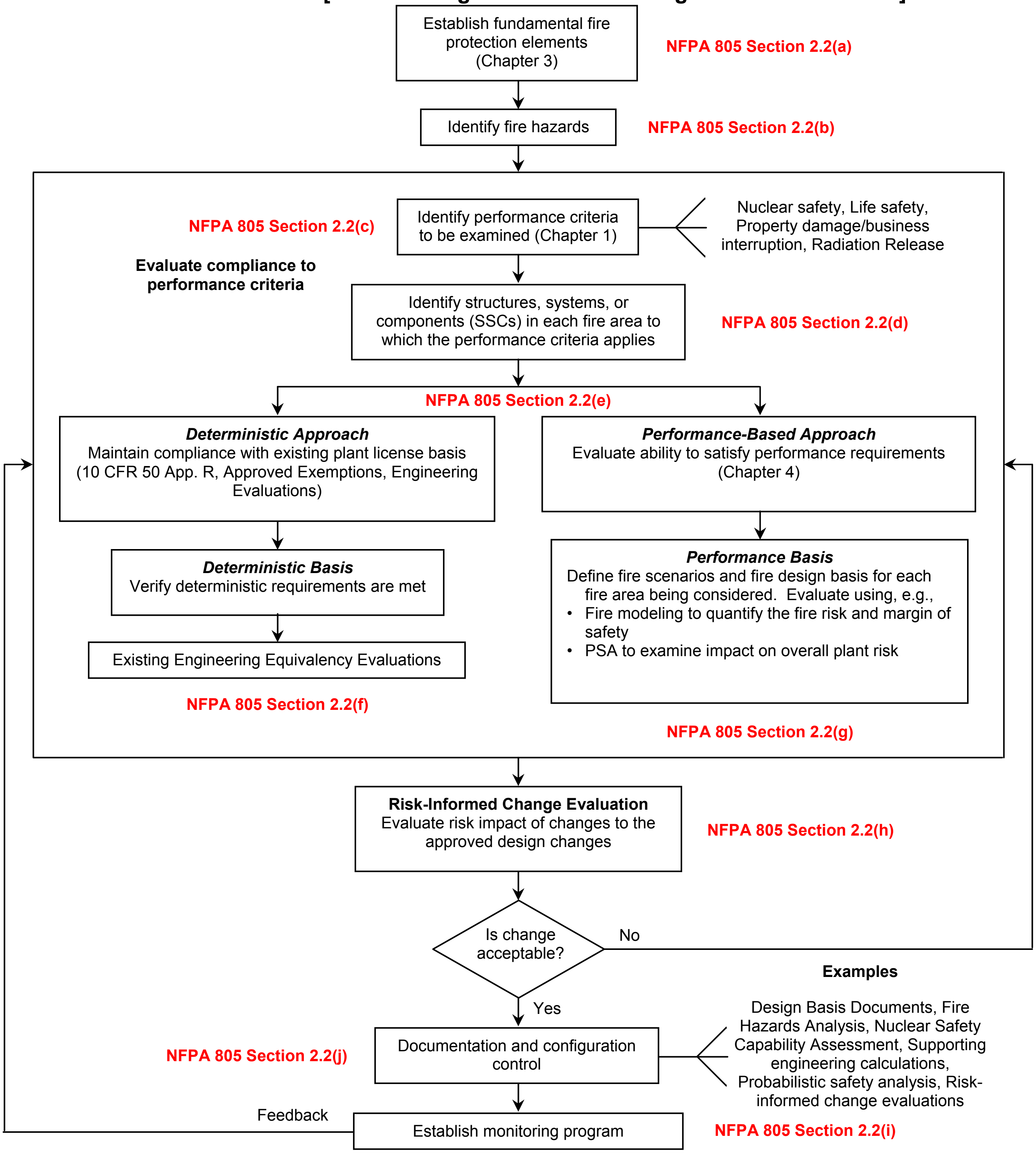
Section 4.0 of NEI 04-02 describes the process for transitioning from compliance with the current fire protection licensing basis to the new requirements of 10 CFR 50.48(c). NEI 04-02 contains the following steps:

1) Licensee determination to transition the licensing basis and devote the necessary resources to it;
2) Submit a Letter of Intent to the NRC stating the licensee's intention to transition the licensing basis in accordance with a tentative schedule;
3) Conduct the transition process to determine the extent to which the current fire protection licensing basis supports compliance with the new requirements and the extent to which additional analyses, plant and program changes, and alternative methods and analytical approaches are needed;
4) Submit a LAR;
5) Complete transition activities that can be completed prior to the receipt of the License Amendment;
6) Receive a Safety Evaluation; and
7) Complete implementation of the new licensing basis, including completion of modifications identified in Attachment S.

3.2 NFPA 805 Process

Section 2.2 of NFPA 805 establishes the general process for demonstrating compliance with NFPA 805. This process is illustrated in Figure 3-1. It shows that except for the fundamental fire protection requirements, compliance can be achieved on a fire area basis either by deterministic or RI-PB methods. Consistent with the guidance in NEI 04-02, ANO-1 has implemented the NFPA 805 Section 2.2 process by first determining the extent to which its current fire protection program supports findings of deterministic compliance with the requirements in NFPA 805. RI-PB methods are applied to the requirements for which deterministic compliance could not be shown.

Figure 3-1
NFPA 805 Process [NEI 04-02 Figure 3-1 based on Figure 2-2 of NFPA 805][2]



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[2] Note: 10 CFR 50.48(c) does not incorporate by reference Life Safety and Plant Damage/Business Interruption goals, objectives and criteria. See 10 CFR 50.48(c) for specific exceptions to the incorporation by reference of NFPA 805.

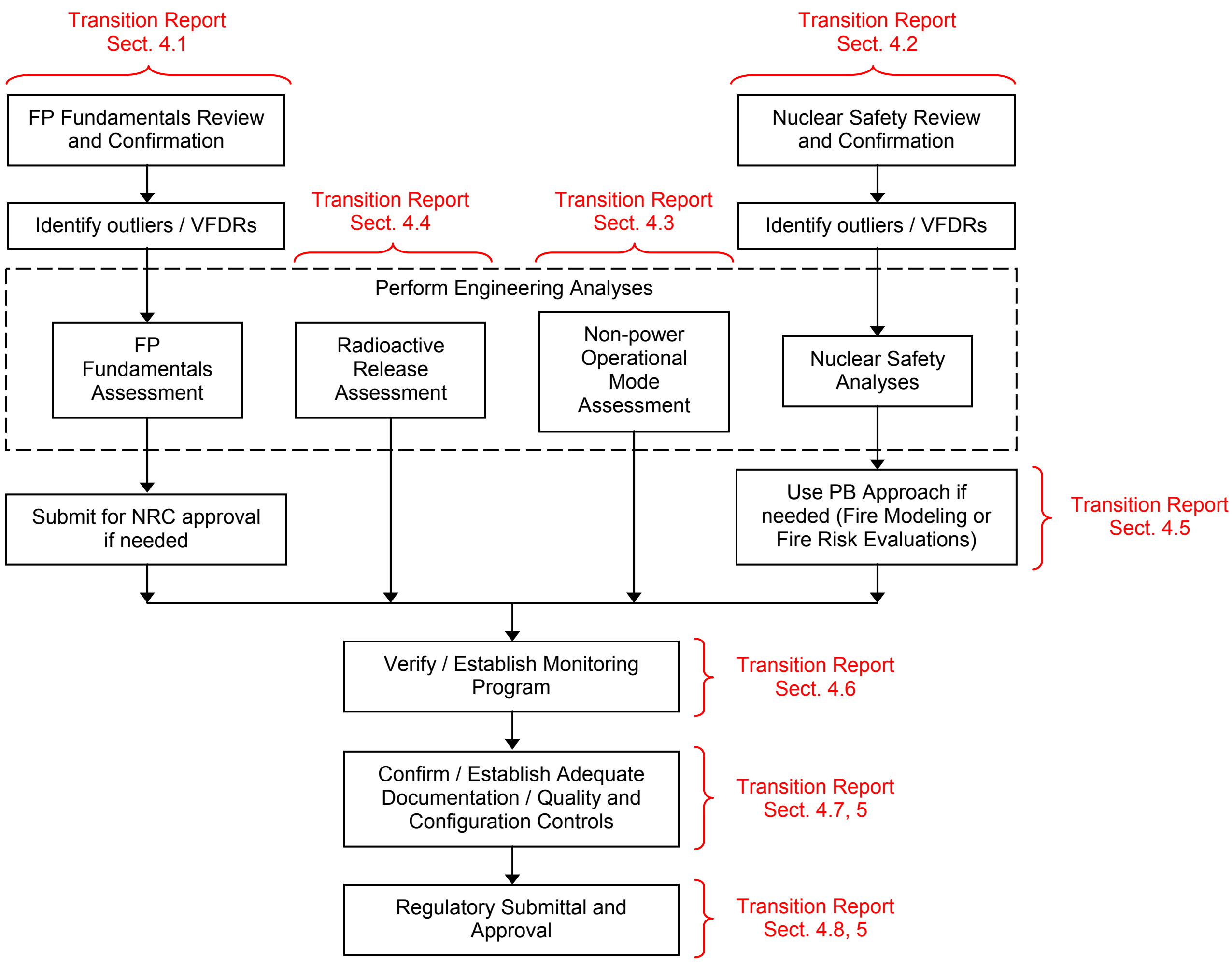
3.3 NEI 04-02 – NFPA 805 Transition Process

NFPA 805 contains technical processes and requirements for a RI-PB fire protection program. NEI 04-02 was developed to provide guidance on the overall process (programmatic, technical, and licensing) for transitioning from a traditional fire protection licensing basis to a new RI-PB method based upon NFPA 805, as shown in Figure 3-2.

Section 4.0 of NEI 04-02 describes the detailed process for assessing a fire protection program for compliance with NFPA 805, as shown in Figure 3-2.

Figure 3-2

Transition Process (Simplified) [based on NEI 04-02 Figure 4-1]



(VFDR - Variances from Deterministic Requirements)

3.4 NFPA 805 Asked Questions (FAQs)

The NRC has worked with NEI and two Pilot Plants (Oconee Nuclear Station and Harris Nuclear Plant) to define the licensing process for transitioning to a new licensing basis under 10 CFR 50.48(c) and NFPA 805. Both the NRC and the industry recognized the need for additional clarifications to the guidance provided in RG 1.205, NEI 04-02, and the requirements of NFPA 805. The NFPA 805 FAQ process was jointly developed by NEI and NRC to facilitate timely clarifications of NRC positions. This process is described in a letter from the NRC dated July 12, 2006, to NEI (ML061660105) and in Regulatory Issues Summary (RIS) 2007-19, "Process for Communicating Clarifications of Staff Positions Provided in RG 1.205 Concerning Issues Identified during the Pilot Application of NFPA Standard 805," dated August 20, 2007 (ML071590227).

Under the FAQ Process, transition issues are submitted to the NEI NFPA 805 Task Force for review, and subsequently presented to the NRC during public FAQ meetings. Once the NEI NFPA 805 Task Force and NRC reach agreement, the NRC issues a memorandum to indicate that the FAQ is acceptable. NEI 04-02 will be revised to incorporate the approved FAQs. This is an on-going revision process that will continue through the transition of NFPA 805 plants. Final closure of the FAQs will occur when future revisions of RG 1.205, endorsing the related revisions of NEI 04-02, are approved by the NRC. It is expected that additional FAQs will be written and existing FAQs will be revised as plants continue NFPA 805 transition after the Pilot Plant Safety Evaluations.

Attachment H contains the list of approved FAQs utilized by ANO-1 not yet incorporated into the endorsed revision of NEI 04-02. These FAQs have been used to clarify the guidance in RG 1.205, NEI 04-02, and the requirements of NFPA 805 and in the preparation of this LAR.

4.0 COMPLIANCE WITH NFPA 805 REQUIREMENTS

4.1 Fundamental Fire Protection Program and Design Elements

The Fundamental Fire Protection Program and Design Elements are established in Chapter 3 of NFPA 805. Section 4.3.1 of NEI 04-02 provides a systematic process for determining the extent to which the pre-transition licensing basis and plant configuration meet these criteria and for identifying the fire protection program changes that would be necessary for compliance with NFPA 805. NEI 04-02 Appendix B-1 provides guidance on documenting compliance with the program requirements of NFPA 805 Chapter 3.

4.1.1 Overview of Evaluation Process

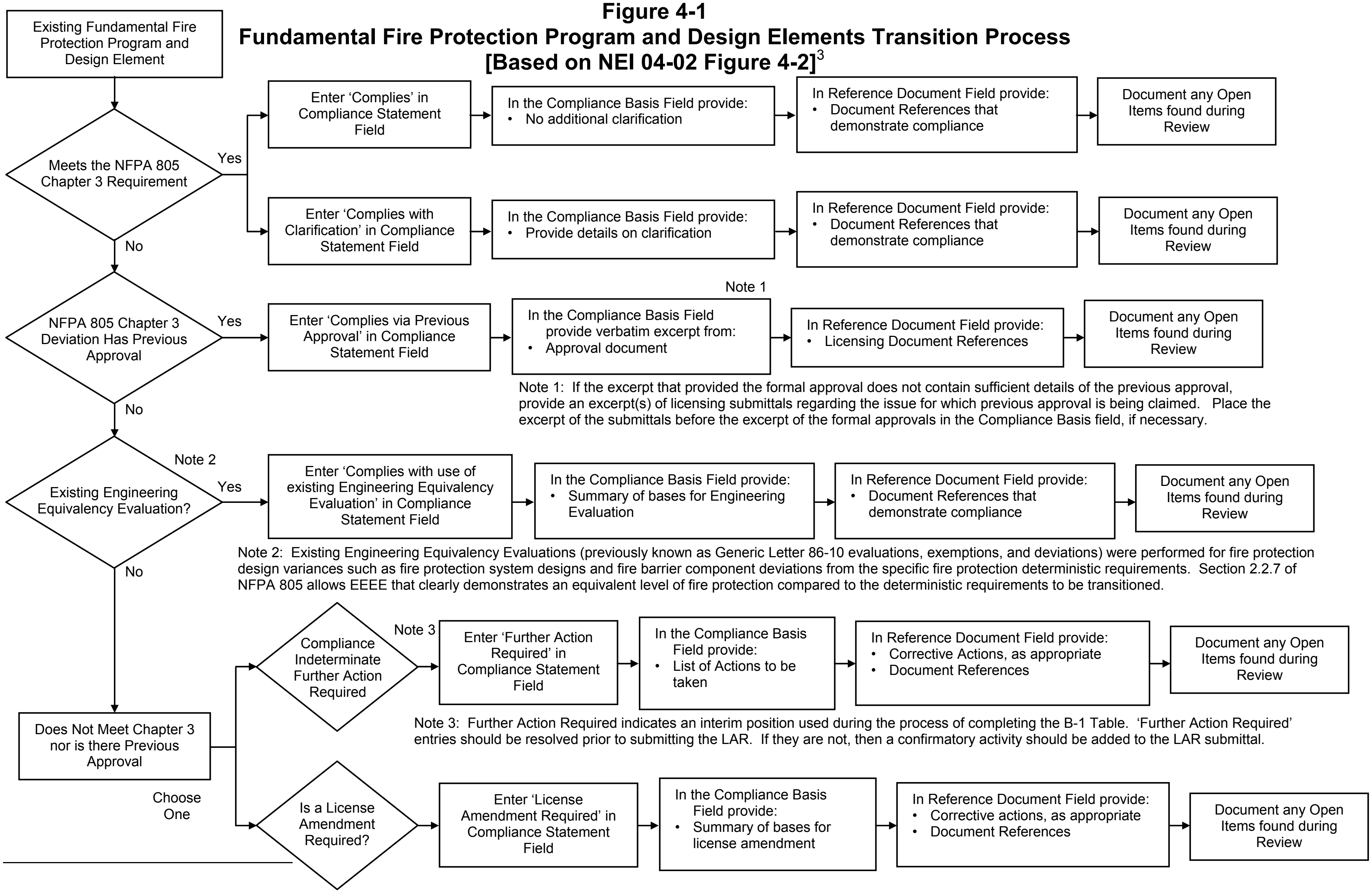
The comparison of the ANO-1 Fire Protection Program to the requirements of NFPA 805 Chapter 3 was performed and documented in Engineering Change (EC)-44138. The EC used the guidance contained in NEI 04-02, Section 4.3.1 and Appendix B-1 (see Figure 4-1).

Each section and subsection of NFPA 805 Chapter 3 was reviewed against the current fire protection program. Upon completion of the activities associated with the review, the following compliance statement(s) was used:

- Complies – For those sections/subsections determined to meet the specific requirements of NFPA 805.
- Complies with clarification – For those sections/subsections determined to meet the requirements of NFPA 805 with clarification.
- Complies by previous NRC approval – For those sections/subsections where the specific NFPA 805 Chapter 3 requirements are not met but previous NRC approval of the configuration exists.
- Complies with use of Existing Engineering Equivalency Evaluations (EEEEs) – For those sections/subsections determined to be equivalent to the NFPA 805 Chapter 3 requirements as documented by engineering analysis.
- Submit for NRC Approval – For those sections/subsections for which approval is sought in this LAR submittal in accordance with 10 CFR 50.48(c)(2)(vii). A summary of the bases of acceptability is provided (see Attachment L for details).

In some cases multiple compliance statements have been assigned to a specific NFPA 805 Chapter 3 section/subsection. Where this is the case, each compliance/compliance basis statement clearly references the corresponding requirement of NFPA 805 Chapter 3.

Figure 4-1
Fundamental Fire Protection Program and Design Elements Transition Process [Based on NEI 04-02 Figure 4-2][3]



[3] Figure 4-1 depicts the process used during the transition and therefore contains elements (i.e., open items) that represent interim resolutions. Additional detail on the transition of EEEEs is included in Section 4.2.2.

4.1.2 Results of the Evaluation Process

4.1.2.1 NFPA 805 Chapter 3 Requirements Met or Previously Approved by the NRC

Attachment A contains the NEI 04-02 Table B-1, Transition of Fundamental Fire Protection (FP) Program and Design Elements. This table provides the compliance basis for the requirements in NFPA 805 Chapter 3. Except as identified in Section 4.1.2.3, Attachment A demonstrates that the fire protection program for ANO-1 either:

- Complies directly with the requirements of NFPA 805 Chapter 3,
- Complies with clarification with the requirements of NFPA 805 Chapter 3,
- Complies through the use of existing engineering equivalency evaluations which are valid and of appropriate quality, or
- Complies with a previously NRC approved alternative to NFPA 805 Chapter 3 and therefore the specific requirement of NFPA 805 Chapter 3 is supplanted.

4.1.2.2 NFPA 805 Chapter 3 Requirements Requiring Clarification of Prior NRC Approval

NFPA 805 Section 3.1 states in part, "Previously approved alternatives from the fundamental protection program attributes of this chapter by the AHJ take precedence over the requirements contained herein." In some cases prior NRC approval of an NFPA 805 Chapter 3 program attribute may be unclear. Clarification of the design of the RCP Oil Collection system that meets the requirements of NFPA 805, Section 3.3.12(2), is provided in Attachment T.

4.1.2.3 NFPA 805 Chapter 3 Requirements Not Previously Approved by NRC

The following sections of NFPA 805 Chapter 3 are not specifically met nor do previous NRC approvals of alternatives exist:

3.2.3(1) – Approval is requested to utilize performance-based inspection, testing, and maintenance frequencies guidance for fire protection systems and features established in Electric Power Research Institute (EPRI) Technical Report TR-1006756, *Fire Protection Equipment Surveillance Optimization and Maintenance Guide,* Final Report, July 2003.

3.3.3 – Approval is requested for epoxy floor coverings at ANO that may not meet the NFPA 805 requirements for "interior finish."

3.3.5.1 – Approval is requested for wiring above suspended ceilings that may not comply with code requirements.

3.3.5.2 – Approval is requested for use of schedule 40 PVC for underground and embedded applications.

3.3.12(1) – Approval is requested for acceptability of oil misting from the reactor coolant pumps/motors.

3.5.3 – Approval is requested for continued use of existing electric fire pump motor and electric fire pump controller that were not UL Listed/Approved for fire pump service at the time of installation. Additionally, approval is requested for not meeting the requirements of NFPA 20 Sections 626a, 626d.e2, and 626d.e5 for the Cummins Diesel Engine controller, since vendor documents do not identify a certification for the batteries and do not identify the discharge rate of the lead acid batteries.

3.5.16 – Approval is requested for use of the fire protection water supply system to supply cooling loads on either unit, during both power operations and unit outages, provided firewater capability remains within limits.

The specific deviation and a discussion of how the alternative satisfies 10 CFR 50.48(c)(2)(vii) requirements are provided in Attachment L. ANO-1 requests NRC approval of these performance-based methods.

4.1.3 Definition of Power Block and Plant

Where used in NFPA 805 Chapter 3 the terms “Power Block” and “Plant” refer to structures that have equipment required for nuclear plant operations, such as Containment, Auxiliary Building, Service Building, Control Building, Fuel Building, Radioactive Waste, Water Treatment, Turbine Building, and intake structures or structures that are identified in the facility’s pre-transition licensing basis.

A list of plant structures was derived from a review of plant layout drawings and supplemented by plant walk downs in order to provide a complete listing of the structures in the owner controlled area. Each structure was reviewed to determine if it was required to meet the NFPA nuclear safety goal, meet the NFPA radioactive release goal, or be evaluated for other NFPA considerations. The structures identified as meeting the aforementioned guidance for the power block are listed in Attachment I.

4.2 Nuclear Safety Performance Criteria

The Nuclear Safety Performance Criteria are established in Section 1.5 of NFPA 805. Chapter 4 of NFPA 805 provides the methodology to determine the fire protection systems and features required to achieve the performance criteria outlined in Section 1.5. Section 4.3.2 of NEI 04-02 provides a systematic process for determining the extent to which the pre-transition licensing basis meets these criteria and for identifying any necessary fire protection program changes. NEI 04-02, Appendix B-2 provides guidance on documenting the transition of Nuclear Safety Capability Assessment Methodology and the Fire Area compliance strategies.

4.2.1 Nuclear Safety Capability Assessment Methodology

The (NSCA) Methodology review consists of four processes:

- Establishing compliance with NFPA 805 Section 2.4.2
- Establishing the Safe and Stable Conditions for the Plant
- Establishing Recovery Actions
- Evaluating Multiple Spurious Operations

The methodology for demonstrating reasonable assurance that a fire during Non-Power Operational (NPO) modes will not prevent the plant from achieving and maintaining the fuel in a safe and stable condition is an additional requirement of 10 CFR 50.48(c) and is addressed in Section 4.3.

4.2.1.1 Compliance with NFPA 805, Section 2.4.2

Overview of Process

NFPA 805 Section 2.4.2 Nuclear Safety Capability Assessment states:

"The purpose of this section is to define the methodology for performing a nuclear safety capability assessment. The following steps shall be performed:

(1) Selection of systems and equipment and their interrelationships necessary to achieve the nuclear safety performance criteria in Chapter 1

(2) Selection of cables necessary to achieve the nuclear safety performance criteria in Chapter 1

(3) Identification of the location of nuclear safety equipment and cables

(4) Assessment of the ability to achieve the nuclear safety performance criteria given a fire in each fire area"

The NSCA methodology review evaluated the existing post-fire Safe Shutdown Analysis (SSA) methodology against the guidance provided in NEI 00-01, Revision 1 (ML050310295), Chapter 3, "Deterministic Methodology," as discussed in Appendix B-2 of NEI 04-02. The methodology is depicted in Figure 4-2 and consisted of the following activities:

- Each specific section of NFPA 805 2.4.2 was correlated to the corresponding section of Chapter 3 of NEI 00-01, Revision 1. Based upon the content of the NEI 00-01 methodology statements, a determination was made of the applicability of the section to the station.
- The plant-specific methodology was compared to applicable sections of NEI 00-01 and one of the following alignment statements and its associated basis were assigned to the section:
    - Aligns
    - Aligns with intent
    - Not in Alignment
    - Not in Alignment, but Prior NRC Approval
    - Not in Alignment, but no adverse consequences

The comparison of the ANO-1 existing post-fire SSA methodology to NEI 00-01, Chapter 3 (NEI 04-02 Table B-2) was performed and documented in CALC-ANO1-FP-09-00024 (EC-30068), Rev. 1, "ANO-1 Transition NSCA Methodology."

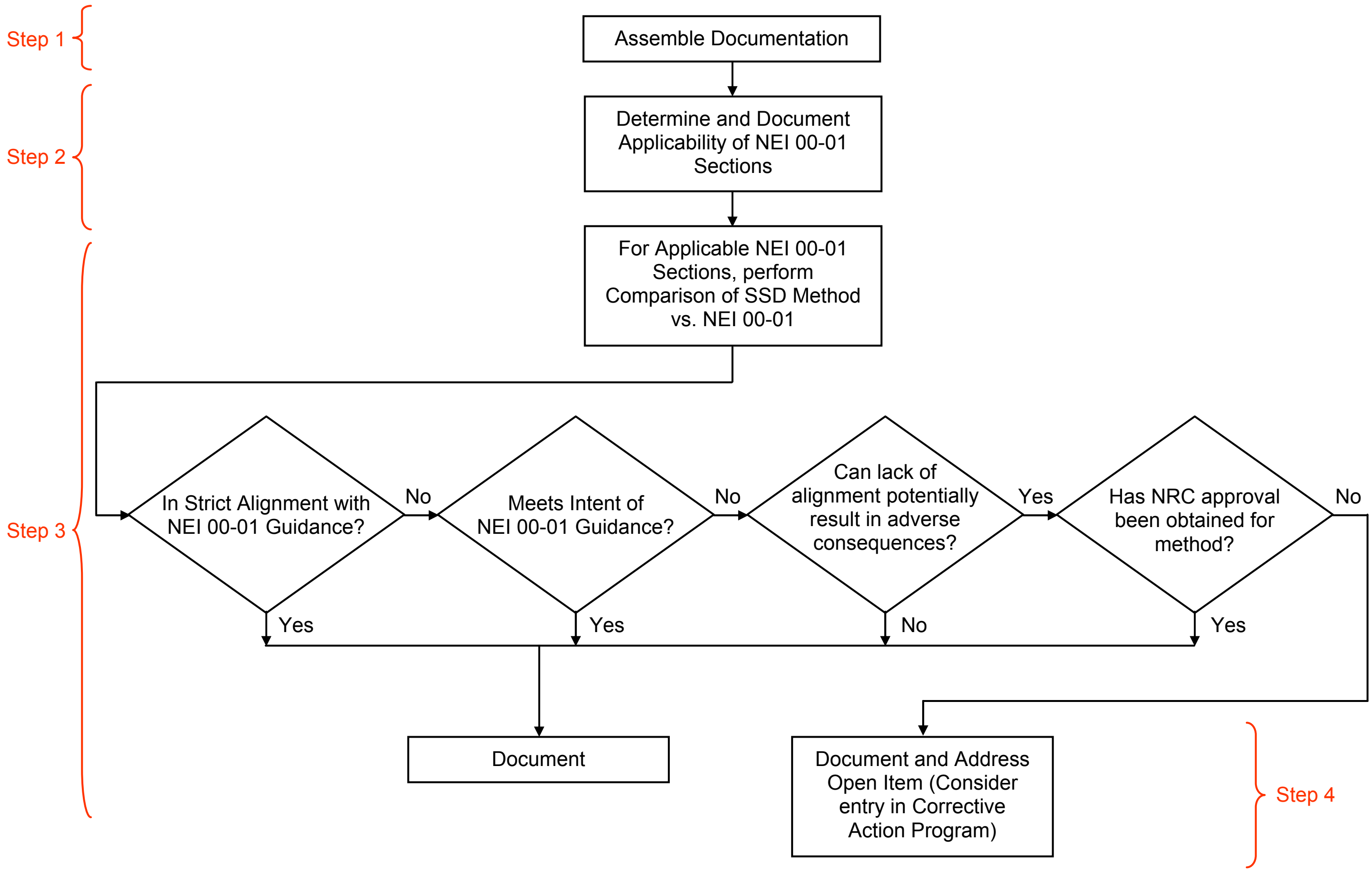
In addition, a review of NEI 00-01, Revision 2, (ML091770265) Chapter 3, was conducted to identify the substantive changes from NEI 00-01, Revision 1 that are applicable to an NFPA 805 fire protection program. This review was performed and documented in EC-40607, "NEI 00-01, Section 3, Rev. 1 to Rev. 2 Gap Analysis for NFPA 805 LAR."

Results from Evaluation Process

The method used to perform the existing post-fire SSA with respect to selection of systems and equipment, selection of cables, and identification of the location of equipment and cables, either meets the NRC endorsed guidance from NEI 00-01, Revision 1, Chapter 3 (as supplemented by the gap analysis) directly or met the intent of the endorsed guidance with adequate justification as documented in Attachment B.

Figure 4-2

Summary of Nuclear Safety Methodology Review Process (FAQ 07-0039)



SSD – Safe Shutdown

Comparison to NEI 00-01, Revision 2

An additional review was performed of NEI 00-01, Revision 2, Chapter 3, for specific substantive changes in the guidance from NEI 00-01, Revision 1 that are applicable to an NFPA 805 transition. The results of this review are summarized below:

- Post-fire manual operation of rising stem valves in the fire area of concern (NEI 00-01, Section 3.2.1.2)

  ANO does not credit Recovery Actions for valves located in the fire affected area.

- Analysis of open circuits on high voltage (e.g., 4.16 kV) ammeter current transformers (NEI 00-01, Section 3.5.2.1)

  The potential for an open circuit on a current transformer (CT) circuit resulting in secondary damage and possibly resulting in the occurrence of an additional fire has been evaluated and is documented in EC15217, “Current Transformer (CT) Open Circuit Concerns.”

- Analysis of control power for switchgear with respect to breaker coordination (NEI 00-01, Section 3.5.2.4)

  The Safe Shutdown Analysis (SSA) does not discuss breaker coordination in detail. Breaker coordination at ANO is addressed in CALC-85-E-0087-24, “Safe Shutdown Cable Analysis,” and described in Upper Level Document ULD-0-TOP-12, “ANO Unit 1 and 2 Electrical Protection/Coordination.” Details are addressed in a series of calculations.

- Evaluating proper-polarity DC faults on non-high low pressure interface components (NEI 00-01, Section 3.5.1.1)

  Section 4.2 of the cable analysis calculation CALC-85-E-0087-24, Revision 1, provides criteria for analysis of DC circuits at ANO. The relevant criteria are:

  4.2.2 All DC grounded and ungrounded circuits must consider any and all shorts, hot shorts, shorts to ground, and open circuits.

  4.2.3 All ungrounded circuits (both AC and DC) will be analyzed as if the circuit is grounded. This process accounts for the possibility of the circuit experiencing a ground fault as result of the fire.

  4.2.5 For ungrounded DC circuits, two hot shorts of the proper polarity (without grounding) causing spurious operation is not considered credible except for high-low pressure interface components.

  Criteria 4.2.2 and 4.2.3 provide the baseline requirements and the appropriate methodology to treat DC circuits as an equivalent AC circuit containing a bonded (grounded) neutral. This approach simplifies DC circuit analysis where only one fault or hot short is necessary to result in either functional failure or spurious actuation. An assumption of a grounded system also envelopes the condition where a separate cable fails due to fire induced damage, and creates half of the path necessary for a complete circuit should a single conductor of the subject cable fail.

  Criterion 4.2.5 is included to prevent elimination of spurious actuation of DC motor operated valves (MOVs) in high-low pressure applications due to the proper polarity hot short requirement. In pressure interface applications that are not high-low, spurious actuation of DC MOVs due to hot short in the power cables to the motor are excluded as non-credible. Spurious actuation of a DC MOV can only occur due to an intercable proper polarity short of both the armature and the field windings exclusive of other failures that would disable the power circuit. This is similar to a proper rotation 3-phase hot short in AC MOVs, but with the added complexity of a fourth proper polarity hot short.

4.2.1.2 Safe and Stable Conditions for the Plant

Overview of Process

The nuclear safety goals, objectives and performance criteria of NFPA 805 allow more flexibility than the previous deterministic programs based on 10 CFR 50 Appendix R and NUREG-0800, Section 9.5-1 (and NEI 00-01, Chapter 3) since NFPA 805 only requires the licensee to maintain the fuel in a safe and stable condition rather than achieve and maintain cold shutdown.

NFPA 805, Section 1.6.56, defines Safe and Stable Conditions as follows

> *"For fuel in the reactor vessel, head on and tensioned, safe and stable conditions are defined as the ability to maintain Keff <0.99, with a reactor coolant temperature at or below the requirements for hot shutdown for a boiling water reactor and hot standby for a pressurized water reactor. For all other configurations, safe and stable conditions are defined as maintaining Keff <0.99 and fuel coolant temperature below boiling."*

The nuclear safety goal of NFPA 805 requires *"...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"* without a specific reference to a mission time or event coping duration.

For the plant to be in a safe and stable condition, it may not be necessary to perform a transition to cold shutdown as currently required under 10 CFR 50, Appendix R. Therefore, the unit may remain at or below the temperature defined by a hot standby / hot shutdown plant operating state for the event.

Results

Based on the NFPA 805 Nuclear Safety Capability Assessment Methodology (Table B-2), the NFPA 805 licensing basis for ANO-1 is to shutdown the reactor and maintain the reactor in a hot standby condition (defined as Mode 3, K_{eff} < 0.99, RCS temperature ≥ 280 °F) following any fire occurring with the reactor operating at power. This NSCA Methodology evaluation compares the NRC endorsed process in Chapter 3 of NEI 00-01, Revision 1, in accordance with NEI 04-02, Revision 2, requirements.

Demonstration of the Nuclear Safety Performance Criteria for safe and stable conditions was performed in two analyses.

- *At-Power analysis, <u>Mode 1</u> through achieving and maintaining <u>Mode 3</u>. This analysis is discussed in Section 4.2.4.*
- *Non-Power analysis, which includes <u>Mode 4</u> and <u>below</u>. This analysis is discussed in Section 4.3.*

Recovery actions (including defense-in-depth recovery actions) are subjected to a feasibility review. This review is conducted in accordance with the NRC endorsed guidance in NEI 04-02, Revision 2.

The functions addressed in the NFPA 805 Nuclear Safety Capability Assessment Methodology (Table B-2) are important to post-fire safe shutdown and generally include, but are not limited to the following:

- Reactivity Control
- Pressure Control Systems
- Inventory Control Systems
- Decay Heat Removal Systems
- Process Monitoring
- Support Systems
    - Electrical Systems
    - Emergency Diesel Generator Fuel Oil
    - Cooling Systems

The ‘At Power’ safe shutdown analysis postulates a single fire occurring at 100% power and provides a listing of conflicts that may impact the assured success path to meet a particular nuclear safety performance goal. The ‘At Power’ safe and stable strategy includes entry into hot standby (Mode 3) and stops prior to the point of manually initiating a cooldown. Safe and stable conditions in Mode 3 may continue long term as described below.

<u>Reactivity Control</u>

Adequate shutdown margin (SDM) post-trip is provided by the Reactor Protection System ensuring insertion of the control rods. The control rod drives (CRDs) require no motive force or electrical power to fulfill their safety function to insert into the core. No addition of boric acid solution is required to support post-trip hot standby conditions and a K_{eff} of < 0.99. However, borated water can be added to the RCS to increase the SDM, as needed, from the Boric Acid Addition Tank (BAAT) or the Borated Water Storage Tank (BWST).

Adequate SDM in support of a plant cooldown to cold shutdown (Mode 5) is assured using the BAAT or BWST aligned to the High Pressure Injection (HPI) pump (makeup pump) suction.

<u>Pressure Control Systems</u>

RCS pressure is maintained by controlling the rate of makeup to the RCS and/or use of Pressurizer high point vents and spray. If Reactor Coolant Pumps (RCPs) are secured, the HPI Pumps provide an auxiliary spray path to support Pressurizer pressure reductions. The two redundant banks of proportional heaters and the auxiliary spray isolation valve are safety-related, vital-powered components. Although utilization of the Pressurizer heaters and/or auxiliary spray reduces operator burden, neither component is required to provide adequate pressure control. Pressure reductions can be made by allowing the RCS to cool/shrink, thus reducing pressurizer level/pressure. Pressurizer vents, hot leg vents, and reactor head vents may also be available, if necessary, to reduce Pressurizer (RCS) pressure. Pressure increases can be made by initiating HPI to maintain Pressurizer level/pressure. Manual control of the related pumps is acceptable.

Inventory Control Systems

Reactor Coolant System Inventory

Inventory makeup to the RCS is only required to account for expected RCS leakage, RCS shrinkage, and RCP seal controlled bleed-off. ANO-1 has design features and procedures to ensure that an adequate source of borated inventory is maintained for RCS inventory control, with regard to long term Mode 3 operations, and to support cooldown to Mode 5 utilizing the Makeup and Purification System, i.e., makeup and letdown. The HPI pumps, taking suction from the BWST, can also be used to control RCS level. The significant volume of borated water available minimizes any concerns with regard to maintaining the fuel in the reactor vessel in a safe and stable condition during or following a fire event.

Spent Fuel Pool (SFP) Inventory

Makeup to the SFP can be supplied by the BAAT, BWST, demineralized water, the Service Water (SW) system from Lake Dardanelle, or from excess RCS water from Clean Waste Receiver Tank. Some of these sources are aligned from different plant locations such that a fire event will not prevent makeup to the SFP. The various sources available minimize any concerns for maintaining the fuel in the SFP in a safe configuration during or following a fire event.

Decay Heat Removal Systems

Decay heat removal is accomplished using forced or natural circulation via the Steam Generators (SGs) in Modes 3 and 4. Upon entry into Mode 3, Emergency Feedwater (EFW) will automatically start or can be manually placed in service (from the Control Room or locally) and will provide secondary makeup water to the SGs (only one SG is required to remove decay heat from the RCS), with pressure control provided by the Atmospheric Dump Valves (ADVs) or the Main Steam Safety Valves (MSSVs).

When RCS pressure and temperature requirements are met, the Decay Heat Removal (DHR) system is placed in service to continue decay heat removal through Mode 4 (hot shutdown) and into Mode 5 (cold shutdown).

Based on the above, long term safe and stable conditions can be maintained with forced or natural circulation via the SGs. Cooldown to Mode 5 may be performed, if desired, and further long term core cooling established via the DHR system. The DHR system will maintain the fuel in the reactor vessel in a safe and stable condition via one of two DHR pumps and respective SW-cooled heat exchanger.

Emergency Feedwater

Mode 3 conditions can be maintained via forced or natural circulation supported by steaming from one or both SGs. A qualified Condensate Storage Tank (QCST) provides a source of condensate grade water to the ANO-1 EFW pumps and, as needed, the ANO-2 EFW pumps. The ANO-1 EFW system also has direct access to a non-qualified CST. ANO-2 also maintains two non-Q CSTs containing condensate grade water. Valves can be manipulated to transfer water between ANO-2 and ANO-1, if needed. In addition to the EFW pumps, a new Auxiliary Feedwater (AFW) pump is planned for installation as part of the ANO-1 transition to NFPA 805. The new pump will be capable of supplying feedwater to either SG and includes a local control panel with applicable instrumentation (see Attachment S). The ANO-1 Technical Specification

(TS) requirements establish a minimum volume of available condensate that ensures ANO-1 can be supplied sufficient EFW to maintain Mode 3 conditions for 30 minutes (minimum) and then transition to Mode 4. However, the other aforementioned tanks normally contain sufficient volume that would support maintaining Mode 3 conditions for a prolonged period of time. In addition, all tanks can receive makeup from the onsite Mobile Water Treatment Facility and the city water supply.

Should condensate sources be exhausted, the ANO-1 EFW pump suctions can be aligned to the SW system (Lake Dardanelle) as an indefinite supply of cooling water. The SW system can also be aligned to/from the Emergency Cooling Pond (ECP) should Lake Dardanelle become unavailable for any reason. Any of these alignments can be manually performed from the Control Room or locally. The ECP is designed to provide the heat sink capability for the SW system for up to 30-days (ANO-1 SAR Section 9.3.4.2). Based on the above, the fuel in the reactor vessel will be maintained in a safe and stable condition during or following a fire event.

<u>Process Monitoring</u>

The instrumentation selected is based on the guidance of NRC Information Notice 84-09 and NRC Regulatory Guide 1.189, which identify the minimum monitoring capability considered necessary for a pressurized water reactor (PWR). Instrumentation is powered from buses that provide power directly from station vital batteries or from Emergency Diesel Generators (EDGs). Battery capacity is maintained via battery chargers powered from EDGs (or offsite power, if available).

<u>Support Systems</u>

Electrical Systems

The AC and DC distribution systems are credited in order to meet fire protection performance goals and functions. The safeguards 4160 V buses can either be aligned to the EDGs, the Alternate AC Diesel Generator (AACDG), or available offsite power sources.

Emergency Diesel Generator Fuel Oil

A source of fuel oil is required for long term reliance on the EDGs. A non-qualified bulk fuel oil storage tank supplies fuel oil to four underground safety-related EDG storage tanks (one tank per EDG, two EDGs for ANO-1 and two for ANO-2). Each ANO-1 underground storage tank supplies a fuel oil day tank associated with the respective EDG. Fuel oil supplies can be cross-connected between ANO-1 and ANO-2, and between EDGs, if needed. The bulk tank also supplies fuel oil to the non-qualified AACDG, sometimes referred to as the station blackout diesel.

A or B EDGs — The capacity of one safety related EDG fuel oil tank plus the capacity of the respective fuel oil day tank will support 3.5 days of operation for one EDG during an extended loss of offsite power condition at full rated load. The mission time assumes post-accident conditions with electrical loads significantly greater than those expected to support a fire event with no concurrent design basis accident (DBA).

AACDG The AACDG has a fuel oil day tank to initially supply the AACDG operation pending fuel transfer. Assuming the bulk fuel oil storage tank (described above) is maintained at minimum level, sufficient fuel oil is available for the AACDG to run at full load for a minimum of 4.5 days. The AACDG acts as a backup to one or both ANO units should EDGs fail for any reason.

The onsite fuel oil capacity is sufficient to operate the EDGs or AACDG for longer than the time that would be necessary to replenish the onsite supply from outside sources.

Cooling Systems

Active heating, ventilation, and air conditioning (HVAC) systems are required for limited plant areas, which include the Unit 1 Control Room, EDG Rooms, and the SPDS Room.

Based on the above, sufficient support systems will remain available to ensure the fuel in the reactor vessel will be maintained in a safe and stable condition during or following a fire event.

Summary

The fire brigade will respond to fire events within the Protected Area boundary in accordance with procedures, thus mitigating the overall impact of the event. In addition, any fire or explosion onsite affecting Engineered Safety Features (ESF) systems will result in an Emergency Class (EC) declaration of Alert or higher, which requires Emergency Response Organization (ERO) activation. The ERO will assist the Control Room personnel with implementation of the longer term actions necessary to maintain the fuel in a safe and stable configuration. Following plant stabilization in Mode 3 (assuming the fire required a unit shutdown), assessment and repair activities would commence to restore plant equipment or replenish supplies needed to support long term Mode 3 operation, RCS cooldown, or reactor restart. ERO resources will be available to assist the Control Room in fire damage assessment and establishing multiple success paths.

The ‘At Power’ safe and stable strategy presents no adverse impact on risk due to the following considerations:

- Procedures exist to address loss of power and other loss of equipment that may result from a fire event
- The ERO will be activated for fires that could affect one or more Engineered Safety Features equipment trains to provide site technical support
- Compensatory measures and recovery plans can be developed based on the fire damage scenario

The transition for ANO-1 to a new NFPA 805 fire protection licensing basis under 10 CFR 50.48(c) per NEI 04-02 requires that the licensee perform an engineering analysis to assess the impact of fires occurring in all operational modes, including non-power operations (NPO). The ‘Non-Power’ analysis strategy is intended to prevent fires from occurring. For all non-power modes, the equipment required to demonstrate key safety functions are identified using a pinch-point analysis. The ‘Non-Power’ safe and stable strategy includes cooldown initiating from hot standby (Mode 3) through Modes 4, 5, 6 and defueled (i.e., no-mode), and places DHR in service for long term cooling capability (see Attachment D).

The balance of ‘At Power’ and ‘Non-Power’ strategies meets the definition of nuclear safety goal of NFPA 805, Section 1.3.1, in that “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.”

4.2.1.3 Establishing Recovery Actions

Overview of Process

NEI 04-02 and RG 1.205 suggest that a licensee submit a summary of its approach for addressing the transition of operator manual actions (OMAs) as recovery actions in the LAR (RG 1.205, Regulatory Position 2.2.1 and NEI-04-02, Section 4.6). As a minimum, NEI 04-02 suggests that the assumptions, criteria, methodology, and overall results be included for the NRC to determine the acceptability of the licensee’s methodology.

The discussion below provides the methodology used to transition pre-transition OMAs and to determine the population of post-transition recovery actions. This process is based on FAQ 07-0030 (ML110070485) and consists of the following steps:

Step 1: Clearly define the primary control station(s) and determine which pre-transition OMAs are taken at primary control station(s) (Activities that occur in the Main Control Room are not considered pre-transition OMAs). Activities that take place at primary control station(s) or in the Main Control Room are not recovery actions, by definition.

Step 2: Determine the population of recovery actions that are required to resolve VFDRs (to meet the risk acceptance criteria or maintain a sufficient level of defense-in-depth).

Step 3: Evaluate the additional risk presented by the use of recovery actions required to demonstrate the availability of a success path

Step 4: Evaluate the feasibility of the recovery actions

Step 5: Evaluate the reliability of the recovery actions

Results

The review results are documented in EC-27717, “ANO1 Fire Area Risk Evaluations for Transition to NFPA 805.” Refer to Attachment G for the detailed evaluation process and summary of the results from the process.

4.2.1.4 Evaluation of Multiple Spurious Operations

NEI 04-02 suggests that a licensee submit a summary of its approach for addressing potential fire-induced MSOs for NRC review and approval. As a minimum, NEI 04-02 suggests that the summary contain sufficient information relevant to methods, tools, and acceptance criteria used to enable the NRC to determine the acceptability of the licensee’s methodology. The methodology utilized to address MSOs for ANO-1 is summarized below.

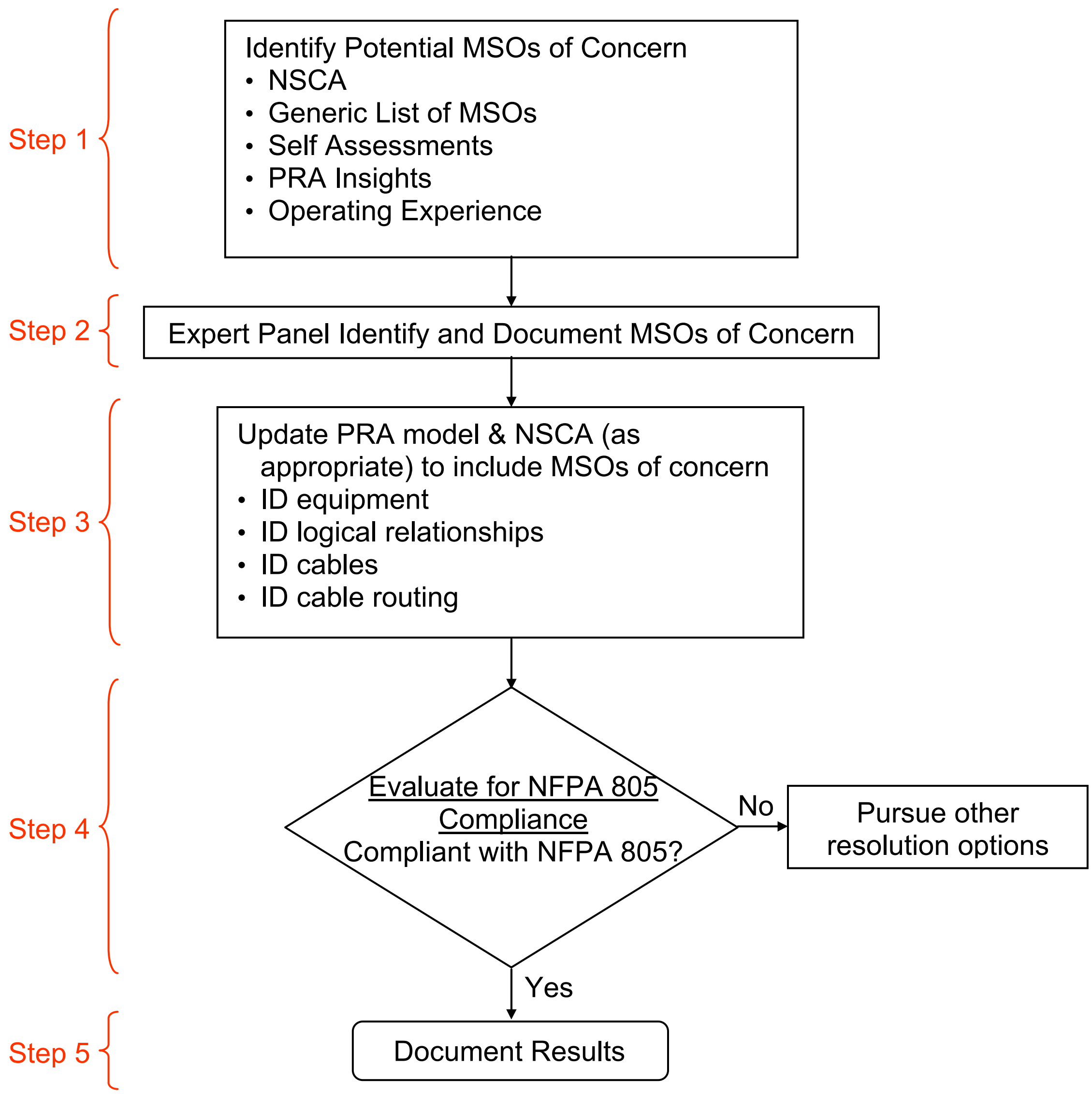
As part of the NFPA 805 transition project, a review and evaluation of ANO-1 susceptibility to fire-induced MSOs was performed. The process was conducted in accordance with NEI 04-02 and RG 1.205, as supplemented by FAQ 07-0038, Revision 3 (ML110140242). The pressurized water reactor (PWR) Generic MSO list in Revision 2 of NEI 00-01, dated May, 2009, was utilized.

The approach outlined in Figure 4-3 (based on Figure XX from FAQ 07-0038) is one acceptable method to address fire-induced MSOs. This method used insights from the Fire PRA developed in support of transition to NFPA 805 and consists of the following:

- Identifying potential MSOs of concern.
- Conducting an expert panel to assess plant specific vulnerabilities (e.g., per NEI 00-01, Revision 1 Section F.4.2).
- Updating the Fire PRA model and existing post-fire NSCA to include the MSOs of concern.
- Evaluating for NFPA 805 Compliance.
- Documenting Results.

This process is intended to support the transition to a new licensing basis. Post-transition changes would use the RI-PB change process. The post-transition change process for the assessment of a specific MSO would be a simplified version of this process, and may not need the level of detail shown in the following section (e.g., an expert panel may not be necessary to identify and assess a new potential MSO; identification of new potential MSOs may be part of the plant change review process and/or inspection process).

Figure 4-3
Multiple Spurious Operations – Transition Resolution Process
(Based on FAQ 07-0038)



Results

Refer to Attachment F for the process used and the results.

4.2.2 Existing Engineering Equivalency Evaluation Transition

Overview of Evaluation Process

The EEEEs that support compliance with NFPA 805 Chapter 3 or Chapter 4 (both those that existed prior to the transition and those that were created during the transition) were reviewed using the methodology contained in NEI 04-02. The methodology for performing the EEEE review included the following determinations:

- The EEEE is not based solely on quantitative risk evaluations,
- The EEEE is an appropriate use of an engineering equivalency evaluation,
- The EEEE is of appropriate quality,
- The standard license condition is met,
- The EEEE is technically adequate,
- The EEEE reflects the plant as-built condition, and
- The basis for acceptability of the EEEE remains valid

In accordance with the guidance in RG 1.205, Regulatory Position 2.3.2, and NEI 04-02, as clarified by FAQ 07-0054, "Demonstrating Compliance with Chapter 4 of NFPA 805," EEEEs that demonstrate that a fire protection system or feature is "adequate for the hazard" are summarized in the LAR as follows:

- If not requesting specific approval for "adequate for the hazard" EEEEs, then the EEEE should be referenced where required and a brief description of the evaluated condition should be provided.
- If requesting specific NRC approval for "adequate for the hazard" EEEEs, then EEEE should be referenced where required to demonstrate compliance and a detailed summary, including sufficient detail to allow the NRC staff to evaluate the EEEE, should be provided. At a minimum, the level of detail is expected to include: (1) a summary of each condition, (2) a summary of the evaluation of each condition, and (3) a summary of the resolution of each condition.

In all cases, the reliance on EEEEs to demonstrate compliance with NFPA 805 requirements should be documented in the LAR.

Results

The review results for EEEEs are documented in EC-31053, "NFPA 805 Existing Engineering Evaluation Transition."

In accordance with the guidance provided in RG 1.205, Regulatory Position 2.3.2, and NEI 04-02, as clarified by FAQ 07-0054, "Demonstrating Compliance with Chapter 4 of NFPA 805," EEEEs used to demonstrate compliance with Chapters 3 and 4 of NFPA 805 are referenced in the Attachments A and C as appropriate.

In addition, none of the transitioning EEEEs require NRC approval.

4.2.3 Licensing Action Transition

The existing licensing actions (exemption requests and safety evaluations) review was performed in accordance with NEI 04-02. The methodology for the licensing action review included the following:

- Determination of the bases for acceptability of the licensing action.
- Determination that these bases for acceptability are still valid and required for NFPA 805.

Results

Attachment K contains the detailed results of the Licensing Action Review. Licensing actions identified as required post-transition will be transitioned into the NFPA 805 fire protection program. These licensing actions are considered compliant under 10 CFR 50.48(c).

The following licensing action will be transitioned into the NFPA 805 fire protection program as previously approved (NFPA 805 Section 2.2.7). However, clarification of prior approval is requested for this licensing action:

- Appendix R Exemption 19, RCP Oil Collection System, Not Meeting III.O Criteria, NRC approval letter 1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988

The discussion of the prior approval, including appropriate reference documents, is provided in Attachment T.

The following licensing actions are no longer necessary and will not be transitioned into the NFPA 805 fire protection program:

- Appendix R Exemption 01, FA-N, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 02, FA-N, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 03, FA-N, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 04, FA-MH04 and FA-MH06, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This exemption is no longer required under the new licensing basis because the cabling has been modified such that each manhole contains redundant cabling for the swing Service Water pump.

- Appendix R Exemption 05, FZ 20-Y, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 06, FZ 20-Y, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 07, FZ 32-K and FZ 33-K, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 08, FZ 34-Y, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 09, FZ 40-Y, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 10, FZ 53-Y Not Meeting III.G.3 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 11, FZ 1MH09 and 1MH10, Not Meeting III.G.3 Criteria, approval letter 0CNA038328 dated March 22, 1983

  This Fire Area was transitioned using updated analyses regarding where a loss of offsite power can occur; therefore, this exemption is no longer required.

- Appendix R Exemption 12, Not Meeting III.L Criteria, approval letter 1CNA058303 dated May 11, 1983

  This exemption is no longer required because NFPA 805 does not require the plant to be capable of reaching cold shutdown within 72 hours during a fire event coincident with a loss of offsite power.

- Appendix R Exemption 13a, FZ 1-E, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

  This Fire Area was transitioned using updated analyses on where a loss of offsite power can occur. This exemption is no longer required.

- Appendix R Exemption 13b, FZ 2-E, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

  This Fire Area was transitioned using updated analyses on where a loss of offsite power can occur. This exemption is no longer required.

- Appendix R Exemption 14, FZ 20-Y, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 15, FZ 38-Y, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 16, FZ 34-Y, Not Meeting III.G.2.c Criteria, approval letter 1CNA108806 dated October 26, 1988

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 17, FZ 4-EE and Yard Area, Not Meeting III.J Criteria, approval letter 1CNA108806 dated October 26, 1988

  This exemption is no longer required because NFPA 805 does not require 8-hour battery backed emergency lighting.

- Appendix R Exemption 18, Yard Area, Not Meeting III.G.2 Criteria, approval letter 1CNA108806 dated October 26, 1988

  This Fire Area was found to be deterministically compliant; therefore, this exemption is no longer required under the new licensing basis.

- Appendix R Exemption 20, FZ 20-Y and 34-Y, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

  This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Since these exemptions are either compliant with 10 CFR 50.48(c) or no longer necessary, in accordance with the requirements of 10 CFR 50.48(c)(3)(i), ANO-1 requests that the exemptions listed in Attachment K, with the exception of Exemption 19 which is being transitioned as previously described, be rescinded as part of the LAR process. It is Entergy's understanding that implicit in the superseding of the current license condition, all prior fire protection program Safety Evaluation Reports and commitments will be superseded in their entirety. See Attachment O, Orders and Exemptions.

4.2.4 Fire Area Transition

Overview of Evaluation Process

The Fire Area Transition (NEI 04-02 Table B-3) was performed using the methodology contained in NEI 04-02 and FAQ 07-0054. The methodology for performing the Fire Area Transition, depicted in Figure 4-4, is outlined as follows:

Step 1 - Assembled documentation. Gathered industry and plant-specific fire area analyses and licensing basis documents.

Step 2 – Documented fulfillment of nuclear safety performance criteria.

- Assessed accomplishment of nuclear safety performance goals. Documented the method of accomplishment, in summary level form, for the fire area.
- Documented evaluation of effects of fire suppression activities. Documented the evaluation of the effects of fire suppression activities on the ability to achieve the nuclear safety performance criteria.
- Performed licensing action reviews. Performed a review of the licensing aspects of the selected fire area and document the results of the review. See Section 4.2.3.
- Performed existing engineering equivalency evaluation reviews. Performed a review of existing engineering equivalency evaluations (or create new evaluations) documenting the basis for acceptability. See Section 4.2.2.
- Pre-transition Operator Manual Action (OMA) reviews. Performed a review of pre-transition OMAs to determine those actions taking place outside of the main control room or outside of the primary control station(s). See Section 4.2.1.3.

Step 3 – VFDR Identification and characterization and resolution considerations. Identified variances from the deterministic requirements of NFPA 805, Section 4.2.3. Documented variances as either a separation issue or a degraded fire protection system or feature. Developed VFDR problem statements to support resolution.

Step 4 – Performance-Based evaluations (Fire Modeling or Fire Risk Evaluations) - see Section 4.5.2 for additional information.

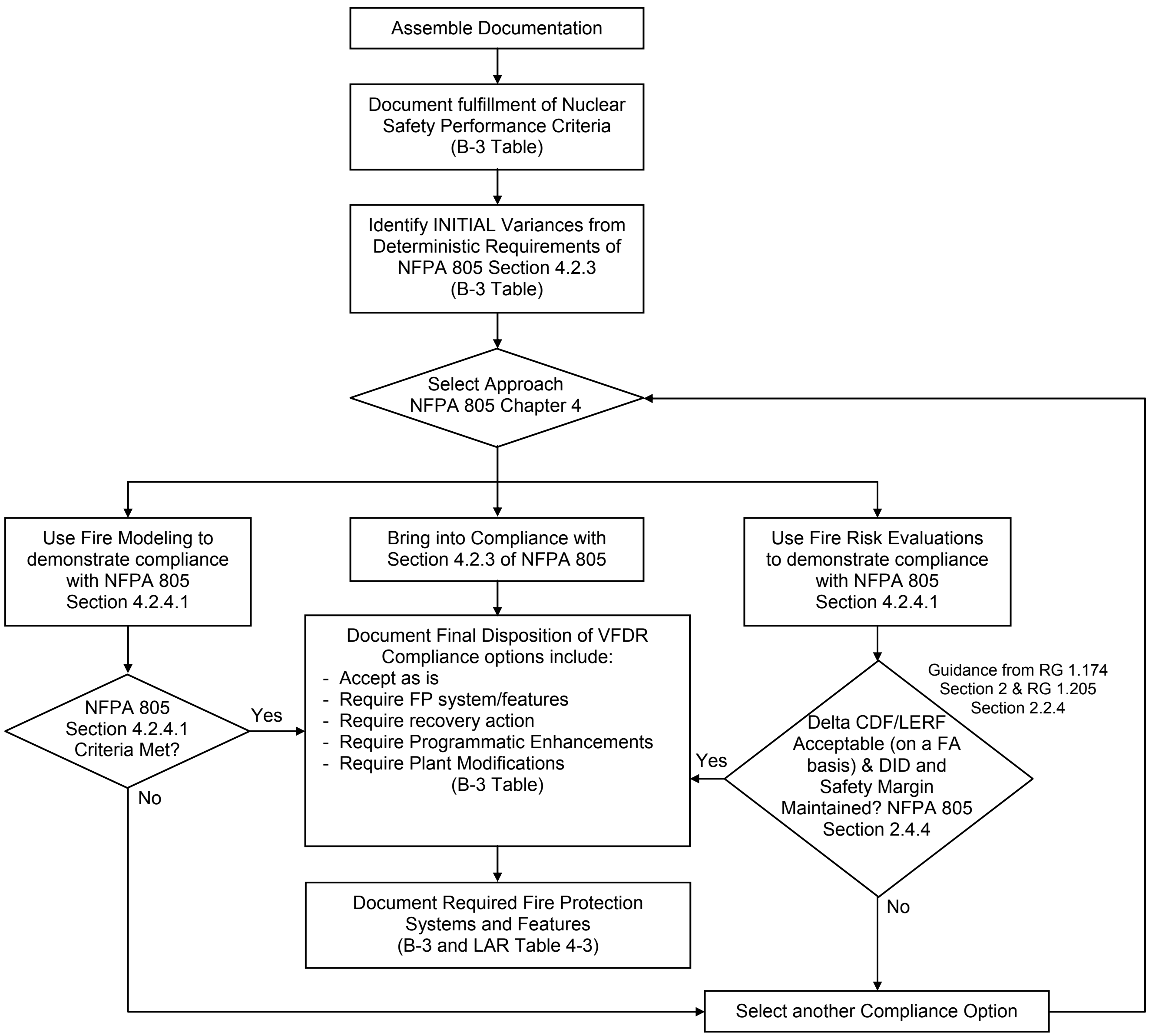
Step 5 – Final Disposition.

- Documented final disposition of the VFDRs in Attachment C (NEI 04-02 Table B-3).
- For recovery action compliance strategies, ensured the manual action feasibility analysis of the required recovery actions was completed. Note: if a recovery action could not meet the feasibility requirements established per NEI 04-02, then alternate means of compliance was considered.
- Documented the post transition NFPA 805 Chapter 4 compliance basis.

Step 6 – Documented required fire protection systems and features. Reviewed the NFPA 805 Section 4.2.3 compliance strategies (including fire area licensing actions and engineering evaluations) and the NFPA 805 Section 4.2.4 compliance strategies (including simplifying deterministic assumptions) to determine the scope of fire protection systems and features 'required' by NFPA 805 Chapter 4. The 'required' fire protection systems and features are subject to the applicable requirements of NFPA 805 Chapter 3.

Figure 4-4

Summary of Fire Area Review
[Based on FAQ 07-0054 Revision 1]



DID – Defense-in-Depth FA – Fire Analysis

Results of the Evaluation Process

Attachment C contains the results of the Fire Area Transition review (NEI 04-02 Table B-3). On a fire area basis, Attachment C summarizes compliance with Chapter 4 of NFPA 805.

NEI 04-02 Table B-3 includes the following summary level information for each fire area:

- Regulatory Basis – NFPA 805 post-transition regulatory bases are included.
- Performance Goal Summary – An overview of the method of accomplishment of each of the performance criteria in NFPA 805 Section 1.5 is provided.
- Reference Documents – Specific references to Nuclear Safety Capability Assessment Documents are provided.
- Fire Suppression Activities Effect on Nuclear Safety Performance Criteria – A summary of the method of accomplishment is provided.
- Licensing Actions – Specific references to exemption requests / deviations / safety evaluations that will remain part of the post-transition licensing basis. A brief description of the condition and the basis for acceptability of the licensing action should be provided.
- EEEE – Specific references to EEEE that rely on determinations of “adequate for the hazard” that will remain part of the post-transition licensing basis. A brief description of the condition and the basis for acceptability should be provided.
- VFDRs – Specific variances from the deterministic requirements of NFPA 805 Section 4.2.3. Refer to Section 4.5.2 for a discussion of the performance-based approach.

4.3 Non-Power Operational Modes

4.3.1 Overview of Evaluation Process

ANO-1 implemented the process outlined in NEI 04-02 and FAQ 07-0040, Clarification on Non-Power Operations. The goal (as depicted in Figure 4-5) is to ensure that contingency plans are established when the plant is in a Non-Power Operational (NPO) mode where the risk is intrinsically high. During low risk periods, normal risk management controls and fire prevention/protection processes and procedures will be utilized.

The process to demonstrate that the nuclear safety performance criteria are met during NPO modes involves the following steps:

- Review the existing Outage Management Processes
- Identify Equipment/Cables:
  - Review plant systems to determine success paths that support each of the defense-in-depth Key Safety Functions (KSFs), and
  - Identify cables required for the selected components and determine their routing.
- Perform Fire Area Assessments (identify pinch points – plant locations where a single fire may damage all success paths of a KSF).
- Manage pinch-points associated with fire-induced vulnerabilities during the outage.

The process is depicted in Figures 4-5 and 4-6. The results are presented in Section 4.3.2.

Figure 4-5

Review Plant Operational States (POSs), KSFs, Equipment, and Cables, and Identify Pinch Points

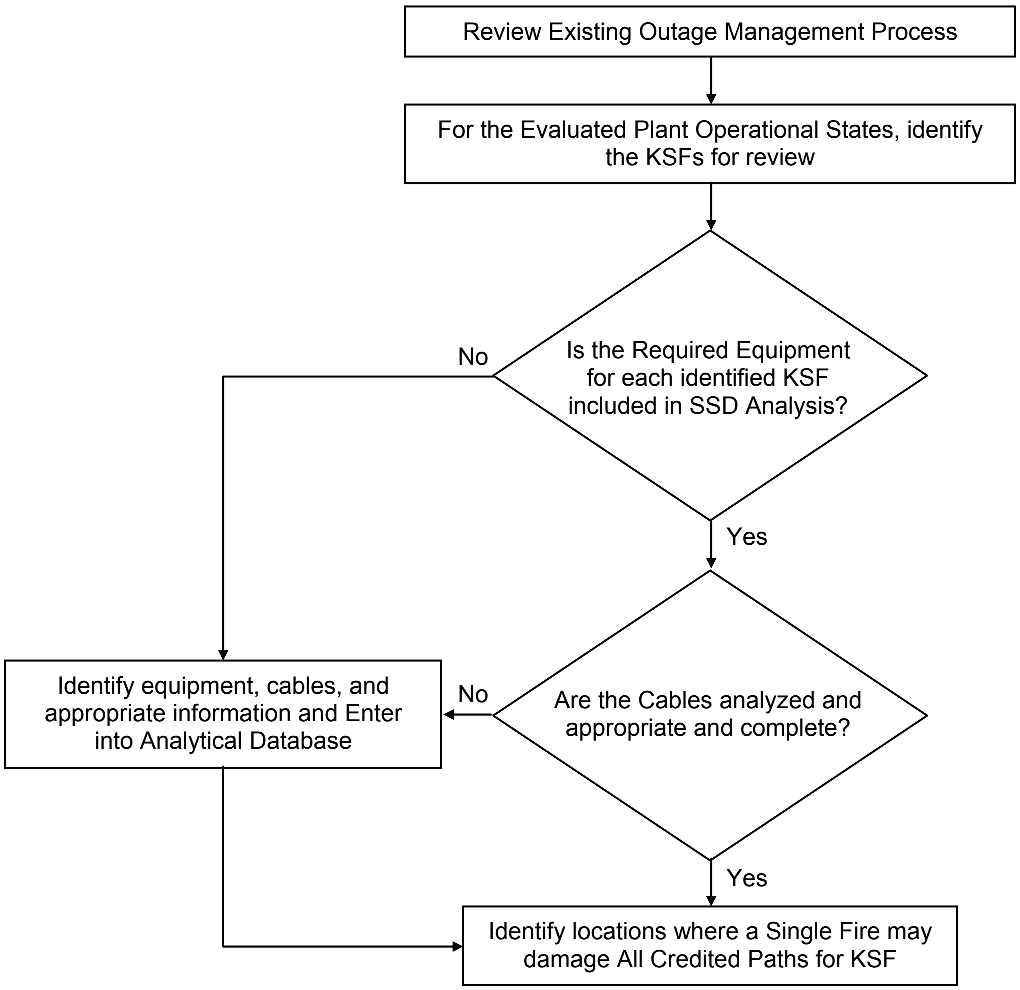
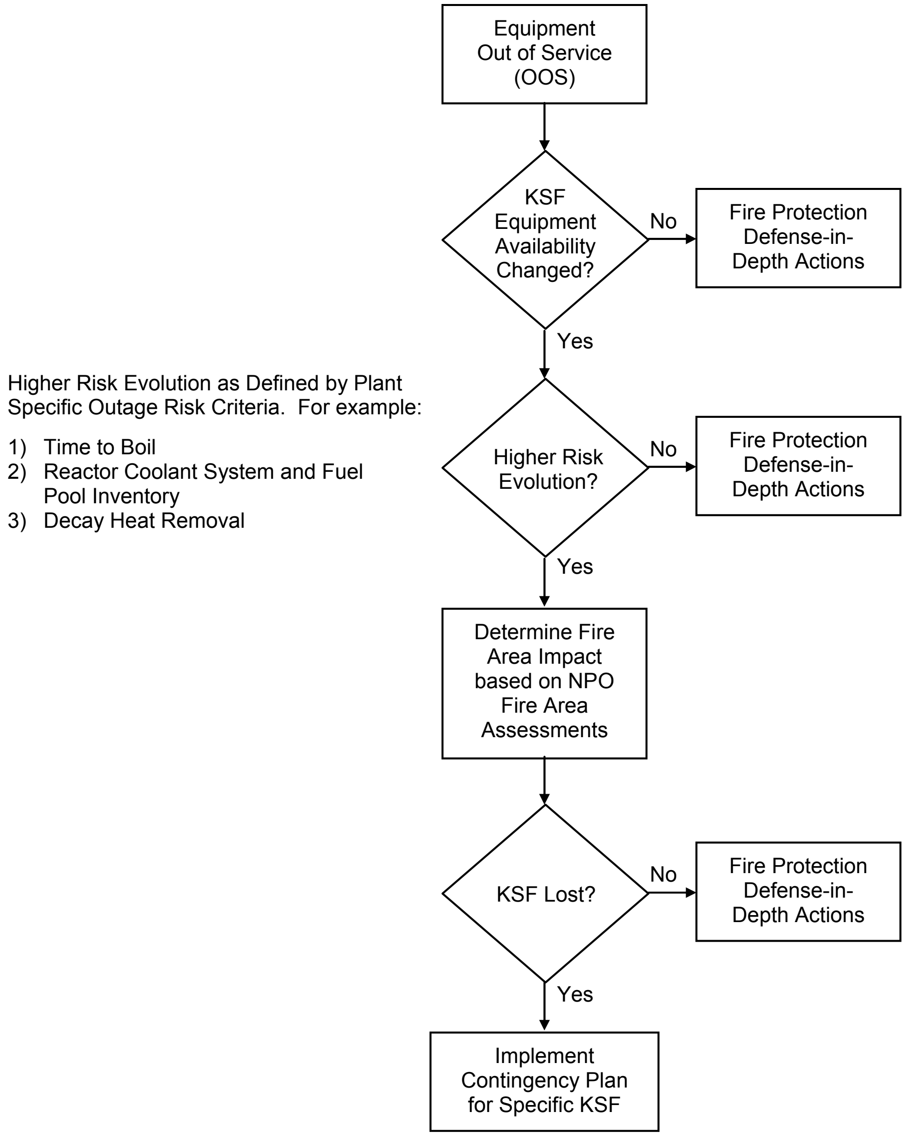


Figure 4-6

Manage Pinch Points



4.3.2 Results of the Evaluation Process

Based on FAQ 07-0040, the plant operating states considered for equipment and cable selection are defined in calculation CALC-09-E-0008-01, "ANO-1 NFPA 805 Non Power Operations Assessment." Once the applicable plant operating state for non-power operations was defined, the systems necessary to maintain and support each KSF were identified. The associated P&IDs and single line drawings for the required systems were marked-up and annotated to identify the necessary equipment and to develop a CAFTA fault tree. The drawing mark-ups and the fault tree are documented in support calculation CALC-09-E-0008-03, "ANO-1 NFPA 805 NPO Fault Tree and PID Attachments." The CAFTA fault tree provides all associations for power supplies, supporting equipment, and other equipment dependencies that could fail equipment necessary to NPO.

The Plant Data Management System (PDMS) is the cable and raceway software that provides the controlled database for NSCA equipment and associated circuit analysis. In general NPO equipment is a subset of NSCA equipment. Existing equipment was evaluated in PDMS to determine if the circuit analysis was appropriate for NPO. Additional equipment identified as being needed for NPO, but not previously evaluated, was evaluated and added as necessary to PDMS and, where added, flagged accordingly as being only required for NPO. All new circuit analyses were performed in accordance with existing methodologies established at ANO consistent with guidance provided within NEI 00-01.

The pinch-point analysis was performed using ARC software. ARC software extracts the necessary data from PDMS and maps it to the NPO CAFTA fault tree. Each Fire Area for NPO was evaluated to determine which equipment could be rendered unavailable. Equipment which could spuriously operate or fail resulting in the loss of a KSF in a Fire Area was given a compliance strategy (i.e., recovery action) to allow NPO compliance (top gate success). This effectively captured affected equipment necessary to maintain a KSF in any plant area/zone which could be compromised due to a fire. In accordance with FAQ 07-0040, any fire area not in deterministic compliance caused by all of the credited success paths for a given KSF being lost is considered a pinch-point.

The results of each Fire Area assessed for NPO are described in detail in calculation CALC-09-E-0008-01 with slightly more than half the fire areas in deterministic compliance. Availability of systems and equipment for each KSF is identified. Recoveries due to a pinch-point are provided by KSF in tabular form. The presence of detection and suppression systems and any existing procedural controls is indicated. Where Fire Areas of multiple zones are comprised, clarification is provided to illustrate the zones impacted (pinch-point) and those unaffected (deterministic compliance). Insights from CALC-08-E-0016-01, “Fire Probabilistic Risk Assessment Plant Partitioning and Fire Ignition Frequency Development,” have been used to provide a risk-informed assessment of any Fire Area determined to be a pinch-point. Consideration and usage of the following methods to manage risk were applied as applicable to any Fire Area that is a pinch-point:

- Prohibition or limitation of hot work in fire zones during periods of increased vulnerability.
- Limitation of combustible materials in fire zones during periods of increased vulnerability.
- Pre-emptive actions such as opening breakers or re-aligning of equipment, if hot work is to be performed.
- Modification to eliminate spurious operation in areas determined to be pinch-points.

4.4 Radioactive Release Performance Criteria

4.4.1 Overview of Evaluation Process

The review of the Fire Protection Program against NFPA 805 requirements for fire suppression related radioactive release was performed using the methodology contained in Engineering Change EC-27452 (CALC-ANO1-FP-08-00001, Rev. 2), “NEI 04-02 Table G-1, Radioactive Release Transition Report.” The objective of the EC was to ensure fire protection goals, objectives, and criteria were met as they relate to potential radioactive release scenarios. The methodology consisted of the following:

- A review of ANO-1 and common fire pre-plans (PFP-U1 and PFP-UC) and fire brigade training materials was performed to identify Fire Protection Plan elements (e.g., systems / components / procedural control actions / flow paths, etc.) that are being credited to meet the radioactive release goals, objectives, and performance criteria during all plant operating modes, including full power and non-power conditions.
- A review of engineering controls to ensure containment of gaseous and liquid effluents (e.g., smoke and fire fighting agents) was also performed. This review included all plant operating modes (including full power and non-power conditions).

4.4.2 Results of the Evaluation Process

The radioactive release review determined the FP program is compliant with the requirements of NFPA 805 and the guidance in NEI 04-02 and RG 1.205. The site specific review of the direct effects of fire suppression activities on radioactive release is summarized in Attachment E.

4.5 Fire PRA and Performance-Based Approaches

RI-PB evaluations are an integral element of an NFPA 805 fire protection program. Key parts of RI-PB evaluations include:

- A Fire PRA (discussed in Section 4.5.1 and Attachments U, V, and W).
- NFPA 805 Performance-Based Approaches (discussed in Section 4.5.2).

4.5.1 Fire PRA Development and Assessment

In accordance with the guidance in RG 1.205, a Fire PRA (FPRA) model was developed for ANO-1 in compliance with the requirements of Part 4 "Requirements for Fires at Power Probabilistic Risk Assessment Requirements," of the American Society of Mechanical Engineers (ASME) and American Nuclear Society (ANS) combined PRA Standard, ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Application," (hereafter referred to as Fire PRA Standard). ANO-1 conducted a peer review by independent industry analysts in accordance with RG 1.200 prior to a risk-informed submittal. The resulting fire risk assessment model is used as the analytical tool to perform Fire Risk Evaluations during the transition process.

Section 4.5.1.1 describes the Internal Events PRA model. Section 4.5.1.2 describes the Fire PRA model. Section 4.5.1.3 describes the results and resolution of the peer review of the Fire PRA, and Section 4.5.1.4 describes insights gained from the Fire PRA.

4.5.1.1 Internal Events PRA

The ANO-1 base internal events PRA (ANO-1 PSA Model 4p00) was the starting point for the Fire PRA (FPRA). Attachment U provides a discussion of the internal events PRA and the results and disposition of the most recent peer review.

4.5.1.2 Fire PRA

The internal events PRA was modified to capture the effects of fire both as an initiator of an event and as a potential failure mode for affected circuits and individual targets. The FPRA was developed primarily through the use of the guidance for FPRA development in NUREG/CR-6850, approved FAQs, and recent EPRI FPRA methodology development efforts. The FPRA was quantified using the EPRI FRANC software.

The FPRA quality and results are discussed in the subsequent sections and in Attachments V and W, respectively.

Fire Model Utilization in the Application

Fire modeling was performed as part of the Fire PRA development (NFPA 805 Section 4.2.4.2). RG 1.205, Regulatory Position 4.2, and Section 5.1.2 of NEI 04-02, provide guidance to identify fire models that are acceptable to the NRC for plants implementing a risk-informed, performance-based licensing basis.

The acceptability of the use of these fire models is included in Attachment J.

4.5.1.3 Results of Fire PRA Peer Review

The ANO-1 FPRA was peer reviewed against the requirements of ASME/ANS RA-Sa-2009, Part 4. The review was conducted by the Westinghouse Owners Group in October 2009.

The results (i.e., standard requirement capability assessments and F&Os) documented in the FPRA peer review report were used to support further development of the FPRA for the NFPA 805 application.

The FPRA update addressed the standard requirements assessed recommended improvements (i.e., Not Met or Capability Category I). Completion of recommendations related to standard requirement assessments and finding type F&Os results in a closure of technical gaps to a Capability Category II assessment for the associated standard requirements. Any outstanding findings have been dispositioned for the potential impact on the FPRA and the application. The results of the peer review are summarized in Attachment V.

4.5.1.4 Risk Insights

Risk insights were documented as part of the development of the Fire PRA. The total plant fire Core Damage Frequency (CDF) / Large Early Release Frequency (LERF) was derived using the NUREG/CR-6850 methodology for fire PRA development and is useful in identifying the areas of the plant where fire risk is greatest. A review of the fire initiating events that collectively represent 95% of the calculated fire risk is included as Attachment W.

4.5.2 Performance-Based Approaches

NFPA 805 outlines the approaches for performing performance-based analyses. As specified in Section 4.2.4, there are generally two types of analyses performed for the performance-based approach:

- Fire Modeling (NFPA 805, Section 4.2.4.1).
- Fire Risk Evaluation (NFPA 805, Section 4.2.4.2).

4.5.2.1 Fire Modeling Approach

The fire modeling approach was not utilized for the transition.

4.5.2.2 Fire Risk Approach

Overview of Evaluation Process

The Fire Risk Evaluations were completed as part of the ANO-1 NFPA 805 transition. These Fire Risk Evaluations were developed using the process described below. This methodology is based upon the requirements of NFPA 805, industry guidance in NEI 04-02, and RG 1.205. These are summarized in Table 4-1.

Table 4-1 Fire Risk Evaluation Guidance Summary Table

Document	Section(s)	Topic
NFPA 805	NFPA 805 2.2(h), 4.2.4, A.2.2(h), A.2.4.4, D.5	Change Evaluation (2.2(h), 2.2.9, 2.4.4 A.2.2(h), A.2.4.4, D.5) Risk of Recovery Actions (4.2.4) Use of FRE (4.2.4.2)
NEI 04-02, Revision 2	4.4, 5.3, Appendix B, Appendix I, Appendix J	Change Evaluation, Change Evaluation Forms (App. I), No specific discussion of FRE
RG 1.205, Revision 1	C.2.2.4, C.2.4, C.3.2	Risk Evaluations (C.2.2.4) Recovery Actions (C.2.4)

During the transition to NFPA 805, variances from the deterministic approach in Section 4.2.3 of NFPA 805 were evaluated using a Fire Risk Evaluation per Section 4.2.4.2 of NFPA 805. A Fire Risk Evaluation was performed for each fire area containing VFDRs.

If the Fire Risk Evaluation meets the acceptance criteria, this is confirmation that a success path effectively remains free of fire damage and that the performance-based approach is acceptable per Section 4.2.4.2 of NFPA 805.

The Fire Risk Evaluation process consists of the following steps (Figure 4-7 depicts the Fire Risk Evaluation process used during transition. This is generally based on FAQ 07-0054, Revision 1):

Step 1 – Preparation for the Fire Risk Evaluation.

- Definition of the Variances from the Deterministic Requirements. The definition of the VFDR includes a description of the problem statement and the section of NFPA 805 that is not met, type of VFDR (e.g., separation issue or degraded fire protection system), and proposed evaluation per applicable NFPA 805 section.
- Preparatory Evaluation – Fire Risk Evaluation Review. Using the information obtained during the development of Attachment C and the Fire PRA, a review of the VFDR was performed. Depending on the scope and complexity of the VFDR, the reviewers may include the Safe Shutdown/NSCA Engineer, the Fire Protection Engineer, and the Fire PRA Engineer. The purpose and objective of this review was to address the following:
    - Review of the Fire PRA modeling treatment of VFDR
    - Ensure discrepancies were captured and resolved

Step 2 – Performed the Fire Risk Evaluation

- The Evaluator coordinated as necessary with the Safe Shutdown/NSCA Engineer, Fire Protection Engineer and Fire PRA Engineer to assess the VFDR using the Fire Risk Evaluation process to perform the following:
    - Change in Risk Calculation with consideration for additional risk of recovery actions and required fire protection systems and features due to fire risk.
    - Fire area change in risk summary

Step 3 – Reviewed the Acceptance Criteria

- The acceptance criteria for the Fire Risk Evaluation consist of two parts. One is quantitatively based and the other is qualitatively based. The quantitative figures of merit are ΔCDF and ΔLERF. The qualitative factors are defense-in-depth and safety margin.
    - Risk Acceptance Criteria. The transition risk evaluation was measured quantitatively for acceptability using the ΔCDF and ΔLERF criteria from RG 1.174, as clarified in RG 1.205, Regulatory Position 2.2.4.
    - Defense-in-Depth. A review of the impact of the change on defense-in-depth was performed, using the guidance from NEI 04-02. NFPA 805 defines defense-in-depth as:
        - Preventing fires from starting
        - Rapidly detecting fires and controlling and extinguishing promptly those fires that do 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.

      In general, the defense-in-depth requirement was considered to be satisfied if the proposed change does not result in a substantial imbalance among these elements (or echelons).

      The review of defense-in-depth was qualitative and addressed each of the elements with respect to the proposed change. Defense-in-depth was performed on a fire area basis.

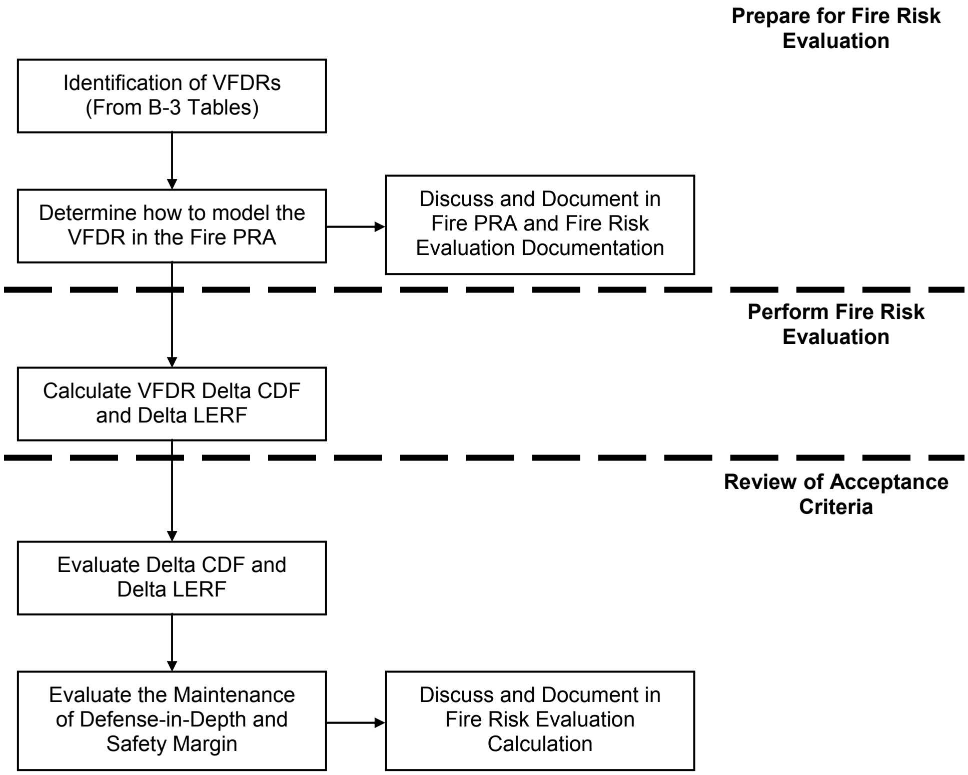
      Fire protection features and systems relied upon to ensure defense-in-depth were identified as a result of the assessment of defense-in-depth.
    - Safety Margin Assessment. A review of the impact of the change on safety margin was performed. An acceptable set of guidelines for completing the assessment is summarized below. Other equivalent acceptance guidelines may also be used.
        - Codes and standards or their alternatives accepted for use by the NRC are met, and
        - Safety analysis acceptance criteria in the licensing basis (e.g., SAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty

      The requirements related to safety margins for the change analysis are described for each of the specific analysis types used in support of the FRE.

FIGURE 4-7

Fire Risk Evaluation Process (NFPA 805 Transition)

[Based on FAQ 07-0054, Revision 1)



Results of Evaluation Process

Disposition of VFDRs

The ANO-1 SSA and the NFPA 805 transition project activities have identified a number of variances from the deterministic requirements of NFPA 805 Section 4.2.3. These variances were dispositioned using the FRE process.

Each variance dispositioned using a FRE was assessed against the FRE acceptance criteria of ΔCDF and ΔLERF; and maintenance of defense-in-depth and safety margin criteria from Section 5.3.5 of NEI 04-02 and RG 1.205. The results of these calculations are summarized in Attachment C.

Following completion of transition activities and planned modifications and program changes, the plant will be compliant with 10 CFR 50.48(c).

Risk Change Due to NFPA 805 Transition

In accordance with the guidance in RG 1.205, Section C.2.2.4, Risk Evaluations, risk increases or decreases for each fire area using FREs and the overall plant should be provided. Note that the risk increase due to the use of recovery actions was included in the risk change for transition for each fire area.

RG 1.205, Section C.2.2.4.2 states in part:

> *"The total increase or decrease in risk associated with the implementation of NFPA 805 for the overall plant should be calculated by summing the risk increases and decreases for each fire area (including any risk increases resulting from previously approved recovery actions). The total risk increase should be consistent with the acceptance guidelines in Regulatory Guide 1.174. Note that the acceptance guidelines of Regulatory Guide 1.174 may require the total CDF, LERF, or both, to evaluate changes where the risk impact exceeds specific guidelines. If the additional risk associated with previously approved recovery actions is greater than the acceptance guidelines in Regulatory Guide 1.174, then the net change in total plant risk incurred by any proposed alternatives to the deterministic criteria in NFPA 805, Chapter 4 (other than the previously approved recovery actions), should be risk neutral or represent a risk decrease."*

The risk increases and decreases are provided in Attachment W.

4.6 Monitoring Program

NFPA 805, Section 3.2.3(3), requires procedures to be established for reviews of the Fire Protection Program related performance and trends. NFPA 805, Section 2.6, requires a monitoring program that, in part, establishes acceptable performance levels and a method to monitor and assess the performance of the Fire Protection Program. The NFPA 805 requirements for reviews of programs related to performance and trending are provided under the ANO NFPA 805 Monitoring program.

The monitoring program will be implemented after issuance of the Safety Evaluation, as part of the Fire Protection Program transition to NFPA 805. In order to assess the impact of the transition to NFPA 805 on the current monitoring program, the ANO Fire Protection Program documentation, such as the maintenance program processes, Fire Protection Program implementing procedures, and plant change processes will be reviewed. Sections 4.5.3 and 5.2 of NEI 04-02, as clarified in the NRC approved version of FAQ 10-0059, will be used during the review process. The process is described in the following sections.

The following scope will be documented appropriately in the ANO NFPA 805 Monitoring Program:

- The scope of SSCs and programmatic elements to monitor
- The levels of availability, reliability, or other criteria for those elements that require monitoring

Development and implementation of the NFPA 805 monitoring program for ANO will be completed as part of NFPA 805 amendment implementation (See Attachment S).

4.6.1 Overview of NFPA 805 Requirements for the NFPA 805 Monitoring Program

Section 2.6 of NFPA 805 states:

> *"A monitoring program shall be established to ensure that the availability and reliability of the fire protection systems and features are maintained and to assess the performance of the fire protection program in meeting the performance criteria. Monitoring shall ensure that the assumptions in the engineering analysis remain valid."*

The intent of the monitoring review is to establish the NFPA 805 monitoring program and to confirm (or modify as necessary) the adequacy of the existing surveillance, testing, maintenance, compensatory measures, and oversight processes for transition to NFPA 805. This review will consider the following:

- The adequacy of the scope of systems and equipment within existing plant programs
- The performance criteria for the availability and reliability of the required structures, systems and components
- The adequacy of the plant corrective action program in determining causes of equipment and programmatic failures and in minimizing their recurrence

4.6.2 Overview of Post-Transition NFPA 805 Monitoring Program

This section provides an overview of the post-transition NFPA 805 monitoring program process. The monitoring program will be implemented after issuance of the NRC Safety Evaluation as part of the FPP transition to NFPA 805 (see item for implementation in Attachment S). The monitoring process is comprised of four phases.

Phase 1 Scoping

Phase 2 Screening Using Risk Criteria

Phase 3 Risk Target Value Determination

Phase 4 Monitoring Implementation

The phases of the monitoring process are described as follows and depicted in Figure 4-8. The results of these phases will be documented in the ANO monitoring program evaluation developed during implementation.

Phase 1 Scoping

In order to meet the NFPA 805 requirements for monitoring, the following categories of SSCs and programmatic elements will be reviewed during the implementation phase for inclusion in the NFPA 805 monitoring program:

- SSCs required to comply with NFPA 805, specifically:
  - Fire protection systems and features required by the NSCA
  - Fire protection systems and features modeled in the FPRA
  - Fire protection systems and features required by Chapter 3 of NFPA 805

  - NSCA equipment (for the purposes of NFPA 805 Monitoring, “NSCA equipment” includes NSCA equipment, Fire PRA equipment, and NPO equipment)
  - SSCs relied upon to meet radioactive release criteria
- Fire protection programmatic elements
- Key assumptions in engineering analyses (specifically analyses performed to demonstrate compliance with the nuclear safety and radioactive release performance criteria)

As a minimum, the fire protection systems and features (required to meet Chapter 3 of NFPA 805 and the NSCA criteria) and SSCs required to meet the radioactive release criteria will be included in the existing inspection and test program, and system/program health program. In addition passive features (barriers, drains, curbs, etc.) that are relied upon to demonstrate compliance with Chapter 4 of NFPA 805 will also be included in the existing inspection and test program, and system/program health program. Once the applicable NFPA 805 radioactive release and passive feature SSCs have been added to the existing inspection and test program as well as system/program health programs, the existing programs will be adequate for routine monitoring of these SSC.

Plant specific initiatives may be undertaken to optimize fire protection surveillance and testing practices and frequencies based upon performance in accordance with the guidance in EPRI Technical Report 1006756, “Fire Protection Surveillance Optimization and Maintenance Guide for Fire Protection Systems and Features.”

Phase 2 Screening Using Risk Criteria

The equipment from the Phase 1 scoping will be screened to determine the appropriate level of NFPA 805 monitoring. As a minimum, the SSCs identified in Phase 1 will be part of an inspection and test program, and/or system/program health reporting process. If not included in the current program, the SSC(s) will be added in order to assure that the criteria can be met reliably.

1. Fire Protection Systems and Features

   Those fire protection systems and features identified in Phase 1 are candidates for additional monitoring in the NFPA 805 program commensurate with risk significance. Compartments smaller than Fire Areas may be used provided the compartments are independent (i.e., share no fire protection SSC). If compartments smaller than Fire Areas are used, the basis will be documented in the NFPA 805 Monitoring Program engineering evaluation.

   The Fire PRA is the primary tool used to establish the risk significance criteria and performance bounding guidelines. The screening thresholds used to determine risk significant analysis units will be those that meet the following criteria:

Risk Achievement Worth (RAW) of the monitored parameter ≥ 2.0

AND either

Core Damage Frequency (CDF) x (RAW) ≥ 1.0E-7 per year

OR

Large Early Release Frequency (LERF) x (RAW) ≥ 1.0E-8 per year

CDF, LERF, and RAW (monitored parameter) are calculated for each fire area. The "monitored parameter" will be established at a level commensurate with the amenability of the parameter to risk measurement (e.g., a fire barrier may be more conducive to risk measurement than an individual barrier penetration).

Fire protection systems and features that meet or exceed the criteria identified above will be included in a monitoring program such as the site Maintenance Rule Program described in applicable Maintenance Rule Program procedures:

- EN-DC-203, "Maintenance Rule Program"
- EN-DC-204, "Maintenance Rule Scope and Basis"
- EN-DC-207, "Maintenance Rule Periodic Assessment"
- EN-DC-205, "Maintenance Rule Monitoring"

Fire protection functions and SSCs will be classified as high or low risk significant in Maintenance Rule and appropriate performance criteria established. The remaining required fire protection systems and features will be monitored in accordance with existing inspection and test programs and in the existing system/program health program and fire impairment processes and procedures, such as EN-DC-143-02.

2. Nuclear Safety Capability Assessment (NSCA) Equipment

Required NSCA equipment identified in Phase 1 (except equipment within the scope of Non-Power Operations) will be screened for safety significance using the Fire PRA and the Maintenance Rule Scope and Basis guidelines, which differentiate High Safety Significance (HSS) equipment from Low Safety Significance (LSS) equipment. HSS NSCA equipment not currently monitored in the Maintenance Rule will be included in the Maintenance Rule program. All NSCA equipment not designated as HSS will be considered LSS and not included in the monitoring program beyond normal inspection and test programs, and system/program health reporting processes and procedures.

For NPO modes, attempting to quantitatively measure the effectiveness of fire prevention to manage fire risk during Higher Risk Evolutions is not feasible. Therefore, fire risk management effectiveness will be monitored programmatically similar to combustible material control and other fire prevention program processes. Additional monitoring beyond inspection and test programs or system/program health reporting will not be necessary to effectively assess fire risk management effectiveness during NPO modes.

3. SSC Relied upon for Radioactive Release Criteria

   Since the evaluations performed to meet the radioactive release performance criteria are qualitative, the SSC relied upon to meet the radioactive release performance criteria are not amenable to quantitative risk measurement. Additionally, since 10 CFR Part 20 limits (which are lower than releases due to core damage and containment breach) for radiological effluents are not being exceeded, equipment relied upon to meet the radioactive performance criteria is considered inherently low risk. Therefore, additional monitoring beyond inspection and test programs and system/program health reporting is not considered necessary.

4. Fire Protection Programmatic Elements

   Monitoring of programmatic elements is required in order to assess the performance of the fire protection program in meeting the performance criteria. These programs form the bases for many of the analytical assumptions used to evaluate compliance with NFPA 805 requirements. Programmatic elements include:

   - Transient combustible control and transient exclusion zones
   - Hot work control and administrative controls
   - Impairment and compensatory measures including program compliance
   - Fire brigade effectiveness

   Monitoring of programmatic elements is qualitative in nature since the programs are not amenable to the numerical methods used derive reliability and availability.

Phase 3 Risk Target Value Determination

Phase 3 establishes the target values for reliability and availability for the fire protection systems and features that met or exceeded the screening criteria and for the HSS NSCA equipment identified in Phase 2.

Target values for reliability and availability for the fire protection systems and features are established at the component level, program level, or functionally through the use of the pseudo-system or the “performance monitoring group” (PMG) concept. The actual action level is determined based on the number of component, program, or functional failures within a sufficient bounding time period (2 to 3 operating cycles).

Since the HSS NSCA equipment is identified using Maintenance Rule guidelines, the associated equipment-specific performance criteria will be established as in the Maintenance Rule, provided the criteria are consistent with Fire PRA assumptions.

The action level threshold for reliability and availability will be no lower than the fire PRA assumptions. Adverse trends and unacceptable levels of availability, reliability, and performance will be reviewed against these action levels. The Monitoring Program failure criteria and action level targets will be documented in the NFPA 805 Monitoring Program engineering evaluation.

Fire protection systems and features, NSCA equipment, SSCs required to meet radioactive release criteria, and fire protection program elements that do not meet the screening criteria in Phase 2 will be included in existing inspection and test programs, and system/program health programs. Reliability and availability criteria will not be assigned.

Phase 4 Monitoring Implementation

Phase 4 is the implementation of the ANO monitoring program, once the monitoring scope and criteria are established. Monitoring consists of periodically gathering, trending, and evaluating information pertinent to the performance and/or availability of the equipment, and comparing the results with established goals and performance criteria to verify the goals and criteria are being met. Results of monitoring activities will be analyzed in a timely manner to assure that appropriate corrective action is identified and taken. The corrective action process will be used to address performance of fire protection and nuclear safety SSCs that do not meet performance criteria.

For fire protection systems and features and NSCA HSS equipment that are monitored, unacceptable levels of availability, reliability, and performance will be reviewed against the established action levels. If an action level is triggered, corrective actions will be initiated to identify the negative trend in accordance with the ANO corrective action processes and procedures. A corrective action plan will then be developed to ensure performance returns to the established level. Fire protection health reports, self-assessments, regulator and insurance company (NEIL) reports provide inputs to this monitoring program, as does the corrective action process delineated in procedure EN-LI-102.

When applicable, a sensitivity study will be performed to determine the margin below the action level that still provides acceptable fire PRA results to assist in prioritizing corrective actions.

A periodic assessment will be performed (e.g., at a frequency of approximately every two to three operating cycles), taking into account, where practical, industry wide operating experience. This will be conducted as part of other established assessment activities. Issues that will be addressed include:

- For systems with performance criteria, do performance criteria still effectively monitor the functions of the system? Do the criteria still monitor the effectiveness of the fire protection and NSCA systems?
- Have the supporting analyses been revised such that the performance criteria are no longer applicable or new fire protection and NSCA SSCs, programmatic elements and/or functions need to be in scope?
- Based on the performance during the assessment period, are there any trends in system performance that should be addressed that are not being addressed?

Figure 4-8

Post-Transition NFPA 805 Monitoring Program

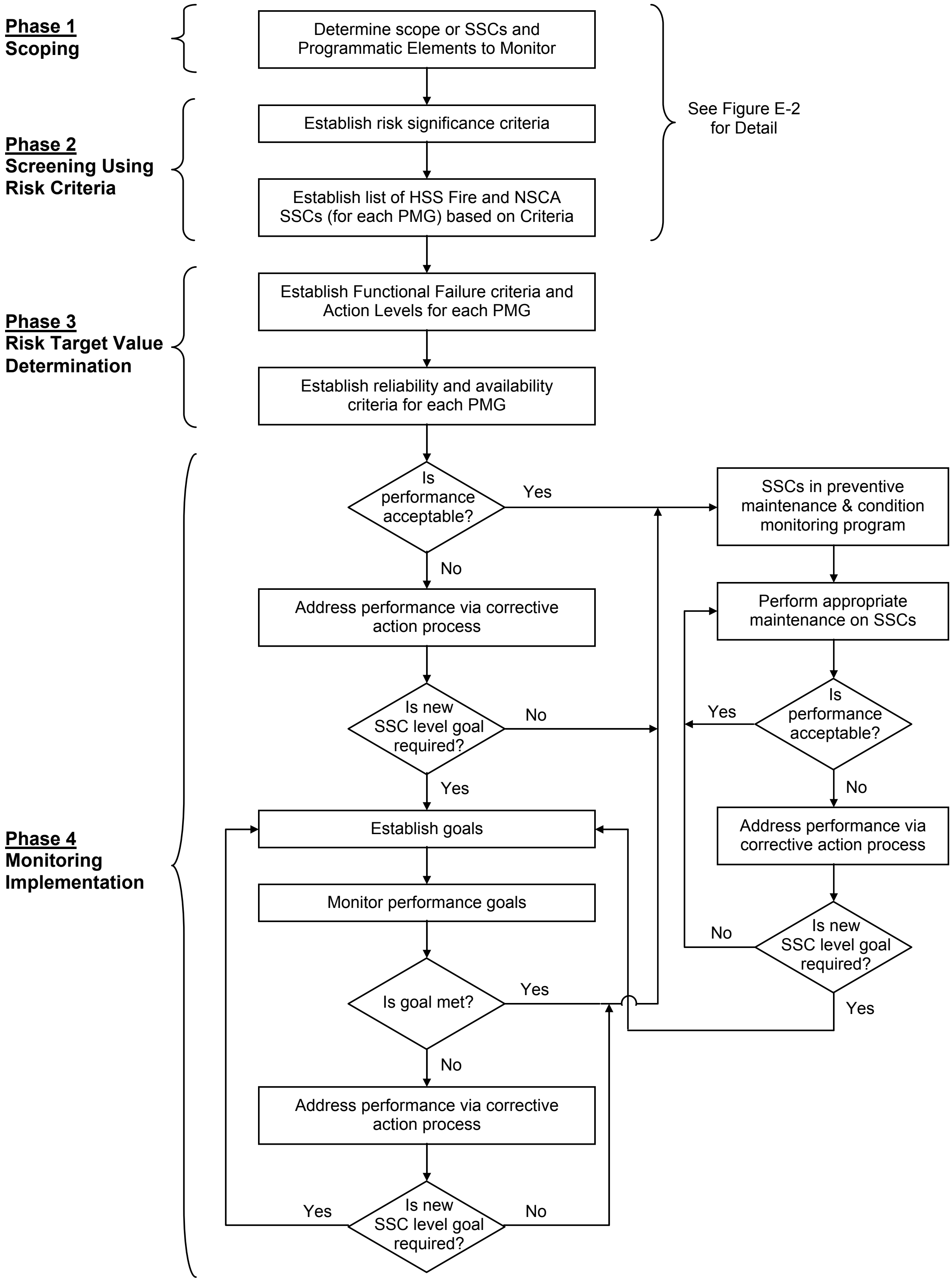
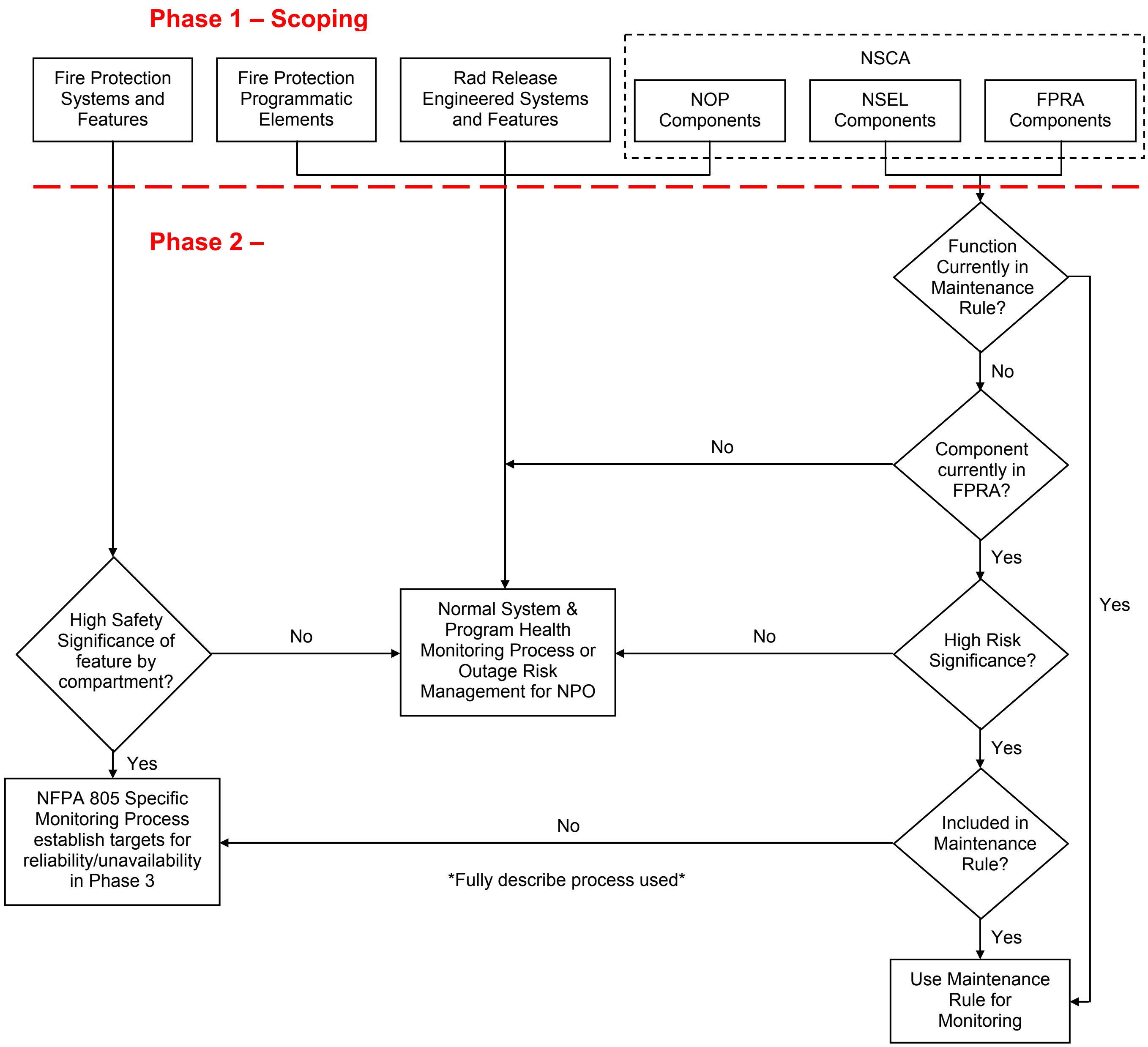


Figure 4-9

NFPA 805 Monitoring – Scoping and Screening



4.7 Program Documentation, Configuration Control, and Quality Assurance

4.7.1 Compliance with Documentation Requirements in Section 2.7.1 of NFPA 805

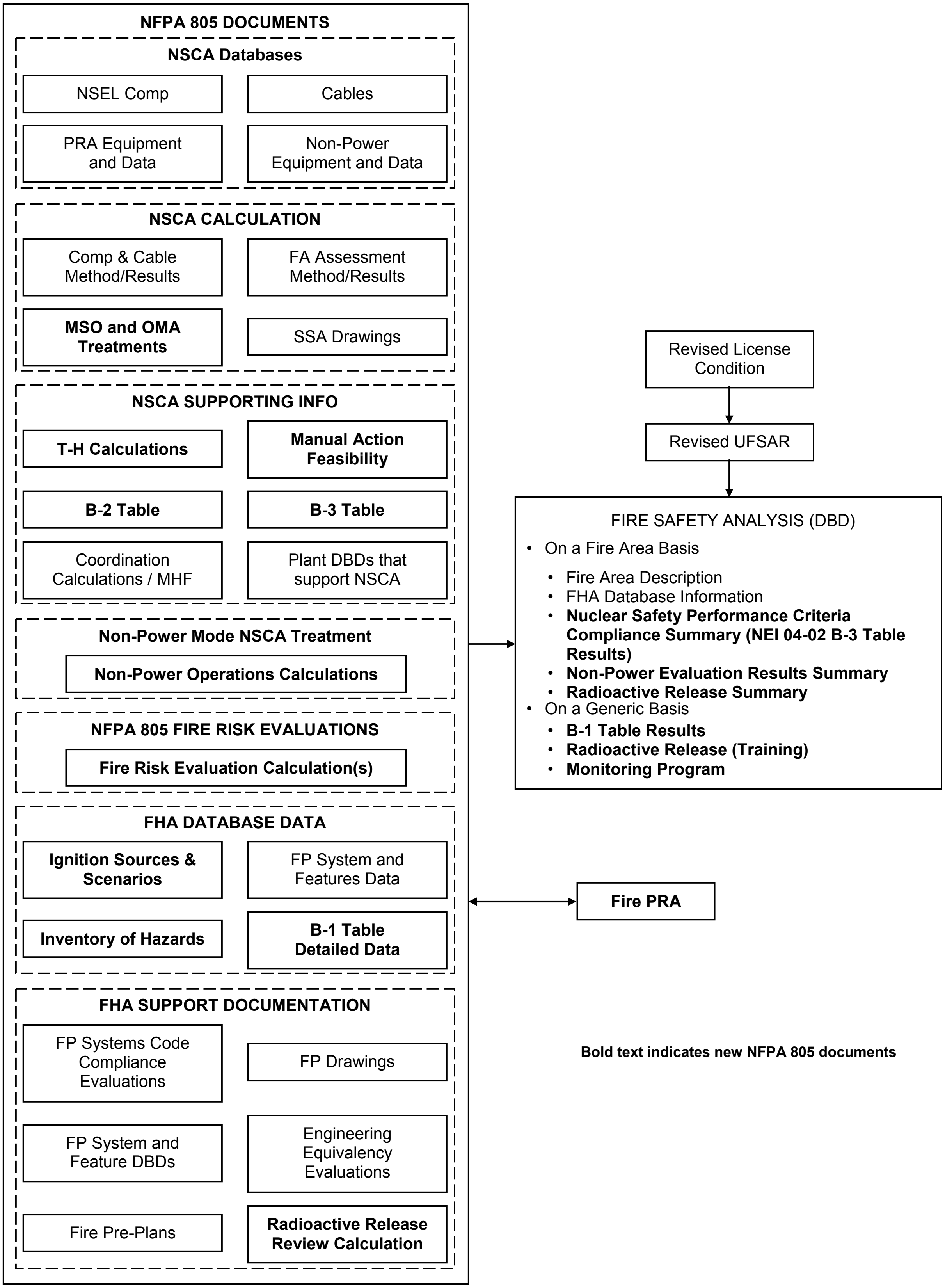
In accordance with the requirements and guidance in NFPA 805 Section 2.7.1 and NEI 04-02, ANO-1 has documented analyses to support compliance with 10 CFR 50.48(c). The analyses are being performed in accordance with Entergy's processes for ensuring assumptions are clearly defined, that results are easily understood, that results are clearly and consistently described, and that sufficient detail is provided to allow future review of the entire analyses.

Analyses, as defined by NFPA 805 Section 2.4, performed to demonstrate compliance with 10 CFR 50.48(c) will be maintained for the life of the plant and organized to facilitate review for accuracy and adequacy. Note these analyses do not include items such as periodic tests, hot work permits, fire impairments, etc.

The Fire Protection Design Basis Document described in Section 2.7.1.2 of NFPA 805 and necessary supporting documentation described in Section 2.7.1.3 of NFPA 805 will be created as part of transition to 10 CFR 50.48(c) to ensure program implementation following receipt of the safety evaluation. Appropriate cross references will be established to supporting documents as required by Entergy processes (see Attachment S). Figure 4-10 provides an example of the post-transition documents and their relationships.

Figure 4-10

NFPA 805 Planned Post-Transition Documents and Relationships



4.7.2 Compliance with Configuration Control Requirements in Section 2.2.9 and 2.7.2 of NFPA 805

Program documentation established, revised, or utilized in support of compliance with 10 CFR 50.48(c) is subject to Entergy configuration control processes that meet the requirements of Section 2.7.2 of NFPA 805. This includes the appropriate procedures and configuration control processes for ensuring that changes impacting the FP program are reviewed appropriately. The RI-PB post transition change process methodology is based upon the requirements of NFPA 805, and industry guidance in NEI 04-02, and RG 1.205. These requirements are summarized in Table 4-2.

Table 4-2 Change Evaluation Guidance Summary Table

Document	Section(s)	Topic
NFPA 805	2.2(h), 2.2.9, 2.4.4, A.2.2(h), A.2.4.4, D.5	Change Evaluation
NEI 04-02	5.3, Appendix B, Appendix I, Appendix J	Change Evaluation, Change Evaluation Forms (Appendix I)
RG 1.205	C.2.2.4, C.3.1, C.3.2, C.4.3	Risk Evaluation, Standard License Condition, Change Evaluation Process, Fire PRA

The Plant Change Evaluation Process consists of the following 4 steps and is depicted in Figure 4-11:

- Defining the Change
- Performing the Preliminary Risk Screening.
- Performing the Risk Evaluation
- Evaluating the Acceptance Criteria

Change Definition

The Change Evaluation process begins by defining the change or altered condition to be examined and the baseline configuration as defined by the Licensing Basis (NFPA 805 Licensing Basis post-transition).

1. The baseline is defined as that plant condition or configuration that is consistent with the Licensing Basis (NFPA 805 Licensing Basis post-transition).
2. The changed or altered condition or configuration that is not consistent with the Licensing Basis is defined as the proposed alternative.

Preliminary Risk Review

Once the definition of the change is established, a screening is then performed to identify and resolve minor changes to the fire protection program. This screening is consistent with fire protection regulatory review processes in place at nuclear plants under traditional licensing bases. This screening process is modeled after the NEI 02-03 process. This process will address most administrative changes (e.g., changes to the combustible control program, organizational changes, etc.).

The characteristics of an acceptable screening process that meets the "assessment of the acceptability of risk" requirement of Section 2.4.4 of NFPA 805 are:

- The quality of the screen is sufficient to ensure that potentially greater than minimal risk increases receive detailed risk assessments appropriate to the level of risk.
- The screening process must be documented and be available for inspection by the NRC.
- The screening process does not pose undue evaluation or maintenance burden.

If any of the above is not met, proceed to the Risk Evaluation step.

Risk Evaluation

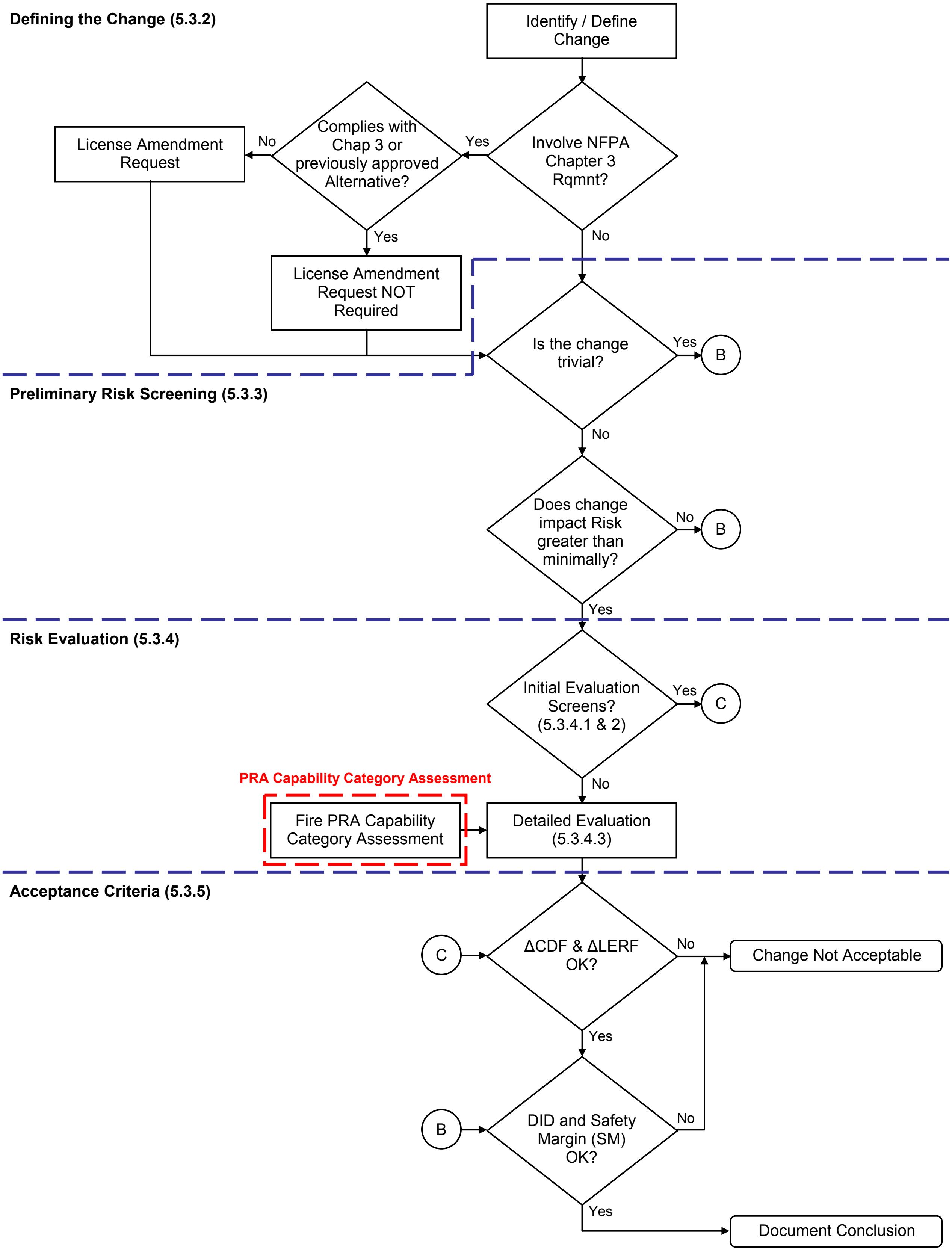
The screening is followed by engineering evaluations that may include fire modeling and risk assessment techniques. The results of these evaluations are then compared to the acceptance criteria. Changes that satisfy the acceptance criteria of NFPA 805 Section 2.4.4 and the license condition can be implemented within the framework provided by NFPA 805. Changes that do not satisfy the acceptance criteria cannot be implemented within this framework. The acceptance criteria require that the resultant change in CDF and LERF be consistent with the license condition. The acceptance criteria also include consideration of defense-in-depth and safety margin, which would typically be qualitative in nature.

The risk evaluation involves the application of fire modeling analyses and risk assessment techniques to obtain a measure of the changes in risk associated with the proposed change. In certain circumstances, an initial evaluation in the development of the risk assessment could be a simplified analysis using bounding assumptions provided the use of such assumptions does not unnecessarily challenge the acceptance criteria discussed below.

Acceptability Determination

The Change Evaluations are assessed for acceptability using the ΔCDF (change in core damage frequency) and ΔLERF (change in large early release frequency) criteria from the license condition. The proposed changes are also assessed to ensure consistency with the defense-in-depth philosophy and that sufficient safety margins were maintained.

Figure 4-11
Plant Change Evaluation [NEI 04-02 Figure 5-1]
Note references in Figure refer to NEI 04-02 Sections



The ANO-1 Fire Protection Program configuration is defined by the program documentation. To the greatest extent possible, the existing configuration control processes for modifications, calculations and analyses, and FPP license basis reviews will be utilized to maintain configuration control of the FPP documents. The configuration control procedures which govern the various ANO-1 documents and databases that currently exist will be revised to reflect the new NFPA 805 licensing bases requirements (see Attachment S).

Several NFPA 805 document types such as NSCA Supporting Information, Non-Power Mode NSCA Treatment, etc., generally require new control procedures and processes to be developed since they are new documents and databases created as a result of the transition to NFPA 805. The new procedures will be modeled after the existing processes for similar types of documents and databases. System level design basis documents will be revised to reflect the NFPA 805 role that the system components now play (see Attachment S).

The process for capturing the impact of proposed changes to the plant on the FPP will continue to be a multiple step review. The first step of the review is an initial screening for process users to determine if there is a potential to impact the FPP as defined under NFPA 805 through a series of screening questions/checklists contained in one or more procedures depending upon the configuration control process being used. Reviews that identify potential FPP impacts will be sent to qualified individuals (Fire Protection, Safe Shutdown/NSCA, PRA) to ascertain the program impacts, if any. If FPP impacts are determined to exist as a result of the proposed change, the issue would be resolved by one of the following:

- Deterministic Approach: Comply with NFPA 805 Chapter 3 and Section 4.2.3 requirements, or
- Performance-Based Approach: Utilize the NFPA 805 change process developed in accordance with NEI 04-02, RG 1.205, and the ANO-1 NFPA 805 fire protection license condition to assess the acceptability of the proposed change. This process would be used to determine if the proposed change could be implemented "as-is" or whether prior NRC approval of the proposed change is required.

This process follows the requirements in NFPA 805 and the guidance outlined in RG 1.174, which requires the use of qualified individuals, procedures that require calculations to be subject to independent review and verification, record retention, peer review, and a corrective action program that ensures appropriate actions are taken when errors are discovered.

4.7.3 Compliance with Quality Requirements in Section 2.7.3 of NFPA 805

Fire Protection Program Quality

During the transition to 10 CFR 50.48(c) and upon implementation of NFPA 805, ANO-1 will perform work in accordance with the quality requirements of Section 2.7.3 of NFPA 805. Future analysis will be conducted in accordance with the requirements of NFPA 805, Section 2.7.3.

Fire PRA Quality

Configuration control of the FPRA model will be maintained by integrating the FPRA model into the existing processes used to ensure configuration control of the internal events PRA model. This process complies with Section 5 of the ASME Standard for PRA Quality and ensures that

Entergy maintains an as-built, as-operated PRA model of the plant. The process has been peer reviewed. Quality assurance of the FPRA is assured via the same processes applied to the internal events model.

This process follows the guidance outlined in RG 1.174, which requires the use of qualified individuals, procedures that require calculations be subject to independent review and verification, record retention, peer review, and a corrective action program that ensures appropriate actions are taken when errors are discovered. Although the entire scope of the formal 10 CFR 50, Appendix B, program is not applied to the PRA models or processes in general, often parts of the program are applied as a convenient method of complying with the requirements of RG 1.174. For example, the procedure which addresses independent review of calculations for 10 CFR 50, Appendix B, is applied to the PRA model calculations, as well.

With respect to quality assurance (QA) requirements for independent reviews of calculations and evaluations, those existing requirements for FPP documents will remain unchanged. Entergy specifically requires that the calculations and evaluations in support of the NFPA 805 LAR, exclusive of the FPRA, be performed within the scope of the QA program, which requires independent review as defined by Entergy procedures. As recommended by NUREG/CR-6850, the sources of uncertainty in the FPRA were identified and analyzed for sensitivity in support of the transition to NFPA 805.

The removal of conservatism inherent in the FPRA remains a long-term goal; nevertheless, the FPRA results were deemed sufficient for evaluating the risk associated with this application. While Entergy continues to strive toward a more "realistic" estimate of fire risk, use of mean values continue to be the best estimate of fire risk. During the FRE process, the uncertainty and sensitivity associated with specific FPRA parameters were considerations in the evaluation of the change in risk relative to the applicable acceptance thresholds.

Specific Requirements of NFPA 805, Section 2.7.3

NFPA 805, Section 2.7.3.1 – Review

Analyses, calculations, and evaluations performed in support of compliance with 10 CFR 50.48(c) and upon implementation of NFPA 805 are performed in accordance with Entergy procedures that require independent review.

NFPA 805, Section 2.7.3.2 – Verification and Validation

Calculational models and numerical methods used in support of compliance with 10 CFR 50.48(c) were verified and validated as required by Section 2.7.3.2 of NFPA 805. This requirement will also be imposed upon implementation of NFPA 805.

NFPA 805, Section 2.7.3.3 – Limitations of Use

Engineering methods and numerical models used in support of compliance with 10 CFR 50.48(c) were used appropriately and will continue to be used as required by Section 2.7.3.3 of NFPA 805.

NFPA 805, Section 2.7.3.4 – Qualification of Users

Cognizant personnel who use and apply engineering analysis and numerical methods in support of compliance with 10 CFR 50.48(c) are competent and experienced as required by Section 2.7.3.4 of NFPA 805.

During the transition to 10 CFR 50.48(c), work was performed in accordance with the quality requirements of Section 2.7.3 of NFPA 805. Personnel who used and applied engineering analysis and numerical methods (e.g., fire modeling) in support of compliance with 10 CFR 50.48(c) are competent and experienced as required by NFPA 805 Section 2.7.3.4.

Post-transition, for personnel performing fire modeling or FPRA development and evaluation, Entergy will develop and maintain qualification requirements for individuals assigned various tasks. Position Specific Guides will be developed to identify and document required training and mentoring to ensure individuals are appropriately qualified per the requirements of NFPA 805, Section 2.7.3.4, to perform assigned work (see Attachment S).

The NFPA 805 change evaluation process will be owned by the Fire Protection staff. The systematic approach to training as described in EN-TQ-201, "Systematic Approach to Training Process," will be utilized to determine what training will be required and which personnel will be required to receive d the training. Current training plans include a qualification card and associated classroom training for the Fire Protection staff.

NFPA 805, Section 2.7.3.5 – Uncertainty Analysis

Uncertainty analyses were performed as required by Section 2.7.3.5 of NFPA 805 and the results were considered in the context of the application. This is of particular interest in fire modeling and FPRA development. When applicable, this requirement will be enforced post-transition.

4.8 Summary of Results

4.8.1 Results of the Fire Area Review

A summary of the NFPA 805 compliance basis and the required fire protection systems and features is provided in Table 4-3. The table provides the following information from the NEI 04-02, Table B-3:

- Fire Area / Fire Zone: Fire Area/Zone Identifier.
- Description: Fire Area/Zone Description.
- NFPA 805 Regulatory Basis: Post-transition NFPA 805 Chapter 4 compliance basis (Note: Compliance is determined on a Fire Area basis; therefore, a compliance basis is not provided for individual fire zones.)
- Required Suppression/Detection: Detection/suppression is required in the Fire Area based on NFPA 805 Chapter 4 compliance. The information is provided on a zone basis. The basis for the requirement of the fire protection system is designated as follows:

S –	Separation Criteria:	Systems required for Chapter 4 Separation Criteria (NFPA 805 Section 4.2.3)
E –	EEEE:	Systems required for acceptability of Existing Engineering Equivalency Evaluations (EEEEs) (NFPA 805 Section 2.2.7)
L –	LA Criteria:	NRC approved Licensing Action (LA) (i.e., Exemptions/ Deviations/Safety Evaluations) (NFPA 805 Section 2.2.7)
R –	Risk Criteria:	Systems required to meet the Risk Criteria for the Performance-Based Approach (NFPA 805 Section 4.2.4)
D –	Defense-in-depth Criteria:	Systems required to maintain adequate balance of Defense-in-Depth for a Performance-Based Approach (NFPA 805 Section 4.2.4)

Attachment W contains the results of the Fire Risk Evaluations, additional risk of recovery actions, and the change in risk on a fire area basis.

4.8.2 Plant Modifications and Items to be Completed During the Implementation Phase

Planned modifications, program, procedure, and evaluation changes and upgrades to comply with NFPA 805 are described in Attachment S. Attachment S contains two tables. Table S-1 identifies plant modifications required to be completed and Table S-2 identifies programs, procedures, and document changes and upgrades to be completed.

The Plant Change Evaluation Process will be implemented using Entergy fleet procedures EN-DC-115, “Engineering Change Process,” and EN-DC-128, “Fire Protection Impact Reviews.” EN-DC-115, which is used to evaluate proposed plant changes, includes steps to ensure proposed activities such as changes in pump motors, cabling, transient combustibles, fire loading, and ignition sources are evaluated for impact to the FPRA. Based on the results of the EN-DC-115 impact review, additional reviews may be required in accordance with EN-DC-128. Guidance will be provided in EN-DC-128 to define changes in relationship to NFPA 805 Chapter 2 or 3 requirements, changes in Radioactive Release performance criteria, NSCA capability in NPO modes, power operations credited NSCA SSCs, changes in combustible loading, changes that may adversely impact fire areas with suppression or detection systems, etc. Based on the type of change, EN-DC-115 will also include a preliminary risk screening that will be followed by either a qualitative or quantitative review. The qualitative and quantitative reviews will include questions to determine if NRC approval is required prior to making the plant change.

The FPRA model will represent the as-built, as-operated and maintained plant following completion of the risk related modifications that are implemented in support of those modifications identified in Attachment S. Following installation of modifications and the as-built installation details, additional refinements surrounding the modification may need to be incorporated into the Fire PRA model. However, these changes are not expected to be significant. See Implementation Item in Table S-2 of Attachment S.

4.8.3 Supplemental Information –Other Licensee Specific Issues

4.8.3.1 None

Table 4-3 Summary of NFPA 805 Compliance Basis and Required Fire Protection Systems and Features

Fire Area	Fire Zone	Description	NFPA 805 Regulatory Basis	Required Suppression System (S, L, E, R, D)	Required Detection System (S, L, E, R, D)	Required Fire Protection Feature (S, L, E, R, D)	Required Fire Protection Feature and System Details
A		East Decay Heat Removal Pump Room					
A	10-EE	East Decay Heat Removal Pump Room	4.2.3.2	None	E	N/A	Detection
B-1		Unit 1 General Plant Multiple Elevations					
B-1@120	120-E	Boric Acid Addition Tank & Pump Room	4.2.4.2	R, D	None	N/A	Partial Suppression
B-1@120	125-E	Respirator Storage Room	4.2.4.2	R, D	None	N/A	Suppression
B-1@120	128-E	Controlled Access	4.2.4.2	E, R, D	R, D	N/A	Detection and Suppression
B-1@120	149-E	Upper North Elect Pen Rm, Hot Mech Shop, Decon Rm	4.2.4.2	E, R, D	E, R, D	N/A	Detection and Suppression
B-1@120	79-U	Upper North Piping Penetration Room	4.2.4.2	E, D	E, R, D	N/A	Detection and Partial Suppression
B-1@170-Z	170-Z	Steam Pipe Room (Penthouse)	4.2.4.2	None	None	N/A	None
B-1@40Y	40-Y	Pipeway Room (Under ICW coolers)	4.2.4.2	None	R, D	N/A	Detection
B-1@73-W	73-W	Condensate Demineralizer Room	4.2.4.2	E, D	E, R, D	N/A	Detection and Partial Suppression
B-1@BOFZ	157-B	Chemical Addition Room (Boric Acid Mix Tank)	4.2.4.2	None	None	N/A	None
B-1@BOFZ	159-B	Spent Fuel Room	4.2.4.2	None	E, R, D	N/A	Detection
B-1@BOFZ	160-B	Computer Room	4.2.4.2	None	E, R, D	N/A	Partial Detection
B-1@BOFZ	161-B	Ventilation Equipment Room	4.2.4.2	None	None	N/A	None
B-1@BOFZ	163-B	Reactor Building Purge Room	4.2.4.2	D	None	N/A	Partial Suppression
B-1@BOFZ	167-B	Computer Transformer Room	4.2.4.2	None	R, D	N/A	Detection
B-1@BOFZ	168-B	Transformer Room	4.2.4.2	None	None	N/A	None
B-1@BOFZ	175-CC	Lube Oil Storage Tank Room	4.2.4.2	D	R, D	N/A	Detection and Suppression
B-1@BOFZ	187-DD	Dirty & Clean Lube Oil Storage Tank Room	4.2.4.2	D	None	N/A	Suppression
B-1@BOFZ	197-X	Turbine Building (Balance of Fire Zone)	4.2.4.2	E, D	E, R, D	N/A	Partial Detection and Suppression
B-1@BOFZ	2026-Y	Drumming Station (Unit 1)	4.2.4.2	None	None	N/A	None
B-1@BOFZ	75-AA	Boiler Room, Ammonia Tank Room	4.2.4.2	E, D	R, D	N/A	Detection and Partial Suppression
B-1@BOFZ	78-BB	Gas Bottle Storage Room	4.2.4.2	None	None	N/A	None
B-1@WHD	197-X	Turbine Building (West Heater Deck)	4.2.4.2	None	E, D	N/A	Partial Detection
B-7		Aux Building Elev 317					
B-7	12-EE	Tendon Gallery Access Room	4.2.3.2	None	None	N/A	None
B-7	14-EE	West Decay Heat Removal Pump Room	4.2.3.2	None	E	N/A	Detection
B-7	4-EE	General Access Room	4.2.3.2	None	None	N/A	None

Table 4-3 Summary of NFPA 805 Compliance Basis and Required Fire Protection Systems and Features

Fire Area	Fire Zone	Description	NFPA 805 Regulatory Basis	Required Suppression System (S, L, E, R, D)	Required Detection System (S, L, E, R, D)	Required Fire Protection Feature (S, L, E, R, D)	Required Fire Protection Feature and System Details
B-8		Aux Bldg South Side					
B-8@SEPR	104-S	Electrical Equipment Room	4.2.4.2	None	E, R, D	N/A	Detection
B-8@SEPR	105-T	Lower South Electrical Penetration Room	4.2.4.2	E, R, D	E, R, D	N/A	Detection and Suppression
B-8@SEPR	144-D	Upper South Electrical Penetration Room	4.2.4.2	E, R, D	E, R, D	N/A	Detection and Suppression
B-8@SEPR	76-W	Compressor Room	4.2.4.2	None	R, D	N/A	Detection
B-8@SPPR	46-Y	Lower South Piping Penetration Room	4.2.4.2	None	E, R, D	N/A	Detection
B-8@SPPR	77-V	Upper South Piping Penetration Room	4.2.4.2	None	E, R, D	N/A	Detection
B-9		General Access Elev 354					
B-9	67-U	Lab & Demineralizer Access Room	4.2.4.2	E, D	E, R, D	N/A	Detection and Partial Suppression
B-9	68-P	Reactor Coolant Makeup Tank Room	4.2.4.2	None	R, D	N/A	Detection
B-9	88-Q	Communications Room	4.2.4.2	None	None	N/A	None
B-9	89-P	Controlled Access (stairwell)	4.2.4.2	None	None	N/A	None
B-10		Stairwell No.1					
B-10	162-A	Stairwell 1	4.2.4.2	None	None	N/A	None
C		General Area 335' Elevation					
C	20-Y	Radwaste Processing Room	4.2.4.2	D	E, R, D	N/A	Detection and Partial Suppression
C	31-Y	Purification Demineralizer Room	4.2.4.2	None	None	N/A	None
C	34-Y	Pipe Room	4.2.4.2	None	E, R, D	N/A	Detection
C	38-Y	Emergency Feedwater Pump Room	4.2.4.2	E, D	E, R, D	N/A	Detection and Partial Suppression
C	47-Y	Penetration Ventilation Room	4.2.4.2	None	E, R, D	N/A	Detection
C	53-Y	Lower North Piping Penetration Room	4.2.4.2	None	E, R, D	N/A	Detection
D		North Emergency Diesel Generator Room					
D	1-E	North Emergency Diesel Generator Exhaust Fans	4.2.3.2	None	E	N/A	Detection
D	86-G	North Emergency Diesel Generator Room	4.2.3.2	E	E	N/A	Detection and Suppression
E		South Switchgear Room					
E	100-N	South Switchgear Room	4.2.4.2	None	E, R, D	N/A	Detection
F		South Battery and DC Equipment Rooms					
F	110-L	South Battery Room	4.2.4.2	None	R, D	N/A	Detection

Table 4-3 Summary of NFPA 805 Compliance Basis and Required Fire Protection Systems and Features

Fire Area	Fire Zone	Description	NFPA 805 Regulatory Basis	Required Suppression System (S, L, E, R, D)	Required Detection System (S, L, E, R, D)	Required Fire Protection Feature (S, L, E, R, D)	Required Fire Protection Feature and System Details
G		Cable Spreading Room and Control Rooms					
G	97-R	Cable Spreading Room	4.2.4.2	E, D	E, R, D	N/A	Detection and Partial Suppression
G	129-F	Control Room	4.2.4.2	E, D	E, R, D	N/A	Detection and Partial Suppression
G	2098-C	CPC Room	4.2.4.2	R, D	R, D	N/A	Detection and Suppression
G	2098-L	Cable Spreading Room	4.2.4.2	R, D	R, D	N/A	Detection and Suppression
G	2119-H	CR Printer Room	4.2.4.2	None	R, D	N/A	Detection
G	2136-I	Health Physics Corridor	4.2.4.2	R, D	R, D	N/A	Detection and Partial Suppression
G	2137-I	USEP Room, Decon, Hot Instrument Shop	4.2.4.2	R, D	R, D	N/A	Detection and Suppression
G	2150-C	Old CPC Room	4.2.4.2	None	R, D	N/A	Detection
G	2199-G	Unit 2 Control Room	4.2.4.2	None	R, D	N/A	Detection
H		South Emergency Diesel Generator Room					
H	2-E	South Emergency Diesel Generator Exhaust Fans	4.2.3.2	None	E	N/A	Detection
H	87-H	South Emergency Diesel Generator Room	4.2.3.2	E	E	N/A	Detection and Suppression
I-1		Corridor					
I-1	98-J	Corridor	4.2.4.2	E, R, D	E, R, D	N/A	Detection and Partial Suppression
I-2		North Switchgear Room					
I-2	99-M	North Switchgear Room	4.2.4.2	None	E, R, D	N/A	Detection
I-3		Lower North Electrical Penetration Room					
I-3	112-I	Lower North Electrical Penetration Room	4.2.4.2	E, R, D	E, R, D	N/A	Detection and Suppression
J		Unit 1 Containment Building					
J-North	32-K	North Side Containment Building	4.2.4.2	N/R	E, R, D	N/A	Partial Detection
J-South	33-K	South Side Containment Building	4.2.4.2	N/R	E, R, D	N/A	Partial Detection
K		Tank Vaults					
K	16-Y	Clean Waste Receiver Tank Room	4.2.3.2	None	None	N/A	None
K	2020-JJ	Boron Holdup Tank Vault	4.2.3.2	None	None	N/A	None
L		Diesel Fuel Storage Vault Area					
L	TKVLT	Diesel Fuel Storage Vault	4.2.3.2	N/R	N/R	N/A	None
MH01		Between Aux Bldg and Intake Structure					
MH01	1MH01	Yard Manhole	4.2.3.2	None	None	N/A	None

Table 4-3 Summary of NFPA 805 Compliance Basis and Required Fire Protection Systems and Features

Fire Area	Fire Zone	Description	NFPA 805 Regulatory Basis	Required Suppression System (S, L, E, R, D)	Required Detection System (S, L, E, R, D)	Required Fire Protection Feature (S, L, E, R, D)	Required Fire Protection Feature and System Details
MH02		Between Aux Bldg and Intake Structure					
MH02	1MH02	Yard Manhole	4.2.3.2	None	None	N/A	None
MH03		Between Aux Bldg and Intake Structure					
MH03	1MH03	Yard Manhole	4.2.4.2	None	None	N/A	None
MH04		Between Aux Bldg and Intake Structure					
MH04	1MH04	Yard Manhole	4.2.3.2	None	None	N/A	None
MH05		Between Aux Bldg and Intake Structure					
MH05	1MH05	Yard Manhole	4.2.4.2	None	None	N/A	None
MH06		Between Aux Bldg and Intake Structure					
MH06	1MH06	Yard Manhole	4.2.3.2	None	None	N/A	None
MH09		Between Aux Bldg and Intake Structure					
MH09	1MH09	Yard Manhole	4.2.3.2	None	None	N/A	None
MH10		Between Aux Bldg and Intake Structure					
MH10	1MH10	Yard Manhole	4.2.3.2	None	None	N/A	None
N		Unit 1 Intake Structure					
N	INTAKE	Intake Structure (Unit 1)	4.2.4.2	N/R	D	N/A	Detection
O		North Battery Room					
O	95-O	North Battery Room	4.2.4.2	None	R, D	N/A	Detection
YD		Miscellaneous Yard Locations					
YD	DEGAS	Degas	4.2.3.2	None	None	N/A	None
YD	YARD	Miscellaneous Yard Locations	4.2.3.2	N/R	N/R	N/A	None
ADMIN		Administration Building					
ADMIN	ADMIN	Administration Building	4.2.3.2	N/R	N/R	N/A	None

Legend:

S – Credited Separation Criteria is derived from PRA in B-3 Table VFDRs.
L –NRC approved Licensing Action is derived from Attachment K and/or B-1 Table VFDRs.
E – EEEE Criteria: Credited Systems/Features are derived from B-1 Table and/or B-3 Table.
R – Risk Criteria is derived from PRA in B-3 Table.
D – Defense-in-depth Criteria is derived from PRA in B-3 Table.
N/R – System is operational in fire area, however it is Not Required.
Fire Protection Features are features required to meet NFPA 805 Chapter 3 requirements.
None – Fire protection feature is not present in the fire zone.

5.0 REGULATORY EVALUATION

5.1 Introduction – 10 CFR 50.48

On July 16, 2004 the NRC amended 10 CFR 50.48, "Fire Protection," to add a new subsection, 10 CFR 50.48(c), which establishes alternative FP requirements. 10 CFR 50.48 endorses, with exceptions, the NFPA's NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants – 2001 Edition (NFPA 805)," as a voluntary alternative for demonstrating compliance with 10 CFR 50.48 Section (b), Appendix R, and Section (f), Decommissioning.

The voluntary adoption of 10 CFR 50.48(c) by ANO-1 does not eliminate the need to comply with 10 CFR 50.48(a) and 10 CFR 50, Appendix A, General Design Criterion (GDC) 3, "Fire Protection." The NRC addressed the overall adequacy of the regulations during the promulgation of 10 CFR 50.48(c) (Reference Federal Register (FR) Notice 69 FR 33536 dated June 16, 2004, ML041340086).

> *"NFPA 805 does not supersede the requirements of GDC 3, 10 CFR 50.48(a), or 10 CFR 50.48(f). Those regulatory requirements continue to apply to licensees that adopt NFPA 805. However, under NFPA 805, the means by which GDC 3 or 10 CFR 50.48(a) requirements may be met is different than under 10 CFR 50.48(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 10 CFR 50.48(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.*
>
> *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 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, its design 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." (Reference FR Notice 69 FR 33536 dated June 16, 2004, ML041340086)*

The new rule provides actions that may be taken to establish compliance with 10 CFR 50.48(a), which requires each operating nuclear power plant to have a fire protection program plan that satisfies GDC 3, as well as specific requirements in that section. The transition process described in 10 CFR 50.48(c)(3)(ii) provides, in pertinent parts, that a licensee intending to adopt the new rule must, among other things, "modify the fire protection plan required by paragraph (a) of that section to reflect the licensee's decision to comply with NFPA 805." Therefore, to the extent that the contents of the existing FP program plan required by 10 CFR 50.48(a) are inconsistent with NFPA 805, the FP program plan must be modified to achieve compliance with the requirements in NFPA 805. All other requirements of 10 CFR 50.48 (a) and GDC 3 have corresponding requirements in NFPA 805.

A comparison of the current requirements in Appendix R with the comparable requirements in Section 3 of NFPA 805 shows that the two sets of requirements are consistent in many respects. This was further clarified in FAQ 07-0032, 10 CFR 50.48(a) and GDC 3 clarification (ML081300697). The following tables provide a cross reference of FP regulations associated with the post-transition ANO-1 FP program and applicable industry and ANO-1 documents that address the topic.

10 CFR 50.48(a)

Table 5-1 10 CFR 50.48(a) – Applicability/Compliance Reference

10 CFR 50.48(a) Section(s)	Applicability/Compliance Reference
(1) Each holder of an operating license issued under this part or a combined license issued under part 52 of this chapter must have a fire protection plan that satisfies Criterion 3 of appendix A to this part. This fire protection plan must:	See below
(i) Describe the overall fire protection program for the facility;	NFPA 805 Section 3.2 Attachment A
(ii) Identify the various positions within the licensee's organization that are responsible for the program;	NFPA 805 Section 3.2.2 Attachment A
(iii) State the authorities that are delegated to each of these positions to implement those responsibilities; and	NFPA 805 Section 3.2.2 Attachment A
(iv) Outline the plans for fire protection, fire detection and suppression capability, and limitation of fire damage.	NFPA 805 Section 2.7 and Chapters 3 and 4 Attachments A and C
(2) The plan must also describe specific features necessary to implement the program described in paragraph (a)(1) of this section such as:	See below
(i) Administrative controls and personnel requirements for fire prevention and manual fire suppression activities;	NFPA 805 Sections 3.3.1 and 3.4 Attachment A
(ii) Automatic and manually operated fire detection and suppression systems; and	NFPA 805 Sections 3.5 through 3.10 and Chapter 4 Attachments A and C
(iii) The means to limit fire damage to structures, systems, or components important to safety so that the capability to shut down the plant safely is ensured.	NFPA 805 Section 3.3 and Chapter 4 Attachment A
(3) The licensee shall retain the fire protection plan and each change to the plan as a record until the Commission terminates the reactor license. The licensee shall retain each superseded revision of the procedures for 3 years from the date it was superseded.	NFPA 805 Section 2.7.1.1 requires that documentation (Analyses, as defined by NFPA 805, Section 2.4, performed to demonstrate compliance with this standard) be maintained for the life of the plant. OP-1003.014, Revision 6, “ANO Fire Protection Program” and EN-AD-103, Revision 13, “Document Control and Records Management Programs,” address the scope and retention standards for ANO-1.
(4) Each applicant for a design approval, design certification, or manufacturing license under part 52 of this chapter must have a description and analysis of the fire protection design features for the standard plant necessary to demonstrate compliance with Criterion 3 of appendix A to this part.	Not applicable. ANO-1 is licensed under 10 CFR 50.

General Design Criterion 3

Table 5-2 GDC 3 – Applicability/Compliance Reference

GDC 3, Fire Protection, Statement	Applicability/Compliance Reference
Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.	NFPA 805 Chapters 3 and 4 Attachments A and C
Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and control room.	NFPA 805 Sections 3.3.2, 3.3.3, 3.3.4, 3.11.4 Attachment A
Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety.	NFPA 805 Chapters 3 and 4 Attachments A and C
Firefighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components	NFPA 805 Sections 3.4 through 3.10 and 4.2.1 Attachment C

10 CFR 50.48(c)

Table 5-3 10 CFR 50.48(c) – Applicability/Compliance Reference

10 CFR 50.48(c) Section(s)	Applicability/Compliance Reference
(1) *Approval of incorporation by reference.* National Fire Protection Association (NFPA) Standard 805, “Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition” (NFPA 805), which is referenced in this section, was approved for incorporation by reference by the Director of the Federal Register pursuant to 5 U.S.C. 552(a) and 1 CFR part 51.	General Information. NFPA 805 2001 edition is the edition used.
(2) Exceptions, modifications, and supplementation of NFPA 805. As used in this section, references to NFPA 805 are to the 2001 Edition, with the following exceptions, modifications, and supplementation:	General Information. NFPA 805 2001 edition is the edition used.
(i) *Life Safety Goal, Objectives, and Criteria.* The Life Safety Goal, Objectives, and Criteria of Chapter 1 are not endorsed.	The Life Safety Goal, Objectives, and Criteria of Chapter 1 of NFPA 805 are not part of the LAR.
(ii) *Plant Damage/Business Interruption Goal, Objectives, and Criteria.* The Plant Damage/Business Interruption Goal, Objectives, and Criteria of Chapter 1 are not endorsed.	The Plant Damage/Business Interruption Goal, Objectives, and Criteria of Chapter 1 of NFPA 805 are not part of the LAR.
(iii) *Use of feed-and-bleed.* In demonstrating compliance with the performance criteria of Sections 1.5.1(b) and (c), a high-pressure charging/injection pump coupled with the Pressurizer Power-Operated Relief Valves (PORVs) as the sole fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability (i.e., feed-and-bleed) for pressurized-water reactors (PWRs) is not permitted.	Feed and bleed is not utilized as the sole fire-protected safe shutdown methodology.
(iv) *Uncertainty analysis.* An uncertainty analysis performed in accordance with Section 2.7.3.5 is not required to support deterministic approach calculations.	Uncertainty analysis was not performed for deterministic methodology.

Table 5-3 10 CFR 50.48(c) – Applicability/Compliance Reference

10 CFR 50.48(c) Section(s)	Applicability/Compliance Reference
(v) *Existing cables.* In lieu of installing cables meeting flame propagation tests as required by Section 3.3.5.3, a flame-retardant coating may be applied to the electric cables, or an automatic fixed fire suppression system may be installed to provide an equivalent level of protection. In addition, the italicized exception to Section 3.3.5.3 is not endorsed.	Electrical cable construction complies with a flame propagation test that was found acceptable to the NRC as documented in Attachment A.
(vi) *Water supply and distribution.* The italicized exception to Section 3.6.4 is not endorsed. Licensees who wish to use the exception to Section 3.6.4 must submit a request for a license amendment in accordance with paragraph (c)(2)(vii) of this section.	ANO-1 complies by previous NRC approval. See Attachment A.
(vii) *Performance-based methods.* Notwithstanding the prohibition in Section 3.1 against the use of performance-based methods, the fire protection program elements and minimum design requirements of Chapter 3 may be subject to the performance-based methods permitted elsewhere in the standard. Licensees who wish to use performance-based methods for these fire protection program elements and minimum design requirements shall submit a request in the form of an application for license amendment under § 50.90. The Director of the Office of Nuclear Reactor Regulation, or a designee of the Director, may approve the application if the Director or designee determines that the performance-based approach; (A) Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; (B) Maintains safety margins; and (C) Maintains fire protection defense-in-depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability).	The use of performance-based methods for NFPA 805 Chapter 3 is requested. See Attachment L.
(3) *Compliance with NFPA 805*.	See below
(i) A licensee may maintain a fire protection program that complies with NFPA 805 as an alternative to complying with paragraph (b) of this section for plants licensed to operate before January 1, 1979, or the fire protection license conditions for plants licensed to operate after January 1, 1979. The licensee shall submit a request to comply with NFPA 805 in the form of an application for license amendment under § 50.90. The application must identify any orders and license conditions that must be revised or superseded, and contain any necessary revisions to the plant's technical specifications and the bases thereof. The Director of the Office of Nuclear Reactor Regulation, or a designee of the Director, may approve the application if the Director or designee determines that the licensee has identified orders, license conditions, and the technical specifications that must be revised or superseded, and that any necessary revisions are adequate. Any approval by the Director or the designee must be in the form of a license amendment approving the use of NFPA 805 together with any necessary revisions to the technical specifications.	The LAR was submitted in accordance with 10 CFR 50.90. The LAR included applicable license conditions, orders, technical specifications/bases that needed to be revised and/or superseded.
(ii) The licensee shall complete its implementation of the methodology in Chapter 2 of NFPA 805 (including all required evaluations and analyses) and, upon completion, modify the fire protection plan required by paragraph (a) of this section to reflect the licensee's decision to comply with NFPA 805, before changing its fire protection program or nuclear power plant as permitted by NFPA 805.	The LAR and transition report summarize the evaluations and analyses performed in accordance with Chapter 2 of NFPA 805.

Table 5-3 10 CFR 50.48(c) – Applicability/Compliance Reference

10 CFR 50.48(c) Section(s)	Applicability/Compliance Reference
(4) Risk-informed or performance-based alternatives to compliance with NFPA 805. A licensee may submit a request to use risk-informed or performance-based alternatives to compliance with NFPA 805. The request must be in the form of an application for license amendment under § 50.90 of this chapter. The Director of the Office of Nuclear Reactor Regulation, or designee of the Director, may approve the application if the Director or designee determines that the proposed alternatives: (i) Satisfy the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; (ii) Maintain safety margins; and (iii) Maintain fire protection defense-in-depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability).	No risk-informed or performance-based alternatives to compliance with NFPA 805 (per 10 CFR 50.48(c)(4)) were utilized.

5.2 Regulatory Topics

5.2.1 License Condition Changes

The current ANO-1 fire protection license condition 2.c.(8) is being replaced with the standard license condition in Regulatory Position 3.1 of RG 1.205, as shown in Attachment M.

5.2.2 Technical Specifications

ANO-1 conducted a review of the Technical Specifications (TSs) to determine which TSs are required to be revised, deleted, or superseded. ANO-1 determined that the changes to the TSs and applicable justification listed in Attachment N are adequate for the ANO-1 adoption of the new FP licensing basis.

5.2.3 Orders and Exemptions

A review was conducted of the ANO-1 docketed correspondence to determine if there were any orders or exemptions that needed to be superseded or revised. A review was also performed to ensure that compliance with the physical protection requirements, security orders, and adherence to those commitments applicable to the plant are maintained. A discussion of affected orders and exemptions is included in Attachment O.

5.3 Regulatory Evaluations

5.3.1 No Significant Hazards Consideration

A written evaluation of the significant hazards consideration of a proposed license amendment is required by 10 CFR 50.92. According to 10 CFR 50.92, a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

- Involve a significant increase in the probability or consequences of an accident previously evaluated; or

- Create the possibility of a new or different kind of accident from any accident previously evaluated; or
- Involve a significant reduction in a margin of safety.

This evaluation is contained in Attachment Q.

Based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public. ANO-1 has evaluated the proposed amendment and determined that it involves no significant hazards consideration.

5.3.2 Environmental Consideration

Pursuant to 10 CFR 51.22(b), an evaluation of the LAR has been performed to determine whether it meets the criteria for categorical exclusion set forth in 10 CFR 51.22(c). That evaluation is discussed in Attachment R. The evaluation confirms that this LAR meets the criteria set forth in 10 CFR 51.22(c)(9) for categorical exclusion from the need for an environmental impact assessment or statement.

5.4 Revision to the SAR

After the approval of the LAR and in accordance with 10 CFR 50.71(e), the ANO-1 SAR will be revised. The format and content will be consistent with NEI 04-02, as addressed in FAQ 12-0062.

5.5 Transition Implementation Schedule

The following schedule for transitioning ANO-1 to the new FP licensing basis requires NRC approval of the LAR in accordance with the following schedule:

- Implementation of new NFPA 805 FP program provided in Attachment S, Table S-2, which includes procedure changes, process updates, and training of affected plant personnel, will occur six months following SER issuance.
- Modifications required to support and complete the ANO-1 transition to NFPA 805 as provided in Attachment S, Table S-1, will be completed prior to startup from the second ANO-1 refueling outage following SER issuance. Appropriate compensatory measures will be maintained until modifications are complete.

6.0 REFERENCES

The following references were used in the development of the Transition Report (TR). Additional references are in the NEI 04-02 Tables in the various Attachments.

Cover Letter

1. National Fire Protection Association (NFPA) Standard 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, National Fire Protection Association, Quincy, MA – <u>not included in portal</u>

2. 10 CFR 50.48, "Fire Protection," 65 FR 38190, June 20, 2000; [69 FR 33550, June 16, 2004; 72 FR 49495, Aug. 28, 2007]

3. Regulatory Guide 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 1, U. S. Nuclear Regulatory Commission, Washington, DC, December 2009 [ADAMS Accession No. ML092730314]

4. NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," Revision 2, Nuclear Energy Institute, Washington, DC, April 2008 [ADAMS Accession No. ML081130188]

Executive Summary

5. 10 CFR 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979" [45 FR 76611, Nov. 19, 1980; 46 FR 44735, Sept. 8, 1981, as amended at 53 FR 19251, May 27, 1988; 65 FR 38191, June 20, 2000; 77 FR 39907, Jul. 6, 2012]

6. 0CAN110502, Entergy letter to the NRC dated November 2, 2005, "Letter of Intent to Adopt NFPA 805 – Performance-Based Standard for Fire Protection for Light Water Reactor Generating Plants, 2001 Edition," [ADAMS Accession No. ML053140128]

7. NUREG/CR-6850, "EPRI/NRC-RES, Fire PRA Methodology for Nuclear Power Facilities," Volumes 1 and 2, U. S. Nuclear Regulatory Commission, Washington, DC, September 2005 [ADAMS Accession Nos. ML052580075 (Volume 1) and ML052580118 (Volume 2)]

1.0 Introduction

8. 0CNA120805, NRC letter to Entergy dated December 22, 2008, "Arkansas Nuclear One, Units 1 and 2 – Evaluation of the Request for an Extension of Enforcement Discretion in Accordance With the Interim Enforcement Policy for Fire Protection Issues During Transition to National Fire Protection Standard NFPA 805," [ADAMS Accession No. ML083500404]

9. 0CNA071107, NRC letter to Entergy dated July 28, 2011, "Arkansas Nuclear one, Units 1 and 2 – Commitment to Submit a License Amendment Request to Transition to 10CFR 50.4(c), National Fire Protection Association Standard NFPA 805, and Request to Extend Enforcement Discretion," [ADAMS Accession No. ML112030193]

10. 1CNA011301, NRC letter to Entergy dated January 24, 2013, Arkansas Nuclear One, Unit No. 1 – Safety Evaluation Regarding the Additional Fire Protection Enforcement Discretion (TAC No. ME9429) [ADAMs Accession No. ML13009A292]

2.0 Overview of Existing Fire Protection Program

11. Appendix A to the Auxiliary and Power Conversion Systems Branch (APCSB) Technical Position 9.5-1 (APCSB 9.5-1), "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976" (August 23, 1976) [ADAMS Accession No. ML070660458]

12. 0CNA039215, NRC letter to Entergy dated March 31, 1992, "Issuance of Amendment Nos. 158 and 132 to Facility Operating License Nos. DPR-51 and NPF-6 – Arkansas Nuclear One, Units 1 and 2"

13. 0CAN027802, Entergy letter to NRC letter dated February 28, 1978, "Fire Protection Safety Evaluation Report"

14. 1CNA087810, NRC letter to Entergy dated August 22, 1978, "ANO-1 Fire Protection Safety Evaluation Report (SER) Amendment 35"

15. 1CAN027914, Entergy letter to NRC dated February 23, 1979, "Proposed Technical Specification Changes"

16. 1CNA057918, NRC letter to Entergy dated May 23, 1979, Issuance of Amendment 43

17. 0CNA088203, NRC letter to Entergy dated August 6, 1982, "NRC Inspection Report 50-313/82-15 50-368/82-12"

18. 0CNA038328, NRC letter to Entergy dated March 22, 1983, Issuance of Exemptions to Certain Requirements of Appendix R to 10 CFR 50

19. 0CNA078522, NRC letter to Entergy dated July 25, 1985, Results of Inspection Conducted May 20-24, 1985

20. 0CAN088508, Entergy letter to NRC dated August 30, 1985, "Results of Reanalysis Against NRC Clarification / Interpretation of Appendix R to 10CFR50 – Supplemental Information"

21. 0CAN108608, Entergy letter to NRC dated October 20, 1986, "Appendix R Exemption Requests-Additional Information"

22. 1CNA108085, NRC letter to Entergy dated October 24, 1980, Appendix R Open Items

23. 0CNA058316, NRC letter to Entergy dated May 13, 1983, "Safety Evaluation Regarding Safe Shutdown Capability in the Event of a Fire"

24. 0CNA098716, NRC letter to Entergy dated September 30, 1987, "NRC Inspection Report 50-313/87-14 50-368/87-14"

25. 1CNA108806, NRC letter to Entergy dated October 26, 1988, “Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1”

26. 1CAN068201, Entergy letter to NRC dated June 2, 1982, “Fire Seal Test Results - Item 3.12 ANO-1 Fire Protection SER”

27. 1CNA047909, NRC letter to Entergy dated April 5, 1979, “Testing of Cable Penetration Fire Stops Installed in Metal Lath and Plaster Walls”

28. 0CAN078202, Entergy letter to NRC dated July 1, 1982, “Results of Appendix R Compliance Review”

29. 0CAN088404, Entergy letter to NRC dated August 15, 1984, “Results of Reanalysis Against NRC Clarification/Interpretation of Appendix R to 10 CFR 50”

30. 1CAN048708, Entergy letter to NRC dated April 22, 1987, “10 CFR 50 Appendix R Exemption Request (Zone 38-Y)”

31. 1CAN068706, Entergy letter to NRC dated June 24, 1987, “10 CFR 50 Appendix R Exemption Request (Zone 38-Y)”

32. 1CAN048808, Entergy letter to NRC dated April 25, 1988, “ANO-1 Appendix R Exemption Requests Modification Schedule”

33. 0CNA058307, NRC letter to Entergy dated May 6, 1983, NRC Inspection Report: 50-313/83-07 50-368/83-07

34. 0CAN118210, Entergy letter to NRC dated November 11, 1982, “Request for Additional Information to Appendix R Compliance Submittal”

35. 1CAN109704, Entergy letter to NRC dated October 22, 1997, “Arkansas Nuclear One - Unit 1 Docket No. 50-313 License No. DPR-51 10CFR50 Appendix R Exemption Clarification for the Makeup Pump Rooms”

36. 1CNA058303, NRC letter to Entergy dated May 11, 1983, Issuance of Exemption Request Related to Section III.L.1 of Appendix R

37. 0CAN108710, Entergy letter to the NRC dated October 29, 1987, “Request for Exemption to Section III.G.2 of Appendix R”

38. 0CNA050603, NRC letter to Entergy dated May 5, 2006, “NRC Integrated Inspection Report 08000313/2006002 and 05000368/2006002 And Exercise of Enforcement Discretion”

39. CR ANO-1-2005-0954, Spray System (UAV-5607) providing protection for EFW pump P-7A may not be installed to meet the NFPA 15, 1985 Edition

40. CR-ANO-C-2006-00048, Corrective Action 18, Action tracks NRC closure of CR-ANO-1-2005-0954 during transition to NFPA 805

3.0 Transition process

41. NRC letter to NEI dated July 12, 2006, "Process for Frequently Asked Questions for Title 10 of the Code of Federal Regulations, Part 50.48(c) Transitions," [ADAMS Accession No. ML06166010]

42. Regulatory Issue Summary 2007-19, "Process for Communicating Clarifications of Staff Positions Provided in Regulatory Guide 1.205 Concerning Issues Identified During the Pilot Application of National Fire Protection Association Standard 805," Revision 0, U. S. Nuclear Regulatory Commission, Washington, DC, dated August 20, 2007 [ADAMS Accession No. ML071590227]

4.0 Compliance with NFPA 805 Requirements

4.1 – Fundamental Fire Protection Program and Design Elements

43. Engineering Change (EC)-44138 (CALC-ANO1-FP-11-00001), "NFPA 805 Transition Fundamental Elements Table B-1"

4.2 – Nuclear Safety Capability Assessment Methodology

44. NEI 00-01, "Guidance for Post-Fire Safe Shutdown Circuit Analysis," Revisions 1 and 2, Nuclear Energy Institute, Washington, DC, January 2005 and May 2009, respectively [ADAMS Accession Nos. ML050310295 and ML091770265, respectively]

45. CALC-ANO1-FP-09-00024 (EC-30068), Rev. 1, "ANO-1 Transition NSCA Methodology"

46. EC-40607, "NEI 00-01, Section 3, Rev. 1 to Rev. 2 Gap Analysis for NFPA 805 LAR"

47. EC-15217, "Current Transformer (CT) Open Circuit Concerns"

48. CALC-85-E-0087-24, "Safe Shutdown Cable Analysis," Rev. 1

49. Upper Level Document ULD-0-TOP-12, "ANO Unit 1 and 2 Electrical Protection/Coordination," Rev. 3

50. NUREG-0800, Section 9.5-1, "Fire Protection Program," Rev. 5

51. Information Notice 84-09, "Lessons Learned from NRC Inspections of Fire Protection Safe Shutdown Systems (10 CFR 50, Appendix R)," U.S. Nuclear Regulatory Commission, Washington, DC, February 13, 1984

52. FAQ 07-0030, "Establishing Recovery Actions," [ADAMS Accession No. ML110070485]

53. EC-27717, "ANO1 Fire Area Risk Evaluations for Transition to NFPA-805."

54. FAQ 07-0038, "Lessons Learned on Multiple Spurious Operations Closure Memo," Revision 3 [ADAMS Accession No. ML110140242]

55. FAQ 07-0054, "Demonstrating Compliance with Chapter 4 of NFPA 805," Rev. 1 [ADAMS Accession No. ML110140183]

56. EC-31053, "NFPA 805 Existing Engineering Evaluation Transition"

4.3 – Non-Power Operational Modes

57. FAQ 07-0040, "Non-Power Operations Clarifications Closure Memo," [ADAMS Accession No. ML082200528]

58. CALC-09-E-0008-01, "ANO-1 NFPA 805 Non Power Operations Assessment," Rev. 0

59. CALC-09-E-0008-03, "ANO-1 NFPA 805 NPO Fault Tree and PID Attachments." Rev. 0

60. CALC-08-E-0016-01, "Fire Probabilistic Risk Assessment Plant Partitioning and Fire Ignition Frequency Development (ERIN Report 0247-06-0006.01, Rev. 5)," Rev. 0

4.4 – Radioactive Release Performance Criteria

61. EC-27452 (CALC-ANO1-FP-08-00001, Rev. 2), "NEI 04-02 Table G-1, Radioactive Release Transition Report"

62. ANO-1 Pre-fire Plan (PFP-U1), Rev. 15

63. Common Pre-Fire Plan (PFP-UC), Rev. 13

4.5 – Fire PRA and Performance-Based Approaches

64. ASME/ANS RA-Sa-2009, "Standard for Level 1 / Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," American Society of Mechanical Engineers and the American Nuclear Society, La Grange Park, IL, 2009 – <u>not included in portal</u>

65. Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 2, U.S. Nuclear Regulatory Commission, Washington, DC, March 2009 [ADAMS Accession No. ML090410014]; RG 1.200, Revision 1, January 2007 [ADAMS Accession No. ML070240001]; Clarification to RG 1.200, Revision 1, July 2007 [ADAMS Accession No. ML071940235]; Draft RG 1.200, Revision 1 (issued as DG-1161), September 2006 [ADAMS Accession No. ML062480134]; RG 1.200, Revision 0, February 2004 [ADAMS Accession No. ML040630078]; RG 1.200, Revision 0 (issued for trial use with SRP Chapter 19.1) [ADAMS Accession No. ML040630300]; Draft RG 1.200, Revision 0 (issued as DG-1122), November 2002 [ADAMS Accession No. ML023360076]

66. ANO-1 base internal events PRA (ANO-1 PSA Model 4p00) – <u>not included in portal</u>

67. Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 1, U. S. Nuclear Regulatory Commission, Washington, DC, November 2002 [ADAMS Accession No. ML023240437]

4.6 – Monitoring

68. FAQ 10-0059,"NFPA 805 Monitoring," Rev. 5 NRC Closure Memo [ADAMS Accession No. ML082200528]

69. EPRI Technical Report 1006756, "Fire Protection Surveillance Optimization and Maintenance Guide for Fire Protection Systems and Features," Electric Power Research Institute, Charlotte, NC, July 2003

70. EN-DC-203, "Maintenance Rule Program," Rev. 1

71. EN-DC-204, "Maintenance Rule Scope and Basis," Rev. 2

72. EN-DC-207, "Maintenance Rule Periodic Assessment," Rev. 2

73. EN-DC-205, "Maintenance Rule Monitoring," Rev. 4

74. EN-DC-143-02, "Program and Component Health Reports Supplemental Guidance," Rev. 2

75. 10 CFR Part 20, "Standards for Protection Against Radiation"

76. EN-LI-102, "Corrective Action Process," Rev. 20

4.7 – Program Documentation, Configuration Control, and Quality Assurance

77. NEI 02-03, "Guidance for Performing a Regulatory Review of Proposed Changes to the Approved Fire Protection Program," June 2003

78. 10 CFR 50, Appendix B, Quality Assurance

4.8 – Summary of Results

79. EN-DC-115, "Engineering Change Process," Rev. 13

80. EN-DC-128, "Fire Protection Impact Review," Rev. 5

5.0 Regulatory Evaluation

81. 10 CFR 50, Appendix A, "General Design Criterion (GDC) 3, Fire Protection"

82. Voluntary Fire Protection Adoption of NFPA 805 Federal Register (FR) Notice 69 FR 33536 dated June 16, 2004, [ADAMS Accession No. ML041340086]

83. FAQ 07-0032, 10 CFR 50.48(a) and GDC 3 clarification [ADAMS Accession No. ML081300697]

84. OP-1003.014, "ANO Fire Protection Program," Rev. 6

85. EN-AD-103, "Document Control and Records Management Programs," Rev. 13

86. FAQ 12-0062, "UFSAR Content," Rev. 1

ATTACHMENTS

A. NEI 04-02Table B-1 – Transition of Fundamental FP Program & Design Elements

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
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.	N/A	General statement, no technical requirements. See sub-sections for specific compliance statements and references.	
3.2 Fire Protection Plan	N/A	N/A	Section header, no technical requirements. See sub-sections for specific compliance statements and references.	
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 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.	Complies	The site-wide fire protection plan is delineated in EN-DC-330 and OP-1003.014. The Fire Protection Program identifies the plant and corporate management positions responsible for implementing the Fire Protection Program and assigns their responsibilities and authorities.	EN-DC-330, Fire Protection Program, Rev. 1 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 2.0 provides scope
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.	Complies	Management responsibilities and authorities are delineated in EN-DC-330 and OP-1003.014.	EN-DC-330, Fire Protection Program, Rev. 1 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 5.0 - Responsibilities
3.2.2.1* Management Policy on Senior Management	The policy document shall designate the senior management position with immediate authority and responsibility for the fire protection program.	Complies	EN-DC-330 delineates responsibilities and authorities to plant and corporate management positions for implementing the Fire Protection Program and assigns ultimate responsibility of the ANO Fire Protection Program to the Site Vice President.	EN-DC-330, Fire Protection Program, Rev. 1 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 5.1 – General Manager, Plant Operations

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.2.2.2* Management Policy on Daily Administration	The policy document shall designate a position responsible for the daily administration and coordination of the fire protection program and its implementation.	Complies	The ANO Fire Protection Program delineates the responsibilities for administration of the current fire protection program across several organizations such as Engineering, Operations, Nuclear Oversight, Training, Maintenance, etc. The Director, Engineering (site) has responsibility to coordinate implementation to ensure compliance.	EN-DC-330, Fire Protection Program, Rev. 1 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 5.9 - Supervisor Fire Protection
3.2.2.3* Management Policy on Interfaces	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.	Complies	The ANO Fire Protection Program assigns responsibilities and authorities among the organizations for implementing the fire protection program.	EN-DC-330, Fire Protection Program, Rev. 1 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 5.0 - Responsibilities
3.2.2.4* Management Policy on AHJ	The policy document shall identify the appropriate AHJ for the various areas of the fire protection program.	Complies	EN-DC-330 and OP-1003.014 define the NRC as the AHJ for areas involving nuclear safety.	EN-DC-330, Fire Protection Program, Rev. 1, Section 3.0 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 4.4
3.2.3* Procedures	Procedures shall be 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:	N/A	General statement. See subsections for specific compliance statements and references.	EN-DC-330, Fire Protection Program, Rev. 1 OP-1003.014, ANO Fire Protection Program, Rev. 6

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.2.3 Procedures (1)*	Inspection, testing, and maintenance for fire protection systems and features credited by the fire protection program Protection Program.	Complies	Procedures are established for inspection, testing and maintenance of fire protection systems as identified in the ANO Fire Protection Program. Attachment L includes a request for ANO to utilize performance-based methods to establish appropriate inspection, testing, and maintenance frequencies for fire protection systems and features required by NFPA 805 in accordance with the guidance provided in EPRI Report TR1006756, Fire Protection Equipment Surveillance Optimization and Maintenance Guide, July 2003.	EN-DC-330, Fire Protection Program, Rev. 1, Section 5.3 [3] OP-1304.025, Fire System Instrumentation Calibration, Rev. 16 OP-1003.014, ANO Fire Protection Program, Rev. 6 OP-1104.032, Fire Protection Systems, Rev. 74 OP-1203.009, Fire Protection System Annunciator Corrective Action, Rev. 27 OP-1307.012, Unit 1 Fire Detection Performance Test, Rev. 51
3.2.3 Procedures (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.	Complies	Compensatory actions are implemented as required by EN-DC-330 and as identified in the ANO-1 Technical Requirements Manual (TRM). Compensatory measures for any new systems required by the transition to NFPA 805 will be maintained in accordance with the requirements for similar systems in the TRM.	ANO-1 TRM, Rev. 43, Sections 3.3.6 and 3.7.8 through 3.7.12 EN-DC-330, Fire Protection Program, Rev. 1, Section 5.3 [4]
3.2.3 Procedures (3)*	Reviews of fire protection program – related performance and trends.	Complies	Program performance including system monitoring and trending along with program health reports are implemented in accordance with administrative control procedures. Implementation Item - The monitoring program required by NFPA 805 will include a process that monitors and trends the fire protection program based on specific goals established to measure effectiveness. This will be done prior to the implementation date. See Implementation Item in Attachment S.	EN-DC-329, Engineering Programs Control and Oversight, Rev. 4 EN-DC-330, Fire Protection Program, Rev. 1, Section 4.14 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 5.0 - Responsibilities OP-1104.032, Fire Protection Systems, Rev. 74, Section 1.0 - Purpose

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.2.3 Procedures (4)	Reviews of physical plant modifications and procedure changes for impact on the fire protection program.	Complies	Plant modifications and procedure changes are reviewed for impact on the fire protection program as described in EN-DC-128.	EN-DC-128, Fire Protection Impact Reviews, Rev. 5, Section 1.0 - Purpose
3.2.3 Procedures (5)	Long-term maintenance and configuration of the fire protection program.	Complies	Long-term maintenance and configuration of the fire protection program are established in the ANO Fire Protection Program procedure.	OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 5.0 – Responsibilities EN-DC-128, Fire Protection Impact Reviews, Rev. 5
3.2.3 Procedures (6)	Emergency response procedures for the plant industrial fire brigade.	Complies	Emergency response procedures for the fire brigade are detailed in OP-1015.007, Fire Brigade Organization and Responsibilities.	OP-1015.007, Fire Brigade Organization and Responsibilities, Rev. 25, Section 1.0, Purpose
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 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.	Complies	The ANO fire prevention program is established and implemented as detailed in the Fire Protection Program. It includes controls on operational activities and design controls that restrict the use of combustible materials. See following subsections for additional specific compliance statements and references.	EN-DC-128, Fire Protection Impact Reviews, Rev. 5, Section 5.4 - Fire Protection Program Review OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 6.0 - Fire Protection Program
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.	Complies	Control of ignition sources (EN-DC-127) and transient combustible materials (EN-DC-161) are established and implemented as detailed in the Fire Protection Program. See following subsections for additional specific compliance statements and references.	EN-DC-127, Control of Hot Work and Ignition Sources, Rev. 12, Section 1.0 – Purpose EN-DC-161, Control of Combustibles, Rev. 7, Section 1.0 – Purpose OP-1003.005, Fire Prevention Inspection, Rev. 13, Section 1.0 - Purpose

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.1.1 General Fire Prevention Activities	The fire prevention activities shall include but not be limited to the following program elements:	Complies	The ANO fire prevention program is established and implemented as detailed in the ANO Fire Protection Program. See subsections for specific compliance statements and references. Entergy has developed multiple directives to address fire prevention. These directives address, at a minimum, the fire protection program elements identified in this section. Upon review of the elements listed below, ANO believes that the NFPA 805 code requirements are satisfied and no other additional elements were evaluated.	EN-DC-330, Fire Protection Program, Rev. 1 OP-1003.014, ANO Fire Protection Program, Rev. 6
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.	Complies	General fire safety training for employees and contractors is covered during initial site indoctrination and annual re-qualification in General Employee Training (GET).	FCBT-GET-PATSS, Plant Access Training, Rev. 19, Objective 18
3.3.1.1 General Fire Prevention Activities (2)*	Documented plant inspections including provisions for corrective actions for conditions where unanalyzed fire hazards are identified.	Complies	Periodic plant inspections are scheduled, conducted and documented as required by OP-1003.005. Corrective actions are initiated for conditions that decrease the effectiveness of the Fire Protection Program.	OP-1003.005, Fire Prevention Inspection, Rev. 13, Section 1.0 - Purpose
3.3.1.1 General Fire Prevention Activities (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.	Complies	Administrative controls requiring the fire protection review of plant modifications and maintenance are covered in EN-DC-128.	EN-DC-128, Fire Protection Impact Reviews, Rev. 5, Section 1.0 – Purpose EN-MA-101, Fundamentals of Maintenance, Rev. 13

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
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:	Complies	The ANO fire prevention program is established and implemented as detailed in the ANO Fire Protection Program. Procedures include, but are not limited to, elements 3.3.1.2 (1) through (6). See subsections for specific compliance statements and references.	EN-DC-330, Fire Protection Program, Rev. 1 OP-1003.014, ANO Fire Protection Program, Rev. 6
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.	Complies	EN-DC-161 states that lumber used in areas within the scope of this procedure should be treated with a pressure impregnated fire retardant chemical. If pressure impregnated wood is not available, obtain Fire Protection Staff approval prior to using wood treated with surface applied chemicals. Heavy wood members with a cross sectional area greater than or equal to 6" x 6" are NOT required to be treated with a fire retardant.	EN-DC-161, Control of Combustibles, Rev. 7, Sections 5.3 [2] & [3]
3.3.1.2 Control of Combustible Materials (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.	Complies	EN-DC-161 states that plastic film and fabrics used as sheeting material for protective floor coatings or temporary enclosures shall be approved self-extinguishing fire retardant plastic sheeting (NFPA 701, UL Standard 214, or equivalent standard).	EN-DC-161, Control of Combustibles, Rev. 7, Section 5.3 [4] & Attachment 9.13
3.3.1.2 Control of Combustible Materials (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.	Complies	Combustibles are controlled by Procedure EN-DC-161. Section 5.2 [6] states that waste, debris, scrap, oil spills, or other combustibles resulting from the work activity should be removed promptly following completion of the work or at the end of each shift, whichever comes first.	EN-DC-161, Control of Combustibles, Rev. 7, Section 5.2 [6] EN-MA-101, Fundamentals of Maintenance, Rev. 13, Section 5.17 OP-1000.018, Housekeeping, Rev. 29

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
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.	Complies	Combustible storage or staging areas are designated and limits established on the types and quantities of stored materials in accordance with EN-DC-161.	EN-DC-161, Control of Combustibles, Rev. 7, Section 5.6 and Attachment 9.1
3.3.1.2 Control of Combustible 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.	Complies with use of EEEEs	This requirement was evaluated by NFPA 30 Code Compliance Evaluation. Per FAQ 06-0020, the following guidance applies as to which NFPA standards referenced in Chapter 3 are applicable: "Where used in NFPA 805, Chapter 3, the term, 'applicable NFPA Standards' is considered to be equivalent to those NFPA standards identified in the current license basis (CLB) for procedures and systems in the Fire Protection Program that are transitioning to NFPA 805." No other NFPA standards were determined to be applicable. See Implementation Item in Attachment S.	CALC-ANOC-FP-09-00007, ANO Code Compliance Report for NFPA 30 2000 Edition, Rev. 0 EN-DC-161, Control of Combustibles, Rev. 7, Section 5.4
3.3.1.2 Control of Combustible Materials (6)*	Controls on use and storage of flammable gases shall be in accordance with applicable NFPA standards.	Complies	Specific administrative directives have been developed for use and control of flammable gases in accordance with NFPA 55 and OSHA. No other NFPA standards were determined to be applicable (FAQ 06-0020).	EN-DC-161, Control of Combustibles, Rev. 7, Section 5.5 EN-IS-109, Compressed Gas Cylinder Handling and Storage, Rev. 7, Section 1.0 - Purpose
3.3.1.3 Control of Ignition Sources	Control of Ignition Sources.	N/A	Section header, no technical requirements. See sub-sections for specific compliance statements and references.	

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.1.3.1* Control of Ignition Sources Code Requirements	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.	Complies	Hot work is controlled through administrative procedures in accordance with NFPA 51B. Notwithstanding the above, there are cases where sprinkler systems are purposely defeated, especially those that are electronically activated (such as those which automatically actuate via a smoke detector) prior to performing hot work in the respective area. In such cases, an operator may be assigned responsibility to unisolate the system should a fire occur in the area while hot work activities are ongoing. Other measures may be established to compensate for these sprinkler types, such as establishing a fire watch with a fire extinguisher. With such measures in place, the ability to respond to a fire in the respective area is not significantly impaired. Although rare, procedures do permit hot work under such conditions with specific management approval, provided suppression capability is made available. Given these controls, ANO complies with the intent of the NFPA 51B requirement. Compliance with NFPA 241 is addressed through compliance with NFPA 51B. NFPA 241, 2000 Edition, as referenced by NFPA 805, 2001 with respect to hot work states: "Responsibility for hot work operations and fire prevention precautions, including permits and fire watches, shall be in accordance with NFPA 51B."	CALC-ANOC-FP-08-00011, ANO Code Compliance Report for NFPA 51B 1999 Edition, Rev. 0 EN-DC-127, Control of Hot Work and Ignition Sources, Rev. 12, Sections 1.0 & 2.0 [1] (a)
3.3.1.3.2 Control of Ignition Sources on Smoking Limitations	Smoking and other possible sources of ignition shall be restricted to properly designated and supervised safe areas of the plant.	Complies	Smoking is required to be prohibited in certain areas by administrative controls. ANO policy prohibits smoking inside buildings.	OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 6.2.2 OP-1000.018, Housekeeping, Rev. 29

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.1.3.3 Control of Ignition Sources for Leak Testing	Open flames or combustion-generated smoke shall not be permitted for leak or air flow testing.	Complies	The use of open flames or combustion smoke as a testing medium is prohibited by EN-DC-127.	EN-DC-127, Control of Hot Work and Ignition Sources, Rev. 12, Section 5.2 [25]
3.3.1.3.4* Control of Ignition Sources on Portable Heaters	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.	Complies	Portable fuel-fired heaters are not permitted in plant areas containing equipment important to nuclear safety or where there is a potential for radiological releases resulting from a fire per EN-DC-127.	EN-DC-127, Control of Hot Work and Ignition Sources, Rev. 12, Sections 5.1 [4], 5.2 [8] & Attachment 9.2
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	Plant buildings are metal and concrete construction with fire walls and/or shield walls to isolate critical areas or equipment. Structural components consist of structural steel or reinforced concrete. In general, areas housing safety-related systems, equipment, and components are of concrete or masonry construction.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Section 4.11 ANO-1 SAR, Unit 1 Safety Analysis Report, Rev. 25, Section 9.8.1.A EN-DC-128, Fire Protection Impact Reviews, Rev. 5 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 6.2.1.D

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.3 Interior Finishes	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.	Submit for NRC approval	ANO-1 License Amendment 35 includes general statements about basic wall, floor and ceiling structures having adequate resistance to prevent the spread of an unsuppressed fire based partly on a September 17, 1976 ANO letter (1CAN097610). ANO letter (1CAN097610), Section IV.B.1.(d) states: "The interior finishes have a U.L. flame spread rating of 25 or less in its use configuration. All doors and materials used in fire barriers have fire ratings equal to that of the fire barriers. The interior wall and structural components, thermal insulation materials and radiation shielding materials and soundproofing are noncombustible." Coatings at ANO are maintained per SPEC-ANO-A-2436 and SPEC-ANO-A-2437. Epoxy floor coverings at ANO may not meet the NFPA 805 requirements for "interior finish" and are an exception to the interior finish requirement. ANO requests formal NRC approval of this exception. See Attachment L for further details on the request for NRC approval for interior finishes.	1CAN097610, Fire Protection (Status of Compliance with BTP APCSB 9.5-1), 9/17/1976, Section IV.B.1.(d) ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Sections 4.11, 5.0, and 8.0 EN-DC-128, Fire Protection Impact Reviews, Rev. 5 SPEC-ANO-A-2436, Furnishing, Delivery and Application of Field Painting Outside of Containment, Rev. 3 SPEC-ANO-A-2437, Furnishing, Delivery and Application of Field Painting Inside of Containment, Rev. 2

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.4 Insulation Materials	Thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials shall be noncombustible or limited combustible.	Complies	Procedure EN-DC-115, Engineering Change Development, specifically addresses fire protection program impact resulting from addition of flammable materials in accordance with EN-DC-128, Fire Protection Impact Reviews. OP-1003.014, ANO Fire Protection Program, states in Section 6.2.1.D that "Materials used in the plant shall be non-combustible or approved by Fire Protection Engineering."	EN-DC-115, Engineering Change Development, Rev. 14, Attachments 9.3 and 9.4 EN-DC-128, Fire Protection Impact Reviews, Rev. 5 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 6.2.1.D
3.3.5 Electrical	N/A	N/A	Section header, no technical requirement. See subsections for specific compliance statements and references.	
3.3.5.1 Electrical Wiring Above Suspended Ceiling Limitations	Wiring above suspended ceiling shall be kept to a 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.	Submit for NRC approval	Wiring above suspended ceilings is addressed in approved Modifications procedures and combustibles in concealed spaces are minimized. ANO has wiring above suspended ceilings that may not comply with the requirements in this code section. See Attachment L of the Transition Report for further details on the request for NRC approval for existing wiring above suspended ceilings.	OP-6030.109, Installation of Electrical Cable and Wire, Rev. 6, Sections 9.1.5 and 9.29.1.D OP-6030.112, Installation of Raceway Systems, Rev. 6, Section 9.1.7
3.3.5.2 Electrical Raceway Construction Limits	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.	Submit for NRC approval	Installation of raceway systems is addressed in approved procedures. Cable tray and conduit material is primarily of substantial metal construction. However, use of Schedule 40 PVC is allowed by procedure for underground and embedded applications per NFPA 70, National Electric Code. See Attachment L for further details on the request for NRC approval for use of PVC for embedded and underground applications.	E-59, Sheet 5, Conduit & Cable Tray Notes & Details, Rev. 3, Item II.4 and II.5 NFPA 70, National Electric Code, Rev. 2008 Edition, Article 352 OP-6030.112, Installation of Raceway Systems, Rev. 6, Sections 9.1.5, 9.2.10, and 9.4.6

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.5.3* Electrical Cable Flame Propagation Limits	Electric cable construction shall comply with a flame propagation test as acceptable to the AHJ.	Complies by previous NRC approval	ANO-1 License Amendment 35, Section 4.8 includes the following text: "The cables used in the plant were required to pass IPCEA Standard S-19-81 flame tests. The flame tests showed that the ANO-1 cabling does not burn vigorously in the configurations used in the test. We find that retest to the IEEE Standard 383 procedure and criteria would not provide information that would change any of our recommendations or conclusions. Accordingly, we find the electrical cables used at the Arkansas Unit 1 plant acceptable." Cable specifications were revised to meet the requirements of IEEE 383-1974, IEEE 323-1974 and applicable IPCEA standards.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Section 4.8 SPEC-ANO-E-2425, 5000 Volt and 8000 Volt Cable, Rev. 1 SPEC-APL-E-2412, 600 Volt Single and Multiconductor EPM Power and Control Cable, Rev. 1 SPEC-APL-E-2413, Instrument and Special Cable, Rev. 2

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.6 Roofs	Metal roof deck construction shall be designed and installed so the roofing system will not sustain a self-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.	Complies by previous NRC approval	NFPA 256 was not an original design requirement for the plant or referenced in BTP 9.5-1 or a condition in previous NRC Safety Evaluation Reports. However, original metal roof deck construction conformed to Underwriters Laboratories Class A roof covering materials and Underwriters Laboratories Metal Deck Assemblies Barriers Construction No. 1 (Ref. 0CAN097705). The requirement to "be listed by Underwriters' Laboratories, Inc., as suitable components for Class A construction" is contained in Technical Specification 6600-A-2, 6600-A-2002 and 6600-A-2023. These specs address roofing requirements for ANO Unit 1 and 2.	0CAN097705, Fire Protection, Additional Answers to Staff Questions, 9/21/1977, Answer to Item 5 ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Section 4.11, Fire Barriers ANO-1 SAR, Unit 1 Safety Analysis Report, Rev. 25, Section 9.8.2.2 SPEC-6600-A-002, Tech Spec for Built-up Roofing, Roof Insulation and Vapor Barrier, Rev. 2 SPEC-6600-A-2002, Tech Spec for Built-up Roofing, Roof Insulation and Vapor Barrier, Rev. 1 SPEC-6600-A-2023, Tech Spec for Elastomeric Roofing, Rev. 1
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.	Complies	Bulk compressed or cryogenic flammable gas storage is not permitted inside structures, housing systems, equipment, or components important to nuclear safety.	EN-IS-109, Compressed Gas Cylinder Handling and Storage, Rev. 7, Section 5.1 [4]

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.7.1 Bulk Flammable Gas Location Requirements	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 storage.	Complies with use of EEEEs	This requirement was evaluated by NFPA 50A Code Compliance Evaluation. This evaluation identified modifications required for the Hydrogen Gas Bottle Room to meet code requirements. See Implementation Item in Attachment S.	CALC-ANOC-FP-09-00008, ANO Code Compliance Report for NFPA 50A 1973 Edition, Rev. 1 EN-DC-115, Engineering Change Development, Rev. 14, Attachments 9.3 and 9.4 EN-DC-161, Control of Combustibles, Rev. 7, Sections 1.0 [2], 5.1 [2], 5.5 EN-IS-109, Compressed Gas Cylinder Handling and Storage, Rev. 7, Section 1.0
3.3.7.2 Bulk Flammable Gas Container Restrictions	Outdoor high-pressure flammable gas storage containers shall be located so that the long axis is not pointed at buildings.	Complies	NFPA 10 defines "High-Pressure Cylinder:" For the purposes of this standard, high-pressure cylinders (and cartridges) are those containing nitrogen, compressed air, carbon dioxide, or other gases at a pressure higher than 500 psi (3447 kPa) at 70°F (21°C). EN-IS-109 requires outdoor high-pressure flammable gas storage containers located so that the long axis is not pointed at buildings.	EN-IS-109, Compressed Gas Cylinder Handling and Storage, Rev. 7, Section 5.1 [5]
3.3.7.3 Bulk Flammable Gas Cylinder Limitations	Flammable gas storage cylinders not required for normal operation shall be isolated from the system.	Complies	Flammable gas cylinders that are not in use are isolated by plant procedures.	EN-DC-161, Control of Combustibles, Rev. 7, Section 5.5 [1] (a) & (b)
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.	Complies with use of EEEEs	This requirement was evaluated by NFPA 30 Code Compliance Evaluation. See Implementation Item in Attachment S.	CALC-ANOC-FP-09-00007, ANO Code Compliance Report for NFPA 30 2000 Edition, Rev. 0 EN-DC-161, Control of Combustibles, Rev. 7, Sections 1.0 [2], 5.1 [2]

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
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.	Complies	ANO procedures include requirements for inspecting transformer oil collection basins and drain paths.	OP-1003.005, Fire Prevention Inspection, Rev. 13, 6.1.3.K OP-1015.033, ANO Switchyard and Transformer Yard Controls, Rev. 23, Section 5.6
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.	Complies	Administrative procedure EN-DC-161 addresses use of combustible liquids around hot pipes or surfaces and prompt cleanup of oil on insulation.	EN-DC-161, Control of Combustibles, Rev. 7, Section 5.4[1](c)
3.3.11 Electrical Equipment	Adequate clearance, free of combustible material, shall be maintained around energized electrical equipment.	Complies	ANO procedures designate storage areas for combustible materials, none of which are around energized electrical equipment. Energized electrical components are maintained free from adjacent combustible material per OP-1003.005, Fire Prevention Inspection.	EN-DC-161, Control of Combustibles, Rev. 7, Section 5.2 OP-1003.005, Fire Prevention Inspection, Rev. 13, Section 6.1.
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.	Complies by previous NRC approval	1CNA108806, includes the following discussion: “8.1 Exemption Requested The licensee requested approval of exemptions from the technical requirements of Section III.O of Appendix R to 10 CFR 50 to the extent that it requires the reactor coolant pump (RCP) oil collection system to be sized to hold the contents of the entire lube oil system for all pumps and to be designed to withstand a safe shutdown earthquake (SSE)… *(continued)*	1CNA108806, Exemptions From the Technical Requirements of Appendix R and SER, 10/26/1988, Section 8.0 of Safety Evaluation FHA, ANO-1 & 2 Fire Hazards Analysis, Rev. 15, Section 29 OP-1504.001, Visual Inspection of the Unit 1 & 2 RCP Oil Collection System, Rev. 9

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.12 *(continued)*			8.4 Conclusion Based on the above evaluation, the licensee's alternative design of the oil collection system provides an equivalent level of safety to that achieved by compliance with Section III.O of Appendix R. Therefore, the licensee's request for exemption is approved." OP-1504.001 provides instructions to inspect the lube oil collection system for operability and integrity on all four of the Reactor Coolant Pumps for both Unit 1 and 2.	
3.3.12 Reactor Coolant Pumps (1)	The oil collection system for each reactor coolant pump shall be capable of collecting lubricating oil from all potential pressurized and non-pressurized leakage sites in each reactor coolant pump oil system.	Submit for NRC Approval	Exemption granted by NRC as documented in 1CNA108806. See discussion in Section 3.3.12, above. The RCP oil collection systems are designed and sized to collect and contain oil from potentially pressurized and unpressurized leakage areas in seismic event resulting in failure of the lubrication system. See Attachment L of the Transition Report for further details on the request for NRC approval for evaluation of oil misting from the reactor coolant pumps/motors.	1CNA108806, Exemptions From the Technical Requirements of Appendix R and SER, 10/26/1988, Section 8.0 of Safety Evaluation
3.3.12 Reactor Coolant Pumps (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.	Complies by previous NRC approval	Exemption granted by NRC as documented in 1CNA108806. See discussion in Section 3.3.12, above. See Attachment T of the Transition Report for additional clarification.	1CNA108806, Exemptions From the Technical Requirements of Appendix R and SER, 10/26/1988, Section 8.0 of Safety Evaluation

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.3.12 Reactor Coolant Pumps (3)	A flame arrestor is required in the vent if the flash point characteristics of the oil present the hazard of a fire flashback.	Complies by previous NRC approval	Exemption granted by NRC as documented in 1CNA108806. See discussion in Section 3.3.12, above.	1CNA108806, Exemptions From the Technical Requirements of Appendix R and SER, 10/26/1988, Section 8.0 of Safety Evaluation
3.3.12 Reactor Coolant Pumps (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.	Complies by previous NRC approval	Exemption granted by NRC as documented in 1CNA108806. See discussion in Section 3.3.12, above.	1CNA108806, Exemptions From the Technical Requirements of Appendix R and SER, 10/26/1988, Section 8.0 of Safety Evaluation
3.3.12 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.	Complies by previous NRC approval	Exemption granted by NRC as documented in 1CNA108806. See discussion in Section 3.3.12, above.	1CNA108806, Exemptions From the Technical Requirements of Appendix R and SER, 10/26/1988, Section 8.0 of Safety Evaluation
3.4 Industrial Fire Brigade	N/A	N/A	Section header, no technical requirements. See subsections for specific compliance statements and references.	
3.4.1 On-Site Fire-Fighting Capability	All of the following requirements shall apply	N/A	General statement. See subsections for any specific compliance statements and references.	
3.4.1 On-Site Fire-Fighting Capability (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:	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation. The on-site fire brigade is appropriately staffed, trained and equipped and complies with NFPA 600. NFPA 1500 and NFPA 1582 do not apply at ANO.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 OP-1015.007, Fire Brigade Organization and Responsibilities, Rev. 25, Sections 5.0 and 6.1.1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.4.1 On-Site Fire-Fighting Capability (a)(1)	NFPA 600, Standard on Industrial Fire Brigades (interior structural fire fighting).	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation. The on-site fire brigade is appropriately staffed, trained and equipped and complies with NFPA 600. NFPA 1500 and NFPA 1582 do not apply at ANO.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 OP-1015.007, Fire Brigade Organization and Responsibilities, Rev. 25, Sections 5.0 and 6.1.1
3.4.1 On-Site Fire-Fighting Capability (a)(2)	NFPA 1500, Standard on Fire Department Occupational Safety and Health Program.	N/A	Not applicable to ANO.	
3.4.1 On-Site Fire-Fighting Capability (a)(3)	NFPA 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians.	N/A	Not applicable to ANO.	
3.4.1 On-Site Fire-Fighting Capability (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.	Complies	A fully staffed, trained, and equipped fire-fighting force is available at all times to control and extinguish all fires on site. This force is required to have a minimum complement of five persons on duty and conforms with the applicable NFPA standards of this element.	OP-1015.007, Fire Brigade Organization and Responsibilities, Rev. 25, Section 5.0
3.4.1 On-Site Fire-Fighting Capability (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.	Complies	The Fire Brigade Leader (Unit 1) and three other members (Unit 2) are from the Operations Department. Fire Brigade members respond to the fire under the direction of the Operations Shift Manager. The Operations Shift Manager is not dedicated to fire brigade support.	OP-1015.007, Fire Brigade Organization and Responsibilities, Rev. 25, Sections 4.1 – 4.3 and 6.1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.4.1 On-Site Fire-Fighting Capability (d)*	The industrial fire brigade shall be notified immediately upon verification of a fire.	Complies	OP-2203.034 requires an action to notify the fire brigade to respond in the event a fire.	OP-2203.034, Fire or Explosion, Rev. 14, Step 1
3.4.1 On-Site Fire-Fighting Capability (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.	Complies	EN-RP-501 and EN-NS-112 requires each member of the fire brigade to maintain a current annual physical that ensure the member is capable of performing strenuous activities and the ability to use respiratory protection equipment.	EN-NS-112, Medical Program, Rev. 10, Section 5.6[2] EN-RP-501, Respiratory Protection Program, Rev. 4, Section 5.3, Medical Surveillance
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.	Complies	Pre-fire Plans are provided for both safety related and non-safety related areas of the facility.	PFP-U1, ANO Prefire Plan (Unit 1), Rev. 15, Section 1.2 PFP-UC, ANO Prefire Plan (Common), Rev. 13, Section 1.2
3.4.2.1* Pre-Fire Plans Contents	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.	Complies	Pre-fire Plans detail the fire area configuration, fire hazards to be encountered and the fire protection systems and features present.	PFP-U1, ANO Prefire Plan (Unit 1), Rev. 15, Sections 1.2 & 1.4 PFP-UC, ANO Prefire Plan (Common), Rev. 13, Sections 1.2 & 1.3
3.4.2.2 Pre-Fire Plans Updates	Pre-fire plans shall be reviewed and updated as necessary.	Complies	Pre-fire Plans shall be reviewed and updated as required by OP-1003.013.	OP-1003.013, Control of Prefire Plans, Rev. 1, Section 5.0 OP-1003.014, ANO Fire Protection Program, Rev. 6, Section 5.8.3
3.4.2.3* Pre-Fire Plans Locations	Pre-fire plans shall be available in the control room and made available to the plant industrial fire brigade.	Complies	Controlled copies of the pre-fire plans are readily available for use by the Fire Brigade Leader, Control Room Supervisor and Shift Manager per OP-1003.013.	OP-1003.013, Control of Prefire Plans, Rev. 1, Section 6.0

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.4.2.4* Pre-Fire Plans Coordination Needs	Pre-fire plans shall address coordination with other plant groups during fire emergencies.	Complies	Pre-fire Plans require the Fire Brigade Leader to maintain contact with the Shift Manager who interfaces with other plant groups.	OP-2203.034, Fire or Explosion, Rev. 14 PFP-U1, ANO Prefire Plan (Unit 1), Rev. 15, Section 1.4 PFP-UC, ANO Prefire Plan (Common), Rev. 13, Section 1.3
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.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 EN-TQ-125, Fire Brigade Drills, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16
3.4.3 Training and Drills (a)(1)	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 Health Program, as appropriate.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation. NFPA 1500 does not apply since ANO uses a Fire Brigade and is not a Fire Department.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16
3.4.3 Training and Drills (a)(2)	(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.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 EN-TQ-125, Fire Brigade Drills, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.4.3 Training and Drills (a)(3)	(3) A written program shall detail the industrial fire brigade training program.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation. The training program is detailed in OP-1063.020, "Fire Brigade Training Program."	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16
3.4.3 Training and Drills (a)(4)	(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.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16
3.4.3 Training and Drills (b)	Training for Non-Industrial Fire Brigade Personnel. Plant personnel who respond with the industrial fire brigade shall be trained as to their responsibilities, potential hazards to be encountered, and interfacing with the industrial fire brigade.	Complies	Non-Industrial Fire Brigade personnel at ANO do not respond with the Industrial Fire Brigade to a fire. Instructions are given for reporting fires.	FCBT-GET-PATSS, Plant Access Training, Rev. 19, Objective 18
3.4.3 Training and Drills (c)* (1)	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.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation. This requirement is addressed specifically by EN-TQ-125, Fire Brigade Drills.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 EN-TQ-125, Fire Brigade Drills, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.4.3 Training and Drills (c)(2)	(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.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 EN-TQ-125, Fire Brigade Drills, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16
3.4.3 Training and Drills (c)(3)	(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.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 EN-TQ-125, Fire Brigade Drills, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16
3.4.3 Training and Drills (c)(4)	(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.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation. Drill records are specifically addressed in EN-TQ-125, Fire Brigade Drills.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 EN-TQ-125, Fire Brigade Drills, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16
3.4.3 Training and Drills (c)(5)	(5) A critique shall be held and documented after each drill.	Complies	This requirement was evaluated by NFPA 600 Code Compliance Evaluation. A critique is specifically required by EN-TQ-125, Fire Brigade Drills.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 EN-TQ-125, Fire Brigade Drills, Rev. 1 OP-1063.020, Fire Brigade Training Program, Rev. 16

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
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	This requirement was evaluated by NFPA 600 Code Compliance Evaluation and is documented in OP-1003.005.	CALC-ANOC-FP-08-00005, ANO Code Compliance Report for NFPA 600 2000 Edition, Rev. 1 OP-1003.005, Fire Prevention Inspection, Rev. 13, Section 5.4.5 and 5.4.6 OP-1015.007, Fire Brigade Organization and Responsibilities, Rev. 25, Section 8.0 and Supplement 1
3.4.5 Off-site Fire Department Interface	N/A	N/A	Section header, no technical requirements. See subsections for specific compliance statements and references.	
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.	Complies	The London Fire Department, by Letter of Agreement, agrees to provide personnel and equipment as required to assist the ANO Fire Brigade in extinguishing fires located at the ANO site, includes both inside and outside the protected area.	ANO Emergency Plan, Rev. 37, Section A, Item 2.4 & App.1, Item 18
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.	Complies	At least once per year a drill is conducted with invited participation of the London Fire Department.	ANO Emergency Plan, Rev. 37, Section N, Item 2.2 EN-TQ-125, Fire Brigade Drills, Rev. 1, Section 5.3
3.4.5.3* Security and Radiation Protection	Plant security and radiation protection plans shall address off-site fire authority response.	Complies	Plant security and radiation protection plans address off-site fire response. Response by security and radiation protection (RP) is initiated by OP-2203.034.	ANO Emergency Plan, Rev. 37, Section A, Item 2.4.1 OP-1043.002, Access Control, Rev. 75, Controlled OP-1203.048, Security Event, Rev. 20, Controlled OP-2203.034, Fire or Explosion, Rev. 14, Step 15

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.4.6* Communications	An effective emergency communications capability shall be provided for the industrial fire brigade.	Complies	Use of plant radios is described in OP-2303.034, Fire or Explosion.	ANO Emergency Plan, Rev. 37, Section 3.1(g), Att. F and H ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Item 4.7 OP-1903.062, Communications System Operating Procedure, Rev. 25 OP-2203.034, Fire or Explosion, Rev. 14
3.5 Water Supply	N/A	N/A	Section header, no technical requirements. See subsections for specific compliance statements and references.	
3.5.1 Water Supply Flow Code Requirements	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. (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.	Complies by previous NRC approval	License Amendment 35 states in Section 4.3.1.1: "Fire water is supplied by two fire pumps located in the intake structure. These pumps are shared by Unit 1 and Unit 2. The two fire pumps take suction from separate service water bays which are normally supplied from Dardanelle Reservoir through intake screens. The service bays can also be supplied from the emergency cooling water pond which is the ultimate heat sink. The ultimate heat sink would not be degraded by fire water supply requirements. We find that the fire water supply system conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable." *(continued)*	1CAN097610, Fire Protection (Status of Compliance with BTP APCSB 9.5-1), 9/17/1976, Item IV.C.2 ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.1 and 4.3.1.2

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.5.1 *(continued)*			ANO-1 License Amendment 35, Section4.3.1.2, includes the following text: "...Either of the two fire pumps has sufficient capacity to supply the maximum sprinkler demand with adequate reserve available for fire hoses."	
3.5.2* Water Supply Tank Code Requirements	The tanks shall be interconnected such that fire 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.	Complies by previous NRC approval	Exception No. 1 applies. License Amendment 35 states in Section 4.3.1.1: "Fire water is supplied by two fire pumps located in the intake structure. These pumps are shared by Unit 1 and Unit 2. The two fire pumps take suction from separate service water bays which are normally supplied from Dardanelle Reservoir through intake screens. The service bays can also be supplied from the emergency cooling water pond which is the ultimate heat sink. The ultimate heat sink would not be degraded by fire water supply requirements. We find that the fire water supply system conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable."	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.1
3.5.3* Water Supply Pump Code Requirements	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.	Submit for NRC approval	This requirement was evaluated by NFPA 20 Code Compliance Evaluation. See Attachment L of the Transition Report for further details regarding the request for NRC approval associated with the electric fire pump.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.2 CALC-ANOC-FP-09-00006, ANO Code Compliance Report for NFPA 20 1969 Edition, Rev. 0

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.5.4 Water Supply Pump Diversity and Redundancy	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 provided.	Complies	This requirement was evaluated by NFPA 20 Code Compliance Evaluation. ANO has a diesel engine-driven fire pump capable of providing 100 percent of the required flow rate and pressure per the SER.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.2 CALC-ANOC-FP-09-00006, ANO Code Compliance Report for NFPA 20 1969 Edition, Rev. 0
3.5.5 Water Supply Pump Separation Requirements	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.	Complies	This requirement was evaluated by NFPA 20 Code Compliance Evaluation. Per the SER, the pump and its driver and controls are separated from the remaining fire pumps and from the rest of the plant by rated fire barriers.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.2 CALC-ANOC-FP-09-00006, ANO Code Compliance Report for NFPA 20 1969 Edition, Rev. 0
3.5.6 Water Supply Pump Start/Stop Requirements	Fire pumps shall be provided with automatic start and manual stop only.	Complies	Fire pumps start automatically when the pressure in the fire main drops. Fire pump shutdown is accomplished by manual means only. See code compliance report for NFPA 20.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.2 CALC-ANOC-FP-09-00006, ANO Code Compliance Report for NFPA 20 1969 Edition, Rev. 0
3.5.7 Water Supply Pump Connection Requirements	Individual fire pump connections to the yard fire main loop shall be provided and separated with sectionalizing valves between connections.	Complies	Fire pump connections to the yard fire main loop are provided and separated with sectionalizing valves between connections per ANO-1 License Amendment 35.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3 CALC-ANOC-FP-09-00006, ANO Code Compliance Report for NFPA 20 1969 Edition, Rev. 0

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.5.8 Water Supply Pressure Maintenance Limitations	A method of automatic pressure maintenance of the fire protection water system shall be provided independent of the fire pumps.	Complies	An automatic electric jockey pump maintains pressure on the fire water piping system.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.2 CALC-ANOC-FP-09-00006, ANO Code Compliance Report for NFPA 20 1969 Edition, Rev. 0
3.5.9 Water Supply Pump Operation Notification	Means shall be provided to immediately notify the control room, or other suitable constantly attended location, of operation of fire pumps.	Complies	Fire pump operation is annunciated in the Unit 1 Control Room.	CALC-ANOC-FP-09-00006, ANO Code Compliance Report for NFPA 20 1969 Edition, Rev. 0 OP-1203.009, Fire Protection System Annunciator Corrective Action, Rev. 27, Annunciator K-12
3.5.10 Water Supply Yard Main Code Requirements	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.	Complies with use of EEEEs	This requirement was evaluated by NFPA 24 Code Compliance Evaluation.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3 CALC-ANOC-FP-09-00015, ANO Code Compliance Report for NFPA 24 1995 Edition, Rev. 1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.5.11 Water Supply Yard Main Maintenance Issues	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.	Complies by previous NRC approval	ANO-1 License Amendment 35, Section 4.3.1.3, includes the following text: "Each of the two fire pumps has a separate discharge into the 12-inch underground fire loop which encircles both Unit 1 and Unit 2. Valving is arranged so that a single break in the discharge piping will not remove both fire pumps from service. All yard fire hydrants, fixed water suppression systems, and interior fire hose stations are supplied by the fire loop. Sectionalizing valves are provided on the loop to allow isolation of various sections for maintenance or repair. For certain areas inside the plant, both automatic suppression systems and fire hose stations are supplied by a common piping system, so that both primary and backup protection would be lost by closure of a single control valve or by a single break. For such piping system failures, hoses could be run from outside hydrants to provide protection during the short interval while repairs are being made. We find that the fire water piping system satisfies Section 2.2 of this report and is, therefore, acceptable."	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.5.12 Water Supply Compatible Thread Connections	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 between plant equipment and the fire department equipment if adequate training and procedures are provided.	Complies	ANO-1 License Amendment 35, Section 4.3.1.3, states in part the following text: "The hydrant hose threads are compatible with those of the local fire department...We find that the fire water piping system satisfies Section 2.2 of this report and is, therefore, acceptable."	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3
3.5.13 Water Supply Header Options	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.	Complies by previous NRC approval	ANO-1 License Amendment 35 SER, Section 4.3.1.3, Fire Water Piping System states: Each of the two fire pumps has a separate discharge into the 12-inch underground fire loop which encircles both Unit 1 and Unit 2. Valving is arranged so that a single break in the discharge piping will not remove both fire pumps from service. All yard fire hydrants, fixed water suppression systems, and interior fire hose stations are supplied by the fire loop. Sectionalizing valves are provided on the loop to allow isolation of various sections for maintenance or repair... We find that the fire water piping system satisfies Section 2.2 of this report and is, therefore, acceptable." Section 2.2 identifies objectives from BTP9.5-1 and Appendix A.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3 ULD-0-SYS-09, ANO Fire Protection System, Rev. 4, Section 4.8, Codes and Standards

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.5.14* Water Supply Control Valve Supervision	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 valves are located within fenced areas or under the direct control of the owner/operator.	Complies by previous NRC approval	ANO-1 License Amendment 35, Section 4.3.1.3, includes the following text: "Some fire water system control valves are electrically supervised; others are not electrically supervised, including those on the underground fire loop and at the fire pumps. The facility's technical specifications require a periodic check of the position of those valves which are not locked, sealed, electrically supervised, or otherwise secured in position to assure that valves are maintained in the open position... We find that the fire water piping system satisfies Section 2.2 of this report and is, therefore, acceptable.”	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3 OP-1104.032, Fire Protection Systems, Rev. 74, Section 1.0, Attachments A and C, and Supplement 7
3.5.15 Water Supply Hydrant Code Requirements	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.	Complies by previous NRC approval	ANO-1 License Amendment 35, Section 4.3.1.3, includes the following text: "Yard fire hydrants have been provided at approximately 250- to 300-foot intervals around the exterior of the plant. An auxiliary gate valve is provided on each hydrant lateral to permit maintenance without removing a portion of the fire loop from service. A hose house at each fire hydrant is equipped with 2 ½-inch fire hose and other manual fire fighting tools... We find that the fire water piping system satisfies Section 2.2 of this report and is, therefore, acceptable.”	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3 CALC-ANOC-FP-09-00015, ANO Code Compliance Report for NFPA 24 1995 Edition, Rev. 1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.5.16* Water Supply Dedicated Limits	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.	Submit for NRC approval	System may be used with a temporary pump to supply cooling loads on either unit during outages. See Attachment L of the Transition Report for further details on the request for NRC approval for use of the fire protection water supply system for non-fire protection purposes.	OP-1104.032, Fire Protection Systems, Rev. 74, Sections 2.2 and 17.0, and Attachment E
3.6 Standpipe and Hose Stations	N/A	N/A	Section header, no technical requirements. See subsections for specific compliance statements and references.	
3.6.1 Standpipe and Hose Stations Code Requirements	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.	Complies with use of EEEEs	This requirement was evaluated by NFPA 14 Code Compliance Evaluation.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.4 CALC-ANOC-FP-09-00005, ANO Code Compliance Report for NFPA 14 1983 Edition, Rev. 2

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.6.2 Standpipe and Hose Stations Capability Limitations	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.	Complies	This requirement was evaluated by NFPA 14 Code Compliance Evaluation.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.4 ANO-1 License Amendment 43, Safety Evaluation Report, 5/23/1979, Supplement 1, Pages 43-11 and 43-12 CALC-ANOC-FP-09-00005, ANO Code Compliance Report for NFPA 14 1983 Edition, Rev. 2
3.6.3 Standpipe and Hose Stations Nozzle Restrictions	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. 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.	Complies	ANO-1 License Amendment 35, Section 4.3.1.4, includes the following text: "Nozzles on the hose lines are of the adjustable spray type; in areas of potential electrical fires, they are of a type rated for this service."	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.4 CALC-ANOC-FP-09-00005, ANO Code Compliance Report for NFPA 14 1983 Edition, Rev. 2

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.6.4 Standpipe and Hose Stations Earthquake Provisions	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).	Complies by previous NRC approval	ANO-1 License Amendment 35, Section 4.3.1.3, includes the following text: "...For certain areas inside the plant, both fixed suppression systems and interior fire hose stations are supplied by a common piping system, so that both primary and backup protection could be lost by a single break or closure of a control valve. For such piping system failures, hoses could be run from outside hydrants to provide protection during the short interval while repairs are being made. Such alternative protection is required to be provided by the technical specifications..."	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3
3.6.5 Standpipe and Hose Stations Seismic Connection Limitations	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.	N/A	Not applicable at ANO. Hose stations are not cross-connected to essential non-fire protection water supply systems.	
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.	Complies with use of EEEEs	This requirement was evaluated by NFPA 10 Code Compliance Evaluation. See Implementation Item in Attachment S.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.3 CALC-ANOC-FP-09-00009, ANO Code Compliance Report for NFPA 10 1998 Edition, Rev. 0
3.8 Fire Alarm and Detection Systems	N/A	N/A	Section header, no technical requirements. See subsections for specific compliance statements and references.	

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
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:	Complies with use of EEEEs	This requirement was evaluated by NFPA 72 Code Compliance Evaluation. ANO-1 License Amendment 35, Section 4.2, includes the following text: "...The system includes actuation and trouble signals from fire detectors, water spray systems, and fire pumps. In general, the system complies with those portions of the NFPA Standards which are considered essential for a facility of this type… We find that, subject to implementation of these modifications, the fire detection and signaling system satisfies the objectives outlined in Section 2.2 of this report and is, therefore, acceptable."	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.2 CALC-ANO1-FP-09-00001, ANO Code Compliance Report for NFPA 72 1996 Edition, Rev. 1 CALC-ANO1-FP-09-00002, ANO Code Compliance Report for NFPA 72A 1975 Edition, Rev. 0 CALC-ANO1-FP-09-00003, ANO Code Compliance Report for NFPA 72D 1975 Edition, Rev. 1 CALC-ANO1-FP-09-00004, ANO Code Compliance Report for NFPA 72E 1974 Edition, Rev. 1
3.8.1 Fire Alarm (1)	Actuation of any fire detection device.	Complies with use of EEEEs	This requirement was evaluated by NFPA 72 Code Compliance Evaluation.	CALC-ANO1-FP-09-00001, ANO Code Compliance Report for NFPA 72 1996 Edition, Rev. 1 CALC-ANO1-FP-09-00002, ANO Code Compliance Report for NFPA 72A 1975 Edition, Rev. 0 CALC-ANO1-FP-09-00003, ANO Code Compliance Report for NFPA 72D 1975 Edition, Rev. 1 CALC-ANO1-FP-09-00004, ANO Code Compliance Report for NFPA 72E 1974 Edition, Rev. 1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.8.1 Fire Alarm (2)	Actuation of any fixed fire suppression system.	Complies with use of EEEEs	This requirement was evaluated by NFPA 72 Code Compliance Evaluation.	CALC-ANO1-FP-09-00001, ANO Code Compliance Report for NFPA 72 1996 Edition, Rev. 1 CALC-ANO1-FP-09-00002, ANO Code Compliance Report for NFPA 72A 1975 Edition, Rev. 0 CALC-ANO1-FP-09-00003, ANO Code Compliance Report for NFPA 72D 1975 Edition, Rev. 1 CALC-ANO1-FP-09-00004, ANO Code Compliance Report for NFPA 72E 1974 Edition, Rev. 1
3.8.1 Fire Alarm (3)	Actuation of any manual fire alarm station.	Complies with use of EEEEs	This requirement was evaluated by NFPA 72 Code Compliance Evaluation.	CALC-ANO1-FP-09-00001, ANO Code Compliance Report for NFPA 72 1996 Edition, Rev. 1 CALC-ANO1-FP-09-00002, ANO Code Compliance Report for NFPA 72A 1975 Edition, Rev. 0 CALC-ANO1-FP-09-00003, ANO Code Compliance Report for NFPA 72D 1975 Edition, Rev. 1 CALC-ANO1-FP-09-00004, ANO Code Compliance Report for NFPA 72E 1974 Edition, Rev. 1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.8.1 Fire Alarm (4)	Starting of any fire pump.	Complies with use of EEEEs	This requirement was evaluated by NFPA 72 Code Compliance Evaluation.	CALC-ANO1-FP-09-00001, ANO Code Compliance Report for NFPA 72 1996 Edition, Rev. 1 CALC-ANO1-FP-09-00002, ANO Code Compliance Report for NFPA 72A 1975 Edition, Rev. 0 CALC-ANO1-FP-09-00003, ANO Code Compliance Report for NFPA 72D 1975 Edition, Rev. 1 CALC-ANO1-FP-09-00004, ANO Code Compliance Report for NFPA 72E 1974 Edition, Rev. 1
3.8.1 Fire Alarm (5)	Actuation of any fire protection supervisory device.	Complies with use of EEEEs	This requirement was evaluated by NFPA 72 Code Compliance Evaluation.	CALC-ANO1-FP-09-00001, ANO Code Compliance Report for NFPA 72 1996 Edition, Rev. 1 CALC-ANO1-FP-09-00002, ANO Code Compliance Report for NFPA 72A 1975 Edition, Rev. 0 CALC-ANO1-FP-09-00003, ANO Code Compliance Report for NFPA 72D 1975 Edition, Rev. 1 CALC-ANO1-FP-09-00004, ANO Code Compliance Report for NFPA 72E 1974 Edition, Rev. 1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.8.1 Fire Alarm (6)	Indication of alarm system trouble condition.	Complies with use of EEEEs	This requirement was evaluated by NFPA 72 Code Compliance Evaluation.	CALC-ANO1-FP-09-00001, ANO Code Compliance Report for NFPA 72 1996 Edition, Rev. 1 CALC-ANO1-FP-09-00002, ANO Code Compliance Report for NFPA 72A 1975 Edition, Rev. 0 CALC-ANO1-FP-09-00003, ANO Code Compliance Report for NFPA 72D 1975 Edition, Rev. 1 CALC-ANO1-FP-09-00004, ANO Code Compliance Report for NFPA 72E 1974 Edition, Rev. 1
3.8.1.1 Fire Alarm Communication Requirements	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.	Complies	Communication of a fire emergency is provided through the use of the plant paging system, the intra-plant telephone system, and radio communication equipment.	ANO Emergency Plan, Rev. 37, Section H, 2.0 - Communication Systems OP-2203.034, Fire or Explosion, Rev. 14
3.8.1.2 Fire Alarm Prompt Notification Limits	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:	Complies	Notification of a fire emergency to all affected personnel is provided by the referenced implementing procedures. The primary line of notification to plant personnel and fire brigade would be through the use of the plant paging system, which is strategically located throughout the plant site. Also, the intra-plant telephone system would be used. This system allows direct dialing between all plant telephones. Additionally, various radio-based equipment can be used.	ANO Emergency Plan, Rev. 37, Section H, 2.0 - Communication Systems OP-2203.034, Fire or Explosion, Rev. 14
3.8.1.2 Fire Alarm Prompt Notification Limits (1)	General site population in all occupied areas.	Complies	The primary line of notification to plant personnel and fire brigade would be through the use of the plant paging system, which is strategically located throughout the plant site.	ANO Emergency Plan, Rev. 37 OP-2203.034, Fire or Explosion, Rev. 14, Steps 1,2

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.8.1.2 Fire Alarm Prompt Notification Limits (2)	Members of the industrial fire brigade and other groups supporting fire emergency response.	Complies	The primary line of notification to plant personnel and fire brigade would be through the use of the plant paging system, which is strategically located throughout the plant site. Also, the intra-plant telephone system and radios would be used.	ANO Emergency Plan, Rev. 375 OP-2203.034, Fire or Explosion, Rev. 14, Steps 1 and 15
3.8.1.2 Fire Alarm Prompt Notification Limits (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.	Complies	Two independent means are available (telephone and radio) for notification of off-site emergency services.	ANO Emergency Plan, Rev. 37 OP-2203.034, Fire or Explosion, Rev. 14, Step 15 OP-1903.062, Communications System Operating Procedure, Rev. 25
3.8.2 Detection	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.	Complies with use of EEEEs	This requirement was evaluated by NFPA 72 Code Compliance Evaluation.	CALC-ANO1-FP-09-00001, ANO Code Compliance Report for NFPA 72 1996 Edition, Rev. 1 CALC-ANO1-FP-09-00002, ANO Code Compliance Report for NFPA 72A 1975 Edition, Rev. 0 CALC-ANO1-FP-09-00003, ANO Code Compliance Report for NFPA 72D 1975 Edition, Rev. 1 CALC-ANO1-FP-09-00004, ANO Code Compliance Report for NFPA 72E 1974 Edition, Rev. 1
3.9 Automatic and Manual Water-Based Fire Suppression Systems	N/A	N/A	Section header, no technical requirements. See subsections for specific compliance statements and references.	

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.9.1* Fire Suppression System Code Requirements	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 accordance with the appropriate NFPA standards including the following:	Complies with use of EEEEs	This requirement was evaluated by NFPA 13 Code Compliance Evaluation and NFPA 15 Code Compliance Evaluation. Compliance is addressed below.	
3.9.1 Fire Suppression System Code Requirements (1)	NFPA 13, Standard for the Installation of Sprinkler Systems.	Complies with use of EEEEs	This requirement was evaluated by NFPA 13 Code Compliance Evaluation. See Implementation Item in Attachment S.	CALC-ANO1-FP-09-00006, ANO Code Compliance Report for NFPA 13 1976 Edition, Rev. 1 CALC-ANO1-FP-09-00007, ANO Code Compliance Report for NFPA 13 1971 Edition, Rev. 1 CALC-ANO1-FP-09-00008, ANO Code Compliance Report for NFPA 13 1972 Edition, Rev. 1 CALC-ANOC-FP-08-00013, ANO Code Compliance Report for NFPA 13 1994 Edition, Rev. 1
3.9.1 Fire Suppression System Code Requirements (2)	NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection.	Complies with use of EEEEs	This requirement was evaluated by NFPA 15 Code Compliance Evaluation. See Implementation Item in Attachment S.	CALC-ANO1-FP-09-00005, ANO Code Compliance Report for NFPA 15 1977 Edition, Rev. 0
3.9.1 Fire Suppression System Code Requirements (3)	NFPA 750, Standard on Water Mist Fire Protection Systems.	N/A	Systems addressed by NFPA 750 are not utilized at ANO.	
3.9.1 Fire Suppression System Code Requirements (4)	NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.	N/A	Systems addressed by NFPA 16 are not utilized at ANO.	

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.9.2 Fire Suppression System Flow Alarm	Each system shall be equipped with a water flow alarm.	Complies	Water flow is alarmed by the system and/or fire pump start alarm.	OP-1203.009, Fire Protection System Annunciator Corrective Action, Rev. 27, Annunciator K-12
3.9.3 Fire Suppression System Alarm Locations	All alarms from fire suppression systems shall annunciate in the control room or other suitable constantly attended location.	Complies	Water flow is alarmed by the system and/or fire pump start alarm.	OP-1203.009, Fire Protection System Annunciator Corrective Action, Rev. 27, Annunciator K-12
3.9.4 Fire Suppression System Diesel Pump Sprinkler Protection	Diesel-driven fire pumps shall be protected by automatic sprinklers.	Complies	A wet pipe sprinkler system provides coverage within the Diesel Fire Pump Room.	FHA, ANO-1 & 2 Fire Hazards Analysis, Rev. 15, Fire Area N, Intake Structure, Section 32
3.9.5 Fire Suppression System Shutoff Controls	Each system shall be equipped with an OS&Y gate valve or other approved shutoff valve.	Complies	This requirement was evaluated by NFPA 24 Code Compliance Evaluation. ANO-1 License Amendment 35, Section 4.3.1.3, includes the following text: "Each of the two fire pumps has a separate discharge into the 12-inch underground fire loop which encircles both Unit 1 and Unit 2. Valving is arranged so that a single break in the discharge piping will not remove both fire pumps from service... We find that the fire water piping system satisfies Section 2.2 of this report and is, therefore, acceptable."	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3 CALC-ANOC-FP-09-00015, ANO Code Compliance Report for NFPA 24 1995 Edition, Rev. 1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.9.6 Fire Suppression System Valve Supervision	All valves controlling water-based fire suppression systems required to meet the performance or deterministic requirements of Chapter 4 shall be supervised as described in 3.5.14.	Complies by previous NRC approval	ANO-1 License Amendment 35, Section 4.3.1.3, includes the following text: "Some fire water system control valves are electrically supervised; others are not electrically supervised, including those on the underground fire loop and at the fire pumps. The facility's technical specifications require a periodic check of the position of those valves which are not locked, sealed, electrically supervised, or otherwise secured in position to assure that valves are maintained in the open position... We find that the fire water piping system satisfies Section 2.2 of this report and is, therefore, acceptable."	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.1.3
3.10 Gaseous Fire Suppression Systems	N/A	N/A	Section header, no technical requirements. See subsections for specific compliance statements and references.	
3.10.1 Gaseous Suppression System Code Requirements	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:	Complies	This requirement was evaluated by NFPA 12A Code Compliance Evaluation. No other fixed gaseous suppression system is relied upon for safety related areas at ANO.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.3.2 CALC-ANO1-FP-09-00019, ANO Code Compliance Report for NFPA 12A 1973 Edition, Rev. 0 FHA, ANO-1 & 2 Fire Hazards Analysis, Rev. 15, Section 6.2.5 SPEC-6600-M-079, Specification for Halon 1301 System for Control Room - Unit 1, Rev. 1, Section 5.1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.10.1 Gaseous Suppression System Code Requirements (1)	NFPA 12, Standard on Carbon Dioxide Extinguishing Systems.	N/A	No fixed gaseous suppression systems other than Halon are relied upon for safety related areas at ANO.	
3.10.1 Gaseous Suppression System Code Requirements (2)	NFPA 12A, Standard on Halon 1301 Fire Extinguishing Systems.	Complies	This requirement was evaluated by NFPA 12A Code Compliance Evaluation.	CALC-ANO1-FP-09-00019, ANO Code Compliance Report for NFPA 12A 1973 Edition, Rev. 0
3.10.1 Gaseous Suppression System Code Requirements (3)	NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems.	N/A	No fixed gaseous suppression systems other than Halon are relied upon for safety related areas at ANO.	
3.10.2 Gaseous Suppression System Alarm Location	Operation of gaseous fire suppression systems shall annunciate and alarm in the control room or other constantly attended location identified.	Complies	Halon system only. This requirement was evaluated by NFPA 12A Code Compliance Evaluation.	CALC-ANO1-FP-09-00019, ANO Code Compliance Report for NFPA 12A 1973 Edition, Rev. 0
3.10.3 Gaseous Suppression System Ventilation Limitations	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.	Complies	The Halon design calculations have confirmed that requirements to prevent over-pressurization are satisfied.	CALC-95-E-0085-01, Halon Concentration in Unit 1 and Unit 2 Control Room Areas, Rev. 0 CALC-ANO1-FP-09-00019, ANO Code Compliance Report for NFPA 12A 1973 Edition, Rev. 0 SPEC-6600-M-079, Specification for Halon 1301 System for Control Room – Unit 1, Rev. 1

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.10.4* Gaseous Suppression System Single Failure Limits	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.	N/A	ANO-1 does not use a backup gaseous suppression system.	
3.10.5 Gaseous Suppression System Disarming Controls	Provisions for locally disarming automatic gaseous suppression systems shall be secured and under strict administrative control.	Complies	This requirement was evaluated by NFPA 12A Code Compliance Evaluation.	CALC-ANO1-FP-09-00019, ANO Code Compliance Report for NFPA 12A 1973 Edition, Rev. 0
3.10.6* Gaseous Suppression System CO_2 Limitations	Total flooding carbon dioxide systems shall not be used in normally occupied areas.	N/A	ANO-1 does not use total flooding carbon dioxide.	
3.10.7 Gaseous Suppression System CO_2 Warnings	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.	N/A	ANO-1 does not use total flooding carbon dioxide systems.	
3.10.8 Gaseous Suppression System CO_2 Required Disarming	Positive mechanical means shall be provided to lock out total flooding carbon dioxide systems during work in the protected space.	N/A	ANO-1 does not use total flooding carbon dioxide systems.	

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.10.9 Gaseous Suppression System Cooling Considerations	The possibility of secondary thermal shock (cooling) damage shall be considered during the design of any gaseous fire suppression system, but particularly with carbon dioxide.	Complies	Halon 1301 has minimal cooling effect.	CALC-ANO1-FP-09-00019, ANO Code Compliance Report for NFPA 12A 1973 Edition, Rev. 0 FHA, ANO-1 & 2 Fire Hazards Analysis, Rev. 15, Section 6.2.5 EN-DC-128, Fire Protection Impact Reviews, Rev. 5, Attachment 9.4, Step 1.2.m
3.10.10 Gaseous Suppression System Decomposition Issues	Particular attention shall be given to corrosive characteristics of agent decomposition products on safety systems.	Complies	No corrosive characteristics from agent decomposition products have been identified.	1CAN097610, Fire Protection (Status of Compliance with BTP APCSB 9.5-1), 9/17/1976, Attachment, Section IV.C.4 CALC-ANO1-FP-09-00019, ANO Code Compliance Report for NFPA 12A 1973 Edition, Rev. 0
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.	N/A	General statement, no technical requirements. See subsections for specific compliance statements.	

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.11.1 Building Separation	Each major building within 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.	Complies with use of EEEEs	This requirement was evaluated by NFPA 80A Code Compliance Evaluation.	CALC-ANOC-FP-08-00009, ANO Code Compliance Report for NFPA 80A 1996 Edition, Rev. 1 FHA, ANO-1 & 2 Fire Hazards Analysis, Rev. 15, Section 6.4.5, Fire Barriers, Seals & Penetrations
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.	Complies with use of EEEEs	This requirement was evaluated by EC1956, ANO-1 & 2 Fire Area/Fire Zone Compliance. ANO-1 License Amendment 35, Section 4.11, includes the following text: "Substantial fire barriers have been provided throughout the plant. The licensee's fire hazards analysis concludes that the basic wall, floor and ceiling structures bounding each fire area have adequate resistance to prevent the spread of an unsuppressed fire through the barrier. In some cases, fire zone boundaries are not established by fire barriers. However, the licensee's fire hazards analysis indicates that sufficient separation is provided by space, low combustible loading and other construction features to preclude fire spread between zones. The staff did not identify in its review any barriers that required modifications to a higher fire resistance rating, or areas where separation of fire zones was inadequate to prevent involvement of equipment in adjacent zones by a fire. *(continued)*	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.11 EC-1956, ANO-1 & 2 Redefined Fire Areas / Fire Zones, Rev. 0 FHA, ANO-1 & 2 Fire Hazards Analysis, Rev. 15, Section 6.4.5

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.11.2 *(continued)*			The fire barriers meet the objectives outlined in Section 2.2 of this report and are, therefore, acceptable." See Implementation Item in Attachment S.	
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 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: (see subsections) 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 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.	Complies with use of EEEEs	ANO complies with clarification in regards to NFPA 101 in that the features referenced in NFPA 101 are documented in the NFPA 80 and 90A Code Compliance Evaluations. NFPA 101 Section 8.2.3.2.1(a), with regards to rated fire door assemblies, refers to NFPA 80. NFPA 101 Section 9.2.1, with regards to rated fire dampers, refers to NFPA 90A.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.9 CALC-ANOC-FP-08-00006, ANO Code Compliance Report for NFPA 80 1999 Edition, Rev. 0 CALC-ANOC-FP-08-00010, ANO Code Compliance Report for NFPA 90A 1999 Edition, Rev. 0 FHA, ANO-1 & 2 Fire Hazards Analysis, Rev. 15, Section 6.4.5
3.11.3* Fire Barrier Penetrations (1)	NFPA 80, Standard for Fire Doors and Fire Windows.	Complies with use of EEEEs	ANO complies with clarification in regards to NFPA 101 in that the features referenced in NFPA 101 are documented in the NFPA 80 and 90A Code Compliance Evaluations. NFPA 101 Section 8.2.3.2.1(a), with regards to rated fire door assemblies, refers to NFPA 80.	CALC-ANOC-FP-08-00006, ANO Code Compliance Report for NFPA 80 1999 Edition, Rev. 0

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.11.3* Fire Barrier Penetrations (2)	NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.	Complies with use of EEEEs	ANO complies with clarification in regards to NFPA 101 in that the features referenced in NFPA 101 are documented in the NFPA 80 and 90A Code Compliance Evaluations. NFPA 101 Section 9.2.1, with regards to rated fire dampers, refers to NFPA 90A.	CALC-ANOC-FP-08-00010, ANO Code Compliance Report for NFPA 90A 1999 Edition, Rev. 0
3.11.3* Fire Barrier Penetrations (3)	NFPA 101, Life Safety Code.	Complies with use of EEEEs	ANO complies with clarification in regards to NFPA 101 in that the features referenced in NFPA 101 are documented in the NFPA 80 and 90A Code Compliance Evaluations. NFPA 101 Section 8.2.3.2.1(a), with regards to rated fire door assemblies, refers to NFPA 80. NFPA 101 Section 9.2.1, with regards to rated fire dampers, refers to NFPA 90A.	CALC-ANOC-FP-08-00006, ANO Code Compliance Report for NFPA 80 1999 Edition, Rev. 0 CALC-ANOC-FP-08-00010, ANO Code Compliance Report for NFPA 90A 1999 Edition, Rev. 0
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.	Complies with use of EEEEs	Through Penetration Fire Stops were approved initially by the NRC as documented in ANO-1 License Amendment 35, Section 4.9. Subsequent EEEE's have been documented in Table B-3 by fire area.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.9
3.11.4* Through Penetration Fire Stops (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 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.	Complies with use of EEEEs	Through Penetration Fire Stops were approved initially by the NRC as documented in ANO-1 License Amendment 35, Section 4.9. Subsequent EEEE's have been documented in Table B-3 by fire area.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.9

NFPA 805 Chapter 3 Section	Requirements / Guidance	Compliance Statement	Compliance Basis	Reference Document
3.11.4* Through Penetration Fire Stops (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 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.	Complies with use of EEEEs	Through Penetration Fire Stops were approved initially by the NRC as documented in ANO-1 License Amendment 35, Section 4.9. Subsequent EEEE's have been documented in Table B-3 by fire area.	ANO-1 License Amendment 35, Safety Evaluation Report, 8/22/1978, Items 4.9

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 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.	N/A	ANO does not credit Electrical Raceway Fire Barrier Systems.

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

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 mal-operation of those components needed to meet the nuclear safety criteria shall be included. Availability and reliability of equipment selected shall be evaluated.

NEI 00-01 Ref	NEI 00-01 Guidance
3 Deterministic Methodology	This section discusses a generic deterministic methodology and criteria that licensees can use to perform a post-fire safe shutdown analysis to address regulatory requirements. The plant-specific analysis approved by NRC is reflected in the plant's licensing basis. The methodology described in this section is also an acceptable method of performing a post-fire safe shutdown analysis. This methodology is indicated in Figure 3-1. Other methods acceptable to NRC may also be used. Regardless of the method selected by an individual licensee, the criteria and assumptions provided in this guidance document may apply. The methodology described in Section 3 is based on a computer database oriented approach, which is utilized by several licensees to model Appendix R data relationships. This guidance document, however, does not require the use of a computer database oriented approach. The requirements of Appendix R Sections III.G.1, III.G.2 and III.G.3 apply to equipment and cables required for achieving and maintaining safe shutdown in any fire area. Although equipment and cables for fire detection and suppression systems, communications systems and 8-hour emergency lighting systems are important features, this guidance document does not address them. Additional information is provided in Appendix B to this document.

Applicability	Comments
Applicable	This is introductory paragraph and contains no specific requirements.

Alignment Statement	Alignment Basis
Aligns	The Appendix R Analysis at ANO was revalidated based on guidance provided in NEI-00-01, Revision 1. This is documented in various calculations.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, ALL
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, ALL
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, ALL
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, ALL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	NEI 00-01 Guidance
3.1 [A, Intro] Safe Shutdown Systems Path Development	This section discusses the identification of systems available and necessary to perform the required safe shutdown functions. It also provides information on the process for combining these systems into safe shutdown paths. Appendix R Section III.G.1.a requires that the capability to achieve and maintain hot shutdown be free of fire damage. It is expected that the term "free of fire damage" will be further clarified in a forthcoming Regulatory Issue Summary. Appendix R Section III.G.1.b requires that repairs to systems and equipment necessary to achieve and maintain cold shutdown be completed within 72 hours. It is the intent of the NRC that requirements related to the use of manual operator actions will be addressed in a forthcoming rulemaking (refer to hard copy of NEI 00-01 for Figure 3-1)

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	The systems and logical relationships to accomplish functional requirements and ensure performance goals are met have been developed in the SSEL and Safe Shutdown Capability Assessment (SSCA) calculations.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.2

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	NEI 00-01 Guidance
3.1 [B, Goals] Safe Shutdown Systems and Path Development	The goal of post-fire safe shutdown is to assure that one train of shutdown systems, structures, and components remains free of fire damage for a single fire in any single plant fire area. This goal is accomplished by determining those functions important to achieve and maintain hot shutdown. Safe shutdown systems are selected so that the capability to perform these required functions is a part of each safe shutdown path. The functions important to post-fire safe shutdown generally include, but are not limited to the following: Reactivity control Pressure control systems Inventory control systems Decay heat removal systems Process monitoring Support systems Electrical systems Cooling systems These functions are of importance because they have a direct bearing on the safe shutdown goal of being able to achieve and maintain hot shutdown, which ensures the integrity of the fuel, the reactor pressure vessel, and the primary containment. If these functions are preserved, then the plant will be safe because the fuel, the reactor, and the primary containment will not be damaged. By assuring that this equipment is not damaged and remains functional, the protection of the health and safety of the public is assured.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns with intent	The systems and logical relationships required to ensure that performance goals are met have been developed in the SSEL and SSCA. The selection of components and system is based on achieving the performance goals in each fire area. There is no specific shutdown path.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	NEI 00-01 Guidance
3.1 [C, Spurious Operations] Safe Shutdown Systems and Path Development	In addition to the above listed functions, Generic Letter (GL) 81-12 specifies consideration of associated circuits with the potential for spurious equipment operation and/or loss of power source, and the common enclosure failures. Spurious operations/actuations can affect the accomplishment of the post-fire safe shutdown functions listed above. Typical examples of the effects of the spurious operations of concern are the following: • A loss of reactor pressure vessel/reactor coolant inventory in excess of the safe shutdown makeup capability • A flow loss or blockage in the inventory makeup or decay heat removal systems being used for the required safe shutdown path. Spurious operations are of concern because they have the potential to directly affect the ability to achieve and maintain hot shutdown, which could affect the fuel and cause damage to the reactor pressure vessel or the primary containment. Common power source and common enclosure concerns could also affect these and must be addressed.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns with intent	The cable selection and circuit analysis for 10 CFR 50, Appendix R, safe shutdown components at ANO-1 considers spurious operation due to associated circuits, common power supplies, and for common enclosures. A special subset of components considered for spurious operation involves reactor coolant pressure boundary components whose spurious operation can lead to an unacceptable loss of reactor pressure vessel / Reactor Coolant System (RCS) inventory via an interfacing system loss of coolant accident (LOCA). These components are defined as high/low pressure interface valves and are subject to more stringent circuit analysis. This high/low pressure interface boundary valve definition is in alignment with those in NEI 00-01, NEI-00-01 Appendix C, and FAQ 06-0006 to NEI 04-02, but is limited to those components potentially subject to interfacing LOCAs in excess of makeup capability.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.3.6
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Sections 7 and 8

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	NEI 00-01 Guidance
3.1.1 Criteria / Assumptions	The following criteria and assumptions may be considered when identifying systems available and necessary to perform the required safe shutdown functions and combining these systems into safe shutdown paths.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4

NEI 00-01 Ref	NEI 00-01 Guidance
3.1.1.1 [GE BWR Paths]	[BWR] General Electric (GE) Report GE-NE-T43-00002-00-01-R01 entitled "Original Safe Shutdown Paths For The BWR" addresses the systems and equipment originally designed into the GE boiling water reactors (BWRs) in the 1960s and 1970s, that can be used to achieve and maintain safe shutdown per Section III.G.1 of 10 CFR 50, Appendix R. Any of the shutdown paths (methods) described in this report are considered to be acceptable methods for achieving redundant safe shutdown.

Applicability	Comments
Not Applicable	ANO-1 is Babcock & Wilcox (B&W) two-loop once-through steam generator (SG) pressurized water reactor (PWR) dry ambient pressure containment with operating license DPR-51 issued 05/21/1974.

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.1.2 [SRVs / LP Systems]	[BWR] GE Report GE-NE-T43-00002-00-03-R01 provides a discussion on the BWR Owners' Group (BWROG) position regarding the use of Safety Relief Valves (SRVs) and low pressure systems (Low Pressure Injection , Reactor Building Spray) for safe shutdown. The BWROG position is that the use of SRVs and low pressure systems is an acceptable methodology for achieving redundant safe shutdown in accordance with the requirements of 10 CFR 50, Appendix R, Sections III.G.1 and III.G.2. The NRC has accepted the BWROG position and issued a Safety Evaluation Report (SER) dated Dec. 12, 2000.
Applicability	**Comments**
Not Applicable	ANO-1 is (B&W) two-loop once-through SG PWR dry ambient pressure containment with operating license DPR-51 issued 05/21/1974.

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.1.3 [Pressurizer Heaters]	[PWR] GL 86-10, Enclosure 2, Section 5.3.5, specifies that hot shutdown can be maintained without the use of pressurizer heaters (i.e., pressure control is provided by controlling the makeup/charging pumps). Hot shutdown conditions can be maintained via natural circulation of the RCS through the SGs. The cooldown rate must be controlled to prevent the formation of a bubble in the reactor head. Therefore, feedwater (either auxiliary or emergency) flow rates as well as steam release must be controlled.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Safe Shutdown credits the use of one SG in natural circulation cooldown (with no credit for pressurizer heaters), Reactor Coolant Pumps (RCPs) tripped, makeup available, and Emergency Feedwater (EFW) aligned to a SG. Cooldown is accomplished using atmospheric dump valves (ADVs) and controlling SG level.

Reference Document

CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 1, Table 1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 6

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.1.4 [Alternative Shutdown Capability]	The classification of shutdown capability as alternative shutdown is made independent of the selection of systems used for shutdown. Alternative shutdown capability is determined based on an inability to assure the availability of a redundant safe shutdown path. Compliance to the separation requirements of Sections III.G.1 and III.G.2 may be supplemented by the use of manual actions to the extent allowed by the regulations and the licensing basis of the plant, repairs (cold shutdown only), exemptions, deviations, GL 86-10, fire hazards analyses, or fire protection design change evaluations, as appropriate. These may also be used in conjunction with alternative shutdown capability.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Alternate shutdown capability is credited when all process monitoring and control functions are no longer available from the main control room due to a fire in either the control room or cable spreading room (control room abandonment scenario).

Comments

Alternate shutdown capability is monitored in the Technical Support Center (TSC) using the Safety Parameter Display System (SPDS). Operators are used throughout the plant to achieve shutdown.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.19
OP-1203.002, Alternate Shutdown, Rev. 23, All

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.1.5 [Initial Conditions]	At the onset of the postulated fire, all safe shutdown systems (including applicable redundant trains) are assumed operable and available for post-fire safe shutdown. Systems are assumed to be operational with no repairs, maintenance, testing, Limiting Conditions for Operation (LCO), etc. in progress. The units are assumed to be operating at full power under normal conditions and normal lineups.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Safe shutdown systems are assumed to be operational with no repairs, maintenance, testing, or LCO in progress. The majority of equipment relied upon for safe shutdown is safety related and/or governed by Technical Specification (TS) or Technical Requirement Manual (TRM) operability requirements.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.2.4

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.1.6 [Other Events in Conjunction with Fire]	No Safety Analysis Report (SAR) accidents or other design basis events (e.g. LOCA, earthquake), single failures or non-fire induced transients need be considered in conjunction with the fire.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	No other external events, accidents, or failures unrelated to the fire are assumed to occur concurrently with the postulated fire or any subsequent activities to achieve cold shutdown conditions.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 5.0
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.1.1

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.1.7 [Offsite Power]	For the case of redundant shutdown, offsite power may be credited if demonstrated to be free of fire damage. Offsite power should be assumed to remain available for those cases where its availability may adversely impact safety (i.e., reliance cannot be placed on fire causing a loss of offsite power (LOOP) if the consequences of offsite power availability are more severe than its presumed loss). No credit should be taken for a fire causing a LOOP. For areas where train separation cannot be achieved and alternative shutdown capability is necessary, shutdown must be demonstrated both where offsite power is available and where offsite power is not available for 72 hours.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Except where demonstrated by analysis to remain available post-fire, offsite power may or may not be available when addressing fire effects. Thus, it cannot be assumed that a LOOP will occur and cause components to fail to their safe shutdown position.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 5.0 3)
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.2.1

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.1.8 [Safety-Related Equipment]	Post-fire safe shutdown systems and components are not required to be safety-related.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Safe Shutdown Equipment (SSE) may or may not be safety-related.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.3.14

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.1.9 [72 Hour Coping]	The post-fire safe shutdown analysis assumes a 72-hour coping period starting with a reactor scram/trip. Fire-induced impacts that provide no adverse consequences to hot shutdown within this 72-hour period need not be included in the post-fire safe shutdown analysis. At least one train can be repaired or made operable within 72 hours using onsite capability to achieve cold shutdown.
Applicability	**Comments**
Applicable	For alternate shutdown, Appendix R, III.L, requires that cold shutdown be achieved in 72 hours. Appendix R, III.G.1.b, requires that system necessary to achieve and maintain cold shutdown can be repaired and be operable in 72 hours.
Alignment Statement	**Alignment Basis**
Aligns	For ANO-1, under Appendix R, an exemption was granted from the requirements of Section III.L that allowed CSD to be achieved within 140 hours from the time of the fire event. The needed systems and components are made available within that time frame to ensure CSD can be achieved. Transition to CSD is not required for Safe and Stable under a NFPA 805 Licensing Basis and repair of non-risk significant equipment for CSD will be addressed post transition in site procedures

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 4.2.2
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 1, Section 2.0

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	NEI 00-01 Guidance
3.1.1.10 [Manual / Automatic Initiation of Systems]	Manual initiation from the main control room or emergency control stations of systems required to achieve and maintain safe shutdown is acceptable where permitted by current regulations or approved by NRC; automatic initiation of systems selected for safe shutdown is not required, but may be included as an option.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	Only manual initiation of main systems is credited. Automatic operation of specific components within main systems is credited where appropriate (such as minimum flow valves). In general, automatic main system initiation (i.e., Engineered Safeguards initiation signals) are not credited unless the initiation signals are shown to be free of fire damage. However, fire induced automatic initiation signals are evaluated for the possibility of spurious component operation and their subsequent adverse impact on safe shutdown.

Reference Document

CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Section 3.1
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.2.6

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.1.11 [Multiple Affected Units]	Where a single fire can impact more than one unit of a multi-unit plant, the ability to achieve and maintain safe shutdown for each affected unit must be demonstrated.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	ANO-1 and ANO-2 do not share resources required to meet performance goals for control of reactivity, inventory, pressure, and decay heat removal.

Reference Document

CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachments 4 through 72

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.2 Shutdown Functions	The following discussion on each of these shutdown functions provides guidance for selecting the systems and equipment required for safe shutdown. For additional information on BWR system selection, refer to GE Report GE-NE-T43-00002-00-01-R01 entitled "Original Safe Shutdown Paths for the BWR."
Applicability	**Comments**
Applicable	This is introductory paragraph and contains no specific requirements.
Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.0

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.2.1 Reactivity Control	[BWR] Control Rod Drive System The safe shutdown performance and design requirements for the reactivity control function can be met without automatic scram/trip capability. Manual scram/reactor trip is credited. The post-fire safe shutdown analysis must only provide the capability to manually scram/trip the reactor. [PWR] Makeup/Charging A method for ensuring that adequate shutdown margin is maintained is provided by ensuring borated water is utilized for RCS makeup/charging.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Adequate shutdown margin for cold shutdown is assured using the Borated Water Storage Tank (BWST) aligned to the makeup pump suction, or should BWST spuriously drain to the sump, by aligning Low Pressure Injection (LPI) pumps suction from the Reactor Building sump with LPI discharge aligned to makeup pump suction (i.e., piggyback).

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 1, Table 1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 6.1.1

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.2.2 Pressure Control Systems	The systems discussed in this section are examples of systems that can be used for pressure control. This does not restrict the use of other systems for this purpose. [BWR] Safety Relief Valves (SRVs) The SRVs are opened to maintain hot shutdown conditions or to depressurize the vessel to allow injection using low pressure systems. These are operated manually. Automatic initiation of the Automatic Depressurization System is not a required function. [PWR] Makeup/Charging RCS pressure is controlled by controlling the rate of charging/makeup to the RCS. Although utilization of the pressurizer heaters and/or auxiliary spray reduces operator burden, neither component is required to provide adequate pressure control. Pressure reductions are made by allowing the RCS to cool/shrink, thus reducing pressurizer level/pressure. Pressure increases are made by initiating charging/makeup to maintain pressurizer level/pressure. Manual control of the related pumps is acceptable.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	RCS pressure will lower slowly as the pressurizer cools due to ambient losses with no pressurizer heaters in operation. Additional depressurization methods credited are the auxiliary spray and Electromatic Relief Valve (ERV).

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 1, Table 1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 6.1.3

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	NEI 00-01 Guidance
3.1.2.3 Inventory Control	[BWR] Systems selected for the inventory control function should be capable of supplying sufficient reactor coolant to achieve and maintain hot shutdown. Manual initiation of these systems is acceptable. Automatic initiation functions are not required. [PWR] Systems selected for the inventory control function should be capable of maintaining level to achieve and maintain hot shutdown. Typically, the same components providing inventory control are capable of providing pressure control. Manual initiation of these systems is acceptable. Automatic initiation functions are not required.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	The makeup pumps aligned from the BWST can be used to control RCS level. If the BWST spuriously drains to the sump, the LPI pumps are aligned to the sump with LPI discharge aligned to makeup pump suction (i.e., piggyback).

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 1, Table 1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 6.1.2.2

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.2.4 Decay Heat Removal	[BWR] Systems selected for the decay heat removal (DHR) function(s) should be capable of: • Removing sufficient decay heat from primary containment, to prevent containment over-pressurization and failure. • Satisfying the net positive suction head requirements of any safe shutdown systems taking suction from the reactor building (suppression pool). • Removing sufficient decay heat from the reactor to achieve cold shutdown. [PWR] Systems selected for the decay heat removal function(s) should be capable of: • Removing sufficient decay heat from the reactor to reach hot shutdown conditions. Typically, this entails utilizing natural circulation in lieu of forced circulation via the RCPs and controlling steam release via the ADVs. • Removing sufficient decay heat from the reactor to reach cold shutdown conditions. This does not restrict the use of other systems.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	DHR is accomplished using natural circulation cooldown. EFW is aligned to a SG with initial pressure control provided by the Main Steam Safety Valve (MSSV) to achieve Hot Standby. Transitioning to cold shutdown utilizes the ADVs until the RCS pressure and temperature requirements are met to align the DHR system for cold shutdown.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 1, Table 1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 6.1.4

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.2.5 Process Monitoring	The process monitoring function is provided for all safe shutdown paths. NRC Information Notice (IN) 84-09, Attachment 1, Section IX, "Lessons Learned from NRC Inspections of Fire Protection Safe Shutdown Systems (10 CFR 50 Appendix R)" provides guidance on the instrumentation acceptable to and preferred by the NRC for meeting the process monitoring function. This instrumentation is that which monitors the process variables necessary to perform and control the functions specified in Appendix R, Section III.L.1. Such instrumentation must be demonstrated to remain unaffected by the fire. The IN 84-09 list of process monitoring is applied to alternative shutdown (III.G.3). IN 84-09 did not identify specific instruments for process monitoring to be applied to redundant shutdown (III.G.1 and III.G.2). In general, process monitoring instruments similar to those listed below are needed to successfully use existing operating procedures (including Abnormal Operating Procedures).

BWR

Reactor coolant level and pressure	Diagnostic instrumentation for safe shutdown systems
Suppression pool level and temperature	Level indication for tanks needed for safe shutdown
Emergency or isolation condenser level	

PWR

Reactor coolant temperature (hot leg / cold leg)	Level indication for tanks needed for safe shutdown
Pressurizer pressure and level	Steam generator level and pressure
Neutron flux monitoring (source range)	Diagnostic instrumentation for safe shutdown systems

The specific instruments required may be based on operator preference, safe shutdown procedural guidance strategy (symptomatic vs. prescriptive), and systems and paths selected for safe shutdown.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	The instrumentation selected is based on the guidance of IN 84-09 and NRC Regulatory Guide (RG) 1.189, which identify the minimum monitoring capability considered necessary for a PWR.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 6.1.5

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.2.6 Support Systems	[Blank Heading - No specific guidance]
Applicability	**Comments**
Applicable	This is introductory header and contains no specific requirements.
Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

References provided in subsequent subsections.

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.2.6.1 Electrical Systems	AC Distribution System Power for the Appendix R safe shutdown equipment is typically provided by a medium voltage system such as 4.16 KV Class 1E busses either directly from the busses or through step-down transformers/load centers/distribution panels for 600, 480 or 120 VAC loads. For redundant safe shutdown performed in accordance with the requirements of Appendix R, Section III.G.1 and 2, power may be supplied from either offsite power sources or the Emergency Diesel Generator (EDG) depending on which has been demonstrated to be free of fire damage. No credit should be taken for a fire causing a LOOP. Refer to Section 3.1.1.7. DC Distribution System Typically, the 125 VDC distribution system supplies DC control power to various 125 VDC control panels, including switchgear breaker controls. The 125 VDC distribution panels may also supply power to the 120 VAC distribution panels via static inverters. These distribution panels typically supply power for instrumentation necessary to complete the process monitoring functions. For fire events that result in an interruption of power to the AC electrical bus, the station batteries are necessary to supply any required control power during the interim time period required for the EDGs to become operational. Once the EDGs are operational, the 125 VDC distribution system can be powered from the EDGs via the battery chargers. [BWR] Certain plants are also designed with a 250 VDC Distribution System that supplies power to Reactor Core Isolation Cooling and/or High Pressure Coolant Injection equipment. The DC control centers may also supply power to various small horsepower Appendix R safe shutdown system valves and pumps. If the DC system is relied upon to support safe shutdown without battery chargers being available, it must be verified that sufficient battery capacity exists to support the necessary loads for sufficient time (either until power is restored, or the loads are no longer required to operate).
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	The AC and DC distribution systems are credited in order to meet performance goals and functions. The safeguards 4.16 kV buses can either be aligned to the EDGs or to available offsite power.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 6.1.6.1

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref

3.1.2.6.2 [B] Cooling Systems

NEI 00-01 Guidance

Heating, Ventilation, and Air Conditioning (HVAC) Systems

HVAC Systems may be required to assure that safe shutdown equipment remains within its operating temperature range, as specified in manufacturer's literature or demonstrated by suitable test methods, and to assure protection for plant operations staff from the effects of fire (smoke, heat, toxic gases, and gaseous fire suppression agents).

HVAC systems may be required to support safe shutdown system operation, based on plant-specific configurations. Typical uses include:

- Main control room, cable spreading room, relay room
- ECCS pump compartments
- Diesel generator rooms
- Switchgear rooms

Plant-specific evaluations are necessary to determine which HVAC systems are essential to safe shutdown equipment operation.

Applicability

Applicable

Comments

None

Alignment Statement

Aligns

Alignment Basis

An active HVAC system is required for the EDGs and the control room. Passive dampers have been included to account for their different position based on seasonal changes.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 1, Table 1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 6.1.6.4

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref **NEI 00-01 Guidance**

3.1.2.6.2 [A] Cooling Systems

Various cooling water systems may be required to support safe shutdown system operation, based on plant-specific considerations. Typical uses include:

RHR (residual heat removal) / SDC (shutdown cooling) / DHR Heat Exchanger cooling water

Safe shutdown pump cooling (seal coolers, oil coolers)

Diesel generator cooling

HVAC system cooling water

Applicability

Applicable

Comments

None

Alignment Statement

Aligns

Alignment Basis

The cooling water system is credited to support Makeup, EDGs, DHR, EFW and HVAC systems.

Reference Document

CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 1, Table 1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 6.1.6.2

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.3 Methodology for Shutdown System Selection	Refer to Figure 3-2 for a flowchart illustrating the various steps involved in selecting safe shutdown systems and developing the shutdown paths. The following methodology may be used to define the safe shutdown systems and paths for an Appendix R analysis (refer to hard copy of NEI 00-01 for Figure 3-2).
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns with intent	The selection of components and systems is based on achieving the performance goals in each fire area. There is no specific shutdown path; both red and green train safe shutdown equipment (SSE) and selected non-1E equipment can be used to accomplish performance goals.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.3.1 Identify Safe Shutdown Functions	Review available documentation to obtain an understanding of the available plant systems and the functions required to achieve and maintain safe shutdown. Documents such as the following may be reviewed: Operating Procedures (Normal, Emergency, Abnormal) System descriptions Fire Hazard Analysis (FHA) Single-line electrical diagrams Piping and Instrumentation Diagrams (P&IDs) [BWR] GE Report GE-NE-T43-00002-00-01-R02 entitled "Original Shutdown Paths for the BWR"

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Various documents were reviewed to determine equipment required to achieve and maintain safe shutdown. The Operation department was consulted in selection process.

Reference Document

CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 1, Table 1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Sections 3.3 through 3.6

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.3.2 Identify Combinations of Systems that Satisfy Each Safe Shutdown Function	Given the criteria/assumptions defined in Section 3.1.1, identify the available combinations of systems capable of achieving the safe shutdown functions of reactivity control, pressure control, inventory control, decay heat removal, process monitoring, and support systems such as electrical and cooling systems (refer to Section 3.1.2). This selection process does not restrict the use of other systems. In addition to achieving the required safe shutdown functions, consider spurious operations and power supply issues that could impact the required safe shutdown function.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	The available combination of systems/components capable of achieving and maintaining the safe shutdown functions are depicted on the fault trees.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, ALL
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 7.0

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.1.3.3 Define Combinations of Systems for Each Safe Shutdown Path	Select combinations of systems with the capability of performing all of the required safe shutdown functions and designate this set of systems as a safe shutdown path. In many cases, safe shutdown paths may be defined on a divisional basis since the availability of electrical power and other support systems must be demonstrated for each path.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns with intent	The logical relationship of safe shutdown equipment is established in the fault trees and illustrates how this equipment functions together to achieve and maintain safe shutdown.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3.4

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2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	NEI 00-01 Guidance
3.1.3.4 Assign Shutdown Paths to Each Combination of Systems	Assign a path designation to each combination of systems. The path will serve to document the combination of systems relied upon for safe shutdown in each fire of area. Refer to Attachment 1 to this document (NEI 00-01) for an example of a table illustrating how to document the various combinations of systems for selected shutdown paths.

Applicability	Comments
Applicable	Attachment refers to BWROG guidance on post-fire safe shutdown, which have more systems combination, whereas a PWR could be differentiated by train/steam generator combinations.

Alignment Statement	Alignment Basis
Aligns with intent	Path designation are not used. The logical relationship of safe shutdown equipment is established in the fault trees and illustrates how this equipment functions together to achieve and maintain safe shutdown.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3.4

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2 Safe Shutdown Equipment Selection	The previous section described the methodology for selecting the systems and paths necessary to achieve and maintain safe shutdown for an exposure fire event (see Section 5.0 DEFINITIONS for "Exposure Fire"). This section describes the criteria/assumptions and selection methodology for identifying the specific safe shutdown equipment necessary for the systems to perform their Appendix R function. The selected equipment should be related back to the safe shutdown systems that they support and be assigned to the same safe shutdown path as that system. The list of safe shutdown equipment will then form the basis for identifying the cables necessary for the operation or that can cause the mal-operation of the safe shutdown systems.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	The SSEL is used as input into the development of the Safe Shutdown Fault Trees. The SSEL is also used to identify those components requiring post-fire safe shutdown circuit analysis.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.1, 4.2

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.1 Criteria / Assumptions	Consider the following criteria and assumptions when identifying equipment necessary to perform the required safe shutdown functions:
Applicability	**Comments**
Applicable	This is introductory paragraph and contains no specific requirements.
Alignment Statement	**Alignment Basis**
Aligns	This is introductory paragraph and contains no specific requirements.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.2

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	NEI 00-01 Guidance
3.2.1.1 [Primary / Secondary Components]	Safe shutdown equipment can be divided into two categories. Equipment may be categorized as (1) primary components or (2) secondary components. Typically, the following types of equipment are considered to be primary components: Pumps, motor operated valves, solenoid valves, fans, gas bottles, dampers, unit coolers, etc. All necessary process indicators and recorders (i.e., flow indicator, temperature indicator, turbine speed indicator, pressure indicator, level recorder), power supplies, or other electrical components that support operation of primary components (i.e., EDGs, switchgear, motor control centers, load centers, power supplies, distribution panels, etc.). Secondary components are typically items found within the circuitry for a primary component. These provide a supporting role to the overall circuit function. Some secondary components may provide an isolation function or a signal to a primary component via either an interlock or input signal processor. Examples of secondary components include flow switches, pressure switches, temperature switches, level switches, temperature elements, speed elements, transmitters, converters, controllers, transducers, signal conditioners, hand switches, relays, fuses and various instrumentation devices. Determine which equipment should be included in the SSEL. As an option, include secondary components with a primary component(s) that would be affected by fire damage to the secondary component. By doing this, the SSEL can be kept to a manageable size and the equipment included on the SSEL can be readily related to required post-fire safe shutdown systems and functions.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	CALC-85-E-0086-18 contains detailed guidelines for the selection of safe shutdown equipment that keep the ANO-1 SSEL at a manageable size by differentiating between primary and secondary components. Simplified descriptions of safe shutdown primary components at ANO are major elements that define a process flow path or support system (i.e. valves, pumps, instruments, and distribution equipment). Secondary components are elements that can be accounted for by the inclusion of the cables associated with these items during the safe shutdown circuit analysis process (i.e. handswitches, relays, and instrument power supplies).

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3.2

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.1.2 [Fire Damage to Mechanical Components (not electrically supervised)]	Assume that exposure fire damage to manual valves and piping does not adversely impact their ability to perform their pressure boundary or safe shutdown function (heat sensitive piping materials, including tubing with brazed or soldered joints, are not included in this assumption). Fire damage should be evaluated with respect to the ability to manually open or close the valve should this be necessary as a part of the post-fire safe shutdown scenario.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Mechanical Components susceptible to fire damage (brazed or soldered instrument lines, instrument tubing for credited instruments, etc.) are identified and evaluated on a fire area basis. This may take the form of a stand-alone evaluation or may be incorporated into the SSEL.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 5.0 (8)
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3.2 (l)

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.1.3 [Manual Valve Positions]	Assume that manual valves are in their normal position as shown on P&IDs or in the plant operating procedures.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	The normal operating position of the component is determined by a review of operating procedures. If the normal operating position of the component is indeterminate (components having more than one operating position/state based on system alignment), both positions are entered.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3.3 (j)

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.1.4 [Check Valves]	Assume that a check valve closes in the direction of potential flow diversion and seats properly with sufficient leak tightness to prevent flow diversion. Therefore, check valves do not adversely affect the flow rate capability of the safe shutdown systems being used for inventory control, decay heat removal, equipment cooling or other related safe shutdown functions.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Properly oriented check valves are assumed to provide adequate isolation when credited for boundary isolation.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3.2.b

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NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.1.5 [Instrument Failures]	Instruments (e.g., resistance temperature detectors, thermocouples, pressure transmitters, and flow transmitters) are assumed to fail upscale, midscale, or downscale as a result of fire damage, whichever is worse. An instrument performing a control function is assumed to provide an undesired signal to the control circuit.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Damage to instrument cables is assumed to fail the instrument in the least desirable state. That is, the instrument could fail high, low, or in some intermediate condition.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.5.2

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.1.6 [Spurious Components]	Identify equipment that could spuriously operate or mal-operate and impact the performance of equipment on a required safe shutdown path during the equipment selection phase. Consider Bin 1 of RIS 2004-03 during the equipment identification process.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Circuit analysis was done on each electrically supervised potentially spurious component. Included in the analysis was whether cable fault mechanism was due to either an intra- or inter-cable hot short to consider Bin 1 of NRC Regulatory Issue Summary (RIS) 2004-03 identification.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.8

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.1.7 [Instrument Tubing]	Identify instrument tubing that may cause subsequent effects on instrument readings or signals as a result of fire. Determine and consider the fire area location of the instrument tubing when evaluating the effects of fire damage to circuits and equipment in the fire area.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Instrument tubing was evaluated to determine effect of exposure fire in addition to cable failure effects.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 5.0 subsections 7) & 8); Attachment 8.41

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.2 Methodology for Equipment Selection	Refer to Figure 3-3 for a flowchart illustrating the various steps involved in selecting safe shutdown equipment. Use the following methodology to select the safe shutdown equipment for a post-fire safe shutdown analysis (refer to hard copy of NEI 00-01 for Figure 3-3).

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	This is an introductory paragraph and contains no specific guidance.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.2.1 Identify the System Flow Path for Each Shutdown Path	Mark up and annotate a P&ID to highlight the specific flow paths for each system in support of each shutdown path. Refer to Attachment 2 for an example of an annotated P&ID illustrating this concept.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Mark-ups of P&IDs were initially developed for verification of the SSEL components, but not maintained as controlled documents once the SSEL was finalized as described in CALC-85-E-0086-18, section 5.3.1.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3.1

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.2.2 Identify the Equipment in Each Safe Shutdown System Flow Path Including Equipment That May Spuriously Operate and Affect System Operation	Review the applicable documentation (e.g. P&IDs, electrical drawings, instrument loop diagrams) to assure that all equipment in each system's flow path has been identified. Assure that any equipment that could spuriously operate and adversely affect the desired system function(s) is also identified. If additional systems are identified which are necessary for the operation of the safe shutdown system under review, include these as systems required for safe shutdown. Designate these new systems with the same safe shutdown path as the primary safe shutdown system under review (Refer to Figure 3-1).

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns with intent	The SSEL identifies the minimum set of plant equipment that is required to demonstrate the plant's ability to achieve and maintain post-fire safe shutdown for all applicable areas of the plant. To develop the list, a thorough review of plant documents, including P&IDs, System Training Manuals, Normal and Abnormal Operating Procedures, and the SAR was conducted. The SSEL is the result of an iterative process including component selection, circuit analysis, and area compliance assessments. Safe shutdown paths are not designated; the method to achieve and maintain safe shutdown is shown on fault trees for each fire area.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.1

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	NEI 00-01 Guidance
3.2.2.3 Develop a List of Safe Shutdown Equipment and Assign the Corresponding System and Safe Shutdown Path(s) Designation to Each	Prepare a table listing the equipment identified for each system and the shutdown path that it supports. Identify any valves or other equipment that could spuriously operate and impact the operation of that safe shutdown system. Assign the safe shutdown path for the affected system to this equipment. During the cable selection phase, identify additional equipment required to support the safe shutdown function of the path (e.g., electrical distribution system equipment). Include this additional equipment in the safe shutdown equipment list. Attachment 3 to this document provides an example of a SSEL. The SSEL identifies the list of equipment within the plant considered for safe shutdown and it documents various equipment-related attributes used in the analysis.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns with intent	The SSEL is controlled in the Plant Database Management System (PDMS). A shutdown path is not used, but instead a method to achieve and maintain safe shutdown is shown on a fault tree available for each fire area.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 7
PDMS, Plant Data Management System, Rev. 3.0.5.0, SSEL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.2.4 Identify Equipment Information Required for the Safe Shutdown Analysis	Collect additional equipment-related information necessary for performing the post-fire safe shutdown analysis for the equipment. In order to facilitate the analysis, tabulate this data for each piece of equipment on the SSEL. Refer to Attachment 3 to this document for an example of a SSEL. Examples of related equipment data should include the equipment type, equipment description, safe shutdown system, safe shutdown path, drawing reference, fire area, fire zone, and room location of equipment. Other information such as the following may be useful in performing the safe shutdown analysis: normal position, hot shutdown position, cold shutdown position, failed air position, failed electrical position, high/low pressure interface concern, and spurious operation concern.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Equipment information required for safe shutdown analysis is maintained in PDMS. This information includes equipment type, equipment description, safe shutdown system, drawing reference, fire area, fire zone, and room location of equipment. Other information maintained in PDMS is normal position, hot shutdown position, cold shutdown position, failed air position, and failed electrical position. Cable analysis linked to safe shutdown equipment indicates high/low pressure interface concerns, and cable failure modes inclusive of spurious operation.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, All
PDMS, Plant Data Management System, Rev. 3.0.5.0, SSEL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.1 Nuclear Safety Capability System and Equipment Selection

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.2.2.5 Identify Dependencies Between Equipment, Supporting Equipment, Safe Shutdown Systems and Safe Shutdown Paths	In the process of defining equipment and cables for safe shutdown, identify additional supporting equipment such as electrical power and interlocked equipment. As an aid in assessing identified impacts to safe shutdown, consider modeling the dependency between equipment within each safe shutdown path either in a relational database or in the form of a Safe Shutdown Logic Diagram (SSLD). Attachment 4 provides an example of a SSLD that may be developed to document these relationships.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns with intent	In the process of defining equipment and cables for safe shutdown, identification of additional supporting equipment such as electrical power and interlocked equipment was completed and is contained within the SSEL in PDMS. A safe shutdown path is not identified for each SSE, a fault tree is used to identify dependency between components.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.39
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3.3, 5.3.4

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

2.4.2.2.1 Circuits Required in Nuclear Safety Functions. Circuits required for the nuclear safety functions shall be identified. This includes circuits that are required for operation, that could prevent the operation, or that result in the mal-operation of the equipment identified in 2.4.2.1. This evaluation shall consider fire-induced failure modes such as hot shorts (external and internal), open circuits, and shorts to ground, to identify circuits that are required to support the proper operation of components required to achieve the nuclear safety performance criteria, including spurious operation and signals. This will ensure that a comprehensive population of circuitry is evaluated.

2.4.2.2.2 Other Required Circuits. Other circuits that share common power supply and/or common enclosure with circuits required to achieve nuclear safety performance criteria shall be evaluated for their impact on the ability to achieve nuclear safety performance criteria.

(a) Common Power Supply Circuits. Those circuits whose fire-induced failure could cause the loss of a power supply required to achieve the nuclear safety performance criteria shall be identified. This situation could occur if the upstream protection device (i.e., breaker or fuse) is not properly coordinated with the downstream protection device.

(b) Common Enclosure Circuits. Those circuits that share enclosures with circuits required to achieve the nuclear safety performance criteria and whose fire-induced failure could cause the loss of the required components shall be identified. The concern is that the effects of a fire can extend outside of the immediate fire area due to fire-induced electrical faults on inadequately protected cables or via inadequately sealed fire area boundaries.

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3 Safe Shutdown Cable Selection and Location	This section provides industry guidance on the recommended methodology and criteria for selecting safe shutdown cables and determining their potential impact on equipment required for achieving and maintaining safe shutdown of an operating nuclear power plant for the condition of an exposure fire. The Appendix R safe shutdown cable selection criteria are developed to ensure that all cables that could affect the proper operation or that could cause the mal-operation of safe shutdown equipment are identified and that these cables are properly related to the safe shutdown equipment whose functionality they could affect. Through this cable-to-equipment relationship, cables become part of the safe shutdown path assigned to the equipment affected by the cable.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	This is introductory guidance information and contains no specific guidance.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, ALL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.1 Criteria / Assumptions	To identify an impact to safe shutdown equipment based on cable routing, the equipment must have cables that affect it identified. Carefully consider how cables are related to safe shutdown equipment so that impacts from these cables can be properly assessed in terms of their ultimate impact on safe shutdown system equipment. Consider the following criteria when selecting cables that impact safe shutdown equipment:
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.0

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.1.1 [Cable Selection]	The list of cables whose failure could impact the operation of a piece of safe shutdown equipment includes more than those cables connected to the equipment. The relationship between cable and affected equipment is based on a review of the electrical or elementary wiring diagrams. To assure that all cables that could affect the operation of the safe shutdown equipment are identified, investigate the power, control, instrumentation, interlock, and equipment status indication cables related to the equipment. Consider reviewing additional schematic diagrams to identify additional cables for interlocked circuits that also need to be considered for their impact on the ability of the equipment to operate as required in support of post-fire safe shutdown. As an option, consider applying the screening criteria from Section 3.5 as a part of this section. For an example of this see Section 3.3.1.4.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	All cables including those from interlocks, instruments, and power supplies that could potentially adversely impact the desired operation of a SSE are listed. This includes cables external to the component control circuit, if any cable fault could adversely impact the required state of the component, unless the cable(s) are included with another SSE. Primary scheme cables for each SSE are listed and any reasons to exclude that cable is documented. The required drawings to perform and verify the cable selection and circuit analysis include the P&ID showing the component, the schematic, and others as required.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.5, 6.1.12

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.3.1.2 [Cables Affecting Multiple Components]	In cases where the failure (including spurious actuations) of a single cable could impact more than one piece of safe shutdown equipment, include the cable with each piece of safe shutdown equipment.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	All cables including those from interlocks, instruments, and power supplies that could potentially adversely impact the desired operation of a SSE are listed. Circuit analysis is done on a component level; where a cable may affect several SSEs, these cables are assigned to those SSE's circuit analysis.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.5

NEI 00-01 Ref	NEI 00-01 Guidance
3.3.1.3 [Isolation Devices]	Electrical devices such as relays, switches and signal resistor units are considered to be acceptable isolation devices. In the case of instrument loops, review the isolation capabilities of the devices in the loop to determine that an acceptable isolation device has been installed at each point where the loop must be isolated so that a fault would not impact the performance of the safe shutdown instrument function.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	Circuit isolation devices credits coordinated fusing, normally open operator controlled contacts, and other isolation devices as noted in PDMS, to determine if cables are not required, and will not impact the SSE and prevent its safe shutdown function.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.5, 6.1.6

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.1.4 [Identify "Not Required" Cables]	Screen out cables for circuits that do not impact the safe shutdown function of a component (i.e., annunciator circuits, space heater circuits and computer input circuits) unless some reliance on these circuits is necessary. However, they must be isolated from the component's control scheme in such a way that a cable fault would not impact the performance of the circuit.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Cables that are listed on scheme drawings are screened out as not required if they will not affect the safe shutdown function of the SSE. These cables are typically for motor space heater, testing, annunciator, or computer inputs.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.6

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.1.5 [Identification of Power Supplies]	For each circuit requiring power to perform its safe shutdown function, identify the cable supplying power to each safe shutdown and/or required interlock component. Initially, identify only the power cables from the immediate upstream power source for these interlocked circuits and components (i.e., the closest power supply, load center or motor control center). Review further the electrical distribution system to capture the remaining equipment from the electrical power distribution system necessary to support delivery of power from either the offsite power source or the emergency diesel generators (i.e., onsite power source) to the safe shutdown equipment. Add this equipment to the safe shutdown equipment list. Evaluate the power cables for this additional equipment for associated circuits concerns.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns with intent	Power supply cable selection shall typically end at the closest electrical isolation device for the component identified in the SSEL. For instance, power supply cables to a motor control center (MCC) will not be listed for a motor operated valve; only the power supply cable from the MCC to the valve will be listed. The MCC would be identified as a safe shutdown component in the SSEL and a separate circuit analysis is performed for the MCC. The circuit analysis for MCC or switchgear (SWGR) shall include the following as appropriate: Feed power cable Feed circuit breaker control circuit 125 VDC control power Spurious actuation of the undervoltage coils Non-safe shutdown load power cables Since the control power cables are listed against the SWGR (when appropriate), and the SWGR availability is linked to the individual component's availability in the safe shutdown fault trees, control power cables are not included with the circuits selected for each individual load powered by that SWGR. This included the circuit analysis performed for individual breakers as well.

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

Comments

Breaker coordination assures that the protective device nearest the fault operates prior to operation of upstream devices. On SWGR and/or load centers where breaker coordination relies on relays, coordination may fail if control power or breaker control cables are lost; therefore, load power cables are assigned to SWGR as required so the analyst may verify that breaker control is not lost, by ensuring breaker control cables are not impacted and that control power is available to trip the breaker, thus ensuring proper coordination. This review may take place in the fire area compliance document or may be documented in circuit selection/analysis by revising circuit analysis to add cables to SSE as required.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.5.3, 7.1

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.1.6 [ESFAS Initiation]	The automatic initiation logics for the credited post-fire safe shutdown systems are not required to support safe shutdown. Each system can be controlled manually by operator actuation in the main control room or emergency control station. If operator actions outside the main control room are necessary, those actions must conform to the regulatory requirements on manual actions. However, if not protected from the effects of fire, the fire-induced failure of automatic initiation logic circuits must not adversely affect any post-fire safe shutdown system function.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Instruments which do not provide a credited control function, but whose spurious operation could adversely affect safe shutdown are considered to be required safe shutdown components. Examples include instrumentation involved in the initiation of the ESAS automatic control logics. The population of cables that are involved with the automatic initiation logics are identified in the safe shutdown analysis and the instrumentation is depicted on the fault trees. Any manual action to recover components due to an actuation signal is evaluated for feasibility.

Reference Document

CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, ALL
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, 6.1.7
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, 6.1.5.2

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.3.1.7 [Circuit Coordination]	Cabling for the electrical distribution system is a concern for those breakers that feed associated circuits and are not fully coordinated with upstream breakers. With respect to electrical distribution cabling, two types of cable associations exist. For safe shutdown considerations, the direct power feed to a primary safe shutdown component is associated with the primary component. For example, the power feed to a pump is necessary to support the pump. Similarly, the power feed from the load center to an MCC supports the MCC. However, for cases where sufficient branch-circuit coordination is not provided, the same cables discussed above would also support the power supply. For example, the power feed to the pump discussed above would support the bus from which it is fed because, for the case of a common power source analysis, the concern is the loss of the upstream power source and not the connected load. Similarly, the cable feeding the MCC from the load center would also be necessary to support the load center.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	Breaker coordination is ensured by reviewing the time current curves from the plant's coordination study to ensure coordination. Coordination assures that the protective device nearest the fault operates prior to operation of upstream devices. The means of assuring circuit protection and coordination is provided in a series of calculations. These calculations demonstrate that the Class 1E and non-Class 1E power supplies credited for safe shutdown compliance do have adequate coordination. To ensure that the existing satisfactory circuit coordination is not compromised by future design changes, all modifications are reviewed in to ensure coordination is not compromised.

Comments

Molded case breakers less than 600V do not require a separate power source to ensure protective features remain available. Breakers for 480V load centers and medium voltage switchgear (4,160V & 6,900V) require DC control power for the protective relaying necessary to assure coordination. This control power is a required input in the fault sub-trees associated with the availability of the aforementioned distribution equipment. The non-safe shutdown loads energized from switchgear that rely on DC control power for relay and metering circuits are deemed required circuits (see comments for alignment statement NEI 00-01 Section 3.3.1.5.).

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 7.1

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.2 Associated Circuit Cables	Appendix R, Section III.G.2, requires that separation features be provided for equipment and cables, including associated non-safety circuits that could prevent operation or cause mal-operation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve hot shutdown. The three types of associated circuits were identified in Reference 6.1.5 and further clarified in a NRC memorandum dated March 22, 1982 from R. Mattson to D. Eisenhut, Reference 6.1.6. They are as follows: Spurious actuations Common power source Common enclosure.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 7.0

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.3.2 [A] Associated Circuit Cables – Cables Whose Failure May Cause Spurious Actuations	Safe shutdown system spurious actuation concerns can result from fire damage to a cable whose failure could cause the spurious actuation/mal-operation of equipment whose operation could affect safe shutdown. These cables are identified in Section 3.3.3 together with the remaining safe shutdown cables required to support control and operation of the equipment.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, 7.0

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.2 [B] Associated Circuit Cables – Common Power Source Cables	The concern for the common power source associated circuits is the loss of a safe shutdown power source due to inadequate breaker/fuse coordination. In the case of a fire-induced cable failure on a non-safe shutdown load circuit supplied from the safe shutdown power source, a lack of coordination between the upstream supply breaker/fuse feeding the safe shutdown power source and the load breaker/fuse supplying the non-safe shutdown faulted circuit can result in loss of the safe shutdown bus. This would result in the loss of power to the safe shutdown equipment supplied from that power source preventing the safe shutdown equipment from performing its required safe shutdown function. Identify these cables together with the remaining safe shutdown cables required to support control and operation of the equipment. Refer to Section 3.5.2.4 for an acceptable methodology for analyzing the impact of these cables on post-fire safe shutdown.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Breaker coordination is ensured by reviewing the time current curves from the plant's coordination study to ensure coordination. Coordination assures that the protective device nearest the fault operates prior to operation of upstream devices. The means of assuring circuit protection and coordination is provided in a series of calculations. These calculations demonstrate that the Class 1E and non-Class 1E power supplies credited for safe shutdown compliance do have adequate coordination.

Comments

Molded case breakers less than 600V do not require a separate power source to ensure protective features remain available. Breakers for 480V load centers and medium voltage switchgear (4,160V & 6,900V) require DC control power for the protective relaying necessary to assure coordination. This control power is a required input in the fault sub-trees associated with the availability of the aforementioned distribution equipment. The non-safe shutdown loads energized from switchgear that rely on DC control power for relay and metering circuits are deemed required circuits (see comments for alignment statement NEI 00-01 section 3.3.1.5.).

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 7.1

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.2 [C] Associated Circuit Cables – Common Enclosure Cables	The concern with common enclosure associated circuits is fire damage to a cable whose failure could propagate to other safe shutdown cables in the same enclosure either because the circuit is not properly protected by an isolation device (breaker/fuse) such that a fire-induced fault could result in ignition along its length, or by the fire propagating along the cable and into an adjacent fire area. This fire spread to an adjacent fire area could impact safe shutdown equipment in that fire area, thereby resulting in a condition that exceeds the criteria and assumptions of this methodology (i.e., multiple fires). Refer to Section 3.5.2.5 for an acceptable methodology for analyzing the impact of these cables on post-fire safe shutdown.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	The electrical circuit design for ANO provides proper circuit protection in the form of circuit breakers, fuses and other devices that are designed to isolate cable faults before the cable ignition temperature is reached. Adequate electrical circuit protection and cable sizing were included as part of the original plant electrical design and are maintained as part of the design change process. Fire rated barrier and penetration seal designs used at ANO preclude the propagation of fire from one fire area to the next to alleviate fire propagation concerns.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Sections 7.0 & 8.0

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.3 Methodology for Cable Selection and Location	Refer to Figure 3-4 for a flowchart illustrating the various steps involved in selecting the cables necessary for performing a post-fire safe shutdown analysis. Use the following methodology to define the cables required for safe shutdown including cables that may cause associated circuits concerns for a post-fire safe shutdown analysis (refer to hard copy of NEI 00-01 for Figure 3-4).
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.0

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.3.1 Identify Circuits Required for the Operation of the Safe Shutdown Equipment	For each piece of safe shutdown equipment defined in section 3.2, review the appropriate electrical diagrams including the following documentation to identify the circuits (power, control, instrumentation) required for operation or whose failure may impact the operation of each piece of equipment: Single-line electrical diagrams Elementary wiring diagrams Electrical connection diagrams Instrument loop diagrams For electrical power distribution equipment such as power supplies, identify any circuits whose failure may cause a coordination concern for the bus under evaluation. If power is required for the equipment, include the closest upstream power distribution source on the safe shutdown equipment list. Through the iterative process described in Figures 3-2 and 3-3, include the additional upstream power sources up to either the offsite or the emergency power source.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns with intent	All cables, including those from interlocks, instruments, and power supplies, that could adversely impact the desired operation of a SSE are listed as safe shutdown cables in PDMS. This includes cables external to the component control circuit, if any cable fault could adversely impact the required state of the component, unless the cable(s) are included with another SSE. Cables in the primary scheme determined to be not required were also listed as a safe shutdown cable in PDMS, but flagged as "Not required" with an appropriate explanatory cable analysis. The required drawings to perform and verify the cable selection and circuit analysis are listed in PDMS for each safe shutdown equipment identity. This typically includes the P&ID showing the component, the schematic, and single-lines as required. In some special cases, circuit analysis was completed based on components being skid mounted.

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

SSE which have support systems that are not modeled/credited in the analysis do not have cables identified (i.e., instrument air not credited and loss of air position was not the same as loss of power, power supplied was not diesel backed and it was determined not to credit non-diesel backed power supplies in order to minimize component selection). These components are assumed to fail in every fire area. These components will always require an operator action to perform their credited safe shutdown function and are termed "Always Fail." This ensures that the required manual action is captured, since it will require the analyst to take action to recover the affected flow path. The AF comp-type designation is used when the plant current configuration cannot be credited without an operator action.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.5, 6.1.12
PDMS, Plant Data Management System

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.3.3.2 Identify Interlocked Circuits and Cables Whose Spurious Operation or Mal-operation Could Affect Shutdown	In reviewing each control circuit, investigate interlocks that may lead to additional circuit schemes, cables and equipment. Assign to the equipment any cables for interlocked circuits that can affect the equipment. While investigating the interlocked circuits, additional equipment or power sources may be discovered. Include these interlocked equipment or power sources in the safe shutdown equipment list (refer to Figure 3-3) if they can impact the operation of the equipment under consideration.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	See alignment basis for previous NEI 00-01 section 3.3.3.1. Circuit analysis includes any interlock generated from schemes separate from the primary component.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 7.0
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.5, 6.1.12

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.3.3.3 Assign Cables to the Safe Shutdown Equipment	Given the criteria/assumptions defined in Section 3.3.1, identify the cables required to operate or that may result in mal-operation of each piece of safe shutdown equipment. Tabulate the list of cables potentially affecting each piece of equipment in a relational database including the respective drawing numbers, their revision and any interlocks that are investigated to determine their impact on the operation of the equipment. In certain cases, the same cable may support multiple pieces of equipment. Relate the cables to each piece of equipment, but not necessarily to each supporting secondary component. If adequate coordination does not exist for a particular circuit, relate the power cable to the power source. This will ensure that the power source is identified as affected equipment in the fire areas where the cable may be damaged.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	All cables that support or could adversely affect the ability to achieve and maintain post-fire safe shutdown have been identified using the methodology defined within CALC-85-E-0087-24. The cables and safe shutdown components with which they are associated have been entered into the PDMS.

Reference Document

CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 7
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 2

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5 Circuit Analysis and Evaluation	This section on circuit analysis provides information on the potential impact of fire on circuits used to monitor, control and power safe shutdown equipment. Applying the circuit analysis criteria will lead to an understanding of how fire damage to the cables may affect the ability to achieve and maintain post-fire safe shutdown in a particular fire area. This section should be used in conjunction with Section 3.4, to evaluate the potential fire-induced impacts that require mitigation. Appendix R, Section III.G.2, identifies the fire-induced circuit failure types that are to be evaluated for impact from exposure fires on safe shutdown equipment. Section III.G.2 of Appendix R requires consideration of hot shorts, shorts-to-ground and open circuits.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.2

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5.1 Criteria / Assumptions	Apply the following criteria/assumptions when performing fire-induced circuit failure evaluations.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.0

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.5.1.1 [Circuit Failure Types and Impact]	Consider the following circuit failure types on each conductor of each unprotected safe shutdown cable to determine the potential impact of a fire on the safe shutdown equipment associated with that conductor. A hot short may result from a fire-induced insulation breakdown between conductors of the same cable, a different cable or from some other external source resulting in a compatible but undesired impressed voltage or signal on a specific conductor. A hot short may cause a spurious operation of safe shutdown equipment. An open circuit may result from a fire-induced break in a conductor resulting in the loss of circuit continuity. An open circuit may prevent the ability to control or power the affected equipment. An open circuit may also result in a change of state for normally energized equipment. (e.g. [for BWRs] loss of power to the Main Steam Isolation Valve (MSIV) solenoid valves due to an open circuit will result in the closure of the MSIVs). Note that RIS 2004-03 indicates that open circuits, as an initial mode of cable failures, are considered to be of very low likelihood. The risk-informed inspection process will focus on failures with relatively high probabilities. A short-to-ground may result from a fire-induced breakdown of a cable insulation system, resulting in the potential on the conductor being applied to ground potential. A short-to-ground may have all of the same effects as an open circuit and, in addition, a short-to-ground may also cause an impact to the control circuit or power train of which it is a part. Consider the three types of circuit failures identified above to occur individually on each conductor of each safe shutdown cable on the required safe shutdown path in the fire area.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	The Safe Shutdown circuit analysis considers cable faults as follows: • All AC grounded circuits must consider any and all shorts, hot shorts, shorts- to-ground, and open circuits. • All DC grounded and ungrounded circuits must consider any and all shorts, hot shorts, shorts-to-ground, and open circuits.[1] • All ungrounded circuits (both AC and DC) will be analyzed as if the circuit is grounded. This process accounts for the possibility of the circuit experiencing a ground fault as result of the fire. [1] • Three phase AC hot short in the proper sequence to cause spurious operation is not considered credible except for high-low pressure interface components.

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

- For ungrounded DC circuits, two hot shorts of the proper polarity (without grounding) causing spurious operation is not considered credible except for high-low pressure interface components.[2]
- Only manual initiation of main systems will be credited for this analysis. Automatic operation of specific components within main systems is credited where appropriate (such as minimum flow valves). In general, automatic main system initiation (i.e., Engineered Safeguards initiation signals) will not be credited in this analysis unless the initiation signals are shown to be free of fire damage. However, fire induced automatic initiation signals must be evaluated for the possibility of spurious component operation and their subsequent adverse impact on safe shutdown.
- The required cable selection for spurious operation components shall identify the minimum population of cables that could cause the component to spuriously operate. This criterion conservatively assumes other cables of the appropriate polarity and potential are routed in the same raceway with the selected cable(s).
- For multiple conductor cables, all potential fault consequences due to any combination of hot shorts (inter or intra), shorts-to-ground, or open circuits should be considered.
- The effect of a cable fault is only seen in fire areas where the cable is routed and recovery of the component, if required, is justified on a fire area basis.

[1] These criteria provide the baseline requirements and the appropriate methodology to treat DC circuits as an equivalent AC circuit containing a bonded (grounded) neutral. This approach simplifies DC circuit analysis where only one fault or hot short is necessary to result in either functional failure or spurious actuation. An assumption of a grounded system also envelopes the condition where a separate cable fails due to fire induced damage, and creates half of the path necessary for a complete circuit should a single conductor of the subject cable fail.

[2] This criterion is included to prevent elimination of spurious actuation of DC motor operated valves (MOVs) in high-low pressure applications due to the proper polarity hot short requirement. In pressure interface applications that are not high-low, spurious actuation of DC MOVs due to hot short in the power cables to the motor are excluded as non-credible. Spurious actuation of a DC MOV can only occur due to an intercable proper polarity short of both the armature and the field windings exclusive of other failures that would disable the power circuit. This is similar to a proper rotation 3-phase hot short in AC MOVs, but with the added complexity of a fourth proper polarity hot short.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.2

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5.1.2 [Circuit Contacts and Operational Modes]	Assume that circuit contacts are positioned (i.e., open or closed) consistent with the normal mode/position of the safe shutdown equipment as shown on the schematic drawings. The analyst must consider the position of the safe shutdown equipment for each specific shutdown scenario when determining the impact that fire damage to a particular circuit may have on the operation of the safe shutdown equipment.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	All circuits contacts are assumed to be normal position, handswitches either in auto, maintain open, maintain closed or other position as determined from documents. Spurious signal from relay and instrument contacts are modeled while selecting cables from interlocks. Relay and instrument contacts are assumed to go to a position that could provide permissive signal or actuate, if monitored parameter or interlocked device changes at a point during shutdown (i.e., temperature switch starts fan, level/pressure switch changes suction source, breaker contact closes to align another breaker), it is assumed to be in the worst position for cable fault and required shutdown position.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.3.7, 6.1.5.1, 6.1.6, 6.1.9

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5.1.3 [Duration of Circuit Failures]	Assume that circuit failure types resulting in spurious operations exist until action has been taken to isolate the given circuit from the fire area, or other actions have been taken to negate the effects of circuit failure that is causing the spurious actuation. The fire is not assumed to eventually clear the circuit fault. Note that RIS 2004-03 indicates that fire-induced hot shorts typically self-mitigate after a limited period of time.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	As shown in fire area compliance calculation and manual action feasibility, circuit failure is either mitigated by operator action in control room or by manual actions. No credit is taken for fault clearing on a component and then being operable. Credit is only taken for reactor trip occurring should a fault occur on a Reactor Protective System (RPS) cable.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, All
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, All
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.2

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.5.1.4 [Cable Failure Configurations]	When both trains are in the same fire area outside of primary containment, all cables that do not meet the separation requirements of Section III.G.2 are assumed to fail in their worst case configuration.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	All equipment and cables are assumed to be damaged in a fire area. Credit is taken for Appendix R, III.G.2, compliance and applicable exemptions in those fire areas outside of primary containment.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 3.1, 5.0

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5.1.5 [A, Circuit Failure Risk Assessment Guidance]	The following guidance provides the NRC inspection focus from Bin 1 of RIS 2004-03 in order to identify any potential combinations of spurious operations with higher risk significance. Bin 1 failures should also be the focus of the analysis; however, NRC has indicated that other types of failures required by the regulations for analysis should not be disregarded even if in Bin 2 or 3. If Bin 1 changes in subsequent revisions of RIS 2004-03, the guidelines in the revised RIS should be followed.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Intra- or inter-cable hot shorts were identified to assist in utilizing information in RIS 2004-03 in a risk-based evaluation on a fire area basis of spurious actuations and to aid in the transition to a risk-informed, performance-based fire protection licensing basis as outlined in NFPA 805. No cable interactions identified in RIS 2004-03 are used to exclude analyzed cable faults.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.8

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.5.1.5 [B, Cable Failure Modes]	For multiconductor cables testing has demonstrated that conductor-to-conductor shorting within the same cable is the most common mode of failure. This is often referred to as "intra-cable shorting." It is reasonable to assume that given damage, more than one conductor-to-conductor short will occur in a given cable. A second primary mode of cable failure is conductor-to-conductor shorting between separate cables, commonly referred to as "inter-cable shorting." Inter-cable shorting is less likely than intra-cable shorting. Consistent with the current knowledge of fire-induced cable failures, the following configurations should be considered: A. For any individual multi-conductor cable (thermoset or thermoplastic), any and all potential spurious actuations that may result from intra-cable shorting, including any possible combination of conductors within the cable, may be postulated to occur concurrently regardless of number. However, as a practical matter, the number of combinations of potential hot shorts increases rapidly with the number of conductors within a given cable. For example, a multi-conductor cable with three conductors (3C) has 3 possible combinations of two (including desired combinations), while a five conductor cable (5C) has 10 possible combinations of two (including desired combinations), and a seven conductor cable (7C) has 21 possible combinations of two (including desired combinations). To facilitate an inspection that considers most of the risk presented by postulated hot shorts within a multi-conductor cable, inspectors should consider only a few (three or four) of the most critical postulated combinations. B. For any thermoplastic cable, any and all potential spurious actuations that may result from intra-cable and inter-cable shorting with other thermoplastic cables, including any possible combination of conductors within or between the cables, may be postulated to occur concurrently regardless of number (the consideration of thermoset cable inter-cable shorts is deferred pending additional research). C. For cases involving the potential damage of more than one multi-conductor cable, a maximum of two cables should be assumed to be damaged concurrently. The spurious actuations should be evaluated as previously described. The consideration of more than two cables being damaged (and subsequent spurious actuations) is deferred pending additional research. D. For cases involving direct current (DC) circuits, the potential spurious operation due to failures of the associated control cables (even if the spurious operation requires two concurrent hot shorts of the proper polarity, e.g., plus-to-plus and minus-to-minus) should be considered when the required source and target conductors are each located within the same multi-conductor cable.

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

E. Instrumentation Circuits. Required instrumentation circuits are beyond the scope of this associated circuit approach and must meet the same requirements as required power and control circuits. There is one case where an instrument circuit could potentially be considered an associated circuit. If fire-induced damage of an instrument circuit could prevent operation (e.g., lockout permissive signal) or cause mal-operation (e.g., unwanted start/stop/reposition signal) of systems necessary to achieve and maintain hot shutdown, then the instrument circuit may be considered an associated circuit and handled accordingly.

Applicability	**Comments**
Applicable	RIS 2004-03, Revision 1 wording:

Consistent with the current knowledge of fire-induced cable failures, the following configurations will be considered for power, control, and instrumentation circuits whose fire-induced failure could prevent operation of safe-shutdown equipment or through mal-operation cause a flow diversion, loss of coolant, or other scenarios that could significantly impact the ability to achieve and maintain hot shutdown:

A. For any individual multi-conductor cable (thermoset or thermoplastic), failure that may result from intra-cable shorting, of any possible combination of conductors within the cable may be postulated to occur concurrently regardless of number. For cases involving the potential damage of more than one multi-conductor cable, assume a maximum of two cables to be damaged. Inspectors should consider only a few (three or four) of the postulated combinations whose failure is likely to significantly impact the ability to achieve and maintain hot shutdown.

B. For any two thermoplastic cables, failures of any combination of conductors that may result from inter-cable shorting (i.e., between two cables) may be postulated to occur concurrently. Inspectors should consider only a few (three or four) of the postulated combinations whose failure is likely to significantly impact the ability to achieve and maintain hot shutdown.

C. For cases involving direct current (DC) control circuits, consider the potential spurious operation due to failures of the control cables (even if the spurious operation requires two concurrent hot shorts of the proper polarity, e.g., plus-to-plus and minus-to-minus). Consider potential spurious actuations when the source and target conductors are each located in the same multi-conductor cable.

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

D. The DHR system isolation valves at high-pressure/low-pressure interfaces may be subject to three-phase, proper-polarity hot short cable failures. Although this failure is unlikely, it could cause the opening of these valves which would pressurize the low-pressure portion of the DHR system piping outside of containment with the reactor coolant at or near normal reactor operating pressure. These three-phase power cables (either thermoset or thermoplastic jacketed) will be inspected to ensure that they are not subject to three-phase hot shorts that could cause the DHR valves to spuriously open.

Alignment Statement	**Alignment Basis**
Aligns	The majority of cable at ANO are thermoset. No additional evaluation of cable failure modes was considered in circuitry analysis other than whether spurious actuation was caused by inter- or intra-cable hot short.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, ALL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.5.2 Types of Circuit Failures	Appendix R requires that nuclear power plants must be designed to prevent exposure fires from defeating the ability to achieve and maintain post-fire safe shutdown. Fire damage to circuits that provide control and power to equipment on the required safe shutdown path and any other equipment whose spurious operation/mal-operation could affect shutdown in each fire area must be evaluated for the effects of a fire in that fire area. Only one fire at a time is assumed to occur. The extent of fire damage is assumed to be limited by the boundaries of the fire area. Given this set of conditions, it must be assured that one redundant train of equipment capable of achieving hot shutdown is free of fire damage for fires in every plant location. To provide this assurance, Appendix R requires that equipment and circuits required for safe shutdown be free of fire damage and that these circuits be designed for the fire-induced effects of a hot short, short-to-ground, and open circuit. With respect to the electrical distribution system, the issue of breaker coordination must also be addressed. This section will discuss specific examples of each of the following types of circuit failures: Open circuit Short-to-ground Hot short.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, ALL

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5.2.1 Circuit Failures Due to an Open Circuit	This section provides guidance for addressing the effects of an open circuit for safe shutdown equipment. An open circuit is a fire-induced break in a conductor resulting in the loss of circuit continuity. An open circuit will typically prevent the ability to control or power the affected equipment. An open circuit can also result in a change of state for normally energized equipment. For example, a loss of power to the MSIV solenoid valves [for BWRs] due to an open circuit will result in the closure of the MSIV. NOTE: The EPRI circuit failure testing indicated that open circuits are not likely to be the initial fire-induced circuit failure mode. Consideration of this may be helpful within the safe shutdown analysis. Consider the following consequences in the safe shutdown circuit analysis when determining the effects of open circuits: • Loss of electrical continuity may occur within a conductor resulting in de-energizing the circuit and causing a loss of power to, or control of, the required safe shutdown equipment. • In selected cases, a loss of electrical continuity may result in loss of power to an interlocked relay or other device. This loss of power may change the state of the equipment. Evaluate this to determine if equipment fails safe. • Open circuit on a high voltage (e.g., 4.16 kV) ammeter current transformer (CT) circuit may result in secondary damage. • Figure 3.5.2-1 shows an open circuit on a grounded control circuit (refer to hard copy of NEI 00-01 for Figure 3.5.2-1). • Open circuit No. 1: An open circuit at location No. 1 will prevent operation of the subject equipment. • Open circuit No. 2: An open circuit at location No. 2 will prevent opening/starting of the subject equipment, but will not impact the ability to close/stop the equipment.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	All grounded and ungrounded circuits consider open circuits as a fire induced failure mechanism.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.2.1, 4.2.2, 4.2.3, 4.2.8
CALC-ANOC-FP-09-00014, Current Transformer (CT) Open Circuit Concerns, Rev. 0, 8/3/2009, All

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5.2.2 Circuit Failures Due to Short-to-Ground [A, General]	This section provides guidance for addressing the effects of a short-to-ground on circuits for safe shutdown equipment. A short-to-ground is a fire-induced a breakdown of a cable insulation system resulting in the potential on the conductor being applied to ground potential. A short-to-ground can cause a loss of power to or control of required safe shutdown equipment. In addition, a short-to-ground may affect other equipment in the electrical power distribution system in the cases where proper coordination does not exist. Consider the following consequences in the post-fire safe shutdown analysis when determining the effects of circuit failures related to shorts-to-ground: • A short to ground in a power or a control circuit may result in tripping one or more isolation devices (i.e. breaker/fuse) and causing a loss of power to or control of required safe shutdown equipment. • In the case of certain energized equipment such as HVAC dampers, a loss of control power may result in loss of power to an interlocked relay or other device that may cause one or more spurious operations.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	All grounded and ungrounded circuits consider any and all shorts to ground.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.2.1, 4.2.2, and 4.2.8

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.5.2.2 Circuit Failures Due to Short-to-Ground [B, Grounded Circuits]	Short-to-Ground on Grounded Circuits. Typically, in the case of a grounded a circuit, a short-to-ground on any part of the circuit would present a concern for tripping the circuit isolation device thereby causing a loss of control power. Figure 3.5.2-2 illustrates how a short-to-ground fault may impact a grounded circuit (refer to hard copy of NEI 00-01, Revision 1 for Figure 3.5.2-2). Short-to-ground No. 1: A short-to-ground at location No. 1 will result in the control power fuse blowing and a loss of power to the control circuit. This will result an inability to operate the equipment using the control switch. Depending on the coordination characteristics between the protective device on this circuit and upstream circuits, the power supply to other circuits could be affected. Short-to-ground No. 2: A short-to-ground at location No. 2 will have no effect on the circuit until the close/stop control switch is closed. Should this occur, the effect would be identical to that for the short-to-ground at location No. 1 described above. Should the open/start control switch be closed prior to closing the close/stop control switch, the equipment will still be able to be opened/started.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	All grounded circuits consider any and all shorts to ground.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Sections 4.2.1, 4.2.2, and 4.2.8

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5.2.2 Circuit Failures Due to a Short-to-Ground [C, Ungrounded Circuits]	Short-to-Ground on Ungrounded Circuits In the case of an ungrounded circuit, postulating only a single short-to-ground on any part of the circuit may not result in tripping the circuit isolation device. Another short-to-ground on the circuit or another circuit from the same source would need to exist to cause a loss of control power to the circuit. Figure 3.5.2-3 illustrates how a short to ground fault may impact an ungrounded circuit (refer to hard copy of NEI 00-01, Revision 1 for Figure 3.5.2-3). Short-to-ground No. 1: A short-to-ground at location No. 1 will result in the control power fuse blowing and a loss of power to the control circuit if short-to-ground No. 3 also exists either within the same circuit or on any other circuit fed from the same power source. This will result in an inability to operate the equipment using the control switch. Depending on the coordination characteristics between the protective device on this circuit and upstream circuits, the power supply to other circuits could be affected. Short-to-ground No. 2: A short-to-ground at location No. 2 will have no effect on the circuit until the close/stop control switch is closed. Should this occur, the effect would be identical to that for the short-to-ground at location No. 1 described above. Should the open/start control switch be closed prior to closing the close/stop control switch, the equipment will still be able to be opened/started.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	All DC ungrounded circuits consider any and all shorts to ground. All DC ungrounded circuits are analyzed as if the circuit is grounded. This process accounts for the possibility of the circuit experiencing a ground fault as result of the fire.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.2.3

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.5.2.3 Circuit Failures Due to a Hot Short [A, General]	This section provides guidance for analyzing the effects of a hot short on circuits for required safe shutdown equipment. A hot short is defined as a fire-induced insulation breakdown between conductors of the same cable, a different cable or some other external source resulting in an undesired impressed voltage on a specific conductor. The potential effect of the undesired impressed voltage would be to cause equipment to operate or fail to operate in an undesired manner. Consider the following specific circuit failures related to hot shorts as part of the post-fire safe shutdown analysis: A hot short between an energized conductor and a de-energized conductor within the same cable may cause a spurious actuation of equipment. The spuriously actuated device (e.g., relay) may be interlocked with another circuit that causes the spurious actuation of other equipment. This type of hot short is called a conductor-to-conductor hot short or an internal hot short. A hot short between any external energized source such as an energized conductor from another cable (thermoplastic cables only) and a de-energized conductor may also cause a spurious actuation of equipment. This is called a cable-to-cable hot short or an external hot short. Cable-to-cable hot shorts between thermoset cables are not postulated to occur pending additional research.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	All grounded circuits and ungrounded circuits consider any and all hot shorts. If the hot short results in a spurious actuation, the circuit failure is reviewed to determine if it is the result of an intra- or inter-cable hot short. A three phase AC hot short in the proper sequence to cause spurious operation is not considered credible except for high-low pressure interface components. For ungrounded DC circuits, two hot shorts of the proper polarity (without grounding) causing spurious operation is not considered credible except for high-low pressure interface components.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 4.2.1, 4.2.2, 4.2.3, 4.2.8, 6.1.8

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.5.2.3 Circuit Failures Due to a Hot Short [B, Grounded Circuits]	A Hot Short on Grounded Circuits. A short-to-ground is another failure mode for a grounded control circuit. A short-to-ground as described above would result in de-energizing the circuit. This would further reduce the likelihood for the circuit to change the state of the equipment either from a control switch or due to a hot short. Nevertheless, a hot short still needs to be considered. Figure 3.5.2-4 shows a typical grounded control circuit that might be used for a motor-operated valve. However, the protective devices and position indication lights that would normally be included in the control circuit for a motor-operated valve have been omitted, since these devices are not required to understand the concepts being explained in this section. In the discussion provided below, it is assumed that a single fire in a given fire area could cause any one of the hot shorts depicted. The following discussion describes how to address the impact of these individual cable faults on the operation of the equipment controlled by this circuit (refer to hard copy of NEI 00-01, Revision 1 for Figure 3.5.2-4). Hot short No. 1: A hot short at this location would energize the close relay and result in the undesired closure of a motor-operated valve. Hot short No. 2: A hot short at this location would energize the open relay and result in the undesired opening of a motor-operated valve.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	All grounded circuits consider any and all hot shorts.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Sections 4.2.1, 4.2.2, and 4.2.8

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2.4.2.2 Nuclear Safety Capability Circuit Analysis

NEI 00-01 Ref	NEI 00-01 Guidance
3.5.2.3 Circuit Failures Due to a Hot Short [C, Ungrounded Circuits]	A Hot Short on Ungrounded Circuits. In the case of an ungrounded circuit, a single hot short may be sufficient to cause a spurious operation. A single hot short can cause a spurious operation if the hot short comes from a circuit from the positive leg of the same ungrounded source as the affected circuit. In reviewing each of these cases, the common denominator is that in every case, the conductor in the circuit between the control switch and the start/stop coil must be involved. Figure 3.5.2-5 depicted below shows a typical ungrounded control circuit that might be used for a motor-operated valve. However, the protective devices and position indication lights that would normally be included in the control circuit for a motor-operated valve have been omitted, since these devices are not required to understand the concepts being explained in this section. In the discussion provided below, it is assumed that a single fire in a given fire area could cause any one of the hot shorts depicted. The discussion provided below describes how to address the impact of these cable faults on the operation of the equipment controlled by this circuit (refer to hard copy of NEI 00-01, Rev. 1 for Figure 3.5.2-5). Hot short No. 1: A hot short at this location from the same control power source would energize the close relay and result in the undesired closure of a motor operated valve. Hot short No. 2: A hot short at this location from the same control power source would energize the open relay and result in the undesired opening of a motor operated valve.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	All ungrounded circuits consider any and all hot shorts. All ungrounded circuits (both AC and DC) are analyzed as if the circuit is grounded. This process accounts for the possibility of the circuit experiencing a ground fault as result of the fire.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Sections 4.2.3 and 6.1.8

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.3 Nuclear Safety Equipment and Cable Location

Nuclear Safety Equipment and Cable Location. Physical location of equipment and cables shall be identified.

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.3.3.4 Identify Routing of Cables	Identify the routing for each cable including all raceway and cable endpoints. Typically, this information is obtained from joining the list of safe shutdown cables with an existing cable and raceway database.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	The Plant Data Management System (PDMS) relates safe shutdown cables to route points (i.e., conduit, junction boxes, tray, equipment). The route points are associated to a fire zone based on conduit and tray drawing. The fire zones are associated with a fire area. These relationships allow determination of cables and equipment impacted on a fire area basis.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 6.1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.3.10
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 2

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.3 Nuclear Safety Equipment and Cable Location

NEI 00-01 Ref	NEI 00-01 Guidance
3.3.3.5 Identify Location of Raceway and Cables by Fire Area	Identify the fire area location of each raceway and cable endpoint identified in the previous step and join this information with the cable routing data. In addition, identify the location of field-routed cable by fire area. This produces a database containing all of the cables requiring fire area analysis, their locations by fire area, and their raceway.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	The PDMS relates safe shutdown cables to route points (i.e., conduit, junction boxes, tray, equipment). The route points are associated to a fire zone based on conduit and tray drawing. The fire zones are associated with a fire area. These relationships allow determination of cables and equipment impacted on a fire area basis.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 6.1
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 4.3.10
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 2

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.3 Nuclear Safety Equipment and Cable Location

NEI 00-01 Ref	NEI 00-01 Guidance
3.5.2.4 Circuit Failures Due to Inadequate Circuit Coordination	The evaluation of associated circuits of a common power source consists of verifying proper coordination between the supply breaker/fuse and the load breakers/fuses for power sources that are required for safe shutdown. The concern is that, for fire damage to a single power cable, lack of coordination between the supply breaker/fuse and the load breakers/fuses can result in the loss of power to a safe shutdown power source that is required to provide power to safe shutdown equipment. For the example shown in Figure 3.5.2-6, the circuit powered from load breaker 4 supplies power to a non-safe shutdown pump. This circuit is damaged by fire in the same fire area as the circuit providing power to from the Train B bus to the Train B pump, which is redundant to the Train A pump. To assure safe shutdown for a fire in this fire area, the damage to the non-safe shutdown pump powered from load breaker 4 of the Train A bus cannot impact the availability of the Train A pump, which is redundant to the Train B pump. To assure that there is no impact to this Train A pump due to the associated circuits' common power source breaker coordination issue, load breaker 4 must be fully coordinated with the feeder breaker to the Train A bus (refer to hard copy of NEI 00-01, Revision 1 for Figure 3.5.2-6). A coordination study should demonstrate the coordination status for each required common power source. For coordination to exist, the time-current curves for the breakers, fuses and/or protective relaying must demonstrate that a fault on the load circuits is isolated before tripping the upstream breaker that supplies the bus. Furthermore, the available short circuit current on the load circuit must be considered to ensure that coordination is demonstrated at the maximum fault level. The methodology for identifying potential associated circuits of a common power source and evaluating circuit coordination cases of associated circuits on a single circuit fault basis is as follows: • Identify the power sources required to supply power to safe shutdown equipment. • For each power source, identify the breaker/fuse ratings, types, trip settings and coordination characteristics for the incoming source breaker supplying the bus and the breakers/fuses feeding the loads supplied by the bus. • For each power source, demonstrate proper circuit coordination using acceptable industry methods.

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2.4.2.3 Nuclear Safety Equipment and Cable Location

- For power sources not properly coordinated, tabulate by fire area the routing of cables whose breaker/fuse is not properly coordinated with the supply breaker/fuse. Evaluate the potential for disabling power to the bus in each of the fire areas in which the associated circuit cables of concern are routed and the power source is required for safe shutdown. Prepare a list of the following information for each fire area:
  - Cables of concern.
  - Affected common power source and its path.
  - Raceway in which the cable is enclosed.
  - Sequence of the raceway in the cable route.
  - Fire zone/area in which the raceway is located.
- For fire zones/areas in which the power source is disabled, the effects are mitigated by appropriate methods.
- Develop analyzed safe shutdown circuit dispositions for the associated circuit of concern cables routed in an area of the same path as required by the power source. Evaluate adequate separation based upon the criteria in Appendix R, NRC staff guidance, and plant licensing bases.

<u>**Applicability**</u>	<u>**Comments**</u>
Applicable	None
<u>**Alignment Statement**</u>	<u>**Alignment Basis**</u>
Aligns with intent	Breaker coordination assures that the protective device nearest the fault operates prior to operation of upstream devices. The means of assuring circuit protection and coordination is provided in a series of calculations. These calculations demonstrate that the Class 1E and non-Class 1E power supplies credited for safe shutdown compliance have adequate coordination. On switchgear and/or load centers where breaker coordination relies on relays, coordination may fail if control power or breaker control cables are lost; therefore, load power cables are assigned to switchgear as required so analyst may verify that breaker control is not lost by ensuring that the breaker control cables are not impacted and that control power is available to trip the breaker thus ensuring proper coordination. The review may take place in the fire area compliance document or may be documented in circuit selection/analysis by revising circuit analysis to add cable to SSE as required.

<u>**Reference Document**</u>

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 6.1.5.3, 7.1

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2.4.2.3 Nuclear Safety Equipment and Cable Location

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5.2.5 Circuit Failures Due to Common Enclosure Concerns	The common enclosure associated circuit concern deals with the possibility of causing secondary failures due to fire damage to a circuit either whose isolation device fails to isolate the cable fault or protect the faulted cable from reaching its ignition temperature, or the fire somehow propagates along the cable into adjoining fire areas. The electrical circuit design for most plants provides proper circuit protection in the form of circuit breakers, fuses and other devices that are designed to isolate cable faults before ignition temperature is reached. Adequate electrical circuit protection and cable sizing are included as part of the original plant electrical design maintained as part of the design change process. Proper protection can be verified by review of as-built drawings and change documentation. Review the fire rated barrier and penetration designs that preclude the propagation of fire from one fire area to the next to demonstrate that adequate measures are in place to alleviate fire propagation concerns.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	The electrical circuit design for ANO provides proper circuit protection in the form of circuit breakers, fuses and other devices that are designed to isolate cable faults before the cable ignition temperature is reached. Adequate electrical circuit protection and cable sizing were included as part of the original plant electrical design and are maintained as part of the design change process. Fire rated barrier and penetration seal designs used at ANO preclude the propagation of fire from one fire area to the next to alleviate fire propagation concerns.

Reference Document

CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, Section 7.1, 8.0

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

Fire Area Assessment.	An engineering analysis shall be performed in accordance with the requirements of Section 2.3 for each fire area to determine the effects of fire or fire suppression activities on the ability to achieve the nuclear safety performance criteria of Section 1.5 (see Chapter 4 for methods of achieving these performance criteria (performance-based or deterministic)).
NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4 Fire Area Assessment and Compliance Assessment	By determining the location of each component and cable by fire area and using the cable to equipment relationships described above, the affected safe shutdown equipment in each fire area can be determined. Using the list of affected equipment in each fire area, the impacts to safe shutdown systems, paths and functions can be determined. Based on an assessment of the number and types of these impacts, the required safe shutdown path for each fire area can be determined. The specific impacts to the selected safe shutdown path can be evaluated using the circuit analysis and evaluation criteria contained in Section 3.5 of this document. Having identified all impacts to the required safe shutdown path in a particular fire area, this section provides guidance on the techniques available for individually mitigating the effects of each of the potential impacts.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, ALL

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2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.1 Criteria / Assumptions	The following criteria and assumptions apply when performing fire area compliance assessment to mitigate the consequences of the circuit failures identified in the previous sections for the required safe shutdown path in each fire area.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 5.0

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.1.1 [Number of Postulated Fires]	Assume only one fire in any single fire area at a time.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	The fundamental basis for the analysis is that a single fire occurs in a single plant area at a time.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 3.1, 5.0 1)

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.1.2 [Damage to Unprotected Equipment and Cables]	Assume that the fire may affect all unprotected cables and equipment within the fire area. This assumes that neither the fire size nor the fire intensity is known. This is conservative and bounds the exposure fire that is required by the regulation.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	A basic assumption of the methodology is that there will be fire damage to equipment and cables located within a fire area. The size and intensity of the fire required causing this equipment damage is not determined. Rather, fire damage is assumed to occur regardless of the level of combustibles in the area, the ignition temperatures of any combustible materials, the lack of an ignition source, or the presence of automatic or manual fire suppression and detection capability.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 3.1, Attachment 8.1 through 8.38

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2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.1.3 [Assess Impacts to Required Components]	Address all cable and equipment impacts affecting the required safe shutdown path in the fire area. All potential impacts within the fire area must be addressed. The focus of this section is to determine and assess the potential impacts to the required safe shutdown path selected for achieving post-fire safe shutdown and to assure that the required safe shutdown path for a given fire area is properly protected.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	The ARC and the safe shutdown fault tree does not require that all affected components be addressed. Components are addressed until the fault tree shows a method to achieve and maintain safe shutdown (i.e., recovery of top gate COMPLIANCE).

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 3.1, Attachment 8.1 through 8.38

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.1.4 [Manual Actions]	Use manual actions where appropriate to achieve and maintain post-fire safe shutdown conditions in accordance with NRC requirements.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns with intent	The process defined in FAQ 07-0030 was used to determine recovery actions.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 6.2.3, Attachment 8.1 through 8.38
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, ALL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	NEI 00-01 Guidance
3.4.1.5 [Repairs]	Where appropriate to achieve and maintain cold shutdown within 72 hours, use repairs to equipment required in support of post fire shutdown.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	The 72 hour requirement from NEI 00-01 is only applicable to the 10 CFR 50 Appendix R licensing bases. NFPA 805 does not require a plant to transition to cold shutdown within 72 hours, but instead requires licensees to provide reasonable assurance to achieve and maintain the fuel in a safe and stable condition. For ANO-1, the required end state of “safe and stable” under NFPA 805 will be met when the plant is in a stable hot shutdown configuration.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 6.2.3, Attachment 8.1 through 8.39
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Section 3.3(3), 5.10, 6.2.10, 7.2.10

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2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	NEI 00-01 Guidance
3.4.1.6 [Assess Compliance with Deterministic Criteria]	Appendix R compliance requires that one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency with control station(s) is free of fire damage (III.G.1.a). When cables or equipment, including associated circuits, are within the same fire area outside primary containment and separation does not already exist, provide one of the following means of separation for the required safe shutdown path(s): • Separation of cables and equipment and associated non-safety circuits of redundant trains within the same fire area by a fire barrier having a 3-hour rating (III.G.2.a) • Separation of cables and equipment and associated non-safety circuits of redundant trains within the same fire area by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area (III.G.2.b). • Enclosure of cable and equipment and associated non-safety circuits of one redundant train within a fire area in a fire barrier having a one-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area (III.G.2.c). • For fire areas inside non-inerted containments, the following additional options are also available: • Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards (III.G.2.d); • Installation of fire detectors and an automatic fire suppression system in the fire area (III.G.2.e); or • Separation of cables and equipment and associated non-safety circuits of redundant trains by a noncombustible radiant energy shield (III.G.2.f). Use exemptions, deviations and licensing change processes to satisfy the requirements mentioned above and to demonstrate equivalency depending upon the plant's license requirements.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	The Appendix R criteria are used to determine compliance strategies on a fire area basis.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 4.2

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2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	NEI 00-01 Guidance
3.4.1.7 [Consider Additional Equipment]	Consider selecting other equipment that can perform the same safe shutdown function as the impacted equipment. In addressing this situation, each equipment impact, including spurious operations, is to be addressed in accordance with regulatory requirements and the NPP's current licensing basis.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	The fire area compliance methodology reviews availability of non-directly affected components to achieve and maintain safe shutdown. If addition equipment that may not be impacted in the fire area was identified, these components were added to SSEL, a circuit analysis completed and basic event included in the safe shutdown fault tree. This is part of the iterative process in performing a safe shutdown analysis.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Section 6.2.3, Figure 6.3

NEI 00-01 Ref	NEI 00-01 Guidance
3.4.1.8 [Consider Instrument Tubing Effects	Consider the effects of the fire on the density of the fluid in instrument tubing and any subsequent effects on instrument readings or signals associated with the protected safe shutdown path in evaluating post-fire safe shutdown capability. This can be done systematically or via procedures such as Emergency Operating Procedures.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	Mechanical components susceptible to fire damage (brazed or soldered instrument lines, instrument tubing for credited instruments, etc.) are identified and evaluated on a fire area basis.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.41
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, Section 5.3.2(l)

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.2 Methodology for Fire Area Assessment	Refer to Figure 3-5 for a flowchart illustrating the various steps involved in performing a fire area assessment. Use the following methodology to assess the impact to safe shutdown and demonstrate Appendix R compliance (refer to hard copy of NEI 00-01 for Figure 3-5).
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Specific guidance is in subsequent subsections.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, ALL

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.2.1 Identify the Affected Equipment by Fire Area	Identify the safe shutdown cables, equipment and systems located in each fire area that may be potentially damaged by the fire. Provide this information in a report format. The report may be sorted by fire area and by system in order to understand the impact to each safe shutdown path within each fire area (see Attachment 5 for an example of an Affected Equipment Report).
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	The ARC software relates the information in PDMS to the safe shutdown fault trees by basic events. Reports can be generated on a fire area basis that are sorted alpha-numerically. In addition, the user interface provided in ARC allows the user to assess the impact on safe shutdown fault tree.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, ALL
CALC-85-E-0086-18, Safe Shutdown Equipment List (SSEL) Methodology for ANO-1, Rev. 2, ALL
CALC-85-E-0087-24, Safe Shutdown Cable Analysis, Rev. 1, ALL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	NEI 00-01 Guidance
3.4.2.2 Determine the Shutdown Paths Least with the least number of Impacted By a Fire in Each Fire Area	Based on a review of the systems, equipment and cables within each fire area, determine which shutdown paths are either unaffected or least impacted by a postulated fire within the fire area. Typically, the safe shutdown path cables and equipment in the fire area would be selected as the required safe shutdown path. Consider the circuit failure criteria and the possible mitigating strategies, however, in selecting the required safe shutdown path in a particular fire area. Review support systems as a part of this assessment since their availability will be important to the ability to achieve and maintain safe shutdown. For example, impacts to the electric power distribution system for a particular safe shutdown path could present a major impediment to using a particular path for safe shutdown. By identifying this early in the assessment process, an unnecessary amount of time is not spent assessing impacts to the frontline systems that will require this power to support their operation. Based on an assessment as described above, designate the required safe shutdown path(s) for the fire area. Identify all equipment not in the safe shutdown path whose spurious operation or mal-operation could affect the shutdown function. Include these cables in the shutdown function list. For each of the safe shutdown cables (located in the fire area) that are part of the required safe shutdown path in the fire area, perform an evaluation to determine the impact of a fire-induced cable failure on the corresponding safe shutdown equipment and, ultimately, on the required safe shutdown path. When evaluating the safe shutdown mode for a particular piece of equipment, it is important to consider the equipment's position for the specific safe shutdown scenario for the full duration of the shutdown scenario. It is possible for a piece of equipment to be in two different states depending on the shutdown scenario or the stage of shutdown within a particular shutdown scenario. Document information related to the normal and shutdown positions of equipment on the safe shutdown equipment list.

Applicability	Comments
Applicable	None

Alignment Statement	Alignment Basis
Aligns	The ARC software relates the safe shutdown fault tree to the information in PDMS to visually present the direct fire losses as well as the interactions of cable/equipment associated with ESAS, power, cooling water and HVAC. This allows the analyst the ability to quickly ascertain what component/functions should be recovered for compliance.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, ALL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.2.3 Determine Safe Shutdown Equipment Impacts	Using the circuit analysis and evaluation criteria contained in Section 3.5 of this document, determine the equipment that can impact safe shutdown and that can potentially be impacted by a fire in the fire area, and what those possible impacts are.
Applicability	**Comments**
Applicable	None
Alignment Statement	**Alignment Basis**
Aligns	Compliance strategies are provided for interactions requiring recovery. These compliance strategies include Appendix R criteria as well as additional circuit analysis as necessary.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, ALL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.2.4 Develop a Compliance Strategy or Disposition to Mitigate the Effects Due to Fire Damage to Each Required Component or Cable	The available deterministic methods for mitigating the effects of circuit failures are summarized as follows (see Figure 1-2): - Provide a qualified 3-fire rated barrier. - Provide a 1-hour fire rated barrier with automatic suppression and detection. - Provide separation of 20 feet or greater with automatic suppression and detection and demonstrate that there are no intervening combustibles within the 20 foot separation distance. - Reroute or relocate the circuit/equipment, or perform other modifications to resolve vulnerability. - Provide a procedural action in accordance with regulatory requirements. - Perform a cold shutdown repair in accordance with regulatory requirements. - Identify other equipment not affected by the fire capable of performing the same safe shutdown function. - Develop exemptions, deviations, Generic Letter 86-10 evaluation or fire protection design change evaluations with a licensing change process. Additional options are available for non-inerted containments as described in 10 CFR 50 Appendix R, Section III.G.2.d, e and f.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	The ARC software relates safe shutdown fault tree to the information in PDMS to visually present the direct fire losses (equipment/cabling) as well as indirect losses due to interactions of ESAS, power, cooling water and HVAC. This allows the analyst the ability to quickly ascertain what component/functions should be recovered for compliance. Compliance strategies for the mitigation of fire induced failures are assigned to the losses as necessary to demonstrate the ability to achieve and maintain safe shutdown.

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

Variances from the Deterministic Requirements (VFDRs) are identified. Mitigating strategies to address the VFDRs in a performance-based Fire Risk Evaluation (FRE) will be developed and documented for transition to NFPA 805. The safe shutdown success paths were analyzed and potential impacts identified. These potential impacts were resolved by specifying one or more of the options listed above such that the least impacted safe shutdown success path could be identified.

Credit for existing features and exemptions is taken wherever possible and procedural (recovery) action specified as a last resort.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.1

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.4.2.5 Document the Compliance Strategy Or Disposition Determined to Mitigate the Effects Due to Fire Damage to Each Required Component or Cable	Assign compliance strategy statements or codes to components or cables to identify the justification or mitigating actions proposed for achieving safe shutdown. The justification should address the cumulative effect of the actions relied upon by the licensee to mitigate a fire in the area. Provide each piece of safe shutdown equipment, equipment not in the path whose spurious operation or mal-operation could affect safe shutdown, and/or cable for the required safe shutdown path with a specific compliance strategy or disposition. Refer to Attachment 6 for an example of a Fire Area Assessment Report documenting each cable disposition.

Applicability	**Comments**
Applicable	None

Alignment Statement	**Alignment Basis**
Aligns	The ARC software relates safe shutdown fault tree to the information in PDMS to visually present the direct fire losses (equipment/cabling) as well as indirect losses due to interactions of ESAS, power, cooling water, and HVAC. This allows the analyst the ability to quickly ascertain what component/functions should be recovered for compliance. Compliance strategies for the mitigation of fire-induced failures are assigned to the losses as necessary to demonstrate the ability to achieve and maintain safe shutdown.

Reference Document

CALC-85-E-0086-01, Unit 1 Safe Shutdown Capability Assessment, Rev. 7, ALL

B. NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment - Methodology Review

2.4.2.4 Fire Area Assessment

NEI 00-01 Ref	**NEI 00-01 Guidance**
3.5.1.5 [C, Likelihood of Undesired Consequences]	Determination of the potential consequence of the damaged associated circuits is based on the examination of specific NPP (P&IDs) and review of components that could prevent operation or cause mal-operation such as flow diversions, loss of coolant, or other scenarios that could significantly impair the NPP's ability to achieve and maintain hot shutdown. When considering the potential consequence of such failures, the [analyst] should also consider the time at which the prevented operation or mal-operation occurs. Failures that impede hot shutdown within the first hour of the fire tend to be most risk significant in a first-order evaluation. Consideration of cold-shutdown circuits is deferred pending additional research.
Applicability	**Comments**
Applicable	RIS 2004-03, Revision 1, wording: The potential consequences of the damaged circuits are determined by examining plant specific system documentation and by reviewing components that could fail to operate, prevent operation, or cause mal-operation, such as flow diversion, loss of coolant, or other scenarios that could significantly impair the NPP's ability to achieve and maintain hot shutdown. When considering the potential consequence of such failures, the inspector will also consider the time at which the prevented operation or mal-operation occurs. Failures that impede hot shutdown within the earliest stages of the fire are significant in a first-order evaluation.
Alignment Statement	**Alignment Basis**
Aligns	A multi-spurious operation expert panel was assembled to determine scenarios that could significantly impair the ability to achieve and maintain hot standby.

Reference Document

CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Section 5.9.1

C. NEI 04-02 Table B-3 – Fire Area Transition

Fire Area ID: A – East Decay Heat Removal Pump Room
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	**Description**
10-EE	East Decay Heat Removal Pump Room

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the Reactor Coolant System (RCS) using borated water from the Borated Water Storage Tank (BWST).	
2. Inventory Control	Letdown is isolated and the Reactor Coolant Pumps (RCPs) secured to maintain seal integrity. The primary makeup pump P-36A or P-36B is available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven Emergency Feedwater (EFW) pump P-7A and motor driven EFW pump P-7B are both available to feed either Steam Generator (SG)-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	Service Water (SW) pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B), and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from Safety Parameter Display System (SPDS) is available.	

Reference Document
CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.2
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 39

Fire Area ID:	A – East Decay Heat Removal Pump Room
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. This area is located at the lowest point in the auxiliary building and is separated from the only other fire area at this elevation by watertight doors and barriers. Discharge of suppression water to the adjacent area is not a concern due to these barriers. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-90-R-1014-52 "Penetration Seal Analysis for Penetration 0009-05-0017"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize it in a three (3) hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal between Fire Zones 4-EE and 10-EE is acceptable based upon availability of fire detection in Fire Zone 10-EE, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-ANO1-FP-09-00014 "Engineering Evaluation for Penetration Seals in Fire Area A"

Summary: Purpose: Evaluate and document the acceptability of ANO-1 penetration FB-10-02-0008 used in a 3-hour rated fire area boundary based on the penetration seal considered adequate for the hazards in the area.

Basis for Acceptability: The bases for the acceptability are the low fire durations, the smoke near side detection system (Fire Zone 10-EE) that alarms in the unit control room, and the response by the fire brigade (with the manual firefighting equipment in the area).

Fire Area ID:	A – East Decay Heat Removal Pump Room
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Engineering Evaluation ID: CALC-ANO1-FP-09-00016 "Engineering Evaluation for Penetration Seals in Fire Area C"

Summary: Purpose: The purpose of this evaluation is to document the acceptability of ANO-1 penetrations in Fire Area C used in 3-hour rated fire area boundaries.

The seals reviewed by this evaluation are:

From Fire Area C (20-Y) to A (10-EE)

FB-0049-01-0001
FB-0049-01-0004

Basis for Acceptability: The penetrations listed are considered adequate for the hazards in the respective area based on:

- Acceptable combustible loading
- Smoke detection systems in Fire Zones 10-EE and 20-Y
- Full depth silicone foam for FB-0049-01-0001 and FB-0049-01-0004
- Response by the fire brigade team with manual firefighting equipment in the areas without automatic suppression

Engineering Evaluation ID: CALC-ANOC-FP-07-00003 "Watertight Fire Doors Evaluation"

Summary: Purpose: Evaluate watertight doors used in 3-hour rated fire barriers.

Basis for Acceptability: The watertight doors (DR-5, DR-30, DR-33, and DR-455) installed at ANO in 3-hour rated fire barriers have been determined to be acceptable for use based on the hazards in the areas. Although these doors are not 3-hour rated fire doors, they will provide the protection needed in the areas they are used.

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
10-EE	East Decay Heat Removal Pump Room	No	Yes	No	No	No	No	No	Yes	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	A – East Decay Heat Removal Pump Room
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area A

Fire Area ID:	ADMIN – Administration Building
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	Description
ADMIN	Administration Building

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B), and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.3
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 38

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. The Administration Building is credited for alternate shutdown when the Technical Support Center is used to monitor shutdown in the event the Control Room is evacuated. Plant equipment in other areas is isolated from effect of fire in this fire area. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: ADMIN – Administration Building
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
ADMIN	Administration Building	Yes	Yes	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area ADMIN

Fire Area ID:	B-1@120-E, 125-E, 128-E, 149-E, and 79-U (North Auxiliary Building)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	Description
120-E	Boric Acid Addition Tank and Pump Room
125-E	Respirator Storage Room
128-E	Controlled Access
149-E	Upper North Electrical Penetration Room Hot Mechanic Shop Decon Room
79-U	Upper North Piping Penetration Room

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	RCS vent paths are secured. Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A and P-36B are available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B is aligned to feed SG-B.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 is aligned to the on-site Emergency Diesel Generator (EDG).	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pumps P-4A or P-4B (swing pump) aligned to SW Loop 1. Auxiliary Cooling Water (ACW) is isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Fire Area ID:	B-1@120-E, 125-E, 128-E, 149-E, and 79-U (North Auxiliary Building)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Reference Document
CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.4
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 40

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. This area has fixed suppression in all fire zones. Propagation of fire water from Fire Zone 79-U to the adjoining Fire Area B-9 is not a concern as there is no nuclear safety equipment impacted. The ponding in zones at elevation 386’ is minimal and excess will propagate to the turbine building or into the stairwell and eventually to Fire Area B-7 at elevation 317’. Equipment located on elevation 317‘ is above the ponding level and not impacted. Suppression water propagating into the turbine building is not significant as the large open area minimizes any ponding concerns. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-90-R-1014-21 “Penetration Seal Analysis for Penetration 0079-01-0001”

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon the total cross section area of the through metal being less than tested and a 6” silicone foam seal will successfully pass an ASTM E-119 fire exposure. This evaluation has determined that these deviations from the tested design have negligible impact and are therefore acceptable.

Engineering Evaluation ID: CALC-90-R-1014-22 “Penetration Seal Analysis for Penetration 0079-01-0160”

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon the total cross section area of the through metal being less than tested and a 6” silicone foam seal will successfully pass an ASTM E-119 fire exposure. This evaluation has determined that these deviations from the tested design have negligible impact and are therefore acceptable.

Fire Area ID:	B-1@120-E, 125-E, 128-E, 149-E, and 79-U (North Auxiliary Building)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-27 "Penetration Seal Analysis for Penetration 0079-01-0016"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon the total cross section area of the through metal being less than tested and a 6" silicone foam seal will successfully pass an ASTM E-119 fire exposure. This evaluation has determined that these deviations from the tested design have negligible impact and are therefore acceptable.

Engineering Evaluation ID: CALC-ANO1-FP-09-00009 "Unit 1 Structural Steel Fire Protection Evaluation"

Summary: Purpose: The purpose of this evaluation is to document the fire protection engineering evaluation for the lack of structural steel fire proofing in the following locations:

B-1 (79-U, 149-E); B-8 (46-Y, 77-V, 105-T, 144-D); C (20-Y, 47-Y, 53-Y); I-1 (98-J); I-3 (112-I)

Basis for Acceptability: These rooms are protected by smoke detection systems that alarm in the control room (and suppression systems in the electrical penetration rooms) and the prompt response by the fire brigade with access to manual firefighting equipment should prevent any fire (in the unlikely event one does occur) from damaging the structural steel.

Engineering Evaluation ID: CALC-ANO1-FP-09-00015 "Engineering Evaluation for Penetration Seals in Fire Area B-1"

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetrations in Fire Area B-1 used in a 3-hour rated fire area boundary.

The seals reviewed by this evaluation are:

- FB-79-01-0057 (From fire zone 79-U to 53-Y)
- FB-73-01-0034 and 0063 (From fire zone 73-W to 31-Y & 34-Y)
- FB-149-01-0055 (From fire zone 149-E to 112-I)
- FB-2026-04-0055 (From fire zone 2026-Y to 34-Y)
- FB-160-01-0366 (From fire zone 160-B to 129-F)
- FB-0074-01-0057 and FB-0074-01-0058 (From fire zone 197-X to 34-Y)

Basis for Acceptability: The bases for the acceptability is the installed penetrations are considered to be adequate for the hazards based on:

- Detection system in Fire Zones 34-Y, 53-Y, 73-W, 79-U, 112-I, 129-F, 149-E, 160-B
- Suppression system in Fire Zones 73-W, 79-U, 112-I, 129-F, 149-E
- Combustible loading and fire brigade response using manual suppression

Fire Area ID:	B-1@120-E, 125-E, 128-E, 149-E, and 79-U (North Auxiliary Building)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANOC-FP-09-00004 "Fire Protection Engineering Evaluation of Units 1 & 2 Containment Building Penetrations"

Summary: Purpose: The purpose of this fire protection engineering evaluation is to evaluate the ANO-1 Reactor Building penetrations used in a 3-hour rated fire area boundary.

Basis for Acceptability:

- Low probability of a fire starting in the areas of the penetrations
- The installed smoke detection and suppression systems in electrical penetration rooms (Fire Zones 105-T, 112-I, 144-D, and 149-E)
- The installed detection in mechanical penetration rooms (Fire Zones 46-Y, 53-Y, 77-V, 79-U, and 159-B) with the exception of Fire Zone 170-Z which does not credit detection
- Fire resistive materials used in the penetrations
- Prompt response by the fire brigade with access to manual firefighting equipment for those areas in the auxiliary buildings.

Engineering Evaluation ID: CALC-ANOC-FP-09-00011 "Fire Protection Engineering Evaluation of Units 1 & 2 Elevator Doors"

Summary: Purpose: The purpose of this EC is to evaluate the ANO-1 auxiliary building elevator doors to function in a 3-hour rated fire barrier. The elevator doors to be evaluated are:

Unit 1 Applicability

335' 20-Y, Fire Area C

354' 67-U, Fire Area B-9

386' 128- E, Fire Area B-1

404' 159-B, Fire Area B-1

Basis for Acceptability: Based on the low combustible loading, the availability of the smoke detection system, suppression in Fire Zones 67-U, and 128-E, and the availability of the fire brigade with manual firefighting equipment, the elevator doors are considered to be adequate for the hazards in the area and acceptable for the 3-hour rated fire barriers.

Fire Area ID: B-1@120-E, 125-E, 128-E, 149-E, and 79-U (North Auxiliary Building)
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Required Fire Protection Systems and Features

		Installed		Required?											
				Separation		LA		EEEE		Risk		DID			
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET		
120-E	Boric Acid Addition Tank and Pump Room	P	No	No	No	No	No	No	No	Yes	No	Yes	No		
125-E	Respirator Storage Room	Yes	No	No	No	No	No	No	No	Yes	No	Yes	No		
128-E	Controlled Access	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes		
149-E	Upper North Electrical Penetration Room Hot Mechanic Shop Decon Room	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes		
79-U	Upper North Piping Penetration Room	P	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes		

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-1@120-E, 125-E, 128-E, 149-E, and 79-U (North Auxiliary Building)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-01

Title: ANO-1 Fire Area B-1@120-E Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with the identified recoveries and modifications. In addition, there are global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new auxiliary feedwater (AFW) pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1 (VFDR B-1@120-02-c), SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- Reactor Building Sump recirc valves CV-1405 and CV-1406 (B-1@120-03-d) have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system for this fire area was credited in the ANO-1 Hot Gas Layer (HGL) and Multi-Compartment analysis (MCA). The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID:	B-1@120-E, 125-E, 128-E, 149-E, and 79-U (North Auxiliary Building)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-01 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the fire risk evaluation (FRE) and shows no additional defense-in-depth (DID) methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: B-1@120-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of control to non-credited EFW steam driven pump P-7A resulting in potential overcooling
b) Loss of control capability of valve CV-2630 results in a potential overfeed to SG-B
c) Loss of power and control capability of valve CV-2626 (IN 92-18) resulting in loss of feedwater path to SG-B
d) Loss of control capability of valve CV-2668 resulting in inability to isolate SG-A
e) Spurious operation of atmospheric dump control valve CV-2618 and block valve CV-2619 results in the inability to control SG-B
f) Spurious operation of condensate pumps P-2A through P-2C could result in uncontrolled source of feedwater

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) No further action is required for EFW pump P-7A
b) No further action is required for CV-2630
c) No further action is required for CV-2626
d) No further action is required for CV-2668
e) No further action is required for CV-2618 and CV-2619
f) No further action is required for P-2A, P2-B, and P-2C

Fire Area ID:	B-1@120-E, 125-E, 128-E, 149-E, and 79-U (North Auxiliary Building)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: B-1@120-02

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of power and control functions associated with ACW loop isolation valve CV-3643 resulting in a flow diversion
b) Spurious closure of CV-3644 if P-4B is aligned to loop 1
c) Spurious closure of sluice gate SG-1 for loop 1

Loss of these functions could challenge the Vital Auxiliaries Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) No further action required for ACW loop isolation valve CV-3643
b) No further action required for SW valve CV-3644
c) Modification to remove spurious closure of sluice gate SG-1

VFDR ID: B-1@120-03

VFDR: Fire damage to control and power cables in the area may impact inventory control functions resulting in the following:

a) A loss of power and control to valve CV-1206 resulting in the loss of isolation capability to prevent thermal shock of the RCP seals
b) Loss of power and control to makeup tank outlet valve CV-1275 resulting in the loss of isolation capability to preclude gas binding of the makeup pumps
c) Loss of control capability of valve CV-1301 results in a MU Pump flow diversion
d) Spurious operation of valve CV-1406 (IN 92-18) results in a loss of BWST inventory diversion to the sump
e) Loss of control to pressurizer heaters M-308 resulting in loss of trip capability from the control room
f) Spurious operation of RCS vent valves SV-1072, SV-1074, SV-1082, SV-1084, SV-1092, and SV-1094 could result in a loss of RCS inventory
g) Spurious operation of RCP seal bleed-off to quench tank valves SV-1270 through SV-1273 could result in a loss of RCS inventory

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Fire Area ID:	B-1@120-E, 125-E, 128-E, 149-E, and 79-U (North Auxiliary Building)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) Since the Fire PRA assumes loss of seal cooling results in a loss of coolant accident (LOCA), failure of CV-1206 is non-minimal, and therefore already conservatively quantified
b) No further action is required for makeup tank outlet valve CV-1275
c) No further action is required for CV-1301
d) Modification to prevent spurious opening of CV-1406
e) No further action is required as spurious operation of pressurizer heaters is not a contributor to core damage sequences in the Fire PRA, and therefore is not risk significant
f) No further action is required for RCS vent valves SV-1072, SV-1074, SV-1082, SV-1084, SV-1092, and SV-1094
g) No further action is required as spurious operation of valves SV-1270 through 1273 is not modeled in the Fire PRA since the leakage through this pathway is not sufficient to be classified as a small break (SB)LOCA

VFDR ID: B-1@120-04

VFDR: Fire damage to cables in the area may impact vital auxiliary functions. The circuits impacted result in the following:

a) Loss of power and control supply to EDG room exhaust fans VEF-24A and VEF-24B. These exhaust fans are required to maintain the room temperature adequate for EDG-1 operation.

Loss of this function could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) No further actions are required for exhaust fans VEF-24A and VEF-24B

End of Fire Area B-1@120-E, 125-E, 128-E, 149-E and 79-U

Fire Area ID:	B-1@170-Z
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
170-Z	Steam Pipe Room (Penthouse)

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B aligned to feed SG-A.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.5
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 41

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. This area has no fixed suppression and the controlled discharge of manual suppression water is directed to adjacent exterior areas where roof drains would prevent any ponding concerns. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: B-1@170-Z
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-ANOC-FP-09-00004 "Fire Protection Engineering Evaluation of Units 1 & 2 Containment Building Penetrations"

Summary: Purpose: The purpose of this fire protection engineering evaluation is to evaluate the ANO-1 Reactor Building penetrations used in a 3-hour rated fire area boundary.

Basis for Acceptability:

- Low probability of a fire starting in the areas of the penetrations
- The installed smoke detection and suppression systems in electrical penetration rooms (Fire Zones 105-T, 112-I, 144-D, and 149-E)
- The installed detection in mechanical penetration rooms (Fire Zones 46-Y, 53-Y, 77-V, 79-U, and 159-B) with the exception of Fire Zone 170-Z, which does not credit detection
- Fire resistive materials used in the penetrations
- Prompt response by the fire brigade with access to manual firefighting equipment for those areas in the auxiliary buildings

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
170-Z	Steam Pipe Room (Penthouse)	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-1@170-Z
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-05

Title: ANO-1 Fire Area B-1@170-Z Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense-in-depth, and maintenance of safety margins, with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN 92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in an unrecoverable position.

Additional Fire Area Considerations

Neither detection nor suppression is credited to screen the scenario within Fire Area B-1@170-Z for a potential fire impact into an adjacent boundary (MCA Analysis). Use of the base scenario CCDP in this analysis incorporates the impact of a potential hot gas layer and envelopes the delta CDF/LERF. Therefore, no credit for detection or suppression is applied to reduce the CDF/LERF for Fire Area B-1@170-Z.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: B-1@170-Z
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-05 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: B1170-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of control capability for main steam isolation valves (MSIVs) CV-2691 (pilot valves SV-0611 & SV-0711) and CV-2692 (pilot valves SV-0621 & SV-0721) preventing isolation of SGs A and B.
b) Loss of control capability of valve CV-2618 resulting in inability to isolate SG-B.

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: Atmospheric dump valve CV-2618 and MSIVs CV-2691 and CV-2692 are not required in the Fire PRA model when crediting the motor driven EFW pump, P-7B. The deterministic analysis requires these valves closed to preclude an overcooling transient of the SG. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and, therefore, recovery of CV-2618, CV-2691, and CV-2692 is not risk significant.

End of Fire Area B-1@170-Z

Fire Area ID:	B-1@40-Y
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
40-Y	Pipeway Room (Under ICW Coolers)

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B can be aligned to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.6
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 43

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. This area has no fixed suppression system and the controlled discharge of manual suppression water would migrate to the turbine building basement, which has no equipment needed to maintain safe and stable conditions. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: B-1@40-Y
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Licensing Actions

Licensing Action: Appendix R Exemption 09, FZ 40-Y, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance-based approach; therefore, this exemption is no longer required under the new licensing basis.

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
40-Y	Pipeway Room (Under ICW Coolers)	No	Yes	No	No	No	No	No	No	No	Yes	No	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-1@40-Y
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-06

Title: ANO-1 Fire Area B-1@40-Y Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense-in-depth, and maintenance of safety margins, with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID:	B-1@40-Y
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-06 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: B1@40Y-01

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of power and control functions associated with SW pump P-4A, P-4B, and P-4C
b) Loss of power and control for SW loop crossover valves CV-3640 and CV-3642
c) Loss of power and control for SW loop crossover valves CV-3644 and CV-3646
d) Loss of power and control functions associated with ACW loop isolation valve CV-3643 resulting in a flow diversion

Loss of these functions could challenge the Vital Auxiliaries Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) No further action is required for P-4A, P-4B, and P-4C
b) No further action is required for CV-3640 and CV-3642
c) No further action is required for CV-3644 and CV-3646
d) No further action is required for CV-3643

End of Fire Area B-1@40-Y

Fire Area ID:	B-1@73-W
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
73-W	Condensate Demineralizer Room

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST (Borated Water Storage Tank).	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36A is aligned with feed from the BWST using normal charging path to RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The turbine driven EFW pump P-7A is aligned to feed SG-B.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pump P-4A or P-4B (swing pump) aligned to feed SW Loop 1. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.7
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 42

Fire Area ID: B-1@73-W
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. This area has fixed suppression and the discharge of suppression water will be directed to the train bay and the turbine building. It is expected that any excess water from suppression activities would ultimately migrate to the turbine building basement which has no equipment needed to maintain safe and stable conditions. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-90-R-1014-36 “Penetration Seal Analysis for Penetration 0099-01-0069”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection on both sides of the seal (73-W & 99-M), automatic suppression in Fire Zone 73-W, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Fire Area ID: B-1@73-W
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-09-00015 “Engineering Evaluation for Penetration Seals in Fire Area B-1”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of unit 1 penetrations in fire area B-1 used in a 3-hour rated fire area boundary.

The seals reviewed by this evaluation are:

- FB-79-01-0057 (from Fire Zone 79-U to 53-Y)
- FB-73-01-0034 and 0063 (from Fire Zone 73-W to 31-Y & 34-Y)
- FB-149-01-0055 (from Fire Zone 149-E to 112-I)
- FB-2026-04-0055 (from Fire Zone 2026-Y to 34-Y)
- FB-160-01-0366 (from Fire Zone 160-B to 129-F)
- FB-0074-01-0057 and FB-0074-01-0058 (from Fire Zone 197-X to 34-Y)

Basis for Acceptability: The bases for the acceptability is the installed penetrations are considered to be adequate for the hazards based on:

- Detection system in Fire Zones 34-Y, 53-Y, 73-W, 79-U, 112-I, 129-F, 149-E, and 160-B
- Suppression system in Fire Zones 73-W, 79-U, 112-I, 129-F, and 149-E
- Combustible loading and fire brigade response using manual suppression

Engineering Evaluation ID: CALC-ANO1-FP-09-00017 “Engineering Evaluation for Penetration Seals in Fire Area E”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration seals in Fire Area E to be used in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability is the low fire duration on both sides, smoke detection systems on both sides (100-N & 73-W), suppression systems in Fire Zone 73-W, and the response by the fire brigade to suppress a fire in the early stage on either side.

Engineering Evaluation ID: CALC-ANO1-FP-09-00018 “Engineering Evaluation for Penetration Seals in Fire Area I-2”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration seals FB 0099-01-17 and FB- 0099-01-0020 for use in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability is the low fire duration on both sides, smoke detection systems on both sides (99-M & 73-W), suppression systems in Fire Zone 73-W, and the response by the fire brigade to suppress a fire in the early stage on either side.

Fire Area ID: B-1@73-W
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-09-00021 "Fire Protection Engineering Evaluation of Supports for 1-Hour Conduits"

Summary: This Evaluation is only applicable under Appendix R as the performance-based method used for this location does not credit the use of fire wraps. This EEEE will not be required post transition to NFPA 805.

Purpose: The purpose of this fire protection engineering evaluation is to evaluate the adequacy of the unprotected conduit supports in Fire Zone 73-W (Versa wrap only).

Basis for Acceptability: The bases for the acceptability are that the areas of concern (1-hour fire wrap) are adequately covered by the suppression system and thus a fire would be suppressed in the early stage and not damage the conduit supports. In addition, the conduits are supported at the floor and the ceiling, which would also provide support should a fire occur in this zone.

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
73-W	Condensate Demineralizer Room	P	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-1@73-W
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-07

Title: ANO-1 Fire Area B-1@73-W Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with the identified recoveries. In addition, global modifications are credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 (VFDR B173-02-b) and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID:	B-1@73-W
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-07 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: B173-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of control capability for MSIVs CV-2691 (pilot valves SV-0611 & SV-0711) and CV-2692 (pilot valves SV-0621 & SV-0721) preventing isolation of SGs A and B
b) Loss of control capability of valve CV-2630 results in a potential overfeed to SG-B from main feedwater pumps

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) No further action is required for MSIVs CV-2691 and CV-2692
b) No further action is required for CV-2630

Fire Area ID:	B-1@73-W
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: B173-02

VFDR: Fire damage to control and power cables in the area may impact inventory control functions resulting in the following:

a) Loss of makeup pumps P-36A, P-36B, and P-36C
b) Spurious operation of valve CV-1405 (IN 92-18) results in a loss of BWST inventory to the sump

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) No further action is required for makeup pumps P-36A, P-36B, and P-36C
b) Modification to remove risk of spurious operation is required for CV-1405

VFDR ID: B173-03

VFDR: Fire damage to cables in the area may impact vital auxiliary functions. The impacted circuits result in the following:

a) Loss of the power supply to battery charger D-03B. Redundant battery charger D-03A is available for a fire in this area, but will require a local manual transfer if not aligned.
b) Loss of control power to load-center B-5 results in a loss AC power to safe shutdown equipment.

Loss of this function could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) No further action is required for battery charger D-03B
b) No further action is required for load-center B-5

Fire Area ID:	B-1@73-W
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: B173-04

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of power and control functions associated with SW pumps P-4A, P-4B, and P-4C
b) Loss of power and control functions associated with ACW loop isolation valve CV-3643 resulting in a flow diversion
c) Spurious closure of CV-3642 if P-4B is aligned to Loop 2
d) Spurious closure of CV-3646 if P-4B is aligned to Loop 1

Loss of these functions could challenge the Vital Auxiliaries (SW) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) No further action is required for SW pumps P-4A, P-4B, and P-4C
b) No further action is required for SW valve CV-3643
c) No further action is required for CV-3642
d) No further action is required for CV-3646

End of Fire Area B-1@73-W

Fire Area ID: B-1@BOFZ
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
157-B	Chemical Addition Rm. (Boric Acid Mix Tank)
159-B	Spent Fuel Room
160-B	Computer Room
161-B	Ventilation Equipment Room
163-B	Reactor Building Purge Room
167-B	Computer Transformer Room
168-B	Transformer Room
175-CC	Lube Oil Storage Tank Room
187-DD	Dirty and Clean Lube Oil Storage Tank Room
197-X	Turbine Building
75-AA	Boiler De-aeration and Expansion Tanks Room Ammonia Tank Room
78-BB	Gas Bottle Storage Room
2026-Y	Drumming Station (Unit 1)

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36C is available with feed from the BWST and using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B is aligned to either SG-A or SG-B.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to the onsite EDGs.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.

Fire Area ID: B-1@BOFZ
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Performance Goal	Method Of Accomplishment	Comments
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.8
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 44

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. All fire zones that have automatic suppression with the exception of Fire Zone 163-B (Reactor Building Purge Room) have flow paths to the turbine building. The large open area of the turbine building minimizes any ponding concerns and it is expected that any excess water from suppression activities would ultimately migrate to the turbine building basement, which has no equipment needed to maintain safe and stable conditions. Fire Zone 163-B contains no equipment needed for safe and stable operations. Excess water will propagate into the auxiliary building stairwell and eventually to Fire Area B-7 at elevation 317’. Equipment located on elevation 317‘is above the ponding level and not impacted. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-84-D-1043-01 “Fire Analysis of Hatch”

Summary: Purpose: Evaluate hatch at elevation 354‘ to determine if fire-proofing is required.

Basis for Acceptability: The hatch between Fire Zones 20-Y and 197-X is adequate for a 3-hour barrier with the application of fire-proofing.

Fire Area ID:	B-1@BOFZ
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-56 “Penetration Seal Analysis for Penetration 0175-1A-0088”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon the depth of seal being obtained by use of a metallic collar. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-90-R-1014-01 “Penetration Seal Analysis for Penetration 0097-05-0001”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression and detection in Fire Zone 97-R, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-90-R-1014-03 “Penetration Seal Analysis for Penetration 0097-01-0037”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression in Fire Zone 97-R, detection on both sides of the seal (97-R & 197-X), and the limited combustible loading. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-90-R-1014-04 “Penetration Seal Analysis for Penetration 0097-01-0040”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression and detection in Fire Zone 97-R, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Fire Area ID:	B-1@BOFZ
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-06 "Penetration Seal Analysis for Penetration 0097-01-0048"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression and detection in Fire Zone 97-R, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-90-R-1014-13 "Penetration Seal Analysis for Penetration 0183-01-0114"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection in Fire Zone 20-Y, partial suppression in Fire Zone 197-X, the limited combustible loading, and equivalent seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-90-R-1014-14 "Penetration Seal Analysis for Penetration 0129-05-0264"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression and detection in Fire Zone 129-F, and the limited combustible loading. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-90-R-1014-19 "Penetration Seal Analysis for Penetration 0034-03-0011"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection in Fire Zone 34-Y, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Fire Area ID: B-1@BOFZ
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-20 “Penetration Seal Analysis for Penetration 0034-03-0013”

Summary:

Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection in Fire Zone 34-Y, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-ANO1-FP-07-00001 “Penetration Seal Analysis for Penetration 0097-01-0045”

Summary:

Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon equivalency of penetrating items, smaller penetration area, and less free space. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-ANO1-FP-09-00010 “Evaluation of Fire Barrier Penetration FB-183-01-0018 (EC13696)”

Summary:

Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration FB-183-01-0018 to be used in a 3-hour rated fire area boundary based on approved fire tests.

Basis for Acceptability: The basis for the acceptability is that the installed configuration is bounded by the tested configuration due to the insignificant differences.

Fire Area ID:	B-1@BOFZ
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-09-00015 “Engineering Evaluation for Penetration Seals in Fire Area B-1”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetrations in Fire Area B-1 used in a 3-hour rated fire area boundary.

The seals reviewed by this evaluation are:

- FB-79-01-0057 (from Fire Zone 79-U to 53-Y)
- FB-73-01-0034 and 0063 (from Fire Zone 73-W to 31-Y & 34-Y)
- FB-149-01-0055 (from Fire Zone 149-E to 112-I)
- FB-2026-04-0055 (from Fire Zone 2026-Y to 34-Y)
- FB-160-01-0366 (from Fire Zone 160-B to 129-F)
- FB-0074-01-0057 and FB-0074-01-0058 (from Fire Zone 197-X to 34-Y)

Basis for Acceptability: The basis for the acceptability is the installed penetrations are considered to be adequate for the hazards based on:

- Detection system in Fire Zone 34-Y, 53-Y, 73-W, 79-U, 112-I, 129-F, 149-E, and 160-B
- Suppression system in Fire Zone 73-W, 79-U, 112-I, 129-F, and 149-E
- Combustible loading and fire brigade response using manual suppression

Engineering Evaluation ID: CALC-ANO1-FP-09-00016 “Engineering Evaluation for Penetration Seals in Fire Area C”

Summary: Purpose: The purpose of this evaluation is to document the acceptability of ANO-1 penetrations in Fire Area C used in 3-hour rated fire area boundaries.

The seals reviewed by this evaluation are:

From Fire Area C (38-Y) to B-@BOFZ (75-AA)

FB-0038-04-0133
FB-0038-04-0004
FB-0038-04-0138

Basis for Acceptability: The penetrations listed are considered adequate for the hazards in their respective area based on:

- Acceptable combustible loading
- Smoke detection systems in Fire Zone 38-Y
- Partial suppression system in Fire Zone 38-Y for the EFW turbine pump
- Response by the fire brigade team with manual firefighting equipment in the areas without automatic suppression

Fire Area ID: B-1@BOFZ
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANOC-FP-07-00003 “Watertight Fire Doors Evaluation”

Summary: Purpose: Evaluate watertight doors used in 3 hour rated fire barriers.

Basis for Acceptability: The watertight doors (DR-5, DR-30, DR-33, and DR-455) installed at ANO-1 in 3-hour rated fire barriers have been determined to be acceptable for use based on the hazards in the areas. Although these doors are not 3-hour rated fire doors, the doors will provide the protection needed in the areas used.

Engineering Evaluation ID: CALC-ANOC-FP-09-00004 “Fire Protection Engineering Evaluation of Units 1 & 2 Containment Building Penetrations”

Summary: Purpose: The purpose of this fire protection engineering evaluation is to evaluate the ANO-1 Reactor Building penetrations used in a 3-hour rated fire area boundary.

Basis for Acceptability:

- Low probability of a fire starting in the areas of the penetrations
- The installed smoke detection and suppression systems in electrical penetration rooms (Fire Zones 105-T, 112-I, 144-D, and 149-E)
- The installed detection in mechanical penetration rooms (Fire Zones 46-Y, 53-Y, 77-V, 79-U, and 159-B) with the exception of Fire Zone 170-Z, which does not credit detection
- Fire resistive materials used in the penetrations
- Prompt response by the fire brigade with access to manual firefighting equipment for those areas in the auxiliary buildings

Engineering Evaluation ID: CALC-ANOC-FP-09-00011 “Fire Protection Engineering Evaluation of Units 1 & 2 Elevator Doors”

Summary: Purpose: The purpose of this EC is to evaluate the ANO-1 and ANO-2 auxiliary building elevator doors to function in a 3-hour rated fire barrier. The elevator doors to be evaluated are:

<u>Unit 1 Applicability</u>

335' 20-Y Fire Area C

354' 67-U Fire Area B-9

386' 128-E Fire Area B-1

404' 159-B Fire Area B-1

Basis for Acceptability: Based on the low combustible loading, the availability of the smoke detection system, suppression in Fire Zones 67-U, 128-E, and the availability of the fire brigade with manual firefighting equipment, the elevator door are considered to be adequate for the hazards in the area and acceptable for the 3-hour rated fire barriers.

Fire Area ID:	B-1@BOFZ
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANOC-FP-09-00013 “Fire protection Engineering Evaluation for Penetration Seals in Fire Area G”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of penetrations in Fire Area G used in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability is the seals are considered to be adequate for the hazards in the area based on the combustible loading, smoke detection system on both sides (97-R, 129-F, and 197-X), suppression system in Fire Zone 97-R, and the response by the fire brigade to suppress the fire in the early stage.

Engineering Evaluation ID: PEAR-95-4007 “Thunderline Link Seal Evaluation for FB-2026-05-0059”

Summary: Purpose: Evaluate the use of link-seals in a 3-hour rated barrier between Fire Zones 20-Y and 2026-Y.

Basis for Acceptability: The use of a link-seal is acceptable based upon lack of safe shutdown equipment in Fire Zone 2026-Y, the separation of this zone from other areas by concrete walls and ceiling, and the low combustible loading of the area.

Fire Area ID: B-1@BOFZ
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Required Fire Protection Systems and Features

		Installed		Required?											
				Separation		LA		EEEE		Risk		DID			
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET		
157-B	Chemical Addition Rm. (Boric Acid Mix Tank)	No	No	No	No	No	No	No	No	No	No	No	No		
159-B	Spent Fuel Room	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes		
160-B	Computer Room	No	P	No	No	No	No	No	Yes	No	Yes	No	Yes		
161-B	Ventilation Equipment Room	No	No	No	No	No	No	No	No	No	No	No	No		
163-B	Reactor Building Purge Room	P	No	No	No	No	No	No	No	No	No	Yes	No		
167-B	Computer Transformer Room	No	Yes	No	No	No	No	No	No	No	Yes	No	Yes		
168-B	Transformer Room	No	No	No	No	No	No	No	No	No	No	No	No		
175-CC	Lube Oil Storage Tank Room	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes		
187-DD	Dirty and Clean Lube Oil Storage Tank Room	Yes	No	No	No	No	No	No	No	No	No	Yes	No		
197-X	Turbine Building	P	P	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes		
2026-Y	Drumming Station (Unit 1)	No	No	No	No	No	No	No	No	No	No	No	No		
75-AA	Boiler De-aeration and Expansion Tanks Room Ammonia Tank Room	P	Yes	No	No	No	No	Yes	No	No	Yes	Yes	Yes		
78-BB	Gas Bottle Storage Room	No	No	No	No	No	No	No	No	No	No	No	No		

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-1@BOFZ
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-10

Title: ANO-1 Fire Area B-1@BOFZ Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense-in-depth, and maintenance of safety margins with the identified recoveries and modifications. In addition, there are global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

There following equipment is recovered in the post transition baseline case:

- RCP P-32A is tripped at the switchgear (VFDR B-1@BOFZ-04)
- RCP P-32B is tripped at the switchgear (VFDR B-1@BOFZ-04)
- RCP P-32C is tripped at the switchgear (VFDR B-1@BOFZ-04)
- RCP P-32D is tripped at the switchgear (VFDR B-1@BOFZ-04)

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps is to be installed. The new AFW pump is not credited as a plant modification in Fire Area 75-AA as it is the suggested installation site for the AFW modification.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

The following modifications are area specific and credited to reduce risk in this fire area:

- Modify circuits for breakers A-309 and A-409 to assure the protective features remain intact, breakers remain tripped, and do not impede automatic start of the associated EDG and closure of EDG breakers (A-308 and A-408) (VFDR B-1@BOFZ-01)
- Separate DC control power for the line and load breaker at H-1 and H-2 to assure tripping of RCPs (VFDR B-1@BOFZ-04)

Fire Area ID:	B-1@BOFZ
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-10 (continued)

Summary: (continued)

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system located in this fire area was credited in the ANO-1 HGL and MCA for all Fire Zones except 78-BB, 157-B, 161-B, 163-B, 168-B, 187-DD, and 2026-Y. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

∆ **CDF:** Refer to Attachment W “Fire PRA Insights”

∆ **LERF:** Refer to Attachment W “Fire PRA Insights”

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

Fire Area ID: B-1@BOFZ
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDRS

VFDR ID: B-1@BOFZ-01

VFDR: Fire damage to control cables in the area may impact the vital auxiliaries function resulting in the following:

a) Spurious closure of breaker A-309 challenging the supply from credited EDG
b) Spurious closure of breaker A-409 challenging the supply from credited EDG

Loss of these functions could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) Modification to prevent spurious closing and maintain automatic trip functions for breaker A-309
b) Modification to prevent spurious closing and maintain automatic trip functions for breaker A-409

VFDR ID: B-1@BOFZ-02

VFDR: Fire damage to control and power cables in the area may impact emergency feedwater functions resulting in the following:

a) Spurious operation of atmospheric dump control valve CV-2618 results in the inability to isolate SG-B
b) Loss of control capability of atmospheric dump control valve CV-2668 results in the inability to isolate SG-A
c) Loss of control power for MSIV CV-2691 (pilot valves SV-0611 & SV-0721) preventing isolation of SG-A
d) Spurious operation of condensate pumps P-2A through P-2C and AFW pump P-75 could result in uncontrolled source of feedwater

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.,4 with the following actions:

a) No further action is required for valve CV-2618
b) No further action is required for valve CV-2668
c) No further action is required for MSIV CV-2691
d) No further action is required for condensate pumps P-2A, P-2B, P-2C, and AFW pump P-75

Fire Area ID:	B-1@BOFZ
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: B-1@BOFZ-03

VFDR: Fire damage to control and power cables in the area may impact inventory control functions resulting in the following:

a) Loss of power and control to makeup tank outlet valve CV-1275 resulting in the loss of isolation capability to preclude gas binding of the makeup pumps
b) Loss of control to pressurizer heaters M-308 resulting in loss of trip capability from the control room

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for CV-1275
b) No further action is required as spurious operation of pressurizer heaters is not a contributor to core damage sequences in the Fire PRA, and therefore is not risk significant

VFDR ID: B-1@BOFZ-04

VFDR: Fire damage to cables in the area may impact pressure and inventory control functions resulting in the following:

a) Loss of the control room trip capability of RCPs P-32A through 2P-32D. Securing the pumps is required to assure normal pressurizer spray is secured and prevent potential RCP seal damage.

Loss of these functions could challenge the Pressure and Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with modification to supply H-1 and H-2 with redundant DC control power and recovery action to trip the RCPs.

Fire Area ID:	B-1@BOFZ
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: B-1@BOFZ-05

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of power and control for SW loop crossover valves CV-3640
b) Loss of power and control for SW loop crossover valve CV-3646
c) Loss of control to SW pump P-4B(C) to Loop 1 if P-4A is out of service

Loss of these functions could challenge the Vital Auxiliaries Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.,4 with the following actions:

a) No further action is required for SW valve CV-3640
b) No further action is required for SW valve CV-3646
c) No further action is required for SW pump P-4B

End of Fire Area B-1@BOFZ

Fire Area ID:	B-1@197-X West Heater Deck
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	Description
197-X	Turbine Building (Between column lines 5 to 5.9; and, F to H; Above elevation 354' to Bottom of the elevation 386' slab)

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A or P-36C are available with feed from the BWST using the normal charging path to the RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The turbine driven EFW pump P-7A is aligned to SG-B.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.9
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 72

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. There is no automatic suppression in this area. The adjacent large open area of the turbine building minimizes any ponding concerns and it is expected that any excess water from suppression activities would ultimately migrate to the turbine building basement, which has no equipment needed to maintain safe and stable conditions. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: B-1@197-X West Heater Deck
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.
Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-ANO1-FP-08-00002 “Penetration Seal Analysis for Penetration 0101-05-0075”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of Unit 1 penetration 0101-05-0075 to be used in a 3-hour rated fire area boundary based on the penetration seal being considered adequate for the hazards in the area.

Basis for Acceptability: The configuration of the installed seal is acceptable based on the installed configuration, the tested configuration both contain similar penetrating items, the installed configuration is only 1/2 the size, and the availability of detection on both sides (Fire Zones 197-X at west heater deck and 104-S).

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
197-X	West Heater Deck	No	P	No	No	No	No	No	Yes	No	No	No	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-1@197-X West Heater Deck
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-09

Title: ANO-1 Fire Area B-1@West Heater Deck Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

<u>Credited Recovery Actions</u>

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

<u>Credited Modifications</u>

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

<u>IN-92-18 Concerns</u>

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

<u>Additional Fire Area Considerations</u>

The detection system for this fire area was not credited in the ANO-1 HGL and MCA since manual suppression is not credited to reduce the fire area CDF/LERF.

ΔCDF: Refer to Attachment W “Fire PRA Insights”

ΔLERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID:	B-1@197-X West Heater Deck
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-09 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF) and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: B-1@WHD-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of control power to the EFW Turbine Control Panel resulting in a loss of control of EFW pump P-7A
b) Loss of control capability of valve CV-2620 (IN 92-18) and CV-2647 resulting in loss of flow from EFW pump P-7A to SG-B
c) Loss of control capability of valves CV-2627 (IN 92-18) and CV-2645 results in inability to isolate EFW flow to non-credited SG-A
d) Loss of atmospheric dump control valve CV-2668 resulting in the inability to isolate SG-A
e) Loss of control capability of valve CV-2630 (IN 92-18) results in potential overfeed to SG-B from main feedwater pumps

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for EFW Turbine Control Panel C531 (P-7A).
b) No further action is required for valves CV-2620 and CV-2647.
c) No further action is required as CV-2627 and CV-2645 are associated with overcooling transients. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and therefore recovery of these valves is not risk significant.
d) No further action is required for CV-2668.
e) No further action is required for CV-2630.

End of Fire Area B-1@ 197-X West Heater Deck

Fire Area ID:	B-7 Aux Building Elev. 317’
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	**Description**
12-EE	Tendon Gallery Access Room
14-EE	West Decay Heat Removal Pump Room
4-EE	General Access Room

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A or P-36C are available with feed from the BWST using the normal charging path to the RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power. The EDGs are available but not credited in this fire area.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.10
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 45

Fire Area ID:	B-7 Aux Building Elev. 317’
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. This area is located at the lowest point in the auxiliary building and is separated from the only other fire area at this elevation by watertight doors and barriers. Discharge of suppression water to the adjacent area is not a concern due to these barriers. In the event that suppression water enters from the stairwell due to firefighting efforts in higher elevations, the ponding depth is much less than the lowest elevation of equipment in the area. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: Appendix R Exemption 17, FZ 4-EE and Yard Area, Not Meeting III.J Criteria, approval letter 1CNA108806 dated October 26, 1988

Licensing Basis: This exemption is no longer required because NFPA 805 does not require 8-hour battery backed emergency lighting.

Engineering Evaluations

Engineering Evaluation ID: CALC-ANO1-FP-09-00016 “Engineering Evaluation for Penetration Seals in Fire Area C”

Summary: Purpose: The purpose of this evaluation is to document the acceptability of ANO-1 penetrations in Fire Area C used in 3-hour rated fire area boundaries.

The seal reviewed by this evaluation is:

From fire area C (53-Y) to B-7 (14-EE)

FB-0053-01-0094

Basis for Acceptability: The penetration listed is considered adequate for the hazards in the area based on:

- Acceptable combustible loading
- Smoke detection systems in Fire Zones 14-EE and 53-Y
- Response by the fire brigade team with manual firefighting equipment in the areas without automatic suppression

Engineering Evaluation ID: CALC-90-R-1014-52 “ Penetration Seal Analysis for Penetration 0009-05-0017”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal installed between Fire Zones 4-EE and 10-EE is acceptable based upon availability of fire detection in Fire Zone 10-EE, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and therefore acceptable.

Fire Area ID:	B-7 Aux Building Elev. 317’
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Engineering Evaluation ID: CALC-ANO1-FP-09-00014 “Engineering Evaluation for Penetration Seals in Fire Area A”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration FB-10-02-0008 used in a 3-hour rated fire area boundary based on the penetration seal considered adequate for the hazards in the area.

Basis for Acceptability: The bases for the acceptability are the low fire durations, the smoke detection system on the near side (Fire Zone 10-EE) that alarms in the unit control room, and the response by the fire brigade (with the manual firefighting equipment in the area).

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
12-EE	Tendon Gallery Access Room	No	No	No	No	No	No	No	No	No	No	No	No
14-EE	West Decay Heat Removal Pump Room	No	Yes	No	No	No	No	No	Yes	No	No	No	No
4-EE	General Access Room	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed.
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area B-7

Fire Area ID:	B-8 @ 104-S, 105-T, 144-D & 76-W (South Electrical Equipment and Penetration Rooms)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
104-S	Electrical Equipment Room
105-T	Lower South Electrical Penetration Room
144-D	Upper South Electrical Penetration Room
76-W	Compressor Room

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36C is available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The turbine driven EFW pump P-7A is aligned to feed either SG-A.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power. The EDGs are available but not credited in this fire area.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pumps P-4B (swing pump) or P-4C aligned to feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Fire Area ID:	B-8 @ 104-S, 105-T, 144-D & 76-W (South Electrical Equipment and Penetration Rooms)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.12
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 46B

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. Only Fires Zones 105-T and 144-D have automatic suppression. Suppression water from Fire Zone 144-D will propagate to adjoining exterior roof. Suppression water from both automatic and controlled manual sources in the remaining three zones will propagate into the turbine building where the large open area minimizes any ponding concerns. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.
Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-ANO1-FP-08-00002 “Penetration Seal Analysis for Penetration 0101-05-0075

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration 0101-05-0075 to be used in a 3-hour rated fire area boundary based on the penetration seal being considered adequate for the hazards in the area.

Basis for Acceptability: The configuration of the installed seal is acceptable based on the installed configuration, the tested configuration both contain similar penetrating items, the installed configuration is only 1/2 the size, and the availability of detection on both sides (Fire Zones 197-X at west heater deck and 104-S).

Engineering Evaluation ID: CALC-ANOC-FP-09-00004 “Fire Protection Engineering Evaluation of Units 1 & 2 Containment Building Penetrations”

Summary: Purpose: The purpose of this fire protection engineering evaluation is to evaluate the ANO-1 Reactor Building penetrations used in a 3-hour rated fire area boundary.

Basis for Acceptability:

- Low probability of a fire starting in the areas of the penetrations
- The installed smoke detection and suppression systems in electrical penetration rooms (Fire Zones 105-T, 112-I, 144-D, and 149-E)
- The installed detection in mechanical penetration rooms (Fire Zones 46-Y, 53-Y, 77-V, 79-U, and 159-B) with the exception of Fire Zone 170-Z, which does not credit detection
- Fire resistive materials used in the penetrations
- Prompt response by the fire brigade with access to manual firefighting equipment for those areas in the auxiliary buildings.

Fire Area ID: B-8 @ 104-S, 105-T, 144-D & 76-W (South Electrical Equipment and Penetration Rooms)
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-09-00009 "Unit 1 Structural Steel Fire Protection Evaluation"

Summary: Purpose: The purpose of this evaluation is to document the fire protection engineering evaluation for the lack of structural steel fire proofing in the following locations:

B-1 (79-U, 149-E); B-8 (46-Y, 77-V, 105-T, 144-D); C (20-Y, 47-Y, 53-Y); I-1 (98-J); I-3 (112-I)

Basis for Acceptability: These rooms are protected by smoke detection systems that alarm in the control room (and suppression systems in the electrical penetration rooms) and the prompt response by the fire brigade with access to manual firefighting equipment should prevent any fire (in the unlikely event one does occur) from damaging the structural steel.

Engineering Evaluation ID: ER-ANO-2004-0803-000 "FB Penetration 79-01-129 Evaluation for Adequate Cellular Concrete Seal"

Summary: Purpose: Evaluate usage of cellular concrete seal.

Basis for Acceptability: The seal was determined to meet 3-hour requirements based upon the depth of cellular concrete exceeding the tested configuration.

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
104-S	Electrical Equipment Room	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes
105-T	Lower South Electrical Penetration Room	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
144-D	Upper South Electrical Penetration Room	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
76-W	Compressor Room	No	Yes	No	No	No	No	No	No	No	Yes	No	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-8 @ 104-S, 105-T, 144-D & 76-W (South Electrical Equipment and Penetration Rooms)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC-10-E-0023-03

Title: ANO-1 Fire Area B-8@SEPR Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 (B8SEPR-03-b) and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer. Automatic suppression is credited in applicable scenarios postulated in the fire area and in the screening analysis of multi compartment fires.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: B-8 @ 104-S, 105-T, 144-D & 76-W (South Electrical Equipment and Penetration Rooms)
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC-10-E-0023-03 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: B8SEPR-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of control room capability to the EFW Turbine Control Panel could result in loss of control of the credited EFW Pump P-7A
b) Spurious operation of atmospheric control valve CV-2668 and block valve CV-2676 results in the inability to control credited SG-A
c) Loss of control capability for MSIVs CV-2691 (pilot valves SV-0611 & SV-0711) and CV-2692 (pilot valves SV-0621 & SV-0721) preventing isolation of SGs A and B
d) Loss of control capability of valve CV-2627 results in loss of flow from EFW pump P-7A to SG-A
e) Loss of control capability of two valves CV-2630 and CV-2680 results in inability to secure main feedwater to SGs A and B

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for control panel C-531 and EFW pump P-7A
b) No further action is required for CV-2668 and CV-2676
c) No further action is required for MSIVs CV-2691 and CV-2692
d) No further action is required for CV-2627
e) No further action is required for CV-2630 and CV-2680

Fire Area ID:	B-8 @ 104-S, 105-T, 144-D & 76-W (South Electrical Equipment and Penetration Rooms)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: B8SEPR-02

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Spurious operation of SW crossover valve CV-3640 if P-4B(G) is feeding Loop 2 and P-4C is out of service

Loss of these functions could challenge the Vital Auxiliaries (SW) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for CV-3640

VFDR ID: B8SEPR-03

VFDR: Fire damage to cables in the area may impact inventory control functions. The circuits impacted result in the following:

a) Spurious operation of valve CV-1301 (IN 92-18) results in loss of recirculation capability for the makeup pump
b) Spurious operation of valve CV-1405 (IN 92-18) results in a loss of makeup inventory from the BWST to the sump
c) Loss of control to pressurizer heater M-308 resulting in a loss of trip capability from the control room
d) Spurious operation of RCS vent valves SV-1073, SV-1077, SV-1083, and SV-1093 could result in a loss of RCS inventory

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for CV-1301

b) Modification to remove spurious opening of CV-1405

c) No further action is required as spurious operation of pressurizer heaters is not a contributor to core damage sequences in the Fire PRA, and therefore is not risk significant

d) No further action is required for RCS vent valves SV-1073, SV-1077, SV-1083, and SV-1093

Fire Area ID:	B-8 @ 104-S, 105-T, 144-D & 76-W (South Electrical Equipment and Penetration Rooms)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: B8SEPR-04

VFDR: Fire damage to cables in the area may impact vital auxiliary functions. The circuits impacted result in the following:

a) Loss of the power supply to battery charger D-03A. Redundant battery charger D-03B is available for a fire in this area but with a local manual transfer if not aligned.

Loss of this function could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for battery charger D-03A

End of Fire Area B-8 @ 104-S, 105-T, 144-D, and 76-W

Fire Area ID:	B-8 @ 46-Y and 77-V (Aux Building South Side)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
46-Y	Lower South Piping Penetration Room
77-V	Upper South Piping Penetration Room

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36B and P-36C are available with feed from the BWST using the normal charging path to the RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B is aligned to feed SG-A.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pumps P-4B (swing pump) or P-4C feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.11
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 46A

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. This fire area has no automatic suppression system, firefighting activities are from controlled manual methods using hose station, and discharge to the adjacent fire area can be controlled. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: B-8 @ 46-Y and 77-V (Aux Building South Side)
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-ANOC-FP-07-00003 “Watertight Fire Doors Evaluation”

Summary: Purpose: Evaluate watertight doors used in 3-hour rated fire barriers.

Basis for Acceptability: The watertight doors (DR-5, DR-30, DR-33, and DR-455) installed at ANO-1 in 3-hour rated fire barriers have been determined to be acceptable for use based on the hazards in the areas. Although these doors are not 3-hour rated fire doors, they will provide the protection needed in the areas they are used.

Engineering Evaluation ID: CALC-90-R-1014-33 “Penetration Seal Analysis for Penetration 0038-05-0110”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and, therefore, is acceptable.

Engineering Evaluation ID: CALC-ANOC-FP-09-00004 “Fire Protection Engineering Evaluation of Units 1 & 2 Containment Building Penetrations”

Summary: Purpose: The purpose of this fire protection engineering evaluation is to evaluate the ANO-1 Reactor Building penetrations used in a 3-hour rated fire area boundary.

Basis for Acceptability:

- Low probability of a fire starting in the areas of the penetrations
- The installed smoke detection and suppression systems in electrical penetration rooms (Fire Zones 105-T, 112-I, 144-D, and 149-E)
- The installed detection in mechanical penetration rooms (Fire Zones 46-Y, 53-Y, 77-V, 79-U, and 159-B) with the exception of Fire Zone 170-Z, which does not credit detection
- Fire resistive materials used in the penetrations
- Prompt response by the fire brigade with access to manual firefighting equipment for those areas in the auxiliary buildings

Fire Area ID: B-8 @ 46-Y and 77-V (Aux Building South Side)
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-09-00009 "Unit 1 Structural Steel Fire Protection Evaluation"

Summary: Purpose: The purpose of this evaluation is to document the fire protection engineering evaluation for the lack of structural steel fire proofing in the following locations:

B-1 (79-U, 149-E); B-8 (46-Y, 77-V, 105-T, 144-D); C (20-Y, 47-Y, 53-Y); I-1 (98-J); I-3 (112-I)

Basis for Acceptability: These rooms are protected by smoke detection systems that alarm in the control room (and suppression systems in the electrical penetration rooms) and the prompt response by the fire brigade with access to manual firefighting equipment should prevent any fire (in the unlikely event one does occur) from damaging the structural steel.

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
46-Y	Lower South Piping Penetration Room	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes
77-V	Upper South Piping Penetration Room	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-8 @ 46-Y and 77-V (Aux Building South Side)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-11

Title: ANO-1 Fire Area B-8@SPPR Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

∆ CDF: Refer to Attachment W “Fire PRA Insights”

∆ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID:	B-8 @ 46-Y and 77-V (Aux Building South Side)
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-11 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF) and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: B8SPPR-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Damage to circuits for the EFW turbine control panel C531 could result in the inability to isolate EFW pump P-7A
b) Loss of control capability of valves CV-2668 and CV-2676 resulting in the inability to isolate SG-A
c) Spurious operation of MSIVs CV-2691 and CV-2692 prevents isolation of SGs A and B

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR is associated with overcooling transients. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and, therefore, recovery of C531 (P-7A), CV-2668, CV-2676, CV-2691, and CV-2692 is not risk significant.

End of Fire Area B-8 @ 46-Y and 77-V

Fire Area ID:	B-9
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	Description
67-U	Lab and Demineralizer Access Room
68-P	Reactor Coolant Makeup Tank Room
88-Q	Communications Room
89-P	Controlled Access (stairway)

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36A or P-36B is available with feed from the BWST using the normal charging path to the RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B is aligned to feed either SG-A or SG-B.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 is aligned to onsite EDG.	
5b. Vital Auxiliaries (SW)	SW pumps P-4A or P-4B (swing pump) feed SW Loop 1. ACW can be isolated to prevent potential pump run-out conditions.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.13
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 47

Fire Area ID:	B-9
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. Only Fire Zone 67-U in this fire area has suppression and propagation of suppression water to adjoining areas does not challenge any equipment as the ponding level is less than the equipment installation heights. The other zones have no automatic suppression system, firefighting activities are from manual methods using hose stations, and discharge to the adjacent fire area can be controlled. Fire suppression activities will therefore not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-90-R-1014-12 “Penetration Seal Analysis for Penetration 0087-01-0042”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: This configuration has differences between the tested detail and the as-built penetration in that the size of the penetrant is larger than that stipulated in the seal detail. There is an additional 6 inches more silicone foam depth than required that results in a greater overall fire resistance of the seal. Therefore, this evaluation has determined that the deviation of penetration size from the tested design has negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-23 “Penetration Seal Analysis for Penetration 0070-01-0021”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The difference in construction between the tested detail and the as-built penetration is the number of penetrants exceeds that stipulated in the detail. The use of lightweight concrete for the seal is considered to be part of the original barrier, has greater heat insulating properties, and is of greater depth than that specified in the detail. This evaluation has determined that the number of penetrations greater than that shown in tested design has negligible impact and is, therefore, acceptable.

Fire Area ID:	B-9
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-26 “Penetration Seal Analysis for Penetration 0067-01-0026”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression in Fire Zone 67-U, detection in Fire Zone 20-Y, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-ANO1-FP-10-00001 “Engineering Evaluation for Penetration Seals in Fire Area H”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration FB-87-01-0042 used in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability are the combustible loading, the smoke detection in both Fire Zones 67-U and 87-H, suppression system in Fire Zone 87-H, and the prompt response by the fire brigade. This penetration is considered to be adequate for the hazards.

Engineering Evaluation ID: CALC-ANOC-FP-07-00003 “Watertight Fire Doors Evaluation”

Summary: Purpose: Evaluate watertight doors used in 3-hour rated fire barriers.

Basis for Acceptability: The watertight doors (DR-5, DR-30, DR-33, and DR-455) installed at ANO-1 in 3-hour rated fire barriers have been determined to be acceptable for use based on the hazards in the areas. Although these doors are not 3-hour rated fire doors, they will provide the protection needed in the areas they are used.

Engineering Evaluation ID: CALC-ANOC-FP-09-00011 “Fire Protection Engineering Evaluation of Units 1 & 2 Elevator Doors”

Summary: Purpose: The purpose of this EC is to evaluate the ANO-1 auxiliary building elevator doors to function in a 3-hour rated fire barrier. The elevator doors to be evaluated are:

Unit 1 Applicability

335' 20-Y, Fire Area C

354' 67-U, Fire Area B-9

386' 128- E, Fire Area B-1

404' 159-B, Fire Area B-1

Basis for Acceptability: Based on the low combustible loading, the availability of the smoke detection system, suppression in Fire Zones 67-U and 128E, and the availability of the fire brigade with manual firefighting equipment, the elevator doors are considered adequate for the hazards in the area and acceptable for the 3-hour rated fire barriers.

Fire Area ID: B-9
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
67-U	Lab and Demineralizer Access Room	P	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes
68-P	Reactor Coolant Makeup Tank Room	No	Yes	No	No	No	No	No	No	No	Yes	No	Yes
88-Q	Communications Room	No	No	No	No	No	No	No	No	No	No	No	No
89-P	Controlled Access (stairway)	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-9
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-12

Title: ANO-1 Fire Area B-9 Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

DID Maintained: The VFDRs, the associated fire area risks (CDF) and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Fire Area ID: B-9
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-12 (continued)

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: B9-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of control to condensate pumps P-2A through P-2C could result in non-controlled source of feedwater.

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR is associated with overcooling and SG overfill transient. Overcooling scenarios do not contribute to the core damage sequences in the fire PRA and therefore recovery of P-2A, P-2B, and P-2C are not risk significant. Overfill can only occur with simultaneous failure to trip the MFW (Main Feed Water) pumps. Since circuit analysis demonstrates that the MFW pump trip circuits remain available from the control room, along with the ability to close MSIVs to deprive the MFW pumps of a motive force (steam), this VFDR is not considered risk significant.

End of Fire Area B-9

Fire Area ID:	B-10
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
162-A	Stairwell No. 1

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power. The EDGs are available but not credited in this fire area.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.14
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 48

Fire Area ID: B-10
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. The stairwell does not contain automatic suppression and firefighting activities are limited to manual methods. The lack of combustibles in the stairwells limits discharge of manual suppression water and ponding in adjacent areas will be minimized. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
162-A	Stairwell No. 1	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	B-10
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-13

Title: ANO-1 Fire Area B-10 Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

Neither detection nor suppression is credited to screen the scenario within this fire area for a potential fire impact into an adjacent boundary (MCA). Use of the base scenario CCDP in this analysis incorporates the impact of a potential hot gas layer and envelopes the delta CDF/LERF. Therefore, no credit for detection or suppression is applied to reduce the CDF/LERF for this fire area.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: B-10
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-13 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: B10-01

VFDR: Fire damage to control and power cables in the area may impact inventory control functions resulting in the following:

a) Loss of power and control to makeup tank outlet valve CV-1275 resulting in the loss of isolation capability to preclude gas binding of the makeup pumps.

Loss of this function could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805,Section 4.2.4, with no further action required.

End of Fire Area B-10

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
20-Y	Radwaste Processing Room
31-Y	Purification Demineralizer Room
34-Y	Pipe Room
38-Y	Emergency Feedwater Pump Room
47-Y	Penetration Ventilation Room
53-Y	Lower North Piping Penetration Room

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Either the turbine driven EFW pump P-7A or the motor driven EFW pump P-7B is available to feed either SG-A or SG-B.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A feeds SW Loop 1 or P-4C feeds SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.15
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 49

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. This fire area has automatic suppression only at P-7A in Fire Zone 38-Y and at the BWST valves from the floor above. A curb surrounds P-7A to prevent propagation to other fire zones in Fire Area C or into Fire Zone 46-Y. The suppression water from the area at the BWST valves does not create sufficient ponding depth to challenge equipment for nuclear safety. Manual suppression activities can be controlled to minimize impact to other fire areas. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: Appendix R Exemption 05, FZ 20-Y, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance-based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 06, FZ 20-Y, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance-based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 08, FZ 34-Y, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance-based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 10, FZ 53-Y Not Meeting III.G.3 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance-based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 14, FZ 20-Y, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

Licensing Basis: This fire area was transitioned using the performance-based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 15, FZ 38-Y, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

Licensing Basis: This fire area was transitioned using the performance-based approach; therefore, this exemption is no longer required under the new licensing basis.

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Licensing Action: Appendix R Exemption 16, FZ 34-Y, Not Meeting III.G.2.c Criteria, approval letter 1CNA108806 dated October 26, 1988

Licensing Basis: This fire area was transitioned using the performance-based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 20, FZ 20-Y and 34-Y, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

Licensing Basis: This fire area was transitioned using the performance-based approach; therefore, this exemption is no longer required under the new licensing basis.

Engineering Evaluations

Engineering Evaluation ID: CALC-84-D-1043-01 "Fire Analysis of Hatch"

Summary: Purpose: Evaluate hatch at elevation 354' to determine if fire-proofing is required.

Basis for Acceptability: The hatch between Fire Zones 20-Y and 197-X is adequate for a 3-hour barrier with the application of fire-proofing.

Engineering Evaluation ID: CALC-90-R-1014-13 "Penetration Seal Analysis for Penetration 0183-01-0114"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection in Fire Zone 20-Y, partial suppression in Fire Zone 197-X, the limited combustible loading, and equivalent seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and therefore acceptable.

Engineering Evaluation ID: CALC-90-R-1014-23 "Penetration Seal Analysis for Penetration 0070-01-0021"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The difference in construction between the tested detail and the as-built penetration is the number of penetrants exceeds that stipulated in the detail. The use of lightweight concrete for the seal is considered to be part of the original barrier, has greater heat insulating properties, and is of greater depth than that specified in the detail. This evaluation has determined that the number of penetrations greater than that shown in tested design has negligible impact and is therefore acceptable.

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-26 “Penetration Seal Analysis for Penetration 0067-01-0026”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression in Fire Zone 67-U, detection in Fire Zone 20-Y, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and therefore acceptable.

Engineering Evaluation ID: CALC-ANO1-FP-09-00010 “Evaluation of Fire Barrier Penetration FB-183-01-0018 (EC13696)”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration FB-183-01-0018 to be used in a 3-hour rated fire area boundary based on approved fire tests.

Basis for Acceptability: The basis for the acceptability is that the installed configuration is bounded by the tested configuration due to the insignificant differences.

Engineering Evaluation ID: CALC-ANOC-FP-09-00011 “Fire Protection Engineering Evaluation of Units 1 & 2 Elevator Doors”

Summary: Purpose: The purpose of this EC is to evaluate the ANO-1 auxiliary building elevator doors to function in a 3-hour rated fire barrier. The elevator doors to be evaluated are:

<u>Unit 1 Applicability</u>

335' 20-Y, Fire Area C

354' 67-U, Fire Area B-9

386' 128- E, Fire Area B-1

404' 159-B, Fire Area B-1

Basis for Acceptability: Based on the low combustible loading, the availability of the smoke detection system, suppression in Fire Zones 67-U and 128-E, and the availability of the fire brigade with manual firefighting equipment, the elevator door are considered adequate for the hazards in the area and acceptable for the 3-hour rated fire barriers.

Engineering Evaluation ID: PEAR-95-4007 “Thunderline Link Seal Evaluation for FB-2026-05-0059”

Summary: Purpose: Evaluate the use of link-seals in a 3-hour rated barrier between Fire Zones 20-Y and 2026-Y.

Basis for Acceptability: The use of a link-seal is acceptable based upon lack of safe shutdown equipment in Fire Zone 2026-Y, the separation of this zone from other areas by concrete walls and ceiling, and the low combustible loading of the area.

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-09-00009 “Unit 1 Structural Steel Fire Protection Evaluation”

Summary: Purpose: The purpose of this evaluation is to document the fire protection engineering evaluation for the lack of structural steel fire proofing in the following locations:

B-1 (79-U, 149-E); B-8 (46-Y, 77-V, 105-T, 144-D); C (20-Y, 47-Y, 53-Y); I-1 (98-J); I-3 (112-I)

Basis for Acceptability: These rooms are protected by smoke detection systems that alarm in the control room (and suppression systems in the electrical penetration rooms) and the prompt response by the fire brigade with access to manual firefighting equipment should prevent any fire (in the unlikely event one does occur) from damaging the structural steel.

Engineering Evaluation ID: CALC-ANO1-FP-09-00015 “Engineering Evaluation for Penetration Seals in Fire Area B-1”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetrations in Fire Area B-1 used in a 3-hour rated fire area boundary.

The seals reviewed by this evaluation are:

- FB-79-01-0057 (from Fire Zones 79-U to 53-Y)
- FB-73-01-0034 and 0063 (from Fire Zones 73-W to 31-Y, and 34-Y)
- FB-149-01-0055 (from Fire Zones 149-E to 112-I)
- FB-2026-04-0055 (from Fire Zones 2026-Y to 34-Y)
- FB-160-01-0366 (from Fire Zones 160-B to 129-F)
- FB-0074-01-0057 and FB-0074-01-0058 (from Fire Zones 197-X to 34-Y)

Basis for Acceptability: The bases for the acceptability is the installed penetrations are considered to be adequate for the hazards based on:

- Detection system in Fire Zones 34-Y, 53-Y, 73-W, 79-U, 112-I, 129-F, 149-E, and 160-B
- Suppression system in Fire Zones 73-W, 79-U, 112-I, 129-F, and 149-E
- Combustible loading and fire brigade response using manual suppression

Engineering Evaluation ID: CALC-90-R-1014-19 “Penetration Seal Analysis for Penetration 0034-03-0011”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection in Fire Zone 34-Y, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and therefore acceptable.

Fire Area ID: C
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-20 "Penetration Seal Analysis for Penetration 0034-03-0013"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection in Fire Zone 34-Y, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and therefore acceptable.

Engineering Evaluation ID: CALC-90-R-1014-33 "Penetration Seal Analysis for Penetration 0038-05-0110"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: ER-ANO-2004-0803-000 "FB Penetration 79-01-129 Evaluation for Adequate Cellular Concrete Seal"

Summary: Purpose: Evaluate usage of cellular concrete seal.

Basis for Acceptability: The seal was determined to meet 3-hour requirements based upon the depth of cellular concrete exceeding the tested configuration.

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-09-00016 “Engineering Evaluation for Penetration Seals in Fire Area C”

Summary:

Purpose: The purpose of this evaluation is to document the acceptability of ANO-1 penetrations in Fire Area C used in 3-hour rated fire area boundaries.

The seals reviewed by this evaluation are:

From Fire Area C (38-Y) to B-@BOFZ (75-AA)
FB-0038-04-0133
FB-0038-04-0004
FB-0038-04-0138

From Fire Area C (53-Y) to B-7 (14-EE)
FB-0053-01-0094

From Fire Area C (20-Y) to A (10-EE)
FB-0049-01-0001
FB-0049-01-0004

From Fire Area C (20-Y) to K (16-Y)
FB-0018-05-0132

Basis for Acceptability: The penetrations listed are considered adequate for the hazards in their respective area based on:

- Acceptable combustible loading
- Smoke detection systems in Fire Zones 10-EE, 14-EE, 20-Y, 38-Y, and 53-Y
- Partial suppression system in Fire Zone 38-Y for the EFW turbine pump
- Full depth silicone foam for FB-0049-01-0001 and FB-0049-01-0004
- Response by the fire brigade team with manual firefighting equipment in the areas without automatic suppression

Engineering Evaluation ID: CALC-90-R-1014-21 “Penetration Seal Analysis for Penetration 0079-01-0001”

Summary:

Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon the total cross section area of the through metal being less than tested and 6 inches of silicone foam will successfully pass an ASTM E-119 fire exposure. This evaluation has determined that these deviations from the tested design have negligible impact and are, therefore, acceptable.

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-22 "Penetration Seal Analysis for Penetration 0079-01-0160"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon the total cross section area of the through metal being less than tested and 6 inches of silicone foam will successfully pass an ASTM E-119 fire exposure. This evaluation has determined that these deviations from the tested design have negligible impact and are, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-27 "Penetration Seal Analysis for Penetration 0079-01-0016"

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon a minimum of 6 inches of silicone foam successfully passing an ASTM E-119 fire exposure and that the as-built penetration having an additional layer of damming material than is required by the seal detail. This evaluation has determined that these deviations from the tested design have negligible impact and are, therefore, acceptable.

Engineering Evaluation ID: CALC-ANOC-FP-09-00004 "Fire Protection Engineering Evaluation of Units 1 & 2 Containment Building Penetrations"

Summary: Purpose: The purpose of this fire protection engineering evaluation is to evaluate the ANO-1 Reactor Building penetrations used in a 3-hour rated fire area boundary.

Basis for Acceptability:

- Low probability of a fire starting in the areas of the penetrations
- The installed smoke detection and suppression systems in electrical penetration rooms (Fire Zones 105-T, 112-I, 144-D, and 149-E)
- The installed detection in mechanical penetration rooms (Fire Zones 46-Y, 53-Y, 77-V, 79-U, and 159-B) with the exception of Fire Zone 170-Z which does not credit detection
- Fire resistive materials used in the penetrations
- Prompt response by the fire brigade with access to manual firefighting equipment for those areas in the auxiliary buildings

Fire Area ID: C
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Required Fire Protection Systems and Features

		Installed		Required?											
				Separation		LA		EEEE		Risk		DID			
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET		
20-Y	Radwaste Processing Room	P	Yes	No	No	No	No	No	Yes	No	Yes	Yes	Yes		
31-Y	Purification Demineralizer Room	No	No	No	No	No	No	No	No	No	No	No	No		
34-Y	Pipe Room	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes		
38-Y	Emergency Feedwater Pump Room	P	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes		
47-Y	Penetration Ventilation Room	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes		
53-Y	Lower North Piping Penetration Room	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes		

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-14

Title: ANO-1 Fire Area C Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with the identified recoveries. In addition, there are global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1(VFDR C-03-e), SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 (VFDR C-01-b) and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system located in Fire Area C is credited in the ANO-1 HGL and MCA for Fire Zones 20-Y, 34-Y, 38-Y, 47-Y and 53-Y. No credit for an automatic suppression system is taken in this fire area.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: C
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-14 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: C-01

VFDR: Fire damage to control and power cables in the area may impact inventory control functions resulting in the following:

a) Spurious operation of valve CV-1220 (IN 92-18) results in the inability to open valve to provide RCS makeup path through HPI line
b) Spurious operation of valve CV-1405 (IN 92-18) results in a loss of BWST to the reactor building sump
c) Loss of BWST outlet valves CV-1407 and CV-1408 results in a loss of borated water source to makeup pumps
d) Loss of makeup pumps P-36A, P-36B and P-36C

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for CV-1220

b) Modification to remove spurious opening of CV-1405

c) No further action is required for CV-1407 and CV-1408

d) No further action is required makeup pumps P-36A, P-36B, and P-36C

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: C-02

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of EFW pump turbine control panel C531 could result in loss of control for EFW Pump P-7A
b) Loss of power to motor driven EFW pump P-7B
c) Loss of control capability for valve CV-2627 and spurious operation of CV-2645 results in the inability to feed SG-A from P-7A
d) Spurious operation of valve CV-2646 results in the inability to feed SG-A from P-7B
e) Spurious operation of valve CV-2647 and CV-2648 results in the inability to reposition the valve to isolate SG-B
f) Loss of control capability for MSIVs CV-2691 (pilot valves SV-0611 & SV-0711) and CV-2692 (pilot valves SV-0621 & SV-0721) preventing isolation of SGs A and B

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for control panel C-531 and EFW pump P-7A

b) No further action is required for P-7B

c) No further action is required for CV-2627 and CV-2645

d) No further action is required for CV-2646

e) No further action is required for CV-2647 and CV-2648

f) No further action is required for MSIVs CV-2691 and CV-2692

Fire Area ID:	C
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: C-03

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of power to SW pumps P-4A, P-4B, and P-4C
b) Loss of CV-3811 and CV-3820 results in the inability to isolate SW loops and the possibility of SW pump run-out
c) Spurious opening of CV-3642 if P-4C is available to feed Loop 2
d) Spurious closure of CV-3644 if P-4A is available to feed Loop 1
e) Spurious closure of Sluice Gate SG-1 could result in loss of SW to Loop 1

Loss of these functions could challenge the Vital Auxiliaries Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for SW pumps P-4A, P-4B, and P-4C

b) No further action is required for CV-3811 and CV-3820

c) No further action is required for CV-3642

d) No further action is required for CV-3644

e) Modification to remove spurious closing of SG-1

End of Fire Area C

Fire Area ID: D
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	Description
1-E	North EDG Exhaust Fans
86-G	North Emergency Diesel Generator Room

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.16
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 50

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. Both doorways leading from this room have installed curb plates that in combination with the scuppers prevents migration of suppression water that could impact the redundant EDG or other equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: D
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: Appendix R Exemption 13a, FZ 1-E, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

Licensing Basis: This fire area was transitioned using updated analyses regarding where a loss of offsite power can occur. This exemption is no longer required.

Engineering Evaluations

Engineering Evaluation ID: CALC-ANO1-FP-09-00013 “Engineering Evaluation of Openings in the West Walls of the EDG Rooms”

Summary: Purpose: The purpose of this evaluation is to evaluate the unprotected openings in the west (exterior) walls of the ANO-1 EDG rooms.

Basis for Acceptability: The bases for the acceptability is that the openings are considered to be adequate for the hazards in the area since the fire barrier does not separate redundant trains of safe shutdown equipment. Additionally, the near side is protected by a smoke detection system, flame detection system, and a suppression system to prevent fire growth. Also, the fire brigade should respond in a timely manner to begin firefighting activities before a fire could grow past the early stage.

Engineering Evaluation ID: CALC-ANO1-FP-10-00002 “Engineering Evaluation for Penetration Seals in Fire Area D”

Summary: Purpose: The purpose of this engineering report is to evaluation the discrepancy between ANO-1 penetration seal FB-86-04-0026 and the tested configuration to determine if the installed penetration seal between Fire Zones 86-G and 87-H is acceptable for use in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability are the combustible loading, the smoke detection and flame detection systems on both sides, the suppression systems on both sides, and the prompt response by the fire brigade. This penetration is considered to be adequate for the hazards.

Engineering Evaluation ID: CALC-ANOC-FP-09-00001 “Ventilation Opening in Units 1 & 2 EDG Room”

Summary: Purpose: The purpose of this evaluation is to evaluate the lack of fire dampers in the ventilation openings for the EDG rooms.

Basis for Acceptability: The bases for the acceptability are the smoke and flame detection systems, and suppression system in the EDG room would detect and suppress a fire in the early stage and prevent its growth. The smoke detection system in the exhaust fan rooms (1-E & 2-E) would also detect a fire in the early stage and alert Operations personnel to the fire. Manual firefighting equipment is located in rooms adjacent to the EDG room and exhaust rooms. The configuration of the exhaust fan rooms would also prevent fire to propagate to the other exhaust fan room or EDG rooms.

Fire Area ID: D
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
1-E	North EDG Exhaust Fans	No	Yes	No	No	No	No	No	Yes	No	No	No	No
86-G	North Emergency Diesel Generator Room	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area D

Fire Area ID:	E – South Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	Description
100-N	South Switchgear Room

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36B and P-36C are available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The turbine driven EFW pump P-7A is aligned to feed SG-B.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-4 is aligned to offsite power. The EDG is available but not credited in this fire area.	
5b. Vital Auxiliaries (SW)	SW pump P-4B (swing pump) or P-4C feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.17
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 51

Fire Area ID: E – South Switchgear Room
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. This fire area has no automatic suppression system and firefighting activities are limited to manual methods where the discharge of suppression water can be controlled. Propagation of any suppression water would go into the turbine building where the large open area of minimizes any ponding concerns. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-ANO1-FP-09-00017 "Engineering Evaluation for Penetration Seals in Fire Area E"

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration seals in Fire Area E to be used in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability is the low fire duration on both sides, smoke detection systems on both sides (73-W and 100-N), suppression systems in Fire Zone 73-W, and the response by the fire brigade to suppress a fire in the early stage on either side.

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
100-N	South Switchgear Room	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	E – South Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-16

Title: ANO-1 Fire Area E Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Fire Area ID:	E – South Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-16 (continued)

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: E-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of EFW turbine control panel C531 resulting in a loss of EFW pump P-7A
b) Spurious operation of valve CV-2620 may result in a loss of flow from EFW pump P-7A to SG-B
c) Spurious operation of valve CV- 2627 may result in a loss of flow from EFW pump P-7A to SG-A
d) Loss of control room capability to MSIV CV-2692 (SV-0621 & SV-0721) preventing isolation capability

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further actions are required for C531/ P-7A
b) No further actions are required for CV-2620
c) No further action is required for CV-2627
d) No further actions are required for CV-2692

Fire Area ID:	E – South Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: E-02

VFDR: Fire damage to cables in the area may affect SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Spurious operation of SW cross connect valve CV-3640 may result in a loss of SW when P-4B is aligned to supply SW Loop 2 and P-4C is out of service
b) Spurious operation of SW cross connect valve CV-3644 may prevent isolation of SW loops to prevent SW pump run-out if only one pump is available

Loss of these functions could challenge the Vital Auxiliaries Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further actions are required for CV-3640
b) No further actions are required for CV-3644

VFDR ID: E-03

VFDR: Fire damage to cables in the area may impact inventory control functions resulting in the following:

a) Spurious operation of reactor building spray pump P-35A resulting in a flow diversion of BWST inventory
b) Loss of control room capability to High Pressure Injection (HPI) pump P-36B(G) if P-36C is out of service

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further actions are required for P-35A
b) No further actions are required for P-36B(G)

End of Fire Area E

Fire Area ID:	F – South Battery and DC Equipment Rooms
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
110-L	South Battery Room

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36B or P-36C is available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A is available to feed either SG-A or SG-B.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-4 is aligned to onsite EDG.	
5b. Vital Auxiliaries (SW)	SW pump P-4B (swing pump) or P-4C feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.18
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 52

Fire Area ID: F – South Battery and DC Equipment Rooms
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. This fire area has no automatic suppression system and one entrance from Fire Zone 98-J where excess fire water from manual suppression activities will propagate. Corridor 98-J is equipped with two large floor drains to minimize any ponding concerns. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.
Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
110-L	South Battery Room	No	Yes	No	No	No	No	No	No	No	Yes	No	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	F – South Battery and DC Equipment Rooms
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-17

Title: ANO-1 Fire Area F Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

<u>Credited Recovery Actions</u>

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

<u>Credited Modifications</u>

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1 (VFDR F-02), and H-2 VFDR F-02) will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

<u>IN-92-18 Concerns</u>

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

<u>Additional Fire Area Considerations</u>

The detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID:	F – South Battery and DC Equipment Rooms
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-17 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: F-01

VFDR: Fire damage to DC equipment and cables in the area may impact EFW functions resulting in the following

a) Loss of control room trip capability to secure the non-credited EFW Pump P-7B
b) Spurious operation and loss of power to valve CV-2620 resulting in loss of flow from EFW pump P-7A to SG-B
c) Spurious operation and loss of power to valve CV-2627 resulting in loss of flow from EFW pump P-7A to SG-A
d) Loss of control to condensate pumps P-2A and P-2C could result in uncontrolled source of feedwater.

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required as securing P-7B is associated with overcooling transients. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and, therefore, failure to trip this pump is not risk significant.
b) No further action is required as additional circuit analysis has shown spurious closure of CV-2620 will not occur.
c) Modification to provide an AFW pump mitigates failure of CV-2627.
d) No further action is required as P-2A and P-2C are associated with overcooling transients. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and, therefore, failure to trip these pumps is not risk significant.

Fire Area ID:	F – South Battery and DC Equipment Rooms
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: F-02

VFDR: Fire damage to cables in the area may impact pressure and inventory control functions resulting in the following:

a) Loss of the control room trip capability of the RCPs P-32A and C. Securing the pumps is required to prevent potential RCP seal damage.

Loss of these functions could challenge the Pressure and Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with modification to supply H-1 & H-2 with redundant DC control power.

End of Fire Area F

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
97-R	Cable Spreading Room
129-F	ANO-1 Control Room
2098-C	CPC Room
2098-L	Unit 2 Cable Spreading Rooms
2119-H	Printer Room
2136-I	Health Physics Room
2137-I	Upper South Electrical Penetration Room
2150-C	Core Protection Calculator Room (Old CPC Room)
2199-G	ANO-2 Control Room

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36B or P-36C is available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The turbine driven EFW pump P-7A is aligned to feed either SG-A or SG-B.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-4 is aligned to onsite power from green train EDG.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pump P-4B (swing pump) or P-4C feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	Control room abandonment. The SPDS room heating, ventilation, and air conditioning (HVAC) is powered from an ANO-2 power source.	
6. Process Monitoring	Instrumentation is available in the TSC (Technical Support Center) to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure using SPDS.	

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Reference Document
CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.19
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 53

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. Automatic suppression in the ANO-1 fire area is limited to the cable spreading room. Propagation of any suppression water from the ANO-1 cable spreading room would go into the turbine building where the large open area of minimizes any ponding concerns. The ANO-2 fire zones with automatic suppression included in this area are either physically isolated or separated by fire doors that can be controlled to limit any excess flow into ANO-1 areas. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: Appendix R Exemption 12, Not Meeting III.L Criteria, approval letter 1CNA058303 dated May 11, 1983.

Licensing Basis: This exemption is no longer required because NFPA 805 does not require 8-hour battery backed emergency lighting.

Engineering Evaluations

Engineering Evaluation ID: CALC-85-E-0053-07 "Suppression Evaluation for Room 96 and Room 111 at Elev. 372'"

Summary: Purpose: Evaluate the need to install an automatic suppression system in Room 96 (ICS Relay Room) in Fire Zone 97-R or Room 111 (Electrical Equipment room) in Fire Zone 98-J.

Basis for Acceptability: Automatic suppression is not needed in Room 111 based upon the installed automatic detection, three (3)-hour rated construction on all sides except for the east wall, and automatic suppression in rooms to the west and east.

Engineering Evaluation ID: CALC-90-R-1014-01 "Penetration Seal Analysis for Penetration 0097-05-0001"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression and detection in Fire Zone 97-R, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-03 "Penetration Seal Analysis for Penetration 0097-01-0037"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression in Fire Zone 97-R, detection on both sides of the seal, and the limited combustible loading. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-04 "Penetration Seal Analysis for Penetration 0097-01-0040"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression and detection in Fire Zone 97-R, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-06 "Penetration Seal Analysis for Penetration 0097-01-0048"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression and detection in Fire Zone 97-R, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-14 "Penetration Seal Analysis for Penetration 0129-05-0264"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire suppression and detection in Fire Zone 129-F, and the limited combustible loading. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Fire Area ID: G – Control Room
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-38 "Penetration Seal Analysis for Penetration 0129-01-0734"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-39 "Penetration Seal Analysis for Penetration 0129-01-0186"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon equivalency of metal instrument tubing to electrical conduit. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-40 "Penetration Seal Analysis for Penetration 0129-01-0020"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-41 "Penetration Seal Analysis for Penetration 0129-01-0023"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Fire Area ID: G – Control Room
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-42 "Penetration Seal Analysis for Penetration 0129-01-0070"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-43 "Penetration Seal Analysis for Penetration 0129-01-0082"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-44 "Penetration Seal Analysis for Penetration 0129-01-0094"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-45 "Penetration Seal Analysis for Penetration 0129-01-0161"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-90-R-1014-46 "Penetration Seal Analysis for Penetration 0129-01-0173"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-47 "Penetration Seal Analysis for Penetration 0129-01-0192"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-48 "Penetration Seal Analysis for Penetration 0129-01-0200"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-90-R-1014-49 "Penetration Seal Analysis for Penetration 0129-01-0212"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection and suppression on both sides of the seal, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-07-00001 “Penetration Seal Analysis for Penetration 0097-01-0045”

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize the seal in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon equivalency of penetrating items, smaller penetration area, and less free space. This evaluation has determined the deviation from tested design as having negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-ANO1-FP-09-00015 “Engineering Evaluation for Penetration Seals in Fire Area B-1”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetrations in Fire Area B-1 used in a 3-hour rated fire area boundary.

The seals reviewed by this evaluation are:

- FB-79-01-0057 (from Fire Zones 79-U to 53-Y)
- FB-73-01-0034 and 0063 (from Fire Zones 73-W to 31-Y, and 34-Y)
- FB-149-01-0055 (from Fire Zones 149-E to 112-I)
- FB-2026-04-0055 (from Fire Zones 2026-Y to 34-Y)
- FB-160-01-0366 (from Fire Zones 160-B to 129-F)
- FB-0074-01-0057 and FB-0074-01-0058 (from Fire Zones 197-X to 34-Y)

Basis for Acceptability: The acceptability is the installed penetrations are considered to be adequate for the hazards based on:

- Detection system in fire zones 34-Y, 53-Y, 73-W, 79-U, 112-I, 129-F, 149-E, and 160-B
- Suppression system in fire zones 73-W, 79-U, 112-I, 129-F, and 149-E
- Combustible loading and fire brigade response using manual suppression

Engineering Evaluation ID: CALC-87-E-0024-01 “Evaluation of Fire Seal Required at Doorway Elev. 386’ ANO-1 CR to ANO-2 CR”

Summary: Purpose: Evaluate seal requirements at doorway between ANO-1 and ANO-2 control rooms.

Basis for Acceptability: The embedded steel plate located at the joint in the doorway between control rooms prevents a fire originating at areas outside Fire Area G from spreading into the control rooms.

Engineering Evaluation ID: CALC-ANOC-FP-09-00013 “Fire Protection Engineering Evaluation for Penetration Seals in Fire Area G”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of penetrations in Fire Area G used in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability is the seal are considered to be adequate for the hazards in the area based on the combustible loading, smoke detection on both sides (97-R, 129-F, and 197-X), suppression system in Fire Zone 97-R, and the response by the fire brigade to suppress the fire in the early stage.

Fire Area ID: G – Control Room
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANOC-FP-10-00001 “Fire Protection Engineering Evaluation for Penetration Seals in Fire Area G”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of penetrations in Fire Area G used in a 3-hour rated fire area boundary.

Basis for Acceptability: The seals are considered to be adequate for the hazards in the area based on the combustible loading, smoke detection system or line type heat detectors in Fire Zones 97-R and 129-F, suppression system in Fire Zones 97-R and 129-F, and the response by the fire brigade to suppress the fire and prevent significant damage (with firefighting equipment in the area).

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
97-R	Cable Spreading Room	P*	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes
129-F	ANO-1 Control Room	P**	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes
2098-C	CPC Room	Yes**	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes
2098-L	Unit 2 Cable Spreading Rooms	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes
2119-H	Control Room Printer Room	No	Yes	No	No	No	No	No	No	No	Yes	No	Yes
2136-I	Health Physics Room	P	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes
2137-I	Upper South Electrical Penetration Room	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes
2150-C	Core Protection Calculator Room (Old CPC Room)	No	Yes	No	No	No	No	No	No	No	Yes	No	Yes
2199-G	ANO-2 Control Room	No	Yes	No	No	No	No	No	No	No	Yes	No	Yes

* No suppression in Room 96 ICS Relay Room
** Halon suppression above control room false ceiling and below auxiliary control room floor. Halon in Fire Zone 2098-C
P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-18

Title: ANO-1 Fire Area G Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with the identified recoveries and modifications. In addition, there are global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

There following equipment is recovered in the post transition baseline case:

- The new AFW pump locally aligned and operated
- Letdown valve CV-1221 is manually closed (VFDR G-02-a)
- PSV-1000 is disabled by removing power (VFDR G-01)
- RCP P-32A is tripped at switchgear (VFDR G-02-d)
- RCP P-32B is tripped at switchgear (VFDR G-02-d)
- RCP P-32C is tripped at switchgear (VFDR G-02-d)
- RCP P-32D is tripped at switchgear (VFDR G-02-d)
- Makeup pump P-36A is tripped at switchgear (VFDR G-02-e)
- Makeup pump P-36B is tripped at switchgear (VFDR G-02-e)
- Makeup pump P-36C is tripped at switchgear (VFDR G-02-e)

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2 (VFDR G-05-a), SG-3, and SG-4 (VFDR G-05-a) have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case (VFDR G-02-c).

Fire Area ID: G – Control Room
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-18 (continued)

Summary: (continued) The following modifications are area specific and credited to reduce risk in this fire area:

- C-20 will have detection installed
- CV-1221 circuit will be modified to prevent spurious operation and resolve IN 92-18 issue (VFDR G-02-a)
- CV-1052 circuit will be modified to prevent spurious opening (LERF)
- CV-1053 circuit will be modified to prevent spurious opening (LERF)
- CV-4400 circuit will be modified to prevent spurious opening (LERF)
- CV-4446 circuit will be modified to prevent spurious opening (LERF)
- CV-5611 circuit will be modified to prevent spurious opening (LERF)
- CV-5612 circuit will be modified to prevent spurious opening (LERF)
- CV-7401 circuit will be modified to prevent spurious opening (LERF)
- CV-7402 circuit will be modified to prevent spurious opening (LERF)
- CV-7403 circuit will be modified to prevent spurious opening (LERF)
- CV-7404 circuit will be modified to prevent spurious opening (LERF)

IN-92-18 Concerns

An operator action has been credited to isolate MOV CV-1221 to secure letdown. CV-1221 may not be repositionable due to damage following spurious operation. A plant modification has been identified to modify MOV CV-1221 to prevent spurious operation.

Additional Fire Area Considerations

The detection system located in Fire Area G in Fire Zones 129-F, 97-R, 2098-C, 2098-L, 2119-H, 2136-I, 2137-I, 2150-C, and 2199-G was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer. Automatic suppression systems are also credited in this fire area in Fire Zones 2098-C, 2098-L, 2136-I, and 2137-I.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-18 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods for echelon 1 (prevention) and echelon 2 (detection & suppression). Defense in depth recovery actions (echelon 3) are identified to protect selected green train equipment listed by verifying/performing the following

Inventory and Pressure Control

- CV-1000 electromatic relief valve (ERV) isolation valve closed
- D-21 breakers 1, 3, 9, 29, and 32 opened to remove DC power to switchgear and fail RCS vent and drain paths closed.
- CV-1408 BWST outlet valve opened
- CV-1275 Makeup tank outlet valve closed
- CV-1227/CV-1228 HPI block valves opened
- CV-1206 RCP seal injection valve closed
- CV-1274 RCP seal bleed off closed
- P-36C HPI/makeup pump locally operated
- P-36B HPI/makeup pump locally operated

DHR (Steam Generator)

- K-2A and K-2B MFW pumps tripped
- K-1 main turbine tripped

Vital Auxiliaries

- CV-3807 SW valve to EDG #2 cooler opened
- CV-3643 ACW isolation valve closed
- P-4B/P-4C SW pumps aligned
- Load Center B-6 manually controlled to align/isolate power as required
- K-4B (EDG #2 secured if output breaker A-408 is open
- Switchgear A-4 breaker A-409 open to isolate non-ES bus
- Switchgear A-410 verified open to prevent EDG2 overload
- 125 VDC Bus RA-2 breakers 3 and 4 opened to prevent spurious operation of P-4B and P-36B
- K-4B (EDG #2) locally operated

Protect Cold Shutdown Equipment/shed unnecessary loads

- P-35B reactor building (RB) spray pump is tripped
- P-34B low pressure injection (LPI) / decay heat removal (DHR) pump tripped

No procedural changes or modifications are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDRS

VFDR ID: G-01

VFDR: Fire damage to control cables in the area may affect pressure control functions. The control circuits affected result in the following:

a) Loss of control and spurious opening of ERV block valve CV-1000 can result in RCS depressurization
b) Loss of control to pressurizer heaters M-308, M-309, and M-310 results in loss of trip capability from the control room

Loss of these functions could challenge the Pressure Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with this function maintained by recovery of PSV-1000. Disposition of specific VFDRs are as follows:

a) Defense in Depth action for CV-1000
b) No further action is required as spurious operation of pressurizer heaters is not a contributor to core damage sequences in the Fire PRA, and therefore is not risk significant

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: G-02

VFDR: Fire damage to control cables in the area may affect inventory control functions resulting in the following:

a) Loss of control to letdown block valve CV-1221 (IN 92-18) preventing isolation of the RCS
b) Spurious operation of valve CV-1206 (IN 92-18) resulting in loss of isolation capability to prevent thermal shock of the RCP seals when restoring makeup from BWST
c) Spurious operation of outboard sump isolation valves CV-1405 (IN 92-18) and CV-1406 (IN 92-18) resulting in loss of makeup inventory to the sump
d) Loss of control and the inability to trip RCPs P-32A, P-32B, P-32C, and P-32D potentially creates a seal LOCA
e) Loss of control and inability to secure makeup pumps P-36A, B, and C and then start P-36B or P-36C depending upon availability
f) Loss of control and spurious operation of RB spray pumps P-35A and P-35B resulting in a loss of makeup inventory
g) Loss of control prevents securing a spuriously started LPI/DH pump P-34B
h) Loss of control and spurious operation of BWST outlet valves CV-1407 (IN-92-18) and CV-1408 (IN 92-18) can prevent alignment to the borated water source for makeup
i) Loss of control of inboard sump isolation valves CV-1414 (IN 92-18) and CV-1415 (IN-92-18) can prevent alignment to sump if drain down of BWST occurs
j) Loss of control to the HPI valves CV-1284 (IN 92-18), CV-1285 (IN 92-18), CV-1227 (IN 92-18), or CV-1228 (IN 92-18). Only one of the four needs to be open.
k) Loss of control to makeup tank outlet valve CV-1275 resulting in the loss of isolation capability to preclude gas binding of the makeup pumps
l) Spurious operation of RCS vent valves SV-1071, SV-1072, SV-1073, SV-1074, SV-1077, SV-1079, SV-1081, SV-1082, SV-1083, SV-1084, SV-1091, SV-1092, SV-1093, and SV-1094 could result in a loss of RCS inventory
m) Spurious operation of RCP seal bleed-off to quench tank valves SV-1270, SV-1271, SV-1272, and SV-1273 could result in a loss of RCS inventory
n) Loss of control and inability to close RCP controlled bleed-off return valve CV-1274 (IN 92-18) can create an inventory loss path to an isolated makeup tank
o) Loss of control of HPI minimum recirculation path valve CV-1300 (IN 92-18) results in a diversion path for RCS makeup

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: G-02 (continued)

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) Modification to prevent spurious operation and a local recovery to close CV-1221
b) Defense in depth action for CV-1206
c) Modification to prevent spurious opening of CV-1405 and CV-1406
d) Defense in depth action to open breaker D-2101 isolating DC control power and recovery actions to locally trip RCPs P-32A, P-32B, P-32C, and P-32D at the switchgear
e) Recovery action to trip P-36A, B, and C and with defense in depth actions to start P-36B or P-36C
f) No further action for P-35A and defense in depth action to locally trip P-35B
g) Defense in depth action to secure P-34B
h) No further action for CV-1407 and defense in depth action to open CV-1408
i) No further action for CV-1414 and CV-1415
j) No further action for CV-1284, CV-1285, and defense in depth actions to open CV-1227 or CV-1228
k) Defense in depth action to close CV-1275
l) Defense in depth action to open breaker D-2129 and fail close SV-1072, SV-1074, SV-1082, SV-1084, SV-1092, and SV-1094. No further action for SV-1071, SV-1073, SV-1077, SV-1079, SV-1081, SV 1083, SV-1091, and SV-1093
m) Defense in depth action to open breaker D-2132 and fail close SV-1270, SV-1271, SV-1272, and SV-1273
n) Defense in depth action to close CV-1274
o) No further action for CV-1300

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: G-03

VFDR: ANO-1 provides actions to align flow from the turbine driven EFW pump P-7A to either SG for control room abandonment. The assumption is that operations will make an informed decision based upon instrumentation and equipment availability to select a SG for DHR. The VFDRs listed below reflect this philosophy. Fire damage to cables in the area may affect EFW functions resulting in the following:

a) Loss of EFW pump turbine control panel C531 could result in loss of control for EFW Pump P-7A
b) Loss of control and trip functions for non-credited motor driven pump P-7B
c) Loss of control and spurious closure of SG-B to P-7A steam block valve CV-2617 (IN 92-18)
d) Loss of control to P-7A steam admission valves CV-2613 (IN 92-18) and CV-2663 (IN 92-18)
e) Loss of control and spurious closure of SG-A to P-7A steam block valve CV-2667 (IN 92-18)
f) Loss of control capability of atmospheric dump block valve CV-2618 resulting in inability to isolate SG-B
g) Loss of control capability of valve CV-2620 (IN 92-18) and CV-2647 resulting in loss of flow from EFW pump P-7A to SG-B
h) Loss of control capability of valves CV-2627 (IN 92-18) and CV-2645 resulting in loss of flow from EFW pump P-7A to SG-A
i) Loss of control capability of atmospheric dump block valve CV-2668 resulting in inability to isolate SG-A
j) Loss of control capability for MSIVs CV-2691 (pilot valves SV-0611 & SV-0711) and CV-2692 (pilot valves SV-0621 & SV-0721) preventing isolation of SGs A and B
k) Spurious operation of condensate supply valve CV-2802 results in loss of a water source to EFW pump P-7A
l) Spurious opening of EFW test recirculation valve CV-2870 (IN 92-18) can result in a diversion of EFW
m) Spurious operation of AFW pump P-75 combined with inability to trip condensate pump P2A, P-2B, or P-2C resulting in uncontrolled feed-water source to the SGs

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action associated with C531 and P-7A
b) No further action for P-7B
c) No further action for CV-2617
d) No further action for CV-2613 and CV-2663
e) No further action for CV-2667
f) No further action for CV-2618
g) No further action for CV-2620 and CV-2647
h) No further action for CV-2627 and CV-2645
i) No further action for CV-2668
j) No further action for CV-2691and CV-2692
k) No further action for CV-2802
l) No further action for CV-2870
m) No further action for P-75, P2A, P-2B, or P-2C

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: G-04

VFDR: Fire damage to control cables in the area may affect vital auxiliary electrical functions resulting in the following:

a) Loss of control and the inability to trip breaker A-409 preventing transfer to EDG #2 (K-4B)
b) Loss of control and spurious closure of A-410 resulting in the A-4 bus being tied to the A-3 bus
c) Loss of control to EDG K-4B results in the loss of onsite power to bus A-4
d) Loss of control and the inability to close breaker A-408 preventing EDG K-4B from energizing engineered safety bus A-4
e) Loss of control to 480 VAC load center B-6 resulting in a loss of power to motor control centers
f) Loss of control to EDG #2 ventilation supply fans VEF-24C and VEF-24D

Loss of these functions could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) Defense in depth action to trip A-409
b) Defense in depth action to open A-410
c) Defense in depth action to secure/locally control EDG K-4B
d) No further action for A-408
e) Defense in depth action to align B-6
f) No further action for VEF-24C and VEF-24D

Fire Area ID:	G – Control Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: G-05

VFDR: Fire damage to control cables in the area may affect SW functions. SW provides cooling to the EDGs and lube oil coolers for the primary makeup pumps. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once depletion of condensate occurs. The control circuits affected result in the following:

a) Loss of control and spurious closure of sluice gate SG-2 and SG-4 depriving the SW pumps of a suction source
b) Loss of control capabilities to SW pump P-4C or swing pump P-4B resulting in a loss of Loop 2 SW
c) Loss of control for valve CV-3643 (IN 92-18) resulting in a diversion of SW to ACW
d) Loss of control and spurious closure of SW cross tie valves CV-3640 and CV-3642 if P-4C is OOS (out of service) and P-4B is aligned to Loop 2
e) Loss of control and spurious opening of CV-3644 if P-4B is aligned to Loop 2 and Loop 1 is to be isolated
f) Loss of control and spurious closure of CV-3807 (IN 92-18) resulting in a loss of EDG #2 jacket cooling
g) Loss of control of valve CV-3811 (IN 92-18) prevents isolation of SW Loop 2 from Loop 1
h) Loss of control of CV-3851 (IN 92-18) prevents opening to supply EFW pump P-7A with SW for long-term heat removal after depletion of condensate

Loss of these functions could challenge the Vital Auxiliaries (Service water) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) Modification to prevent spurious closure of SG-2 and SG-4
b) Defense in depth actions to align P-4C or P-4B
c) Defense in depth action for CV-3643
d) No further action for CV-3640 and CV-3642
e) No further action for CV-3644
f) Defense in depth action for CV-3807
g) No further action for CV-3811
h) No further action for CV-3851

End of Fire Area G

Fire Area ID:	H – South Emergency Diesel Generator Room
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	**Description**
2-E	South EDG Exhaust Fans
87-H	South Emergency Diesel Generator Room

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using the normal charging path to the RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.20
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 54

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. The curb plate in the doorway to the adjacent diesel generator room, in combination with the scuppers, prevents migration of suppression water that could impact the redundant diesel generator. The other door leads to an upward sloping corridor that would prevent migration of water to other areas. Fire suppression activities will therefore not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: H – South Emergency Diesel Generator Room
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: Appendix R Exemption 13b, FZ 2-E, Not Meeting III.G.2.b Criteria, approval letter 1CNA108806 dated October 26, 1988

Licensing Basis: This fire area was transitioned using updated analyses on where a loss of offsite power can occur. This exemption is no longer required.

Engineering Evaluations

Engineering Evaluation ID: CALC-90-R-1014-12 "Penetration Seal Analysis for Penetration 0087-01-0042"

Summary: Purpose: Evaluate the penetration seal to determine if it is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: This configuration has differences between the tested detail and the as-built penetration in that the size of the penetrant is larger than that stipulated in the seal detail. There is an additional 6 inches more silicone foam depth than required that results in a greater overall fire resistance of the seal. Therefore, this evaluation has determined that the deviation of penetration size from the tested design has negligible impact and is, therefore, acceptable.

Engineering Evaluation ID: CALC-ANO1-FP-09-00013 "Engineering Evaluation of Openings in the West Walls of the EDG Rooms"

Summary: Purpose: The purpose is to evaluate the unprotected openings in the west (exterior) walls of the ANO-1 EDG rooms.

Basis for Acceptability: The bases for the acceptability is that the openings are considered to be adequate for the hazards in the area since the fire barrier does not separate redundant trains of safe shutdown equipment. Additionally, the near side is protected by a smoke detection system, flame detection system, and a suppression system to prevent fire growth. Also, the fire brigade should respond in a timely manner to begin firefighting activities before a fire could grow past the early stage.

Engineering Evaluation ID: CALC-ANO1-FP-10-00001 "Engineering Evaluation for Penetration Seals in Fire Area H"

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration FB-87-01-0042 used in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability are the combustible loading, the smoke detection in both Fire Zones 67-U and 87-H, the suppression system in Fire Zone 87-H, and the prompt response by the fire brigade. This penetration is considered to be adequate for the hazard.

Engineering Evaluation ID: CALC-ANO1-FP-10-00002 "Fire Protection Engineering Evaluation for Penetration Seals in Fire Area D"

Summary: Purpose: The purpose of this engineering report is to evaluation the discrepancy between ANO-1 penetration seal FB-86-04-0026 and the tested configuration to determine if the installed penetration seal between Fire Zones 86-G and 87-H is acceptable for use in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability are the combustible loading, the smoke detection and flame detection systems on both sides, the suppression systems on both sides, and the prompt response by the fire brigade. This penetration is considered to be adequate for the hazards.

Fire Area ID: H – South Emergency Diesel Generator Room
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Engineering Evaluation ID: CALC-ANOC-FP-09-00001 "Ventilation Opening in Units 1 & 2 EDG Room"

Summary: Purpose: The purpose of this evaluation is to evaluate the lack of fire dampers in the ventilation openings for the EDG rooms.

Basis for Acceptability: The bases for the acceptability are the smoke and flame detection systems, and suppression system in the EDG room would detect and suppress a fire in the early stage and prevent its growth. The smoke detection system in the exhaust fan rooms (1-E & 2-E) would also detect a fire in the early stage and alert Operations personnel to the fire. Manual firefighting equipment is located in rooms adjacent to the EDG room and exhaust rooms. The configuration of the exhaust fan rooms would also prevent fire to propagate to the other exhaust fan room or EDG rooms.

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
2-E	South EDG Exhaust Fans	No	Yes	No	No	No	No	No	Yes	No	No	No	No
87-H	South Emergency Diesel Generator Room	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area H

Fire Area ID:	I-1 Corridor
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
98-J	Corridor

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36A or P-36B is available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B is aligned to SG-A.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 is aligned to offsite power.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pump P-4A or P-4B (swing pump) feed SW Loop 1. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.21
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 55

Fire Area ID:	I-1 Corridor
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. This area has automatic suppression and ponding in the fire area is minimized by the presence of two floor drains. A curb plate leading to Fire Area I-2, Fire Zone 99-M, prevents propagation of fire water to electrical switchgear rooms, and propagation into Fire Area F is limited by Door 480. Equipment located in adjacent Fire Area O, Fire Zone 95-O, is above the anticipated ponding level. Excess water can propagate to the south EDG room (Fire Zone 87-H), but this equipment is not required due to offsite power being available. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-85-E-0053-07 “Suppression Evaluation for Room 96 and Room 111 at Elev. 372’”

Summary: Purpose: Evaluate the need to install an automatic suppression system in Room 96 (ICS Relay Room) in Fire Zone 97-R or Room 111 (Electrical Equipment room) in Fire Zone 98-J.

Basis for Acceptability: Automatic suppression is not needed in Room 111 based upon the installed automatic detection, three (3)-hour rated construction on all sides except for the east wall, and automatic suppression in rooms to the west and east.

Engineering Evaluation ID: CALC-ANO1-FP-09-00009 “Unit 1 Structural Steel Fire Protection Evaluation”

Summary: Purpose: The purpose of this evaluation is to document the fire protection engineering evaluation for the lack of structural steel fire proofing in the following locations:

B-1 (79-U, 149-E); B-8 (46-Y, 77-V, 105-T, 144-D); C (20-Y, 47-Y, 53-Y); I-1 (98-J); I-3 (112-I)

Basis for Acceptability: These rooms are protected by smoke detection systems that alarm in the control room (and suppression systems in the electrical penetration rooms) and the prompt response by the fire brigade with access to manual firefighting equipment should prevent any fire (in the unlikely event one does occur) from damaging the structural steel.

Fire Area ID: I-1 Corridor
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-13-00001 "Fire Zone 98-J Wall 4-S-43 Evaluation"

Summary: Purpose: The purpose of this engineering report is to review the characteristics of the wall at Column Line 4 in Fire Zone 98-J, Fire Area I-1, to determine the ability to prevent fire spread between the east and west ends of the fire zone for 30 minutes. The wall at Column Line 4 is currently a non-fire rated barrier.

Basis for Acceptability: The wall at Column Line 4 (4-S-43) is expected to prevent fire spread and/or hot gases from Room 111 (west end) to Room 98 (east end), or vice-versa, for at least 30 minutes based on the following reasons:

- Type of fuel package present on both sides (mostly rated cable)
- Line type heat detectors and smoke detection systems on both sides
- Deluge system on the east side
- Construction of the barriers/penetration seals
- Response by the fire brigade

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
98-J	Corridor	P*	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

* No suppression in room 111

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID: I-1 Corridor
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC - 10-E-0023-20

Title: ANO-1 Fire Area I-1 Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with the identified recovery. In addition, there are global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1(VFDR I1-04), and H-2 (VFDR I1-04) will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 (VFDR I1-03-c) have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The suppression and detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID:	I-1 Corridor
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC - 10-E-0023-20 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

Fire Area ID:	I-1 Corridor
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDRS

VFDR ID: I1-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of control room capability to the EFW Turbine Control Panel could result in loss of trip capability for EFW Pump P-7A
b) Loss of control room capability to the credited EFW Pump P-7B
c) Spurious operation of atmospheric dump control valve CV-2618 results in the inability to isolate SG-B
d) Loss of power and spurious operation of valve CV-2626 (IN 92-18) results in the inability to isolate SG-B
e) Spurious operation of valve CV-2646 and CV-2670 (IN 92-18) results in the loss of EFW flow path to SG-A
f) Spurious operation of atmospheric dump control valve CV-2668 results in the inability to isolate SG-A
g) Loss of control capability for MSIV CV-2692 (pilot valves SV-0621 & SV-0721) preventing isolation of SG-B
h) Spurious operation of condensate supply valve CV-2800 results in loss of water source to EFW pump P-7B
i) Spurious operation of AFW pump P-75 combined with inability to trip condensate pump P-2B resulting in uncontrolled feedwater source

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for non-credited P-7A as an over-feed scenario will not impact the ability of the motor driven EFW pump to perform its function
b) No further action is required for EFW motor driven pump P-7B
c) No further action is required for CV-2618
d) No further action is required CV-2626
e) No further action is required for CV-2646 and CV-2670
f) No further action is required for CV-2668
g) No further action is required for MSIV CV-2692
h) No further action is required for CV-2800
i) No further action is required for P-75 as an over-feed scenario will not impact the ability of the motor driven EFW pump to perform its function

Fire Area ID:	I-1 Corridor
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: I1-02

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of control capabilities to SW pump P-4A resulting in a loss of Loop 1 SW if P-4B is OOS
b) Loss of valve CV-3643 (IN 92-18) resulting in a diversion of SW to ACW
c) Spurious closure of CV-3644 if P-4B is aligned to Loop 1

Loss of these functions could challenge the Vital Auxiliaries (Service water) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for SW pump P-4A
b) No further action is required for SW valve CV-3643
c) No further action is required for SW valve CV-3644

Fire Area ID:	I-1 Corridor
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: I1-03

VFDR: Fire damage to control and power cables in the area may impact inventory control functions resulting in the following:

a) Spurious operation of valve CV-1206 (IN 92-18) resulting in loss of isolation capability to prevent thermal shock of the RCP seals
b) Loss of power and control to makeup tank outlet valve CV-1275 resulting in the loss of isolation capability to preclude gas binding of the makeup pumps
c) Spurious operation of valve CV-1408 (IN 92-18) results in a loss of BWST inventory to the reactor building sump
d) Loss of control to makeup pumps P-36A and P-36B(R) from the control room
e) Loss of control to pressurizer heaters M-309 and M-310 resulting in loss of trip capability from the control room
f) Spurious operation of RB spray pump P-35B resulting in a loss of BWST inventory

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin and defense-in-depth meet the acceptance criteria of NFPA 805 Section 4.2.4 with the following actions:

a) No further action is required for CV-1206 since the Fire PRA assumes loss of seal cooling results in a LOCA, failure of CV-1206 is non-minimal, and therefore already conservatively quantified
b) No further action is required for makeup tank outlet valve CV-1275
c) No further action is required for CV-1408; however modification to prevent spurious operation of CV-1406 will eliminate the need to recover (close/verify close) CV-1408
d) No further action is required makeup pumps P-36A and P-36B(R)
e) No further action is required as spurious operation of pressurizer heaters is not a contributor to core damage sequences in the Fire PRA, and therefore is not risk significant
f) No further action is required for P-35B

Fire Area ID:	I-1 Corridor
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: I1-04

VFDR: Fire damage to cables in the area may impact pressure and inventory control functions resulting in the following:

a) Loss of the control room trip capability of RCPs P-32A, P-32B, P-32C, and P-32D. Securing the pumps is required to assure normal pressurizer spray is secured and prevent potential RCP seal damage. Tripping the RCPs for a fire in this location also assures that a fault on the RCP P-32C and P-32D power cables cannot propagate back to transformer X-03 and cause a loss of off-site power.

Loss of these functions could challenge the Pressure and Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with modification to supply H-1 & H-2 with redundant DC control power.

VFDR ID: I1-05

VFDR: Fire damage to cables in the area may impact vital auxiliary functions. The circuits impacted result in the following:

a) Loss of the power supply to distribution panels RS-1, RS-2, RS-3, and RS-4.

Loss of this function could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with no further actions for panels RS-1, RS-2, RS-3, and RS-4.

End of Fire Area I-1

Fire Area ID:	I-2 North Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
99-M	North Switchgear Room

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36A or P-36B(R) is available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B is aligned to SG-A.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 is aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A or P-4B (swing pump) feed SW Loop 1. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B) are available.	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.22
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 56

Fire Area ID:	I-2 North Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. This fire area has no automatic suppression system and firefighting activities are limited to manual methods where the discharge of suppression water can be controlled. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-90-R-1014-36 “Penetration Seal Analysis for Penetration 0099-01-0069”

Summary: Purpose: Evaluate the penetration seal to determine if the seal is acceptable to utilize it in a three (3)-hour rated fire boundary since the seal deviates from the tested configuration.

Basis for Acceptability: The configuration of the installed seal is acceptable based upon availability of fire detection on both sides of the seal (73-W & 99-M), automatic suppression in Fire Zone 73-W, the limited combustible loading, and the equivalent penetration seal construction as compared to the tested configuration. This evaluation has determined the deviation from tested design as having negligible impact and therefore acceptable.

Engineering Evaluation ID: CALC-ANO1-FP-09-00018 “Engineering Evaluation for Penetration Seals in Fire Area I-2”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetration seals FB 0099-01-17 and FB- 0099-01-0020 used in a 3-hour rated fire area boundary.

Basis for Acceptability: The bases for the acceptability is the low fire duration on both sides, smoke detection systems on both sides (99-M & 73-W), suppression systems in Fire Zone 73-W, and the response by the fire brigade to suppress a fire in the early stage on either side.

Fire Area ID:	I-2 North Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
99-M	North Switchgear Room	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-21

Title: ANO-1 Fire Area I-2 Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with the identified recovery and modifications. In addition, there are global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

Fire Area ID:	I-2 North Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-21 (continued)

Summary: (continued) The following modifications are area specific and credited to reduce risk in this fire area:

- A-3 (re-route of DC control power to support P-4A, P-7B, P-36A) VFDRs I2-01b, I2-02-a, and I2-03c
- P-36A (reroute of a breaker control circuit cable going to control room) VFDR I2-03-c
- P-4A (reroute of a breaker control circuit cable going to control room and installation of interposing relays) VFDR I2-02-a
- P-7B (reroute of a breaker control circuit cable going to the control room) VFDR I2-01-b

<u>IN-92-18 Concerns</u>

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

<u>Additional Fire Area Considerations</u>

The detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

Fire Area ID:	I-2 North Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDRS

VFDR ID: I2-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of control to non-credited EFW steam driven pump P-7A resulting in potential overcooling
b) Loss of control to credited EFW motor driven pump P-7B
c) Spurious closure of condensate suction valve CV-2800 to EFW pump P-7B
d) Loss of power and control capability of valve CV-2626 (IN 92-18) resulting in failure to isolate non-credited SG-B
e) Loss of control capability of valves CV-2646 and 2670 resulting in the inability to align flow from EFW pump P-7B to SG-A
f) Loss of control room capability to MSIV-B (CV-2692) preventing isolation capability

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required as securing P-7A is associated with overcooling transients. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and therefore failure to trip this pump is not risk significant.
b) Modification to maintain DC power to switchgear A-3 combined with the reroute of a breaker control cable restores control functions for P-7B.
c) No further actions are required for CV-2800.
d) No further action is required as closing CV-2626 is associated with overcooling transients. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and therefore failure to trip this pump is not risk significant.
e) No further actions are required for CV-2646 and 2670.
f) No further action is required as closing MSIV CV-2692 for this scenario is associated with overcooling transients. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and therefore failure to trip this pump is not risk significant.

Fire Area ID:	I-2 North Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: I2-02

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of control functions associated with SW pump P-4A or P-4B(R)
b) Loss of power and control for SW loop crossover valves CV-3640, CV-3642, CV-3644, and CV-3646
c) Loss of valve CV-3643 (IN 92-18) resulting in a diversion of SW to ACW

Loss of these functions could challenge the Vital Auxiliaries Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) Modification to maintain DC power to switchgear A-3 combined with the reroute of a breaker control cable restores control functions for P-4A. No further action is required for P-4B(R).
b) No further actions are required for CV-3640, CV-3642, CV-3644, and CV-3646.
c) No further action is required for CV-3643.

Fire Area ID:	I-2 North Switchgear Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: I2-03

VFDR: Fire damage to control and power cables in the area may impact inventory control functions resulting in the following:

a) Spurious operation of valve CV-1206 (IN 92-18) resulting in loss of isolation capability to prevent thermal shock of the RCP seals
b) Loss of power and control to makeup tank outlet valve CV-1275 resulting in the loss of isolation capability to preclude gas binding of the makeup pumps
c) Loss of control room capability for makeup pump P-36A or P-36B(R)
d) Loss of control to pressurizer heater M-309 resulting in loss of trip capability from the control room

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further actions are required for CV-1206.
b) No further actions are required for CV-1275.
c) Modification to maintain DC power to switchgear A-3 combined with the reroute of a breaker control cable restores control functions for P-36A. No further action is required for P-36B(R).
d) No further action is required as spurious operation of pressurizer heaters is not a contributor to core damage sequences in the Fire PRA, and therefore is not risk significant.

End of Fire Area I-2

Fire Area ID: I-3 Lower North Electrical Penetration Room
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	Description
112-I	Lower North Electrical Penetration Room

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36A or P-36B is available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B is aligned to SG-A.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure.	

Reference Document
CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.23
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 57

Fire Area ID:	I-3 Lower North Electrical Penetration Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. This fire area has automatic suppression system and one entrance from Fire Zone 98-J where excess fire water will propagate. Corridor 98-J is equipped with two large floor drains to minimize any ponding concerns. Fire suppression activities will therefore not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-85-E-0053-07 “Suppression Evaluation for Room 96 and Room 111 at Elev. 372’”

Summary: Purpose: Evaluate the need to install an automatic suppression system in Room 96 (ICS Relay Room) in Fire Zone 97-R or Room 111 (Electrical Equipment room) in Fire Zone 98-J.

Basis for Acceptability: Automatic suppression is not needed in Room 111 based upon the installed automatic detection, three (3)-hour rated construction on all sides except for the east wall, and automatic suppression in rooms to the west and east.

Engineering Evaluation ID: CALC-ANO1-FP-09-00009 “Unit 1 Structural Steel Fire Protection Evaluation”

Summary: Purpose: The purpose of this evaluation is to document the fire protection engineering evaluation for the lack of structural steel fire proofing in the following locations:

B-1 (79-U, 149-E); B-8 (46-Y, 77-V, 105-T, 144-D); C (20-Y, 47-Y, 53-Y); I-1 (98-J); I-3 (112-I)

Basis for Acceptability: These rooms are protected by smoke detection systems that alarm in the control room (and suppression systems in the electrical penetration rooms) and the prompt response by the fire brigade with access to manual firefighting equipment should prevent any fire (in the unlikely event one does occur) from damaging the structural steel.

Fire Area ID:	I-3 Lower North Electrical Penetration Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: CALC-ANO1-FP-09-00015 “Engineering Evaluation for Penetration Seals in Fire Area B-1”

Summary: Purpose: The purpose of this evaluation is to evaluate and document the acceptability of ANO-1 penetrations in Fire Area B-1 used in a 3-hour rated fire area boundary.

The seals reviewed by this evaluation are:

- FB-79-01-0057 (from Fire Zones 79-U to 53-Y)
- FB-73-01-0034 and 0063 (from Fire Zones 73-W to 31-Y, and 34-Y)
- FB-149-01-0055 (from Fire Zones 149-E to 112-I)
- FB-2026-04-0055 (from Fire Zones 2026-Y to 34-Y)
- FB-160-01-0366 (from Fire Zones 160-B to 129-F)
- FB-0074-01-0057 and FB-0074-01-0058 (from Fire Zones 197-X to 34-Y)

Basis for Acceptability: The bases for the acceptability is the installed penetrations are considered to be adequate for the hazards based on:

- Detection system in Fire Zones 34-Y, 53-Y, 73-W, 79-U, 112-I, 129-F, 149-E, and 160-B
- Suppression system in Fire Zones 73-W, 79-U, 112-I, 129-F, and 149-E
- Combustible loading and fire brigade response using manual suppression

Engineering Evaluation ID: CALC-ANOC-FP-09-00004 “Fire Protection Engineering Evaluation of Units 1 & 2 Containment Building Penetrations”

Summary: Purpose: The purpose of this fire protection engineering evaluation is to evaluate the ANO-1 RB penetrations used in a 3-hour rated fire area boundary.

Basis for Acceptability:

- Low probability of a fire starting in the areas of the penetrations
- The installed smoke detection and suppression systems in electrical penetration rooms (Fire Zones 105-T, 112-I, 144-D, and 149-E)
- The installed detection in mechanical penetration rooms (Fire Zones 46-Y, 53-Y, 77-V, 79-U, and 159-B) with the exception of Fire Zone 170-Z which does not credit detection
- Fire resistive materials used in the penetrations
- Prompt response by the fire brigade with access to manual firefighting equipment for those areas in the auxiliary buildings

Fire Area ID: I-3 Lower North Electrical Penetration Room
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Engineering Evaluation ID: ER-ANO-2003-0397-000 “Evaluate lack of structural steel 3 hour coating in fire zones 112-I and 2111-T”

Summary: Purpose: Evaluate lack of structural steel 3-hour coating in Fire Zones 112-I and 2111-T

Basis for Acceptability: Lack of structural steel coating is justified based upon full suppression in Fire Zone 112-I activated by the detection system.

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
112-I	Lower North Electrical Penetration Room	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	I-3 Lower North Electrical Penetration Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-22

Title: ANO-1 Fire Area I-3 Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 (VFDR I3-03-e) have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The suppression and detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: I-3 Lower North Electrical Penetration Room
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-22 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: I3-01

VFDR: Fire damage to cables in the area may impact EFW functions resulting in the following:

a) Loss of control capability of valve CV-2626 (IN 92-18) resulting in failure to isolate non-credited SG-B
b) Loss of control capability of valve CV-2618 resulting in inability to isolate SG-B
c) Loss of power and control capability of valve CV-2670 (IN 92-18) resulting in the inability to align flow from EFW pump P-7B to SG-A

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required as closing CV-2626 is associated with overcooling transients. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and therefore failure to close this valve is not risk significant.
b) No further action is required for CV-2618
c) No further action is required for CV-2670

Fire Area ID:	I-3 Lower North Electrical Penetration Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: I3-02

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Spurious operation of SW cross connect valve CV-3642 may result in a loss of SW when P-4B is aligned to supply SW Loop 2 and P-4C is OOS
b) Spurious operation of SW cross connect valve CV-3644 may result in a loss of SW when P-4B is aligned to supply SW Loop 1 and P-4A is OOS

Loss of these functions could challenge the Vital Auxiliaries (SW) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for SW cross connect valve CV-3642
b) No further action is required for SW cross connect valve CV-3644

Fire Area ID:	I-3 Lower North Electrical Penetration Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: I3-03

VFDR: Fire damage to cables in the area may impact inventory control functions. The circuits impacted result in the following:

a) Loss of control capability to valve CV-1206 resulting in failure to isolate RCP seal injection capability to prevent thermal shock of the RCP seals
b) Loss of control to pressurizer heaters M-308, M-309, and M-310 resulting in loss of trip capability from the control room
c) Spurious operation of RCS vent valves SV-1072, SV-1084, and SV-1094 could result in a loss of RCS inventory
d) Spurious operation of RCP seal bleed-off to quench tank valves SV-1270 through SV-1273 could result in a loss of RCS inventory
e) Spurious operation of valve CV-1408 (IN 92-18) results in a loss of BWST inventory to the RB sump

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for CV-1206 since the Fire PRA assumes loss of seal cooling results in a LOCA, failure of CV-1206 is non-minimal, and therefore already conservatively quantified
b) No further action is required as spurious operation of pressurizer heaters is not a contributor to core damage sequences in the Fire PRA, and therefore is not risk significant
c) No further action is required for RCS vent valves SV-1072, SV-1084, and SV-1094
d) No further action is required for RCP seal bleed-off to quench tank valves SV-1270 through SV-1273, as they are not risk contributors in the Fire PRA model
e) Modification to prevent spurious opening of CV-1406 mitigates risk associated with spurious opening of CV-1408

VFDR ID: I3-04

VFDR: Fire damage to cables in the area may affect vital auxiliary functions. The circuits impacted result in the following:

a) Loss of the power supply to battery charger D-04A. The redundant battery charger D-04B is available for a fire in this area, but will require a local manual transfer if not aligned.

Loss of this function could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for battery charger D-04A

End of Fire Area I-3

Fire Area ID:	J Unit 1 Reactor Building - North
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	Description
32-K	North Side Reactor Building

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.24
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 58

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. The physical configuration of the RB prevents suppression water from migrating to other areas. Equipment important to safety in the RB is environmentally qualified for post-accident conditions inclusive of spray and flooding and therefore bounds the effects of suppression. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID:	J Unit 1 Reactor Building - North
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Licensing Actions

Licensing Action: Appendix R Exemption 07, FZ 32-K and FZ 33-K, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 19, RCP Oil Collection System, Not Meeting III.O Criteria, NRC approval letter 1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988

Licensing Basis: This licensing action will be transitioned into the NFPA 805 fire protection program as previously approved and considered compliant under 10 CFR 50.48(c).

Refer to LAR Attachment K for detailed discussion of this licensing action.

Engineering Evaluations

Engineering Evaluation ID: CALC-ANOC-FP-09-00004 “Fire Protection Engineering Evaluation of Units 1 & 2 Containment Building Penetrations”

Summary: Purpose: The purpose of this fire protection engineering evaluation is to evaluate the ANO-1 RB penetrations used in a 3-hour rated fire area boundary.

Basis for Acceptability:

- Low probability of a fire starting in the areas of the penetrations
- The installed smoke detection and suppression systems in electrical penetration rooms (Fire Zones 105-T, 112-I, 144-D, and 149-E)
- The installed detection in mechanical penetration rooms (Fire Zones 46-Y, 53-Y, 77-V, 79-U, and 159-B) with the exception of Fire Zone 170-Z, which does not credit detection fire-resistive materials used in the penetrations
- Prompt response by the fire brigade with access to manual firefighting equipment for those areas in the auxiliary buildings

Fire Area ID: J Unit 1 Reactor Building - North
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Required Fire Protection Systems and Features

		Installed		Required?											
				Separation		LA		EEEE		Risk		DID			
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET		
32-K	North Side Reactor Building	P*	P*	No	No	No	No	No	Yes	No	Yes	No	Yes		

* Automatic suppression and detection at electrical penetrations

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	J Unit 1 Reactor Building - North
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-23

Title: ANO-1 Fire Area J-N Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system located in Fire Area J-North was credited in accordance with FAQ 08-0050 for the manual non-suppression times in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer. The MCA does not credit a barrier failure between Fire Areas J-North and J-South.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: J Unit 1 Reactor Building - North
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-23 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF) and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: JN-01

VFDR: Fire damage to power cables in the area could result in a potential spurious opening of both high-low pressure interface valves CV-1050 and CV-1410 due to a fire-induced 3-phase fault. Power to these valves is isolated by opening the breakers during normal at-power operations.

Loss of these functions could challenge the Pressure and Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: Motor operated valves CV-1050 and CV-1410 require a concurrent three phase hot short of cables for both valves to spuriously open. This VFDR is not a concern in the Fire PRA model since the probability of a three phase hot short is 5.00E-08, per NUREG/CR-6850, p. 9-8, which when combined with other failures in the zone, will result in a product that is significantly less than the delta CDF acceptance criterion. No further analysis is necessary for this VFDR since the quantification will result in a negligible ΔCDF/LERF.

Fire Area ID:	J Unit 1 Reactor Building - North
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: JN-02

VFDR: Fire damage to control and power cables in the area may impact inventory control functions resulting in the following:

a) Loss of control to pressurizer heaters M-308 and M-309 resulting in loss of trip capability from the control room
b) Spurious operation of RCS vent valves SV-1071 through SV-1074, SV-1077, SV-1079, SV-1081 through SV-1084, and SV-1091 through SV-1094 could result in a loss of RCS inventory
c) Spurious operation of RCP seal bleed-off to quench tank valves SV-1270 through SV-1273 could result in a loss of RCS inventory

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required as spurious operation of pressurizer heaters is not a contributor to core damage sequences in the Fire PRA, and therefore is not risk significant.

b) No further action is required as additional analysis shows the cables for the valves are routed through dedicated conduits in Fire Area J-North. The dedicated conduits preclude the valves from spuriously opening since no power source is available to create a hot-short.

c) No further action is required as spurious operation of valves SV-1270 through 1273 is not modeled in the Fire PRA since the leakage through this pathway is not sufficient to be classified as a SBLOCA.

End of Fire J - North

Fire Area ID:	J Unit 1 Reactor Building - South
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	Description
33-K	South Side Reactor Building

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed SG-A.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.25
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 58

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. The physical configuration of the RB prevents suppression water from migrating to other areas. Equipment important to safety in the RB is environmentally qualified for post-accident conditions inclusive of spray and flooding and therefore bounds the effects of suppression. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID:	J Unit 1 Reactor Building - South
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Licensing Actions

Licensing Action: Appendix R Exemption 07, FZ 32-K and FZ 33-K, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 19, RCP Oil Collection System, Not Meeting III.O Criteria, NRC approval letter 1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988

Licensing Basis: This licensing action will be transitioned into the NFPA 805 fire protection program as previously approved and considered compliant under 10 CFR 50.48(c).

Refer to LAR Attachment K for detailed discussion of this licensing action.

Engineering Evaluations

Engineering Evaluation ID: CALC-ANOC-FP-09-00004 “Fire Protection Engineering Evaluation of Units 1 & 2 Containment Building Penetrations”

Summary: Purpose: The purpose of this fire protection engineering evaluation is to evaluate the ANO-1 RB penetrations used in a 3-hour rated fire area boundary.

Basis for Acceptability:

- Low probability of a fire starting in the areas of the penetrations
- The installed smoke detection and suppression systems in electrical penetration rooms (Fire Zones 105-T, 112-I, 144-D, and 149-E)
- The installed detection in mechanical penetration rooms (Fire Zones 46-Y, 53-Y, 77-V, 79-U, and 159-B) with the exception of Fire Zone 170-Z, which does not credit detection
- Fire resistive materials used in the penetrations
- Prompt response by the fire brigade with access to manual firefighting equipment for those areas in the auxiliary buildings

Fire Area ID: J Unit 1 Reactor Building - South
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
33-K	South Side Reactor Building	P*	P*	No	No	No	No	No	Yes	No	Yes	No	Yes

* Automatic suppression and detection at electrical penetrations

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	J Unit 1 Reactor Building - South
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC-10-E-0023-24

Title: ANO-1 Fire Area J-S Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system located in Fire Area J-South was credited in accordance with FAQ 08-0050 for the manual non-suppression times in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer. The MCA does not credit a barrier failure between Fire Areas J-North and J-South.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: J Unit 1 Reactor Building - South
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC-10-E-0023-24 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: JS-01

VFDR: Fire damage to control and power cables in the area may impact pressure and inventory control functions resulting in the following:

a) Spurious opening of both high-low pressure interface valves CV-1050 and CV-1410 due to a 3-phase fault resulting in depressurization and loss of RCS inventory. The power to both valves is isolated (breakers open) during normal at-power operations.

Loss of these functions could challenge the Pressure and Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: Motor operated valves CV-1050 and CV-1410 require a concurrent three phase hot short of cables for both valves to spuriously open. This VFDR is not a concern in the Fire PRA model since the probability of a three phase hot short is 5.00E-08, per NUREG/CR-6850, p. 9-8, which when combined with other failures in the zone, will result in a product that is significantly less than the delta CDF acceptance criterion. No further analysis is necessary for this VFDR since the quantification will result in a negligible ∆CDF/LERF.

Fire Area ID:	J Unit 1 Reactor Building - South
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: JS-02

VFDR: Fire damage to control and power cables in the area may impact inventory control functions resulting in the following:

a) Loss of control to pressurizer heaters M-308 and M-309 resulting in loss of trip capability from the control room
b) Spurious operation of RCS vent valves SV-1071 through SV-1074, SV-1077, SV-1079, SV-1081 through SV-1084, and SV-1091 through SV-1094 could result in a loss of RCS inventory
c) Spurious operation of RCP seal bleed-off to quench tank valves SV-1270 through SV-1273 could result in a loss of RCS inventory

Loss of these functions could challenge the Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required as spurious operation of pressurizer heaters is not a contributor to core damage sequences in the Fire PRA, and therefore is not risk significant.

b) No further action is required as additional analysis shows the cables for the valves are routed through dedicated conduits in Fire Area J-North. The dedicated conduits preclude the valves from spuriously opening since no power source is available to create a hot-short.

c) No further action is required as spurious operation of valves SV-1270 through 1273 is not modeled in the Fire PRA since the leakage through this pathway is not sufficient to be classified as a SBLOCA.

End of Fire J - South

Fire Area ID: K – Tank Vaults
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	Description
16-Y	Clean Waste Receiver Tank Room
2020-JJ	Boron Holdup Tank Vault

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.26
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 59

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. This fire area is a tank vault with a low combustible loading, has no automatic suppression system, and firefighting activities are limited to manual methods. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: K – Tank Vaults
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: CALC-ANO1-FP-09-00016 "Engineering Evaluation for Penetration Seals in Fire Area C"

Summary: Purpose: The purpose of this evaluation is to document the acceptability of ANO-1 penetrations in Fire Area C used in 3-hour rated fire area boundaries.

The seal reviewed by this evaluation impacting this fire area is:

From Fire Area C (20-Y) to K (16-Y)
FB-0018-05-0132

Basis for Acceptability: The penetration listed is considered adequate for the hazards in the area based on:

- Acceptable combustible loading
- Smoke detection systems in zone 20-Y
- Response by the fire brigade team with manual firefighting equipment in the areas without automatic suppression

Required Fire Protection Systems and Features

		Installed		Required?											
				Separation		LA		EEEE		Risk		DID			
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET		
16-Y	Clean Waste Receiver Tank Room	No	No	No	No	No	No	No	No	No	No	No	No		
2020-JJ	Boron Holdup Tank Vault	No	No	No	No	No	No	No	No	No	No	No	No		

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	K – Tank Vaults
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area K

Fire Area ID:	L – Diesel Fuel Storage Vault Area
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	**Description**
TKVLT	Diesel Fuel Storage Vault

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.27
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 60

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of this fire area. Fire suppression activities would only impact the diesel fuel storage and transfer fire area. Plant equipment in other areas is isolated from effect of fire in this fire area. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: L – Diesel Fuel Storage Vault Area
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
TKVLT	Diesel Fuel Storage Vault	P*	P*	No	No	No	No	No	No	No	No	No	No

* In vaults only / No automatic suppression or detection in corridor

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area L

Fire Area ID:	MH01
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	Description
1MH01	Between Aux Building and Intake Structure

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip is from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power. The EDGs are available but not credited in this fire area.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 31
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 61

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. No automatic suppression is installed in this area and only electrical cables are present. Electrical manholes have been periodically subject to weather related flooding with no adverse short-term consequences. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: MH01
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
1MH01	Between Aux Building and Intake Structure	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area MH01

Fire Area ID:	MH02
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	**Description**
1MH02	Between Aux Building and Intake Structure

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to onsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.32
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 62

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. No automatic suppression is installed in this area and only electrical cables are present. Electrical manholes have been periodically subject to weather related flooding with no adverse short-term consequences. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: MH02
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
1MH02	Between Aux Building and Intake Structure	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area MH02

Fire Area ID:	MH03
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
1MH03	Between Aux Building and Intake Structure

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A or P-36B is available with feed from the BWST using the normal charging path to the RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pump P-4A or P-4B (swing pump) feed SW Loops 1. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.33
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 63

Fire Area ID: MH03
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. No automatic suppression is installed in this area and only electrical cables are present. Electrical manholes have been periodically subject to weather related flooding and with no adverse short-term consequences. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
1MH03	Between Aux Building and Intake Structure	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	MH03
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-25

Title: ANO-1 Fire Area MH03 Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

Detection and suppression is not credited in this fire area. The fire is assumed to be contained within the manhole and cannot spread to additional fire zones. Use of the base scenario CCDP in this analysis incorporates the impact of a potential HGL and envelopes the delta CDF/LERF.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: MH03
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-25 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: MH03-01

VFDR: Fire damage to cables in the area may damage the automatic trip/open circuit to the circulating water pumps P-3C and P-3D. Due to lack of breaker control, the need to clear this fault is necessary to re-establish offsite power.

Loss of these functions could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with no further action required.

Fire Area ID:	MH03
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: MH-03-02

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of control capabilities to SW pump P-4B resulting in a loss of SW Loop 1 if P-4A is OOS
b) Loss of valve CV-3643 resulting in a diversion of SW

Loss of these functions could challenge the Vital Auxiliaries Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for SW pump P-4B
b) No further action is required for SW valve CV-3643

End of Fire Area MH03

Fire Area ID:	MH04
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	Description
1MH04	Between Aux Building and Intake Structure

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36B or P-36C is available with feed from the BWST using the normal charging path to the RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power. The EDGs are available but not credited in this fire area.	
5b. Vital Auxiliaries (SW)	SW pump P-4B (swing pump) or P-4C feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.34
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 64

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. No automatic suppression is installed in this area and only electrical cables are present. Electrical manholes have been periodically subject to weather related flooding with no adverse short-term consequences. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: MH04
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: Appendix R Exemption 04, FA-MH04 and FA-MH06, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This exemption is no longer required under the new licensing basis because the cabling has been modified such that each manhole contains redundant cabling for the SW swing pump.

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
1MH04	Between Aux Building and Intake Structure	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area MH04

Fire Area ID:	MH05
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	**Description**
1MH05	Between Aux Building and Intake Structure

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36A or P-36B is available with feed from the BWST using the normal charging path to the RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pump P-4A or P-4B (swing pump) feed SW Loop 1. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.35
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 65

Fire Area ID:	MH05
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. No automatic suppression is installed in this area and only electrical cables are present. Electrical manholes have been periodically subject to weather related flooding with no adverse short-term consequences. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.
Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
1MH05	Between Aux Building and Intake Structure	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	MH05
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-26

Title: ANO-1 Fire Area MH05 Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

Detection and suppression is not credited in this fire area. The fire is assumed to be contained within the manhole and cannot spread to additional fire zones. Use of the base scenario CCDP in this analysis incorporates the impact of a potential HGL and envelopes the delta CDF/LERF.

Δ CDF: Refer to Attachment W “Fire PRA Insights”

Δ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: MH05
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-26 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF) and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: MH05-01

VFDR: Fire damage to cables in the area may damage the automatic trip/open circuit to the circulating water pumps P-3C and P-3D. Due to lack of breaker control, the need to clear this fault is necessary to reestablish offsite power.

Loss of these functions could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with no further action required.

Fire Area ID:	MH05
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: MH-05-02

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of control capabilities to SW pump P-4B resulting in a loss of Loop 1 SW if P-4A is OOS
b) Loss of valve CV-3643 resulting in a diversion of SW

Loss of these functions could challenge the Vital Auxiliaries Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for SW pump P-4B

b) No further action is required for SW valve CV-3643

End of Fire Area MH05

Fire Area ID:	MH06
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	Description
1MH06	Between Aux Building and Intake Structure

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36B or P-36C is available with feed from the BWST using the normal charging path to the RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4B (swing pump) or P-4C feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.36
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 66

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. No automatic suppression is installed in this area and only electrical cables are present. Electrical manholes have been periodically subject to weather related flooding with no adverse short-term consequences. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: MH06
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: Appendix R Exemption 04, FA-MH04 and FA-MH06, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This exemption is no longer required under the new licensing basis because the cabling has been modified such that each manhole contains redundant cabling for the SW swing pump.

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.
Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
1MH06	Between Aux Building and Intake Structure	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area MH06

Fire Area ID:	MH09
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	Description
1MH09	Between Aux Building and Diesel Fuel Vault

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 9, Attachment 8.37
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 67

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. No automatic suppression is installed in this area and only electrical cables are present. Electrical manholes have been periodically subject to weather related flooding with no adverse short-term consequences. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: MH09
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: Appendix R Exemption 11, FZ 1MH09 and 1MH10, Not Meeting III.G.3 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using updated analysis regarding where a loss of offsite power can occur; therefore, this exemption is no longer required.

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
1MH09	Between Aux Building and Diesel Fuel Vault	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area MH09

Fire Area ID: MH10
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	**Description**
1MH10	Between Aux Building and Diesel Fuel Vault

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.38
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 68

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. No automatic suppression is installed in this area and only electrical cables are present. Electrical manholes have been periodically subject to weather related flooding with no adverse short-term consequences. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: MH10
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: Appendix R Exemption 11, FZ 1MH09 and 1MH10, Not Meeting III.G.3 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using updated analysis regarding where a loss of offsite power can occur; therefore, this exemption is no longer required.

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.
Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
1MH10	Between Aux Building and Diesel Fuel Vault	No	No	No	No	No	No	No	No	No	No	No	No

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area MH10

Fire Area ID: N – Unit 1 Intake Structure
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	Description
INTAKE	Intake

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to offsite power. The EDGs are available but not credited in this fire area.	
5b. Vital Auxiliaries (SW)	SW pump P-4A or P-4B (swing pump) feed SW Loop 1. If Loop 1 is impacted then P-4C or P-4B (swing pump) feed SW Loop 2. ACW can be isolated to prevent potential pump run-out conditions.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document
CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.28
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 69

Fire Area ID:	N – Unit 1 Intake Structure
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

The ANO-1 intake structure contains all SW pumps, sluice gates, and SW crossover valves for both trains of equipment. All other equipment and actions utilized to maintain safe and stable are outside of the area of fire suppression activity. The physical configuration of the structure and locations of equipment prevents a credible fire from affecting both trains. Pumps are located at higher elevations in the structure where ponding is not a concern. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: Appendix R Exemption 01, FA-N, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 02, FA-N, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action: Appendix R Exemption 03, FA-N, Not Meeting III.G.2 Criteria, approval letter 0CNA038328 dated March 22, 1983

Licensing Basis: This fire area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Fire Area ID: N – Unit 1 Intake Structure
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
INTAKE	Intake	P*	Yes	No	No	No	No	No	No	No	No	No	Yes

* Suppression installed in diesel fire pump room and elevation 354’

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	N – Unit 1 Intake Structure
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC -10-E-0023-02

Title: ANO-1 Fire Area N Risk Evaluation

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1, and H-2 will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system located in Fire Area N was not credited in the ANO-1 HGL and MCA to reduce the fire area CDF/LERF, since the PRA does not credit suppression to reduce the fire area CDF/LERF.

∆ CDF: Refer to Attachment W “Fire PRA Insights”

∆ LERF: Refer to Attachment W “Fire PRA Insights”

Fire Area ID: N – Unit 1 Intake Structure
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC -10-E-0023-02 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: N-01

VFDR: Fire damage to cables in the area may impact SW functions. SW provides cooling to the EDGs and primary makeup pump lube oil coolers. In addition, the SW system provides an assured long-term source of feedwater to the SGs via its connection to the EFW system once condensate is depleted. Offsite power is available eliminating the immediate need for SW cooling of the EDG. The circuits impacted result in the following:

a) Loss of power and control functions associated with SW pump P-4A, P-4B, and P-4C
b) Loss of power and control for SW Loop crossover valves CV-3640, CV-3642, CV-3644, and CV-3646
c) Loss of power and control functions associated with ACW Loop isolation valve CV-3643 resulting in a flow diversion

Loss of these functions could challenge the Vital Auxiliaries (SW) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with the following actions:

a) No further action is required for SW pumps P-4A, P-4B, and P-4C
b) No further action is required for SW valves CV-3640, CV-3642, CV-3644, and CV-3646
c) No further action is required for SW valve CV-3643

End of Fire Area N

Fire Area ID:	O – North Battery Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Zone ID	Description
95-O	North Battery room

Performance Goal	Method Of Accomplishment	Comments
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pump P-36A or P-36B(R) is available with feed from the BWST using the normal charging path to the RCS.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. The motor driven EFW pump P-7B is aligned to feed SG-A.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 is aligned to offsite power.	Variance from the deterministic requirements of NFPA 805 exists for this performance goal. A Fire Risk Evaluation is required.
5b. Vital Auxiliaries (SW)	SW pump P-4A or swing pump P-4B aligned to feed SW Loop 1. ACW can be isolated to prevent potential pump run-out conditions.	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.29

CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 70

Fire Area ID: O – North Battery Room
Compliance Basis: NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. This fire area has no automatic suppression system and one entrance from Fire Zone 98-J where excess fire water from manual suppression activities will propagate. Corridor 98-J is equipped with two large floor drains to minimize any ponding concerns. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Licensing Actions

Licensing Action: No licensing actions are applicable to this fire area.

Licensing Basis: N/A

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

		Installed		Required?									
				Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
95-O	North Battery room	No	Yes	No	No	No	No	No	No	No	Yes	No	Yes

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Fire Area ID:	O – North Battery Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary

FRE Calculation: CALC - 10-E-0023-27

Title: ANO-1 Fire Area O Risk Evaluation

CALC -10-E-0023-27 "ANO-1 Fire Area Risk Evaluation Supplemental"

Summary: The fire risk evaluation has determined that the variances identified for this fire area are acceptable based upon the measured change in CDF and LERF, adequate defense in depth, and maintenance of safety margins with only the global modifications credited to reduce CDF and LERF in all ANO-1 fire areas. This fire area is compliant with the risk-informed, performance-based approach as the results of this fire risk evaluation meet the requirements of NFPA 805 and the guidance of Regulatory Guide 1.205.

Credited Recovery Actions

- There are no recovery actions credited in this fire area to reduce the area risk or mitigate the risk of VFDRs.

Credited Modifications

Listed below are plant modifications that are credited globally to reduce the area CDF and LERF for all Fire PRA scenarios:

- A new AFW pump with controls independent of the existing EFW pumps.
- A redundant DC control power supply to switchgear A-1, A-2, H-1 (VFD O-01-a), and H-2 (VFDR O-01-a) will be installed to eliminate loss of switchgear due to loss of normal DC control power. This modification is credited in the compliant and variant case.
- Sluice gates SG-1, SG-2, SG-3, and SG-4 have a proposed modification to remove spurious operation that could close these valves. The sluice gates will remain open in all Fire PRA scenarios and are credited in both the compliant and variant case.
- CV-1405 and CV-1406 have a proposed modification to remove spurious operation that could open these valves. This modification is credited in the compliant and variant case.

IN-92-18 Concerns

There are no recovery actions credited in this fire area to manually position motor operated valves that may have spuriously operated and failed in a non-recoverable position.

Additional Fire Area Considerations

The detection system for this fire area was credited in the ANO-1 HGL and MCA. The detection system is required to support fire brigade response to mitigate the formation of a hot gas layer.

Δ CDF: Refer to Attachment W "Fire PRA Insights"

Δ LERF: Refer to Attachment W "Fire PRA Insights"

Fire Area ID:	O – North Battery Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

Risk Summary (continued)

FRE Calculation: CALC - 10-E-0023-27 (continued)

DID Maintained: The VFDRs, the associated fire area risks (CDF), and consequences (CCDP) were evaluated to identify general defense-in-depth echelon imbalances. This review is documented in Table 6.2.3 of the FRE and shows no additional DID methods are required beyond those inherent to the fire area.

No procedural changes, modifications, or recoveries are needed for maintenance of DID for this fire area.

Safety Margin Maintained: All analyses and assessments have been performed utilizing accepted techniques and industry accepted standards and are specifically documented within the FRE calculation.

Comments: None

VFDRS

VFDR ID: O-01

VFDR: Fire damage to DC equipment and power cables in the area may impact pressure and inventory control functions resulting in the following:

a) Loss of control room trip capability to reactor coolant pumps P-32B and P-32D. Securing the pumps is required to assure normal pressurizer spray is secured and prevent potential RCP seal damage.

Loss of these functions could challenge the Pressure and Inventory Control Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with modification to supply H-1 and H-2 with redundant DC control power.

Fire Area ID:	O – North Battery Room
Compliance Basis:	NFPA 805 Section 4.2.4.2 – Performance Based – Fire Risk Evaluation

VFDR ID: O-02

VFDR: Fire damage to cables in the area may impact decay heat removal functions resulting in the following:

a) Loss of control room trip capability of condensate pumps P-2B and AFW P-75 to secure a non-controlled source of feedwater.

Loss of these functions could challenge the Decay Heat Removal Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: No further action is required as failure to secure P-2B and P-75 is associated with overcooling transients. Overcooling scenarios do not contribute to the core damage sequences in the Fire PRA and therefore failure to trip these pumps is not risk significant.

VFDR ID: O-03

VFDR: Fire damage to cables in the area may impact vital auxiliary functions resulting in the following:

a) Loss of power from Load Center B-6 to MCC B-56. Transfer capability exists to power B-56 from Load Center B-5 outside the control room.

Loss of these functions could challenge the Vital Auxiliaries (Electrical) Performance Criterion. This condition represents a variance from the deterministic requirements of Section 4.2.3 of NFPA 805. This is a separation issue and evaluation of the additional risk is required in accordance with Section 4.2.4 of NFPA 805.

Disposition: This VFDR has been evaluated and it was determined that the risk, safety margin, and defense-in-depth meet the acceptance criteria of NFPA 805, Section 4.2.4, with no further action required.

End of Fire Area O

Fire Area ID:	YD – Miscellaneous Yard Locations
Compliance Basis:	NFPA 805 Section 4.2.3.2 – Deterministic Approach

Fire Zone ID	**Description**
YARD	Miscellaneous Yard Locations
DEGAS	Degas

Performance Goal	**Method Of Accomplishment**	**Comments**
1. Reactivity Control	Manual reactor trip from the control room for short-term reactivity control. Long-term reactivity control is by inventory addition to the RCS using borated water from the BWST.	
2. Inventory Control	Letdown is isolated and the RCPs secured to maintain seal integrity. The primary makeup pumps P-36A, P-36B, and P-36C are available with feed from the BWST using normal charging path to RCS.	
3. Pressure Control	RCS vent paths are secured. Pressurizer heaters are de-energized, normal pressurizer spray secured (RCPs turned off), and auxiliary pressurizer spray path is secured. RCS pressure is maintained by inventory addition using the primary makeup pumps.	
4. Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using main steam safety valves if atmospheric dump valves are not immediately available. Turbine driven EFW pump P-7A and motor driven EFW pump P-7B are both available to feed either SG-A or SG-B.	
5a. Vital Auxiliaries (Electrical)	Engineered safety feature 4.16KV switchgear A-3 and A-4 are aligned to onsite power.	
5b. Vital Auxiliaries (SW)	SW pump P-4A aligned to feed SW Loop 1 and P-4C aligned to feed SW Loop 2. The swing pump P-4B is available to feed either loop	
5c. Vital Auxiliaries (HVAC)	ANO-1 shares a common control room envelope with ANO-2. The control room is cooled by air conditioning unit VUC-9, ANO-2 condensing units (2VE-1A and 2VE-1B) and the control room emergency recirculation units (2VUC-27A and 2VUC-27B).	
6. Process Monitoring	Instrumentation is available in the Control Room to monitor neutron flux, pressurizer level, RCS pressure, RCS temperature, and credited SG level and pressure. Backup from SPDS is available.	

Reference Document

CALC-85-E-0086-01, SSCA Safe Shutdown Capability Assessment, Rev. 7, Attachment 8.30
CALC-85-E-0086-02, Manual Action Feasibility Methodology and Common Results, Rev. 4, Attachment 71

Fire Suppression Activities Effect on Nuclear Safety Performance Criteria

Safe and stable conditions can be achieved and maintained utilizing equipment and actions outside of the area of fire suppression activity. Each outdoor deluge system provides local protection, specifically for individual transformers, and sub-grade basins installed to catch and carry away oil and water to a remote separator. Discharge of manual suppression water to adjacent areas is non-consequential as site grading carries any water away from structures and equipment. Fire suppression activities will, therefore, not adversely affect the plant's ability to achieve the nuclear safety performance criteria.

Fire Area ID: YD – Miscellaneous Yard Locations
Compliance Basis: NFPA 805 Section 4.2.3.2 – Deterministic Approach

Licensing Actions

Licensing Action: Appendix R Exemption 18, Yard Area, Not Meeting III.G.2 Criteria, approval letter 1CNA108806 dated October 26, 1988

Licensing Basis: This fire area was found to be deterministically compliant; therefore, this exemption is no longer required under the new licensing basis.

Engineering Evaluations

Engineering Evaluation ID: No engineering evaluations are applicable to this fire area.

Summary: N/A

Required Fire Protection Systems and Features

				Required?									
		Installed		Separation		LA		EEEE		Risk		DID	
Fire Zone	Fire Zone Description	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET	SUP	DET
YARD	Miscellaneous Yard Locations	P*	P*	No	No	No	No	No	No	No	No	No	No
DEGAS	Degas	No	No	No	No	No	No	No	No	No	No	No	No

* Associated with deluge system for main, unit auxiliary, and startup transformers

P – Indicates a partial system is installed
Separation - Required for Chapter 4 Separation Criteria
LA- Required for NRC-Approved Licensing Action
EEEE- Required for Existing Engineering Equivalency Evaluation
Risk - Required for Risk Significance
DID- Required to Maintain an Adequate Balance of Defense-in-Depth in a Change Evaluation or Fire Risk Evaluation

Risk Summary

This fire area complies with the deterministic requirements of Section 4.2.3.2 of NFPA 805 and a fire risk evaluation is not required.

VFDRS

This fire area is in deterministic compliance and has no VFDRs.

End of Fire Area YD

D. NEI 04-02 Non-Power Operational Modes Transition

(NEI 04-02 Table F-1)

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.

Implementing Guidance F.1

Review Existing Outage Management Processes

Define Higher Risk Evolutions (HREs), if not already defined in plant outage management procedures. The HRE definition should consider the following:

- Time to boil
- Reactor coolant system and fuel pool inventory
- Decay heat removal capability

Review

OP-1015.048 is the ANO Shutdown Operations Protection Plan (SOPP) and defines HREs as "Activities, plant configurations, or conditions during outages where the plant is more susceptible to an event causing a loss of Key Safety Function."

The Shutdown Conditions dealt with by the SOPP are divided into six conditions based on fuel location, Reactor Coolant System (RCS) and fuel transfer canal inventory, and RCS status of either intact or open. The six shutdown conditions from low to high risk are:

1. The reactor vessel defueled with all fuel in the spent fuel pool.
2. Fuel Transfer Canal (FTC) is flooded greater than 23' above the core with fuel in the vessel and no refueling in progress.
3. FTC is flooded greater than 23' above the core with fuel in the vessel and refueling is in progress.
4. RCS is intact with fuel in the vessel and the RCS level is greater than 376.5' (reactor vessel flange).
5. RCS is open with fuel in the vessel, the RCS level is greater than 376.5', and FTC level is less than 23'.
6. RCS is open, with fuel in the vessel, and the RCS level is in a lowered inventory condition less than 376.5'.

Unit Applicability 1

Comments None

Reference Document	Document Detail
CALC-09-E-0008-01, ANO-1 NFPA 805 Non Power Operations Assessment, Rev. 0	Sections 3.1, 4.2
OP-1015.048, Shutdown Operations Protection Plan, Rev. 9	All

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.

Implementing Guidance F.2

Identify Components and Cables

The identification of systems and components to be included in this Non-Power Operations (NPO) Review begins with the identification of the Plant Operational States (POSs) that need to be considered.

Review

As described in NUMARC 91-06, the five Key Safety Functions (KSFs) are:

- Decay Heat Removal Capability
- Inventory Control
- Reactivity Control
- Containment Closure
- Electrical Power Availability

Based on Frequently Asked Question (FAQ) 07-0040, Revision 4, the POSs considered for equipment and cable selection in the ANO NPO review are:

- POS 1
- POS 2
- POS 3

The evaluation of these POSs resulted in the exclusion of the Containment Closure KSF from further consideration. Spent fuel pool cooling was also excluded from the Decay Heat Removal (DHR) KSF. The remaining KSFs were evaluated to determine which POS required consideration for selection of equipment and cable necessary to maintain the KSF. The summary of each KSF in relationship to the POS considered in the ANO-1 NFPA 805 NPO Assessment are:

Decay Heat Removal Capability

An evaluation of the DHR system during POS 2 (mid-loop) effectively bounds POS 1a (drain-down). A loss of DHR during POS 3 is not an immediate concern due to the large inventory available and long times to boil.

Inventory Control

An evaluation of the Inventory Control KSF (drain paths & makeup) during POS 2 (mid-loop) effectively bounds POS 1a (drain-down) and POS 3 (drain paths).

Reactivity Control

The inclusion of source range nuclear instrumentation assures reactivity changes are quickly identified and actions can be taken to assure maintenance of this KSF during all POS.

Electric Power Availability

Offsite power and both trains of onsite emergency power are evaluated to assure this support function is maintained for all POS considered for DHR, Inventory Control, and Reactivity Control KSFs. Electrical power will be limited to those electrical systems needed to directly support equipment required for DHR, Inventory Control, and Reactivity Control.

The equipment needed for each KSF was determined by review of applicable Piping & Instrument Diagrams (P&IDs), single line diagrams, schematics, and procedures to determine the extent needed for NPO. Markups of the P&IDs and single line diagrams are performed and included as an attachment to CALC-09-E-0008-03. Fault tree development, equipment operating states, and circuit analysis needed for NPO are described in detail in CALC-09- E-0008-01, "ANO-1 NFPA 805 Non Power Operations Assessment."

Unit Applicability 1

Comments None

Reference Document	**Document Detail**
CALC-09-E-0008-01, ANO-1 NFPA 805 Non Power Operations Assessment, Rev. 0	Sections 4.2, 4.3, 4.4, and 4.5
CALC-09-E-0008-03, ANO-1 NFPA 805 NPO Fault Tree and P&ID Attachments, Rev. 0	All

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.

Implementing Guidance F.3

Perform Fire Area Assessments (Identify Pinch Points)

Identify locations where:

- Fires may cause damage to the equipment (and cabling) credited above, or
- Recovery actions credited for the KSF are performed (for those KSFs that are achieved solely by recovery action, i.e., alignment of gravity feed).

Fire modeling may be used to determine if postulated fires in a fire area are expected to damage equipment (and cabling) thereby eliminating a pinch point.

Review

The pinch point analysis is performed using ARC software. ARC software extracts the necessary data from the Plant Data Management System (PDMS) and maps it to the CAFTA fault tree. Each Fire Area for NPO is evaluated to determine which equipment could be rendered unavailable. Equipment which could spuriously operate or result in the loss of a KSF was given a compliance strategy (typically a manual action) to allow NPO compliance (top gate success). This effectively captures equipment necessary to maintain a KSF in any fire area/zone but could be compromised due to a fire. This provides for each fire area a maximum set of recovery actions that may potentially be required to restore each KSF.

Areas not in deterministic compliance have recovery actions noted and a risk-informed process is used to determine if the defense-in-depth strategy is adequate to maintain the KSFs. This was performed using the following sequence for each impacted area/zone:

- Determine the NFF (NPO Compartment Fire Ignition Frequency)
- Review area/zone for detection and suppression
- Consideration of recovery actions
- Circuit failure likelihood

No pinch point was excluded in the current NPO analysis but may be considered a viable option for future plant changes.

Unit Applicability 1

Comments None

Reference Document	Document Detail
CALC-09-E-0008-01, ANO-1 NFPA 805 Non Power Operations Assessment, Rev. 0	Section 6.0

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.

Implementing Guidance F.4

Manage Risks Associated with Fire-Induced Vulnerabilities During the Outage

During Those NPO Evolutions Where Risk is Relatively Low

The following actions are considered to be adequate to address minor losses of system capability or redundancy:

- Control of Ignition Sources
  - Hot Work (cutting, welding and/or grinding)
  - Temporary Electrical Installations
  - Electric Portable Space Heaters
- Control of Combustibles
  - Transient Fire Hazards
  - Modifications
  - Flammable and Combustible Liquids and Gases
- Compensatory Actions for Fire Protection System Impairments
  - Openings in Fire Barriers
  - Inoperable Fire Detectors or Detection Systems
  - Inoperable Fire Suppression Systems
- Housekeeping

During Those NPO Evolutions that are Defined as HREs

Additional fire protection defense in depth measures will be taken during HREs by:

- Managing risk in fire areas that contain known pinch points
- Managing risk in fire areas where pinch points may arise because of equipment taken out of service

For those areas, consider combinations of the following options to reduce fire risk depending upon the significance of the potential damage:

- Prohibition or limitation of hot work in fire areas during periods of increased vulnerability
- Verification of operable detection and/or suppression in the vulnerable areas
- Prohibition or limitation of combustible materials in fire areas during periods of increased vulnerability
- Plant lineup modifications (removing power from equipment once it is placed in its desired position)
- Provision of additional fire patrols at periodic intervals or other appropriate compensatory measures (such as surveillance cameras) during increased vulnerability
- Use of recovery actions to mitigate potential losses of key safety functions
- Identification and monitoring in-situ ignition sources for "fire precursors" (e.g., equipment temperatures)

In addition, for KSF Equipment removed from service during the HREs, the impact should be evaluated based on KSF equipment status and the Fire Area Assessment to develop needed contingency plans/actions.

Review

The normal fire protection programs such as combustible and hot work control are maintained during NPO modes. Operability of detection and suppression systems is maintained.

In fire areas/zones where a pinch point is created, a risk-informed evaluation is performed to determine if defense-in-depth strategies are adequate to assure maintenance of each KSF. The type of equipment present and its role in maintenance of KSFs provide locations where no hot work is to be performed during NPO without additional compensatory actions in place, such as securing of equipment in the safe position (i.e., power removed). Identification of modifications is included to reduce risk.

Unit Applicability 1

Comments None

Reference Document	Document Detail
CALC-09-E-0008-01, ANO-1 NFPA 805 Non Power Operations Assessment, Rev. 0	Sections 6.0 and 6.1
CALC-08-E-0016-01, Fire Probabilistic Risk Assessment Plant Partitioning and Fire Ignition Frequency Development, Rev. 0	All
EN-DC-127, Control of Hot Work and Ignition Sources, Rev. 11	All
EN-DC-161, Control of Combustibles, Rev. 7	All
EN-DC-330, Fire Protection Program, Rev. 1	All

VFDR ID	NPO-Procedure
Description	Operations procedures for NPO are required for transition to NFPA 805 based upon the insights gained from the ANO-1 NPO calculation. This can be accomplished by either incorporation into an existing procedure such as OP-1203.049, "Fires in Areas Affecting Safe Shutdown," or the development of a new procedure (refer to Attachment S of this Enclosure). This task will be completed during NFPA 805 implementation following issuance of the NRC Safety Evaluation (SE). The NPO procedure will incorporate: • Available equipment by fire affected area • Manual recovery actions • Compensatory Actions
Disposition	This open item is being tracked to completion by CR-ANO-C-2006-00048 CA 71
Status	Open
Corrective Action Reference	CR-ANO-C-2006-00048 CA 71
Include in LAR/TR	Yes
FRE / Change Eval / Mod Reference	

VFDR ID	NPO-RCS-DHR
Description	ANO-1 has no redundancy with respect to the single RCS drop line with three in-series valves CV-1050, CV-1410, and CV-1404. The risk associated with the RCS drop line valves is low, but the consequences of a spurious failure is high (loss of DHR without recovery) as all three valves are NRC Information Notice (IN) 92-18 concerns and can fail in the closed position. Procedural changes will be made to secure valve(s) by removing power and/or modification of the credited valve(s) performed to prevent spurious operation (refer to Attachment S of this Enclosure). The impacted fire areas for each valve are as follows: CV-1050: B-1 @ NAB, B-8, C CV-1410: B-1 @ NAB CV-1404: I-1, I-2
Disposition	This open item is being tracked to completion by CR-ANO-C-2006-00048 CA 71 One or more valves in this path require either physical or electrical modification to eliminate IN 92-18 issues. Procedural changes can be made to immediately secure (open breaker) any valve that will not be required to remain in service once it is opened to establish flow. The most economical approach would be to procedurally disable two of the three valves in the drop line by opening the breaker after the system is aligned. The single valve selected to remain active will require circuit modification to prevent spurious operation or physical modification/replacement of the valve/operator to prevent damage that could prevent repositioning. The circuit modification performed for CV-1275 is applicable to this application.
Status	Open
Corrective Action Reference	CR-ANO-C-2006-00048 CA 71
Include in LAR/TR	Yes
FRE / Change Eval / Mod Reference	

E. NEI 04-02 Radioactive Release Transition

Pre-fire Plan Review

A review of the ANO-1 Pre-Fire Plans (PFP-U1 and PFP-UC) was conducted to ensure that containment and monitoring of potentially contaminated fire suppression water is addressed. Each Pre-Fire Plan contains information which may be utilized by Fire Brigade or other support personnel in responding to a fire within the facility. In addition, information has been included which may be pertinent to Operation's support personnel in performing safe shutdown activities in response to any single fire scenario.

Pre-Fire Plans contain the following information:

Header	- This section identifies the Fire Zone, Fire Area, Name of the Zone, and the Elevation.
Occupancy	- This section identifies the number and location of plant personnel normally assigned to a work location in the fire zone or whose escape through the affected fire zone would be blocked by the postulated fire.
Fire Brigade Access	- This section identifies primary and secondary route for fire brigade members to expediently respond to the affected fire zone.
Plant Personnel Egress	- This section identifies primary and secondary routes for plant personnel to escape from the work location that could be affected by a fire in the zone.
Lighting/Communication	- This section provides a listing of emergency lighting available to the affected fire zone. In addition, a primary and secondary listing of communication equipment available to the fire brigade both inside and outside of the affected fire zone is provided.
Barriers	- This section identifies only those barriers, three-hour or one-hour, that separate redundant systems/equipment and could be directly affected by a breach in the barrier (i.e., the barrier between the switchgear rooms or the barrier between the emergency diesel generators).
Hazards	- This section provides a listing of the fire hazards, radiation hazards, hazardous materials (both in itself and products produced during combustion), physical hazards, electrical hazards, and compressed gases.

		The electrical hazards section includes the major electrical components in a particular fire zone (i.e. pumps, fans, power panels, lighting panels, motor control centers, switchgear, etc.). However, the fire brigade is instructed to take common precautions for electrical fires since electrical cables to other components may be present. Additionally, battery-backed emergency lights are located throughout the plant, but are not identified as being in the fire zones.
Fixed Fire Systems	-	This section lists both suppression systems and detection systems available in the affected fire zone. In addition, the control and isolation valve numbers and their location for suppression systems are provided.
Manual Suppression Equipment	-	This section lists portable fire extinguishers and fire hose stations located in and en route to the affected fire zone.
Ventilation	-	The fixed ventilation/exhaust systems to the fire zone are provided in this section. The portable exhaust fans setup and discharge points are provided under “General Fire Fighting Strategies.”
Affected Components of Interest	-	This section contains a list of those components and equipment utilized in the safe shutdown of the plant that could be affected by a fire in the fire zone.
Available Safe Shutdown Instrumentation	-	This section lists the assured safe shutdown instrumentation availability for a fire in the effected fire zone.
Guidelines for Fire Attack	-	This section contains a descriptive listing of general fire brigade actions, specific attack methodologies to be implemented based on the previously listed information, and strategies to be implemented both at the fire scene and by the Control Room.
Special Precautions/Notes	-	This section contains a descriptive listing of special precautions or actions to be taken in the affected fire zone (i.e., ponding concern for zones containing suppression systems whose operation could flood the area or areas below the fire floor).

The Pre-Fire Plans also provide the following guidance:

- In general, utilize portable fans with flexible ductwork to evacuate smoke from the Auxiliary Building both inside and outside controlled access.
- For rooms at Elevation 372’ of the Auxiliary Building, utilize the diesel room exhaust fans as much as possible.
- At Elevation 317’ in the Auxiliary Building, evacuate smoke via the tendon gallery access hatches outside the Reactor Building.
- At Elevation 335’ of the Auxiliary Building, evacuate smoke through the roof hatch in the ventilation equipment area.
- At Elevation 354’ of the Auxiliary Building, evacuate smoke down the train bay to the transformer yard.
- At Elevation 386’ of the Auxiliary Building, evacuate smoke into the open area around the diesel generator room exhaust fans.
- At Elevation 404’ of the Auxiliary Building, evacuate smoke to the outside.
- For a fire in the Turbine Building, utilize existing smoke vents or roof exhaust fans.
- If the decision is made to re-energize permanent plant ventilation systems, it is important to energize exhaust air first. Tripped fire dampers may be wired open to provide a flow path.
- Any decision to ventilate a room using the permanent plant ventilation systems and ductwork should not be made until the fire is out with a fire watch established at each wired-open fire damper. Dampers between fire floor/area and discharge point will need to be manually closed during this operation to prevent the smoke from transcending and accumulating in other rooms/areas where this smoke is unwanted.
- Radiation Protection (RP) will need to provide portable monitoring of all smoke releases from the contaminated areas of the plant.

The Pre-Fire Plans address areas where run-off or ponding of fire suppression water may be an issue. "Guidelines for Fire Attack" and "Special Precautions/Notes" sections of the Pre-Fire Plans contain specific steps to take based on the potential problems for the fire zone.

Auxiliary Building drains are collected and monitored per operator procedures OP-1104.014, "Dirty Liquid Waste and Drain Processing" for ANO-1 and OP-2104.014, "LRW and BMS Operations" for ANO-2.

The Turbine Building is generally open to the outdoors. Potential sources of radioactivity are generally contained within steel vessels and piping that are not expected to be breached as a result of firefighting activities. Turbine building drains are routed to the turbine building sump and retained for monitoring prior to processing and/or release.

Reactor Building Closure

Closure of the Reactor Building is controlled per Operations procedure OP-1015.002, “Decay Heat Removal and LTOP System Control,” and an obstruction list is maintained during Modes 5 and 6. Reactor Building openings are internal to the plant during non-power operations with the exception of the Equipment Hatch and the Emergency Escape Hatch. Closure of the Equipment Hatch for Reactor Building integrity during Modes 5 and 6 is established by a Reactor Building closure plan with a specific closure time identified. While a specific closure time is not specified for the defueled condition, plant procedure OP-1104.033, “Reactor Building Ventilation,” provides instructions for Operations to control ventilation in the Reactor Building to maintain negative pressure and thereby prevent effluent flow from the Equipment Hatch or Emergency Personnel Hatch. In addition, Radiation Protection monitors the airflow at the Equipment Hatch per procedure EN-RP-131, “Air Sampling,” and maintains a continuous air monitor.

Additionally, based on the volume of the Reactor Building for collection of smoke and the location of the equipment hatch in relation to the top of the Reactor Building (~150' below top of dome), the potential for smoke migration to lower levels is generally not considered creditable prior to containment integrity and monitoring actions being taken. Large ignition sources such as Reactor Coolant Pumps and their associated oil supply were considered the largest contributor. Due to lack of large components such as these pumps/motors operating during this plant configuration, no ignition source could be identified.

Given heightened personnel attendance and monitoring of the Reactor Building, the potential for fire hazards large enough to present a potential release is unlikely. Administrative controls for hot work and handling of transient combustibles during outages further enhance the prevention, detection and response elements of defense in depth for this area, ensuring the potential for radioactive release is minimized.

In conclusion, radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) is expected to be as low as reasonably achievable and not exceed applicable 10 CFR 20 limits.

Common Areas

The Common Pre-Fire Plans specifically address three areas that store low level radioactive waste or materials. These three areas are common to both units and are identified as the Old Radwaste Storage Building, the Low Level Radwaste Storage Building, and the RP Storage Building.

Engineering Controls

A review of engineering controls to ensure containment of gaseous and liquid effluents (e.g., smoke and fire fighting agents) was performed for ANO-1 and areas common between ANO-1 and ANO-2. This review included all plant operating modes (including full power and non-power conditions). Where applicable, the specific engineering controls are provided in the attached table.

Training Review

Procedure OP-1063.020, “Fire Brigade Training Program,” describes the Fire Brigade Training Sequence to assure the capability to fight potential fires is established and maintained. The procedure is applicable to the initial training and retraining of the Fire Brigade personnel at ANO-1 and ANO-2. Fire Protection Engineering has responsibility for reviewing and being knowledgeable of the training requirements of the Fire Brigade and for assessing the effectiveness of the Fire Brigade training.

Initial training for Fire Brigade Members and Support Members consists of a scheduled 40-hour program of instruction as detailed in the Fire Brigade Training Program and Course Summary. The Initial Fire Brigade Training class includes classroom training and hands on training and practice, as well as firefighting scenarios using controlled fire environments. Fire Brigade Leader Training is provided to Operation's personnel to ensure that personnel meeting the requirements for Fire Brigade Leader are capable of taking charge at the scene of a fire.

Continuing Fire Brigade Training is taught on a periodic basis to ensure that the capability to fight fires is maintained. Topic areas (content) of the Initial Training are repeated every two years in the Continuing Training Program. Fire Brigade members and support members attend Annual Practice Class and drills to maintain needed skills.

Training on radiological release potential is provided in lesson plan ASLP-FP-CAFRS, "Responding to Fires in Controlled Access," in the Fire Brigade training program. This lesson plan addresses radioactive contamination and the need for monitoring and containment. Specifically, the areas of "Flooding Concerns" and "Ventilation Concerns" are addressed. The lesson plan states that "consideration must be given to the path the smoke and gases will take when they are evacuated." Additionally, "any ventilation path that does not provide for the smoke and gases from the fire to be monitored for radiological contamination should be discussed with the Control Room and Radiation Protection prior to being used." These principles are further supported and enhanced in Fire Brigade Leader training. Radioactive materials areas outside "Controlled Access" are addressed in the Pre-Fire Plans.

Attachments

Support Documentation is provided in an attached table that lists Pre-Fire Plans by fire zone for ANO-1 and also for areas common to ANO-1 and ANO-2. Fire zones were "screened in" for consideration based on radiation levels greater than "low" for the presence of radiological hazards identified in the Pre-Fire Plan. Areas for controlled storage of radioactive sources, transitional areas, and some isolated areas with low levels of fixed contamination are not listed in source documents.

Reference Documents

1. EN-RP-131, Air Sampling, Rev. 10, Section 5.2[6]
2. OP-1003.013, Control of Prefire Plans, Rev. 1
3. OP-1015.002, Decay Heat Removal and LTOP System Control, Rev. 44
4. OP-1015.007, Fire Brigade Organization and Responsibilities, Rev. 25
5. OP-1104.014, Dirty Liquid Waste and Drain Processing, Rev. 30
6. OP-1104.033, Reactor Building Ventilation, Rev. 73
7. OP-1104.044, Turbine Building Draining System, Rev. 14
8. OP-1203.009, Fire Protection System Annunciator Corrective Action, Rev. 27
9. OP-2203.034, Fire or Explosion, Rev. 14
10. PFP-U1, ANO Prefire Plan (Unit 1), Rev. 15
11. PFP-UC, ANO Prefire Plan (Common), Rev. 13

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review								
TAB	FIRE ZONE	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plan Elev. 404	157-B	Chemical Addition Area (Boric Acid Makeup Tank)	Y	Y	VEF14A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 404	159-B	Spent Fuel Area	Y	Y	VEF14A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 404	160-B	Computer and Control Rod Drive(CRD) Equipment Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 404	161-B	Ventilation Equipment Area	Y	Y	VEF30	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 404	163-B	Reactor Building Purge Room	Y	Y	VEF14A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 404	167-B	Computer Transformer Room (CRD AC Breakers)	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 404	168-B	Transformer Room (X-8)	Y	Y	VEF14A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 404	170-Z	Steam Pipe Area (Penthouse)	Y	N	N/A	N/A	N/A	Not in RCA and rad levels are low.

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review								
TAB	FIRE ZONE	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plan Elev. 404	197-X	Turbine Building 404’	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 386	120-E	Boric Acid Addition Tank and Pump Room	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 386	125-E	HP Work Room	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 386	128-E	Controlled Access and Health Physics Area (CA-1)	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 386	129-F	Control Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 386	144-D	Upper South Electrical Penetration Room	Y	Y	VEF8A/B VEF38A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 386	149-E	Upper North Electrical Penetration Room, Hot Tool Room, Decon Room	Y	Y	VEF8A/B VEF38A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 386	197-X	Turbine Building 386’	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 386	1-E	North Emergency Diesel Generator Exhaust Fans	N	N	N/A	N/A	N/A	Not Required

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review								
TAB	FIRE ZONE	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plan Elev. 386	2-E	South Emergency Diesel Generator Exhaust Fans	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	100-N	South Switchgear Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	104-S	South Electrical Equipment Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	105-T	Lower South Electrical Penetration Room	Y	Y	VEF8A/B VEF38A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 372	110-L	South Battery Room and DC Equipment Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	112-I	Lower North Electrical Penetration Room	Y	Y	VEF8A/B VEF38A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 372	197-X	Turbine Building 372’	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	75-AA	Chiller Room, Ammonia Tank Room, and Main Steam Lines	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	86-G	North Diesel Generator Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	87-H	South Diesel Generator Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	88-Q	Communications Room	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review								
TAB	FIRE ZONE	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plan Elev. 372	89-P	Controlled Access Corridor	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 372	95-O	North Battery Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	97-R	Cable Spreading Room and Relay Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	98-J	Access Corridor 98	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 372	99-M	North Switchgear Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 354	175-CC	Lube Oil Reservoir Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 354	197-X	Turbine Building 354’	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 354	67-U	Lab and Demineralizer Access Area	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 354	68-P	Makeup Tank Room	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 354	73-W	Condensate Demineralizer Area	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 354	75-AA	Chiller Room, Ammonia Tank Room, and Main Steam Lines	N	N	N/A	N/A	N/A	Not Required

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review

TAB	FIRE ZONE	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plan Elev. 354	76-W	Compressor Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 354	77-V	Upper South Piping Penetration Room	Y	Y	VEF8A/B VEF38A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 354	78-BB	Gas Bottle Storage Area	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 354	79-U	Upper North Piping Penetration Room	Y	Y	VEF8A/B VEF38A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 335	16-Y	Clean Waste Receiver Tank Area	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 335	187-DD	Dirty & Clean Lube Oil Storage Tank Room	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 335	197-X	Turbine Building 335’	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 335	2026-Y	Drumming Station	Y	Y	VEF14A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 335	20-Y	Radwaste Processing Area	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review								
TAB	FIRE ZONE	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plan Elev. 335	31-Y	Purification Demineralizer Area	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 335	34-Y	Safeguard Pipeway (North)	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 335	38-Y	Emergency Feedwater Pump Area	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 335	40-Y	Safeguard Pipeway (South)	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan Elev. 335	46-Y	Lower South Piping Penetration Room	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 335	47-Y	Penetration Ventilation Area	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 335	53-Y	Lower North Piping Penetration Area	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 335	75-AA	Chiller Room, Ammonia Tank Room, and Main Steam Lines	N	N	N/A	N/A	N/A	Not Required

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review								
TAB	FIRE ZONE	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plan Elev. 317	10-EE	East (B) Decay Heat Removal Pump Room	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 317	12-EE	Tendon Gallery Access Area	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 317	14-EE	West (A) Decay Heat Removal Pump Room	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan Elev. 317	4-EE	General Access Area	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan	162-A	Stairwell No. 1	Y	Y	VEF8A/B	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan	32-K	Reactor Building (North Side)	Y	Y	VEF15	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plan	33-K	Reactor Building (South Side)	Y	Y	VEF15	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review								
TAB	FIRE ZONE	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plan	Diesel Fuel Vaults	Diesel Fuel Storage Vaults	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan	Main Transformers	ANO-1 Main Transformer Area	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan	Manholes 1 MH03/MH05	Yard Manholes 1MH03, 1MH05	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan	Manholes 1 MH04/MH06	Yard Manholes 1MH04, 1MH06	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan	Manholes 1 MH09/MH10	Yard Manholes 1MH09, 1MH10	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plan	ANO-1 Intake	ANO-1 Intake Structure	N	N	N/A	N/A	N/A	Not Required

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review								
TAB	PFP	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plans for Support Facilities	1	Administration Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	2	Old Chlorination Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	3	Oily Water Separator Facility	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	4	Hydrogen & CO_2 Gas Bottle Storage Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	5	Lube Oil Storage Building (Warehouses #14 and #21)	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	6	Old AP&L Warehouse (Warehouses #1 and #2)	Y	N	N/A	N/A	N/A	Transient storage only and rad levels are low.

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review

TAB	PFP	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plans for Support Facilities	7	Old Radwaste Storage Building (Warehouse #19)	Y	Y	None	OP-1104.014	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plans for Support Facilities	8	Pipe Fitter's Welding Shop / Lunchroom (Warehouses #17 & #20)	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	9	Old NSSS Warehouse (Warehouse #3)	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	10	Low Level Radwaste Storage Building	Y	Y	Exhaust Fan A/B	Sump	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.
Pre-fire Plans for Support Facilities	11	Network Computer Diesel & Plant Services Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	12	Central Support Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	13	New Maintenance Facility	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	14	Cable Reel Storage Warehouse (Warehouse #6)	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	15	New NSSS Warehouse (Warehouse #5)	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	16	Insulation Warehouse (Warehouse #7)	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	17	Alternate AC Generator Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	18	Receiving Warehouse (Warehouse #4)	N	N	N/A	N/A	N/A	Not Required

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review

TAB	PFP	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plans for Support Facilities	19	System Engineering Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	20	Primary Access Point	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	21	Technical Support Building	N	N	N/A	N/A	N/A	Not Required – NDE sources are programmatically controlled.
Pre-fire Plans for Support Facilities	22	ANO Sally Port	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	22	FZ-3065 ANO Sally Port	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	23	Vacuum Degasifier Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	24	Start-Up Boiler Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	25	Generation Support Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	26	Reeves E. Ritchie Training Facility	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	27	Simulator Building (Training Facility)	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	28	New Fabrication Shop	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	29	Bulk Storage Warehouse #12	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	30	Freight Receiving Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	31	Bulk Diesel Fuel Storage Tank, T-25	N	N	N/A	N/A	N/A	Not Required

NEI 04-02 Table E-1 – Radioactive Release Transition Radioactive Release Compartment Review								
TAB	PFP	COMPARTMENT	RAD CONCERNS	SCREENED IN	ENGINEERING CONTROLS		TRAINING REVIEW RESULTS	CONCLUSIONS
					Smoke	Water		
Pre-fire Plans for Support Facilities	32	Turbine Rotor Maintenance Facility	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	33	Reactor Vessel Head Assembly Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	34	Switchyard Control Building	N	N	N/A	N/A	N/A	Not Required
Pre-fire Plans for Support Facilities	35	Radiation Protection Storage Building	Y (fixed)	Y	None	None	The NFPA 805 performance requirements for Training are satisfied.	The NFPA 805 performance requirements for radiological release are satisfied.

F. Fire-Induced Multiple Spurious Operations Resolution

The following provides the guidance from FAQ 07-0038, Revision 3, along with the process and results.

Step 1 – Identify potential MSOs of concern

Information sources that may be used as input include:

- Post-fire safe shutdown analysis (NEI 00-01, Revision 1, Chapter 3)
- Generic lists of MSOs (e.g., from Owners Groups and/or later versions of NEI 00-01, if endorsed by NRC for use in assessing MSOs)
- Self assessment results (e.g., NEI 04-06 assessments performed to addressed RIS 2004-03)
- PRA insights (e.g., NEI 00-01, Revision 1, Appendix F)
- Operating Experience (e.g., licensee event reports, NRC Inspection Findings, etc.)

Results of Step 1:

Information sources that were used as input to the ANO expert panel assessment held September 27th and 28th, 2005, and described in Step 2 include the following.

1. United States Nuclear Regulatory Commission Regulatory Issue Summary 2004-03, *Risk-Informed Approach for Post-Fire Safe-Shutdown Circuit Inspections*, Revision 1, December 29, 2004.
2. United States Code of Federal Regulations, Title 10, Part 50, Appendix R, *Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979*.
3. United States Nuclear Regulatory Commission Generic Letter 86-10, *Implementation of Fire Protection Requirements*, April 24, 1986.
4. ANO Calculation CALC-85-E-0086-01, *Unit 1 Safe Shutdown Capability Assessment*, Revision 4.
5. ANO Calculation CALC-99-R-0002-01, *Evaluation of High / Low Pressure Interface Valves with Respect to 10 CFR 50 Appendix R*, Revision 1.
6. ANO Calculation CALC-85-E-0086-02, *Manual Action Feasibility Methodology and Common Results*, Revision 4.
7. Nuclear Energy Institute Technical Report NEI 04-06, *Guidance for Self-Assessment of Circuit Failure Issues*, Draft Revision L, March 2005.
8. United States Nuclear Regulatory Commission Inspection Procedure Attachment 71111.05T, *Fire Protection (Triennial)*, April 21, 2006.
9. United States Nuclear Regulatory Commission Auxiliary and Power Conversion Systems Branch (APCSB) Branch Technical Position APCSB 9.5-1, *Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976*, August 23, 1976.
10. ANO Calculation CALC-85-E-0087-24, *Safe Shutdown Cable Analysis*, Revision 0

These information sources for the expert panel assessment included the post-fire safe shutdown analysis (Item 4), PRA insights (expert panel experience), and operating experience (Items 5 and 6 and expert panel experience). The expert panel meeting was also part of the NEI 04-06 assessment performed to address RIS 2004-03 (see Items 7 and 10). Thus, with the exception of a generic list of MSOs, the information sources recommended by FAQ 07-0038 were utilized for the expert panel assessment.

A PWROG generic list of MSOs was not yet available at the time of the expert panel meeting in 2005. However, the list of PWR generic MSOs from Revision 2 of NEI 00-01 was evaluated to ensure that applicable MSOs from this list have been included in the NSCA and Fire PRA model.

Step 2 – Conduct an expert panel to assess plant specific vulnerabilities (e.g., per NEI 00-01, Rev. 1 Section F.4.2).

The expert panel should focus on system and component interactions that could impact nuclear safety. This information will be used in later tasks to identify cables and potential locations where vulnerabilities could exist.

The documentation of the results of the expert panel should include how the expert panel was conducted including the members of the expert panel, their experience, education, and areas of expertise. The documentation should include the list of MSOs reviewed as well as the source for each MSO. This documentation should provide a list of the MSOs that were included in the PRA and a separate list of MSOs that were not kept for further analysis (and the reasons for rejecting these MSOs for further analysis).

Describe the expert panel process (e.g., when it was held, what training was provided to the panel members, what analyses were reviewed to identify MSOs, how was consensus achieved on which MSOs to keep, and any dispute resolution process criteria used in decision process, etc.).

Note: The physical location of the cables of concern (e.g., fire zone/area routing of the identified MSO cables), if known, may be used at this step in the process to focus the scope of the detailed review in further steps.

Results of Step 2:

On September 27th and 28th, 2005, a panel of plant and industry personnel met at ANO to identify those combinations of spurious actuations which, if they occurred concurrently, could be risk significant.

A specific intent of assembling this panel was to ensure potential combinations that may not have been considered previously due to the plant's existing licensing basis would be identified. The safe shutdown analysis addresses spurious actuation on an any-and-all, one-at-a-time basis. Except for high-low pressure interfaces, concurrent spurious actuations had not been previously considered. In particular, the synergistic effects of concurrent failures in different systems may not have been considered.

The panel discussion focused on potential transients that could adversely affect achievement and maintenance of the post-fire safe shutdown functions. Thus, the discussion focused on those fire-induced transients that would require operator action in the first hour after the fire and subsequent reactor trip, and those that could potentially damage equipment that may be required later, such as the credited low pressure injection (LPI) pump used for shutdown cooling. The panel also considered whether the synergistic effects of concurrent spurious actuation in different systems serving different safe shutdown functions could adversely affect safe shutdown.

The alternate approach described in NEI 04-06 was used to ensure all potentially risk-significant combinations were evaluated for all fire areas. Since all potential spurious actuations of equipment identified as required for safe shutdown were in the process of being evaluated, the initial focus was placed on identifying those spurious actuations that, if they occurred concurrently, could result in an unrecoverable plant condition or lead to unrecoverable equipment damage. The safe shutdown equipment list had been validated and the circuit analysis validation had been completed at the time of the assessment.

The panel assembled at ANO focused on identifying those spurious actuations and combinations thereof that could be risk significant. An initial screening was performed by the panel based on the function affected, the potential consequences, and the time available to mitigate the potential transient. In this manner, spurious actuations and combinations of spurious actuations that did not require a mitigating action in the first hour after the reactor trip were identified.

The expert panel included members with experience in electrical design engineering, mechanical design engineering, nuclear design engineering, system engineering, fire protection, safe-shutdown analysis, operations, reactor safety analysis, maintenance, probabilistic risk assessment, and accident management. A list of the expert panel members, including their education, experience and area(s) of expertise is contained in on-site documentation.

Step 3 – Update the Fire PRA model and NSCA to include the MSOs of concern.

This includes the:

- Identification of equipment (NUREG/CR-6850, Task 2)
- Identification of cables that, if damaged by fire, could result in the spurious operation (NUREG/CR-6850, Task 3, Task 9)
- Identify routing of the cables identified above, including associating that routing with fire areas, fire zones and/or Fire PRA physical analysis units, as applicable.

Include the equipment/cables of concern in the Nuclear Safety Capability Assessment (NSCA). Including the equipment and cable information in the NSCA does not necessarily imply that the interaction is possible since separation/protection may exist throughout the plant fire areas such that the interaction is not possible.

Note: Instances may exist where conditions associated with MSOs do not require update of the Fire PRA and NSCA analysis. For example, Fire PRA analysis in NUREG/CR-6850, Task 2, Component Selection, may determine that the particular interaction may not lead to core damage, or pre-existing equipment and cable routing information may determine that the particular MSO interaction is not physically possible. In other instances, the update of the PRA may not be warranted if the contribution is negligible. The rationale for exclusion of identified MSOs from the Fire PRA and NSCA should be documented and the configuration control mechanisms should be reviewed to provide reasonable confidence that the exclusion basis will remain valid.

Results of Step 3:

The Fire PRA addresses spurious operations, including multiple spurious operations, identified in the post-fire safe shutdown analysis. These include those that resulted from the expert panel review and from review of the more recent PWROG generic list of MSOs (as applicable). The Fire PRA model includes a correlation of safe shutdown components to PRA basic events and a correlation of PRA basic events to safe shutdown components.

The NSCA includes equipment and cables of concern identified during the expert panel review and during review of the more recent PWROG generic list of MSOs (as applicable). As noted in FAQ 07-0038, including the equipment and cable information in the NSCA does not necessarily imply that the interaction is possible since separation or protection may exist throughout the plant fire areas such that the interaction is not possible.

The PWROG generic list of MSOs was not yet available at the time of the expert panel meeting in 2005. However, the list of PWR generic MSOs from Revision 2 of NEI 00-01 was evaluated to ensure that applicable MSOs from this list have been included in the NSCA and Fire PRA model.

Step 4 – Evaluate for NFPA 805 Compliance

The MSO combinations included in the NSCA should be evaluated with respect to compliance with the deterministic requirements of NFPA 805, as discussed in Section 4.2.3 of NFPA 805. For those situations in which the MSO combination does not meet the deterministic requirements of NFPA 805 (VFDR), the issue with the components and associated cables should be mitigated by other means (e.g., performance-based approach per Section 4.2.4 of NFPA 805, plant modification, etc.)

The performance-based approach may include the use of feasible and reliable recovery actions. The use of recovery actions to demonstrate the availability of a success path for the nuclear safety performance criteria requires that the additional risk presented by the use of these recovery actions be evaluated (NFPA 805 Section 4.2.4).

Results of Step 4:

The MSO combinations included in the NSCA were evaluated with respect to compliance with the deterministic requirements of NFPA 805 Section 4.2.3, “Deterministic Approach.” For those situations in which the MSO combination did not meet the deterministic requirements of NFPA 805, the components and associated cables were added to the scope of the FREs performed for the associated fire area. Table B-2 describes the NSCA methods and Table B-3 provides the transition results for each fire area, indicating which areas required performance-based analysis.

The performance-based analyses are described in Section 4.5 and the results are provided in Attachment W.

Step 5 - Document Results

The results of the process should be documented. The results should provide a detailed description of the MSO identification, analysis, disposition, and evaluation results (e.g., references used to identify MSOs; the composition of the expert panel, the expert panel process, and the results of the expert panel process; disposition and evaluation results for each MSO, etc.). High level methodology utilized as part of the transition process should be included in the 10 CFR 50.48(c) License Amendment Request/Transition Report.

Results of Step 5:

The list of PWR generic MSOs from Revision 2 of NEI 00-01 was evaluated to ensure that applicable MSOs from this list have been included in the NSCA and Fire PRA model. This evaluation is documented in CALC-ANO1-FP-09-0020, *ANO-1 NFPA 805 Evaluation of Multiple Spurious Operations (MSOs)*.

G. Recovery Actions Transition

In accordance with the guidance provided in NEI 04-02, FAQ 07-0030, Revision 5, and RG 1.205, the following methodology was used to determine recovery actions required for compliance (i.e., determining the population of post-transition recovery actions). The methodology consisted of the following steps:

Step 1: Clearly define the primary control station(s) and determine which pre-transition OMAs are taken at primary control station(s) (Activities that occur in the Main Control Room are not considered pre-transition OMAs). Activities that take place at primary control station(s) or in the Main Control Room are not recovery actions, by definition.

Step 2: Determine the population of recovery actions that are required to resolve VFDRs (to meet the risk acceptance criteria or maintain a sufficient level of defense-in-depth).

Step 3: Evaluate the additional risk presented by the use of recovery actions required to demonstrate the availability of a success path

Step 4: Evaluate the feasibility of the recovery actions

Step 5: Evaluate the reliability of the recovery actions

An overview of these steps and the results of their implementation are provided below.

Step 1 - Clearly define the primary control station(s) and determine which pre-transition OMAs are taken at primary control station(s)

The first task in the process of determining the post-transition population of recovery actions is to apply the NFPA 805 definition of recovery action and the RG 1.205 definition of primary control station to determine those activities that are taken at primary control station(s).

Results of Step 1:

Based on the definition provided in RG 1.205, and the additional guidance provided in FAQ 07-0030, no primary control stations were identified.

Step 2 - Determine the population of recovery actions that are required to resolve VFDRs (to meet the risk or defense-in-depth criteria)

On a fire area basis all VFDRs were identified in the NEI 04-02, Table B-3 (See Attachment C). Each VFDR not brought into compliance with the deterministic approach was evaluated using the performance-based approach of NFPA 805, Section 4.2.4. The performance-based evaluations resulted in the need for recovery actions to meet the risk acceptance criteria or maintain a sufficient level of defense-in-depth.

Results of Step 2:

The final set of recovery actions are provided in Table G-1 - Recovery Actions.

Step 3 - Evaluation of the Additional Risk of the Use of Recovery Actions

NFPA 805 Section 4.2.3.1 does not allow recovery actions when using the deterministic approach to meet the nuclear safety performance criteria. However, the use of recovery actions is allowed by NFPA 805 using a risk informed, performance-based, approach, provided that the additional risk presented by the recovery actions is evaluated in accordance with NFPA 805 Section 4.2.4.

Results of Step 3:

The set of recovery actions that are necessary to demonstrate the availability of a success path for the nuclear safety performance criteria (see Table G-1) were evaluated for additional risk using the process described in NEI 04-02, FAQ 07-0030, Revision 5, and RG 1.205 and compared against the guidelines of RG 1.174 and RG 1.205. The additional risk is provided in Attachment W.

All of the recovery actions were reviewed for adverse impact and dispositioned in EC-27717, "ANO1 Fire Area Risk Evaluations for Transition to NFPA 805." None of the recovery actions were found to have an adverse impact on the Fire PRA (FPRA).

Step 4 - Evaluation of the Feasibility of Recovery Actions

Recovery actions were evaluated against the feasibility criteria provided in the NEI 04-02, FAQ 07-0030, Revision 5, and RG 1.205.

Results of Step 4:

Each of the feasibility criteria in FAQ 07-0030 were assessed for the recovery actions listed in Table G-1. The results of the assessment are included in EC-27717, "ANO1 Fire Area Risk Evaluations for Transition to NFPA 805." Feasibility is based in part on ANO-1 Functional Requirements included in CALC-85-E-0086-02, "Manual Action Feasibility and Common Results."

Implementation items resulting from the feasibility evaluation are included in the corrective action program. These items include:

- Development/revision of procedures.
- Revisions to the Training Program to reflect procedure changes.

These items are included in Attachment S.

Step 5 - Evaluation of the Reliability of Recovery Actions

The evaluation of the reliability of recovery actions depends upon its characterization.

- The reliability of recovery actions that were modeled specifically in the FPRA were addressed using FPRA methods (i.e., Human Reliability Analysis or HRA).
- The reliability of recovery actions not modeled specifically in the FPRA are bounded by the treatment of additional risk associated with the applicable VFDR. In calculating the additional risk of the VFDR, the compliant case recovers the fire-induced failure(s) as if the variant condition no longer exists. The resulting delta risk between the variant and compliant condition bounds any additional risk for the recovery action even if that recovery action were modeled.

Results of Step 5:

Specific recovery actions were added to the FPRA. For the bounding reliability treatment see results in Attachment W.

Table G-1 – Recovery Actions and Activities

Fire Area	Component	Component Description	Actions	VFDR	RA/PCS
B-1@BOFZ	P-32A/B/C/D	Reactor Coolant Pumps (RCPs)	Manually trip load breakers (H-11, H-22, H-12, H-21) and trip RCPs. For fire at switchgear H1/H2/A1/A2, the DC modification design maintains trip capability of the RCPs.	B-1@BOFZ-04	RA
G	CV-1221	Letdown Coolers Outlet	De-energize CV-1221 at panel B-61, breaker B-6154, located in Fire Area B-1, Fire Zone 149-E. Verify closed / manually close CV-1221 in Fire Area B-1, Fire Zone 79-U.	G-02	RA
G	P-32A	RCP	Manually open H-1 and H-2 feeder breakers to trip RCPs following fire damage to control circuits.	G-02	RA
G	P-32B	RCP	Manually open H-1 and H-2 feeder breakers to trip RCPs following fire damage to control circuits.	G-02	RA
G	P-32C	RCP	Manually open H-1 and H-2 feeder breakers to trip RCPs following fire damage to control circuits.	G-02	RA
G	P-32D	RCP	Manually open H-1 and H-2 feeder breakers to trip RCPs following fire damage to control circuits.	G-02	RA
G	P-36A	Primary Makeup Pump	De-energize DC control power to P-36A at D-11, D-1104, located in Fire Area F, Fire Zone 110-L. Verify tripped / manually trip A-306 in Fire Area E, Fire Zone 100-N.	G-02	RA
G	P-36B	Primary Makeup Pump	De-energize DC control power to P-36B(C) at RA-2, RA-204, located in Fire Area I-1, Fire Zone 98-J. Verify closed / manually close A-801 in Fire Area B-8, Fire Zone 104-S. De-energize DC control power to P-36B at A-4, A-407, located in Fire Area I-2, Fire Zone 99-M. Verify tripped / manually trip A-407, in Fire Area I-2, Fire Zone 99-M.	G-02	RA
G	P-36C	Primary Makeup Pump	De-energize DC control power to P-36C at A-4, A-406, located in Fire Area I-2, Fire Zone 99-M. Verify tripped / manually trip A-406 in Fire Area I-2, Fire Zone 99-M.	G-02	RA
G	P-75B**	New Auxiliary Feedwater (AFW) Pump	Manually start and align AFW pump to establish primary to secondary heat removal.	G-03, -04, -05	RA
G	PSV-1000	Pressurizer ERV	Manually disable PSV-1000 at breaker D-1124, local panel D-11 in Fire Area I-1, Fire Zone 98-J.	G-01	RA

Table G-1 – Recovery Actions and Activities

Fire Area	Component	Component Description	Actions	VFDR	RA/PCS
G	A-4	4160V Vital Power Switchgear	Verify breaker A-409 open and open DC control power breaker.	N/A	RA*
G	A-410	Vital Power Switchgear A4-A3 Crosstie	Verify breaker open and open DC control power breaker.	N/A	RA*
G	B-6	480V Vital Power	De-energize B6 locally by opening A-401 and open DC control power when Electromatic Relief Valve (ERV) isolation valve position verified.	N/A	RA*
G	CV-1000	ERV Isolation Valve	Remotely close valve.	N/A	RA*
G	CV-1206	RCP Seal Injection Valve	Verify valve closed.	N/A	RA*
G	CV-1227 CV-1228	High Pressure Injection (HPI) Block Valves	Verify valves open.	N/A	RA*
G	CV-1274	RCP Seal Bleed Off Isolation Valve	Verify valve closed.	N/A	RA*
G	CV-1275	Makeup Tank Outlet Valve	Verify valve closed.	N/A	RA*
G	CV-1408	Borated Water Storage Tank (BWST) Outlet Valve	Manually open CV-1408 while monitoring flow.	N/A	RA*
G	CV-3643	Auxiliary Cooling Water (ACW) Isolation Valve	Verify valve closed.	N/A	RA*
G	CV-3807	Service Water (SW) to Emergency Diesel Generator #2 (EDG2) Coolers	Verify valve open.	N/A	RA*
G	D21-1, -3, -9, -29 and -32	DC Power To Various Equipment	Open breakers to remove DC power to switchgear H2 and A2, and load center B-6 (RCP seal return to Quench Tank and High Point Vents).	N/A	RA*
G	K-1	Main Turbine	Manually trip Main Turbine with TRIP lever at front standard.	N/A	RA*
G	K-2A, K-2B	Main Feed Pumps	Manually trip both Main Feedwater Pumps locally.	N/A	RA*

Table G-1 – Recovery Actions and Activities

Fire Area	Component	Component Description	Actions	VFDR	RA/PCS
G	K-4B	EDG2	If EDG2 output breaker (A-408) is open, then secure EDG by opening EDG2 Engine Control Power breaker (D-2114A) inside Control Panel C-108.	N/A	RA*
G	K-4B	EDG2	Place EDG2 in *no DC* override condition to start or maintain operating if running.	N/A	RA*
G	P-34B	Low Pressure Injection / Decay Heat Removal (LPI/DHR) Pump	Verify breaker A-405 open and open DC control power breaker.	N/A	RA*
G	P-35B	Reactor Building Spray Pump	Verify breaker A-404 open and open DC control power breaker.	N/A	RA*
G	P-36B	Primary Makeup Pump	Manually start P-36B(G) at A-4, breaker A-407, located in Fire Area I-2, Fire Zone 99-M.	N/A	RA*
G	P-36C	Primary Makeup Pump	Manually start P-36C at A-4, breaker A-406, located in Fire Area I-2, Fire Zone 99-M.	N/A	RA*
G	P-4B, P-4C	SW Pump	Align Loop 2 SW.	N/A	RA*
G	RA2-3 and -4	SW Pump P-4B and Primary Makeup Pump P-36B MOD control power	Open breakers RA2-3 and 4.	N/A	RA*

** Tentative Component Number

RA – Recovery Action PCS – Primary Control Station RA* – Defense in Depth Recovery Action

H. NFPA 805 Frequently Asked Question Summary Table

This table includes the approved FAQs that have not been incorporated into the current endorsed revision of NEI 04-02 and utilized in this submittal:

Table H-1 - NEI 04-02 FAQs Utilized in LAR Submittal

No.	Rev.	Title	FAQ Ref.	Closure Memo
06-0008	9	NFPA 805 Fire Protection Engineering Evaluations	ML090560170	ML073380976
06-0022	3	Acceptable Electrical Cable Construction Tests	ML090830220	ML091240278
07-0030	5	Establishing Recovery Actions	ML103090602	ML110070485
07-0032	2	Clarification of 10 CFR 50.48(c), 10 CFR 50.48(a) and GDC 3 Clarification	ML081300697	ML081400292
07-0035	2	Bus Duct Counting Guidance for High Energy Arcing Faults	ML091610189	ML091620572
07-0038	3	Lessons Learned on Multiple Spurious Operations	ML103090608	ML110140242
07-0039	2	Lessons Learned - NEI B-2 Table	ML091420138	ML091320068
07-0040	4	Non-Power Operations Clarification	ML082070249	ML082200528
07-0054*	1	Demonstrating Compliance with Chapter 4 of NFPA 805	ML103510379	ML110140183
08-0042	0	Fire Propagation from Electrical Cabinets	ML080230438 ML091460350	ML092110537
08-0043	1	Electrical Cabinet Fire Location	ML083540152 ML091470266	ML092120448
08-0044	0	Large Oil Fires	ML081200099 ML091540179	ML092110516
08-0047	1	Spurious Operation Probability	ML082770662	ML082950750
08-0048	0	Revised Fire Ignition Frequencies	ML081200291 ML092180383	ML092190457
08-0049	0	Cable Fires	ML081200309 ML091470242	ML092100274
08-0050	0	Non Suppression Probability	ML081200318 ML092510044	ML092190555
08-0052	0	Transient Fire Growth Rate and Control Room Non-Suppression	ML081500500 ML091590505	ML092120501
08-0053	0	Kerite-FR Cable Failure Thresholds	ML082660021	ML120060267
09-0056	2	Radioactive Release Transition	ML102810600	ML102920405
10-0059	5	NFPA 805 Monitoring	ML111180481	ML120750108
12-0062	1	UFSAR Content	ML121430035	ML121160046

* The FAQ submittal number was 08-0054, but the NRC closure memo for the FAQ was listed as 07-0054. FAQ 07-0054 was used to be consistent with the Closure Memo.

I. Definition of Power Block

The methodology of the review process is discussed in Section 4.1.3 of this enclosure. For the purposes of establishing the structures included in the FPP in accordance with 10 CFR 50.48(c) and NFPA 805, plant structures listed in the following table are considered to be part of the power block.

Table I-1 – Power Block Definition

Power Block Structures	Fire Area(s)
Auxiliary Building	Various (Refer to FHA)
Containment Building	J
Electrical Manholes	1MH01 through 10
Emergency Diesel Fuel Oil Storage Tank Vault	L
Intake Structure	N
Radwaste Storage Buildings[1]	YD
Turbine Building	B-1 (Fire Zone 197-X)

[1] The Radwaste Storage Buildings include Warehouse #19 (Old Radwaste Storage Building), the Radiation Protection (RP) Storage Building (Pole Barn and Mockup Area), and the Low Level Radwaste Building.

J. Fire Modeling Verification and Validation (V&V)

This attachment documents the Verification and Validation (V&V) basis for the Arkansas Nuclear One, Unit 1 (ANO-1) Fire Probabilistic Risk Assessment (FPRA) fire modeling applications. Plant specific fire modeling used to support the ANO-1 FPRA consists of the following:

- The calculation of the Main Control Room (MCR) operator abandonment times (CALC-ANO1-FP-09-00011);
- The use of generic fire modeling treatments and associated supplements as applicable to develop Zones of Influence (ZOI) (PRA-A1-05-004);
- A detailed assessment of plant specific fire scenarios involving secondary cable tray combustibles (PRA-A1-05-011);
- An assessment of the fire resistance of embedded conduit used as a basis for excluding such conduit from fire zones (EC-494); and
- Administrative and Turbine Building separation analysis (CALC-ANO1-FP-08-00003).

<u>Main Control Room Abandonment Report</u>

The goal of the MCR abandonment report, "Evaluation of Unit 1 Control Room Abandonment Times at ANO Facility" (CALC-ANO1-FP-00011), is to compute the time operators would abandon the ANO-1 MCR given a fire in either the ANO-1 or ANO-2 MCR. The abandonment times are assessed for various electronic equipment fires and for ordinary combustible fires as defined by the discretized heat release rate conditional probability distributions presented in NUREG/CR-6850. The abandonment time in the main control room is estimated by calculating the time to reach threshold values for temperature and visibility as identified by NUREG/CR-6850.

The focus of the MCR abandonment evaluation is on the first twenty-five minutes after ignition because the non-suppression probability (NSP) decreases to 0.001 at 20.9 minutes (NUREG/CR-6850, NUREG/CR-6850, Supplement 1). The abandonment calculations are performed using the zone fire model Consolidated Fire and Smoke Transport (CFAST), Version 6.0.10 (National Institute of Standards and Technology (NIST) Special Publication (SP) 1026 and NIST SP 1041).

The MCR area geometry and fire parameters for the simulations fall within the model limits listed in NIST SP 1026 and NIST SP 1041. Specifically, the vent area to enclosure volume ratio is less than two and the aspect ratio of the enclosures is less than five (for the true geometry). The physical input dimensions are adjusted to account for obstructions and boundary heat losses and the resulting model geometry has a length-to-width aspect ratio greater than five for some spaces. However, the input geometry conserves the boundary area, room volume, and enclosure height. Therefore, a corridor flow model is intentionally avoided because the true geometry has an aspect ratio that is within the model limitations.

The verification for the CFAST model (Version 6.0.5) is provided in NUREG-1824, Volume 5. Supplemental verification for CFAST, Version 6.0.10 is provided as an appendix to CALC-ANO1-FP-09-00011 as well as in NIST SP 1086.

The non-dimensional parameters that affect the model results, as documented in NUREG-1824, Volumes 1 and 5 and NUREG-1934, include the model geometry, the global equivalence ratio, the fire Froude Number, and the flame length ratio. Non-dimensional parameters that relate to target exposure conditions (heat flux) and sprinkler actuation (ceiling jet) are not applicable to this calculation because these output parameters are not used.

The non-dimensional geometry parameters (length-to-height and width-to-height, which range from about 1.5 – 3 for the true geometry, depending on whether the fire is in the operator area or the equipment area) fall within the NUREG-1824, Volume 1, validation range (0.6 – 5.7).

CFAST, Version 6.0.10, does not use a fire diameter (NIST SP 1026; NIST SP 1041); therefore, the determination of the appropriate fire Froude Number is based on the application rather than the fire model inputs. The fire scenarios considered in the abandonment calculation include electrical panels and transient ignition sources that are typical of nuclear power plants and comparable to the types of fire scenarios envisioned in the NUREG-1824, Volume 1, V&V effort. The application of the fire modeling results are toward ignition sources that fall within the NUREG/CR-6850 conditional probability distribution for transient and electrical panel ignition sources and are thus considered typical of those used in NUREG-1824, Volumes 1 and 5, used to validate the CFAST fire model. The exception to this is the workstation fuel package fire scenario. The workstation fire involves a relatively large fire over a desk footprint. The fire Froude Number as computed using the methods described in NUREG-1934 is about 1.32 assuming a 1.2 x 0.76 m (4 x 2.5 ft) desk plan, which is within the NUREG-1824, Volume 1, validation range of 0.4 – 2.4.

The global equivalence ratio applicable to the entire ANO-1 MCR domain (equipment area and the operator area) for normal Heating, Ventilation, and Air-Conditioning (HVAC) conditions may be assessed using the ratio of the maximum supported fire size to the fire size postulated. Based on the fresh air supply flow of 0.94 m^3/s (2,000 cfm), the maximum fire size that could be supported is about 3.3 MW (3,130 Btu/s). The maximum fire size postulated is about 4 MW (3,790 Btu/s) for the workstation fire scenario; thus, the maximum global equivalence ratio is expected to be about 1.2, which exceeds the NUREG-1824, Volume 1, validation range of 0.04 – 0.6. However, the maximum average heat release rate, which better reflects the oxygen consumption that would be expected over the twenty-five minute interval, is about 2.4 MW (2,270 Btu/s). This means the maximum global equivalence ratio is expected to be on the order of 0.72, which still exceeds the NUREG-1824, Volume 1, validation range of 0.04 – 0.6. When the initial oxygen reservoir in the MCR volume is considered (539 m^3 [19,020 ft^3], capable of supporting a 860 kW [815 Btu/s] source fire for twenty-five minutes at a global equivalence ratio of 0.6), the maximum global equivalence ratio decreases to 0.47, which falls within the NUREG-1824, Volume 1, validation range. The conditions for the smoke purge mode involve a fresh air supply that is 4.5 times greater than the normal HVAC mode; thus, the maximum equivalence ratio during this HVAC mode is on the order of 0.12.

In the case of no forced ventilation, the maximum global equivalence ratio is determined using the initial mass of oxygen available. The bounding case with respect to the NUREG-1824, Volume 1, validation space is when the boundary doors remain closed. The initial oxygen reservoir can support an 860 kW (815 Btu/s) fire for twenty-five minutes at an equivalence ratio of 0.6. In the case of the transient fuel package fire, abandonment is predicted in 3.5 minutes, thus the equivalence ratio at this time would be 0.084, which is within the NUREG-1824, Volume 1, V&V range. Similarly, in the case of the multiple electrical panel fire (Bin 15), abandonment is predicted in 11.7 minutes. The average fire size at this time is about 600 kW (569 Btu/s), and the global equivalence ratio is about, 0.6 x (600 / 860) x (11.7 / 25) = 0.2, which also falls within the NUREG-1824, Volume 1, validation parameter range. Given that this is the most adverse electrical panel fire scenario postulated, the global equivalence ratio at the predicted abandonment time is expected to be comparable or lower for the less severe electrical panel fire scenarios and the transient fire scenarios. Consequently, even when the HVAC is inoperative and the boundary doors are closed, the maximum global equivalence ratio within the MCR domain is expected to remain within the NUREG-1824, Volume 1, validation range up until the time at which abandonment is predicted.

Finally, the flame length ratio is normally met, but in the case of the largest fire sizes postulated, the flame height may reach or exceed the ceiling height. Because sprinkler actuation and thermal radiation to targets are not computed with the CFAST model, this parameter is not an applicable metric. Rather, the plume entrainment below the hot gas layer controls the layer descent time and the concentration of soot products in the layer. This aspect of the model is not affected by the flame height to ceiling height ratio. Consequently, the application of CFAST to model fires in the ANO-1 Control Room falls entirely within the NUREG-1824, Volume 1, validation space.

Additional V&V studies are contained in NIST SP 1086 and NRL/MR/6180-04-8746. These studies have a broader parameter validation space than NUREG-1824, Volume 1. NIST SP 1086 is based in part on the methods of American Society for Testing and Materials (ASTM) E1355. NRL/MR/6180-04-8746 provides a Navy specific V&V study, which includes an assessment of CFAST, Version 3.1.7, predictions in multiple enclosures and multiple elevation configurations. These additional V&V studies extend the range of the validation space to include configurations and conditions applicable to the MCR abandonment sensitivity analysis (Appendix B of CALC-ANO1-FP-09-00011).

The MCR abandonment report also provides benchmark and validation simulations for CFAST as applicable to the ANO-1 MCR area. In particular, the control room tests documented in NUREG/CR-4527, Volume 2, are used to provide additional validation basis for control room application of CFAST. Table J-1 provides a summary of the validation and verification basis for CFAST, Version 6.0.10, as applied in the MCR abandonment report.

Generic Fire Modeling Treatments

The "Generic Fire Modeling Treatments," (Hughes Associates) document is used to establish zones of influence for specific classes of ignition sources and primarily serves as a screening calculation in the FPRA under NUREG/CR-6850, Sections 8 and 11. The "Generic Fire Modeling Treatments" document (Hughes Associates) has two fundamental uses within the FPRA:

- Determine the ZOI inside which a particular ignition source is postulated to damage targets or ignite secondary combustible materials; and

- Determine the potential of the ignition sources to generate a hot gas layer within an enclosure that can either lead to full room burnout or invalidate the generic treatment ZOIs for a particular class of combustible materials.

The ZOI is determined using a collection of empirical and algebraic models and correlations. The potential for a hot gas layer having a specified temperature to form within an enclosure is determined using the zone model CFAST, Version 6.0.10 (NIST SP 1026, NIST SP 1041).

Wall and corner configurations are addressed using the 'Image' Method in which the source heat release rate and area are doubled for a wall configuration and quadrupled for a corner configuration. The enclosure boundary surface area and ventilation are also doubled and quadrupled for wall and corner configurations, respectively. This treatment takes advantage of the proportionality of the entrainment to the fire perimeter and the constant plume angle [Beyler, 1986; SFPE Handbook of Fire Protection Engineering, Section 2-1, 2008; Thomas et al. 1963; NIST-GCR-90-580] and results in more adverse conditions when the entrainment/fire perimeter ratio is reduced. However, explicit scenarios are not generated; rather, alternate scenarios are selected that have characteristics that are consistent with the 'Image' method adjustments.

Verification

The calculation development and review process in place at the time the "Generic Fire Modeling Treatments" document was prepared included contributions from a calculation preparer, a calculation reviewer, and a calculation approver. The responsibilities for each are as follows:

- The calculation preparer develops and prepares the calculation using appropriate methods.
- The calculation reviewer provides a detailed review of the report and supporting calculations, including spreadsheets and fire model input files. The reviewer provides comments to the preparer for resolution.
- Calculation approver provides a reasonableness review of the report and approves the document for release.

The calculation preparation occurred over a two year period ending in 2007. The review stage was conducted in 2007 at the completion of the preparation stage. The calculation was approved January 23, 2008. The approved document, the signature page, and an affidavit were transmitted to the Document Control Desk at the Nuclear Regulatory Commission in Washington, D. C., on January 23, 2008.

In the case of the empirical equations/correlations that form part of the basis of the "Generic Fire Modeling Treatments" document, a considerable amount of verification was performed during the preparation stage by the preparer. The empirical equations/correlations were solved using Excel® spreadsheets using either direct cell solutions (algebraic manipulation) or Visual Basic macros. All direct cell solutions were validated by the preparer through the use of alternate calculation. For simple equations, this entailed matching spreadsheet solution to the solution obtained using a hand calculator. For more complex solutions, the alternate calculation verification entailed either subdividing the problem into many sub-components and matching the solution using a hand calculator or matching the solution to a verified solution (i.e., the NUREG-1805 Solid Flame Heat Flux models). The verification of the Visual Basic macros also depended on the type of macro. In situations where the macro is used to perform multiple direct computations, the macro results were verified against the verified spreadsheet solutions that were verified through alternate calculation. In cases where the macro is used to find a root, the root was verified to be a zero by direct substitution into an alternate form of the solved equation.

The empirical equations/correlations were further verified by the reviewer using a Design Review method as indicated in the signature sheet. An independent reviewer was provided access to the draft report and all supporting calculation materials in late 2007. The reviewer conducted a detailed review of the implementation of the equations within the spreadsheets and the reporting of the equation result in the draft report. Comments and insights were provided to the preparer over the review period and were addressed to the satisfaction of the reviewer. Upon the completion of the review, a revised draft was prepared for review by the approver. The approver provided a higher level reasonableness check of the methods, approach, and the results. Comments and insights that were provided by the approver were addressed to the satisfaction of the reviewer and Revision 0 of the report was prepared and approved on January 23, 2008.

The verification for the CFAST model (Version 6.0.5) is provided in NUREG-1824, Volume 5. Supplemental verification for CFAST, Version 6.0.10, is provided as an appendix to the CALC-ANO1-FP-09-00011 as well as in NIST SP 1086.

Validation

The empirical equations and correlations are drawn from a variety of sources that are documented in various chapters of the Society of Fire Protection Engineers (SFPE) *Handbook of Fire Protection Engineering,* peer reviewed journals (e.g., the *Fire Safety Journal*), or engineering textbooks. The empirical models primarily fall into three groups:

- Flame height;
- Plume temperatures; and
- Heat fluxes (at a target location).

Table J-2 of this attachment identifies the empirical models that are used either directly or indirectly in the “Generic Fire Modeling Treatments” report. The table also identifies the original correlation source documentation and the correlation range in terms of non-dimensional parameters. The table also provides where applicable supplemental validation work that may have been performed on the correlations and provides limits applied in the “Generic Fire Modeling Treatments” report as applicable.

Except for the cable tray ZOI calculation, the flame height calculation is used only as a means of placing a limit on the applicability of the ZOI tables, which are based on the plume temperature and thermal radiation heat flux. The flame height calculation for axisymmetric source fires is robust and has considerable pedigree. The original documentation and basis of the flame height correlation is Heskestad (1981) as noted in Table J-2 of this attachment. Although there are earlier forms of the flame height equation, Heskestad provides a link between the flame height and plume centerline temperature calculation and identifies the range over which the plume equations are applicable. Because the flame height and plume centerline temperature equations are linked, the plume centerline range cited by Heskestad applies to the flame height calculation as well. The plume centerline temperature equations, and thus the flame height correlation, are applicable over the following range as noted in Table J-2 (Heskestad, 1981; Heskestad , 1984):

$$-5 \lesssim \log_{10}\left[\left[\frac{c_p T_\infty}{g\rho_\infty(\Delta H_{c/r})^3}\right]\frac{\dot{Q}^2}{D^5}\right] \lesssim 5 \qquad \text{(J-1)}$$

where c_p is the heat capacity of ambient air (kJ/kg-K [Btu/lb-°R]), T_∞ is the ambient temperature (K [°R]), g is the acceleration of gravity (m/s^2 [ft/s^2]), ρ_∞ the ambient air density (kg/m^3 [lb/ft^3]), $\dot{Q}$ is the fire heat release rate (kW [Btu/s]), r is the stoichiometric fuel to air mass ratio, D is the fire diameter (m [ft]), and ΔH_c is the heat of combustion of the fuel (kJ/kg [Btu/lb]). Application of Equation (J–1) depends on the fuel as well as a non-dimensional form of the fire heat release rate (fire Froude Number). In practice, the heat of combustion to air fuel ratio for most fuels will fall between 2,900 – 3,200 kJ/kg (1,250 – 1,380 Btu/lb), and for typical ambient conditions the $\dot{Q}^{2/5}/D$ ratio, for which the plume equations have validation basis, is between 7 – 700 kW$^{2/5}$/m (2.1 – 208 Btu$^{2/5}$/s-ft) (Heskestad , 1984). For fire sizes on the order of 25 kW (24 Btu/s) or greater, this means that the plume centerline equation is valid for heat release rates of 100 kW/m^2 (8.81 Btu/s-ft^2) to well over 3,000 kW/m^2 (264 Btu/s-ft^2). For weaker fires (heat release rates less than 100 kW/m^2 (8.81 Btu/s-ft^2), the tendency of the model is clearly to over-predict the temperature and flame height; thus for applications outside the range, but below the lower limit, the result will be conservative. The concern is therefore entirely on the upper range of the empirical model. The tables in the "Generic Fire Modeling Treatments" report are specifically developed with transient, lubricant spill fires, and electrical panel fires with a heat release rate per unit area within the validation range. When the heat release rate per unit area falls outside the applicable range, the table entry is not provided and it is noted that the source heat release rate per unit area is greater than the applicable range for the correlations. This applies to the flame height and the plume temperature for axisymmetric source fires.

The flame height and plume centerline temperature for line type fires (fires having a large aspect ratio) are applied only to cable tray fires. The correlation used has pedigree and has existed in its general form since at least Yokoi. Most recently, Yuan et al. provided a basis for the empirical constant using experimental data with source fires having a width of 0.015 m – 0.05 m (0.05 – 0.16 ft) and a length of 0.2 – 0.5 m (0.7 – 1.64 ft). When normalized, the applicable height to heat release rate per unit length range ($Z/\dot{Q}'$) for the correlations based on the experiments of Yuan et al. is between 0.002 and 0.6. This range includes the flame height as well as the elevation at which the temperature is between 204 – 329 °C (400 – 625 °F), the temperature at which cable targets are considered to be damaged under steady state exposure conditions. Yuan et al. also provide a tabular comparison of the empirical constant against seven preceding line fire test series, which include a broader range of physical fire sizes and dimensions. The Yuan et al. constant is greater than the other seven and thus the temperatures and flame heights are more conservatively predicted using the Yuan et al. data. The application of the Yuan et al. correlation in the "Generic Fire Modeling Treatments" document falls within the normalized applicability range reported by Yuan et al.

Four flame heat flux models are used in the "Generic Fire Modeling Treatments" document as described in Table J-2 of this attachment: the Point Source Model, the Simple Method of Shokri and Beyler, the Method of Mudan and Croce, and the Detailed Method of Shokri and Beyler. The former two are simple algebraic models using the heat release rate, separation distance, and the fire diameter. The latter two are considered detailed radiant models that account for the emissivity of the fire and the shape of the flame. Due to limitations in the target placement, the (Simple) Method of Shokri and Beyler are shown to be inapplicable for calculating the ZOI dimensions. Similarly, for the fuels considered, it is shown that the Method of Mudan and Croce produces a net heat flux that exceeds the fire size. The ZOIs are therefore determined using the Point Source Model and the Detailed Method of Shokri and Beyler. The method that produces the largest ZOI dimension is used for each fuel and fire size bin.

The Point Source Model and the Method of Shokri and Beyler have been shown in the NUREG-1824, Volume 3, verification and validation study to provide reasonably accurate predictions when the target separation to fire diameter (R/D_f) ratio is between 2.2 and 5.7 (NUREG-1824, Volume 1). Furthermore, the fire size ranges considered in the "Generic Fire Modeling Treatments" report are between about 25 – 12,000 kW (24 – 11,400 Btu/s) and the heat release rates per unit area range between about 100 – 3,000 kW/m^2 (8.1 – 264 Btu/s-ft^2) for all fuels and fire size bins.

Using this information, the following table may be assembled for the applicable target heat flux range, based on the NUREG-1824, Volume 1, validation range:

Fire Size KW (Btu/s)	Heat Release Rate Per Unit Area, KW/m^2 (Btu/s-ft^2)	Fire Diameter, m (ft)	Point Source Model Heat Flux Range, KW/m^2 (Btu/s-ft^2)	Shokri and Beyler Heat Flux Range, KW/m^2 (Btu/s-ft^2)
25 (24)	100 (8.8)	0.56 (1.9)	0.07 – 0.45 (0.006 – 0.04)	0.36 – 3.8 (0.03 – 0.4)
25 (24)	3,000 (264)	0.1 (0.3)	2 – 13.6 (0.2 – 1.2)	2.84 – 10 (0.3 – 0.9)
12,000 (11,400)	100 (8.8)	12.4 (41)	0.07 – 0.45 (0.006 – 0.04)	0.55 – 5 (0.05 – 0.4)
12,000 (11,400)	3,000 (264)	2.3 (7.4)	2 – 13.6 (0.2 – 1.2)	0.45 – 4.6 (0.04 – 0.4)

The threshold heat fluxes that define the steady state ZOI dimensions range from 5.7 - 11.4 kW/m^2 (0.5 – 1 Btu/s-ft^2). Transient ZOI dimensions, addressed in the "Supplemental Generic Fire Modeling Treatments: Transient Ignition Source Strength" may approach 16 - 18 kW/m^2 (1.4 – 1.6 Btu/s-ft^2). Clearly, the steady state ZOI dimensions based on critical heat fluxes of 5.7 – 11.4 kW/m^2 (0.5 – 1 Btu/s-ft^2) overlay with the range of valid predicted heat fluxes identified in NUREG-1824, Volume 1. Fuels that identify the most conservative value over a range of heat release rates per unit area (transient and electrical panels) will thus include at least one point within the validation range (i.e., 5.7 kW/m^2 [0.5 Btu/s-ft^2]). Since the algorithm searches for the most adverse value, the result will be at least as conservative as the value obtained within the model validation range.

There are combinations of fuels and source strength ranges that do not produce heat fluxes that fall within the validation range. This is especially true for the higher target heat flux values (11.4 kW/m^2 [1 Btu/s-ft^2] and higher) combined with the lower transient fuel package heat release per unit area range (200 – 1,000 kW/m^2 [17.6 – 88.1 Btu/s-ft^2]). This is addressed through an extended validation range of the heat flux models provide by the SFPE (1999). As noted in Table J-2 of this attachment, the SFPE assessed the predictive capabilities of the Point Source Model and the Detailed Method of Shokri and Beyler against available pool fire data. The pool diameters ranged from 1 – 80 m (3.3 – 262 ft). The conclusion was that the Point Source Model was conservative, but not necessarily bounding, when the predicted heat flux is less than 5 kW/m^2 (0.44 Btu/s-ft^2) and the empirical constant (radiant fraction) is 0.21. The method is bounding when a safety factor of two is applied to the predicted heat flux. The application in the "Generic Fire Modeling Treatments" report uses an empirical constant (radiant fraction) of 0.35, indicating the application is essentially bounding. Similarly, it was concluded that that Method of Shokri and Beyler is conservative when the predicted heat flux is greater than 5 kW/m^2 (0.44 Btu/s-ft^2) and the method is bounding when a safety factor of two is applied to the predicted heat flux. The implementation in the "Generic Fire Modeling Treatments" report is conservative, though not bounding. Although the SFPE considered fire diameters greater than about 1 m (3.3 ft), smaller diameter pool fires are not optically thick and have a lower emissive power (SFPE Handbook of Fire Protection Engineering, Section 3.1). Thus, the use of the methods for smaller fires is conservative though outside the SFPE validation range.

The use of the heat flux models largely falls within the NUREG-1824, Volume 1, validation parameter space range; however there are cases where this is not so. For larger diameter fires, the SFPE provides comprehensive validation against full scale test data of the methods applied. The application in the “Generic Fire Modeling Treatments” report and the applicable supplements necessarily fall within the validation range or are more conservative because the solution algorithm identifies the most adverse solution among the methods. Smaller fires may fall outside the validation range of both studies, but such fires have a lower emissive power and are conservatively treated using the methods designed for high emissive power source fires.

A number of other empirical models that appear in the generic fire modeling treatments are applied within the stated range of the models or the data for which the models were developed. For example, the cable heat release rate per unit area model is based on cables that have a small scale heat release rate that ranges between 100 – 1,000 kW/m^2 (8.8 – 88.1 Btu/s-ft^2). The solution tables are provided for this range. The unconfined spill fire model (heat release rate reduction factor) is based on observations of pool fires having a diameter between 1 – 10 m (3.3 – 33 ft). The diameter range for which ZOI data is provided is 0.7 – 5 m (2.2 – 17 ft). The lower range value is less of a concern due the reduction in the optical thickness of the fire when the diameter falls below 1 m (3.3 ft). The upper range is maintained in the ZOI solutions. The offset distance for flame extensions outside a burning panel have an upper observational limit of about 1,000 kW (950 Btu/s), though it is applied in a normalized form (extension to panel height ratio). The ratio is applied as determined from the test data.

The CFAST applications in the “Generic Fire Modeling Treatments” report consist of simple geometries with a single natural vent path connected to an ambient boundary condition. The simulations are used to determine the time after the start of the fire that the hot gas layer temperature reaches a predetermined critical temperature. No consideration for the hot gas layer depth is made; if the hot gas layer temperature reaches the critical temperature at any time, then this time is the sole output parameter used in the “Generic Fire Modeling Treatments” report. The enclosure geometry is specified as a function of the volume in such a way as to minimize the heat losses to the boundary. Three vent configurations are evaluated for each volume-room geometry-vent fraction; the most adverse result among the three vent configurations is used.

The room geometry and fire parameters for the “Generic Fire Modeling Treatments” simulations fall within the model limits listed in NIST SP 1026 and NIST SP 1041. Specifically, the vent area to enclosure volume ratio is less than two and the aspect ratios of the enclosures are less than five.

The non-dimensional parameters that affect the model results as documented in NUREG-1824, Volumes 1 and 5, and NUREG-1934 include the model geometry, the global equivalence ratio, the fire Froude Number, and the flame length ratio. The non-dimensional parameters that relate to target exposure conditions (heat flux) and sprinkler actuation (ceiling jet) are not applicable to this calculation because these output parameters are not used. The non-dimensional geometry parameters (length-to-height and width-to-height, which range from 3.3 – 4.3) fall within the NUREG-1824, Volume 1, validation range (0.6 – 5.7). As previously noted, CFAST does not use a fire diameter; therefore, it is possible to specify a fire that falls within the range of fire Froude numbers considered in the NUREG-1824, Volumes 1 and 5, validation documentation. The source fires considered are consistent with those described in NUREG/CR-6850 and subsequently those that are the subject of the NUREG-1824, Volume 1, validation effort. The global equivalence ratio does exceed the ratio validated in NUREG-1824, Volume 1, in some cases by a significant margin. Large fires in very small volumes with low ventilation could effectively result in equivalence ratios that even exceed the maximum values observed in fully developed fires (3 – 5) (SFPE Handbook of Fire Protection Engineering, Sections 2-5 and 3-4, 2008). However, the limiting oxygen index used in the model is zero, which forces the combustion process to use all available oxygen within the enclosure and the heat release rate to decrease to a value set by the natural ventilation oxygen inflow. The maximum temperature over the course of the fire occurs at some time prior to the oxygen being consumed in the enclosure, thus the global equivalence ratio for the data reported is based on a condition where it is less than unity and within the validation basis of NUREG-1824, Volume 1. Further, for a given volume and fire size, an optimum ventilation condition will occur over the vent range considered. Because of potential variations in a ventilation condition, the FPRA uses the most adverse time over the reported range and effectively performs an optimization on this parameter.

Finally, the flame length ratio is not always met, especially for large fires postulated in small enclosures. Because sprinkler actuation and thermal radiation to targets are not computed with the CFAST model, this parameter is not an applicable metric. Rather, the plume entrainment below the hot gas layer controls the layer decent time and the concentration of soot products in the layer. This aspect of the model is not affected by the flame height to ceiling height ratio. Consequently, the application of CFAST in the “Generic Fire Modeling Treatments” document falls within the NUREG-1824, Volume 1, validation parameter space.

Additional V&V studies, which are useful for extending the range of applicability of the model, are contained in NIST SP 1086 and NRL/MR/6180-04-8746. These studies have a broader parameter validation space than NUREG-1824, Volume 1. NIST SP 1086 is based in part on the methods of ASTM E1355. NRL/MR/6180-04-8746 provides a Navy specific V&V study, which includes an assessment of CFAST, Version 3.1.7, predictions in multiple enclosures and multiple elevation configurations. These additional V&V studies extend the range of the validation parameter space to include configurations and conditions presented in Appendix B of the “Generic Fire Modeling Treatments” report.

Appendix B of the “Generic Fire Modeling Treatments” report provides an in depth analysis of the parameters used as input and Table B-2 indicates the basis for the input parameter selection. The parameters are either selected as absolutely bounding over the credible range or establish an application limit (e.g., elevated temperature environment and boundary thermal properties).

A summary of the validation basis for both the CFAST and the empirical models is provided in Tables J-1 and J-2 of this attachment. Based on the information in the tables and the preceding discussion, it is shown that that the empirical fire model applications in the “Generic Fire Modeling Treatments” either fall within the original correlation bounds or they are outside the bounds, but used in a way that is demonstrably conservative. Likewise, CFAST is used within the model limitations described in the User’s Guide (NIST SP 1041) and the Technical Reference Guide (NIST SP 1026). The results as reported in the “Generic Fire Modeling Treatments” document are based on conditions that meet the NUREG-1824, Volumes 1 and 5, validation space, although there are input specifications that fall outside this range. The use of the “Generic Fire Modeling Treatments” report in the FPRA performs an optimization over the ventilation fraction and necessarily is based on a condition that falls within the NUREG-1824, Volumes 1 and 5, validation space for the global equivalence ratio. Given these considerations, it is concluded that the CFAST application in the “Generic Fire Modeling Treatments” document has a validation and verification basis that meets the requirements of NFPA 805, Section 2.4.1.2.3.

<u>Generic Fire Modeling Treatments Supplements</u>

There are five supplements to the "Generic Fire Modeling Treatments", two of which are used by the ANO-1 FPRA (PRA-A1-05-004; PRA-A1-05-009):

- Supplement 2: "Evaluation of the Development and Timing of Hot Gas Layer Conditions in Generic ANO-1 Fire Compartments," (PRA-ES-05-007); and
- Supplement 3: "Supplemental Generic Fire Modeling Treatments: Transient Fuel Package Ignition Source Characteristics" (PRA-ES-05-006).

Supplement 1, "Supplemental Generic Fire Modeling Treatments: Closed Electrical Panels," Supplement 4, "Supplemental Generic Fire Modeling Treatments: Transient Target Response to transient Ignition Source Fire Exposures," and Supplement 5, "Supplemental Generic Fire Modeling Treatments: Solid State Control Component ZOI and Hot Gas Layer Tables" are not used by the ANO-1 FPRA (PRA-A1-05-004; PRA-A1-05-009).

Supplement 2

Supplement 2, "Evaluation of the Development and Timing of Hot Gas Layer Conditions in Generic ANO-1 Fire Compartments" (PRA-ES-05-007), provides hot gas layer tables for additional critical temperatures, and ignition source heat release rates, including some ignition source-secondary fuel package combinations. The hot gas layer tables and ZOI dimensions are calculated using the same calculation procedures as were used for the original "Generic Fire Modeling Treatments" report, but with different input parameters. These procedures were verified and approved as previously described. The validation basis for the ZOI dimensions is identical to that of the original "Generic Fire Modeling Treatments" report.

Hot gas layers are provided for a single generic secondary combustible configuration, i.e., two horizontal cable trays located 0.3 m (1 ft) above an electrical panel ignition source located in an open configuration. The cable trays are simultaneously ignited five minutes after ignition at a single point and the fire is allowed to propagate laterally in each direction. The horizontal flame propagation rate used in the analysis for thermoset cables is as recommended in NUREG/CR-6850 (0.3 mm/s [0.1 in/s]). This propagation rate has been shown to be broadly applicable to the cable class in NUREG/CR-7010, Volume 1. The assumed heat release rate per unit area for the cables is constant and assumed to be 225 kW/m^2 (19.8 Btu/s-ft^2), which is slightly less than the value recommended in NUREG/CR-7010, Volume 1, for thermoplastic cables (250 kW/m^2 [22 Btu/s-ft^2]). The applicable value for thermoset cables is 150 kW/m^2 (13.2 Btu/s-ft^2) per NUREG/CR-7010, Volume 1. Wall and corner configurations are addressed using the open burn configurations adjusted using the 'Image' Method as previously described. However, explicit scenarios are not generated; rather alternate scenarios are selected that have characteristics that are consistent with the 'Image' method adjustments.

The secondary combustible hot gas layer tables are primarily used as a tool for addressing scenarios with the potential to involve one or two cable trays as secondary combustibles. Scenarios with more adverse cable tray arrangements are addressed in the plant specific detailed fire modeling report (PRA-A1-05-011).

Supplement 3

The focus of Generic Fire Modeling Treatments, Supplement 3, "Supplemental Generic Fire Modeling Treatments: Transient Fuel Package Ignition Source Characteristics" (PRA-ES-05-006), is to provide an analysis of and basis for the transient ignition source heat release rate per unit area, the fire duration, and flame height. The analysis uses the original transient fire test data referenced in NUREG/CR-6850 to estimate the transient ignition source characteristics of interest in order to provide a narrower range of input parameters for the ZOI calculations addressed in the "Generic Fire Modeling Treatments" report and Supplement 2 (PRA-ES-05-007). Wall and corner effects are evaluated explicitly using the 'Image' method as previously described.

Supplement 3 is primarily an analysis of test data; however, several revised ZOI tables using the results of the analysis are provided. The ZOI tables determined using the same processes and fire models used to generate the original ZOI tables in the "Generic Fire Modeling Treatments" report. The validation and verification developed for the "Generic Fire Modeling Treatments" report for the model is thus applicable to this supplement.

<u>Detailed Fire Modeling Calculations</u>

The detailed fire modeling calculations as documented in PRA-A1-05-011 assess the potential for hot gas layers to exceed certain critical temperature thresholds when secondary combustibles are involved. The calculation provides detailed calculations for approximately twenty-seven specific ignition source – cable tray configurations at ANO-1, primarily those that involve more than two cable trays.

The calculation uses two different fire models or calculation methods:

- FLASH-CAT, as incorporated in plant specific Excel spreadsheets (PRA-A1-05-011, NUREG/CR-7010, Volume 1); and
- CFAST, Version 6.1.1 (NIST SP 1026; NIST SP 1041).

The FLASH-CAT calculation method (NUREG/CR-7010, Volume 1), which essentially involves a group of recommended heat release rate and flame spread parameters for cables in cable trays, is used in PRA-A1-05-011 to generate the heat release rate contribution from secondary combustibles. The zone computer model CFAST, Version 6.1.1, is used to generate hot gas layer tables for specific plant spaces and source fire configurations. The CFAST results are evaluated over a range of natural ventilation conditions (0.001 – 10 percent of the boundary). The large natural ventilation range considered in the analysis readily encompasses the ability of a forced ventilation system to provide oxygen while conservatively ignoring the mixing or diluting aspects of such systems. In other words, a forced ventilation system is not postulated to provide more oxygen than is already assumed over the range of natural ventilation conditions and the system would tend to improve the result when dilution of the hot gas layer is considered.

FLASH-CAT

The FLASH-CAT application in PRA-A1-05-011 is used to generate the temporal heat release rate for specific cable tray arrangements. The input parameters used are those recommended in NUREG/CR-7010, Volume 1, and the initial conditions (initial area and ignition criteria) are those recommended in NUREG/CR-6850. The calculation itself is performed using an Excel™ spreadsheet.

The verification basis for the FLASH-CAT model as incorporated in the Excel™ spreadsheet involves numerical comparisons against results presented in NUREG/CR- 7010, Volume 1. These comparisons are provided with the detailed fire modeling report (PRA-A1-05-011) and serve as the verification that the model is correctly implemented as an Excel™ spreadsheet. The validation for the FLASH-CAT model is provided in NUREG/CR-7010, Volume 1, using about thirty different cable samples. The samples include cables having the same or similar materials as the predominant cable types used at ANO-1 (e.g., chlorosulfonated polyethylene per CALC-ANOC-FP-09-00019) such that the results and conclusions are applicable. An added measure of conservatism is provided in the FLASH-CAT analysis by assuming thermoplastic cable flame spread and propagation properties.

There is no validation range per se specified for the FLASH-CAT model (NUREG/CR- 7010, Volume 1). Rather, it may be inferred that if the configuration is similar (i.e., horizontal cable tray stacks) and the cable composition is similar, the results are applicable and NUREG/CR-7010, Volume 1, serves as the validation basis. The FLASH-CAT applications described in PRA-A1-05-011 involve horizontal cable tray stacks with some vertical or vertically sloped segments involving materials that are among those tested. The horizontal segments conform to the NUREG/CR-7010, Volume 1, test configuration, but the vertical segments do not. However, the vertical segments are conservatively assumed to propagate at a faster rate as recommended in NUREG/CR-6850. Therefore, the FLASH-CAT application has a validation and verification basis that meets the requirements of NFPA 805, Section 2.4.1.2.3.

CFAST

CFAST, Version 6.1.1 (NIST SP 1026; NIST SP 1041), is used to generate hot gas layer tables that provide the time various temperature thresholds are reached in the specific spaces using the FLASH-CAT temporal heat release rates. The CFAST application is identical to the approach adopted in the “Generic Fire Modeling Treatments” with the following exceptions:

- The height of the specific space is used in lieu of a generic room shape.
- The room volume is used rather than the generic room volumes. The length and width of the space are determined by minimizing the surface area given a height and volume.
- The fire heights are set based on the particular fuel packages examined. Thus, panel fires are modeled at the top of the panel and transient fuel packages are modeled 0.6 m (2 ft) above the floor.

The CFAST analysis assesses the time the hot gas layer temperature reaches threshold values over a range of ventilation conditions (0.001 – 10 percent of the boundary area). The ventilation condition that results in the most adverse time for a given scenario is used in the FPRA (PRA-A1-05-004).

The verification for the CFAST model (Version 6.0.5) is provided in NUREG-1824, Volume 5. Supplemental verification for CFAST, Version 6.1.1, is provided as an attachment to the PRA-A1-05-011 report as well as in NIST SP 1086.

The validation for CFAST described for the original “Generic Fire Modeling Treatments” report applies, except as follows:

- The equivalence ratio for some ventilation cases will fall outside the NUREG-1824 validation parameter space. However, at least one ventilation condition will be within this range, and the results are thus no less conservative than a case that falls within the NUREG-1824, Volume 1, validation parameter space. In general, the most adverse results will be predicted when the equivalence ratio is near unity (optimum burning conditions). Validation work has been performed for CFAST at these equivalence ratios (e.g., NIST SP 1086, NRL/MR/6180-04-8746) and applies to the ANO-1 calculation.
- The geometry for some volume-height combinations exceeds the length-width or length-height ratio for the NUREG-1824, Volume 1, validation cases. The procedure adopted in this analysis is to truncate the room dimensions (and volume) such that the ratio falls within the validation range for NUREG-1824, Volume 1, consistent with the guidelines provided in NUREG-1934.

Based on these considerations, it is concluded that the V&V basis for the CFAST application analysis meets the NFPA 805, Section 2.4.1.2.3, requirements.

<u>Embedded Conduit Fire Resistance</u>

The fire resistance for conduit embedded in concrete boundaries is determined in ANOC-FP-07-00001. This calculation serves as part of the basis for excluding raceways from the adjoining fire zone(s) (EC-494) and is therefore implicitly credited in the FPRA.

The fire resistance of concrete embedded conduit is calculated using the finite difference conduction heat transfer model HEATING, Version 7.3 (Technical Report PSR-199), for various types and sized conduits and conduit embed depths. HEATING, Version 7.3, was developed at the Oak Ridge National Laboratories as a general purpose finite difference heat transfer model for use in the commercial and government nuclear industries. There are a number of validation and verification reports and benchmark solution cases for general applications of the HEATING model (e.g., Technical Report K/CSD/INF-89/4, Technical Report K/CSD/TM-61, Technical Report ORNL/NUREG/CSD-2/V2/R3). A verification and validation study for fire related applications is documented in NRL/MR/6180-04-8746. The model verification summarized in NRL/MR/6180-04-8746 is based on the methodology developed by Wickström (Wickström, 1999; Wickström et al., 1999; Pålsson et al., 2000) for which the solutions of eight fire exposure configurations of increasing complexity are provided. The simplest cases have exact analytic solutions whereas the more complex cases involve a comparison against a baseline heat transfer solution generated by the conduction finite element model TASEF (Sterner et al.). The model validation documented by NRL/MR/6180-04-8746 is based on eight test cases of increasing complexity for which measured data is available, one of which includes steel embedded in concrete. These sixteen V&V cases are consistent with the ASTM E1355 procedure for providing fire model V&V and thus meet the NFPA 805, Section 2.4.1.2.3, requirement for using a fire model that has undergone a V&V process and is applied within its limitations.

The embedded conduit calculation (ANOC-FP-07-00001) provides a detailed description of the Wickström et al. verification case involving a convection fire exposure to a two-dimensional concrete slab as documented in NRL/MR/6180-04-8746, a similar configuration to the concrete embedded conduit evaluated at ANO-1. This verification case has an analytic solution and serves as the model benchmark for the calculation and serves as a demonstration that the application is within the model limitations. A parameter sensitivity analysis is provided in the embedded concrete calculation, including material property uncertainty, boundary condition uncertainty, and mesh dependencies. Table J-1 provides a summary of the validation and verification basis for HEATING, Version 7.3, as applied in the embedded conduit calculation.

Building Separation Calculation

The purpose of the building separation calculation (CALC-ANO1-FP-08-00003) is to assess whether there is adequate separation between the Administration Building and the ANO-1 Turbine Building. A site review of the building separation concluded that the Administration Building and the ANO-1 Turbine Building do not meet the separation requirements of NFPA 80A and thus a fire involving one building could affect the other. CALC-ANO1-FP-08-00003 assesses the adequacy of the building separation through the use of two radiant heat transfer models as contained in the FDT^S model (NUREG-1805). Based on these radiant heat transfer calculations, it is concluded that a fire in the Administration Building would not propagate into the ANO-1 Turbine Building. This calculation is indirectly credited in the FPRA by virtue of excluding the Administration Building from areas that can affect plant risk (PRA-A1-05-004, PRA-A1-05-009, CALC-08-E-00016-01).

The radiant heat transfer calculations are conducted using the Point Source Model and the Solid Flame Model as contained in FDT^S (NUREG-1805); specifically, the spreadsheet 05.1_Heat_Flux_Calculations_Wind_Free.xls is used. The most adverse prediction among the two models is selected for comparison to the performance criterion for fire propagation (12.5 kW/m^2 [1.1 Btu/s-ft^2]). The predicted heat flux (1.34 kW/m^2 [0.12 Btu/s-ft^2]) is over nine times lower than the performance threshold.

The verification basis for the FDT^S (NUREG-1805) wind free heat flux model is provided in NUREG-1824, Volume 3, which also provides a validation basis for the heat flux correlations; however, the application at ANO-1 falls outside the parameter space. This may be seen by comparing the *R/D* non-dimensional parameter as described in NUREG-1934, where *R* is the separation distance between the target and the fire centerline and *D* is the effective fire diameter. The NUREG-1824, Volume 3, range for this parameter is 2.2 – 5.7; the value used at ANO-1 is 1.5.

Additional validation for the low *R/D* value is available in the SFPE empirical heat flux model validation report (SFPE 1999). Based on a comprehensive assessment of various heat flux correlations against large scale fire test data, it is found that the Point Source Model is conservative when the predicted heat flux is less than 5 kW/m^2 (0.44 Btu/s-ft^2) and that the Solid Flame model is conservative when the predicted heat flux is greater than 5 kW/m^2 (0.44 Btu/s-ft^2). In addition, the Point Source Model is bounding when a safety factor of two is applied to the predicted value (SFPE 1999). The *R/D* range considered in SFPE (1999) is between about 0.7 – 10, which brackets the value of 1.5 used in CALC-ANO1-FP-08-00003.

With regard to the radiant heat transfer analysis described in CALC-ANO1-FP-08-00003, the most adverse prediction of the Point Source Model and the Solid Flame Model is used, thus ensuring at least one model meets the recommended application of SFPE (1999). Further, because the margin between the predicted heat flux and the threshold heat flux is about nine, a safety factor of two can be applied to the results and it can be concluded that the result is bounding. In summary, the verification for the FTD^S model used in CALC-ANO1-FP-08-00003 is provided in NUREG-1824, Volume 3. The ANO-1 application falls outside the NUREG-1824, Volume 3, validation space; however, SFPE (1999) provides additional validation for the models used that encompasses the application at ANO-1. Given that the ANO application falls within the validation space of the SFPE (1999) study and is used in a manner consistent with this study, it is concluded that V&V basis for the FDT^S (NUREG-1805) analysis meets the NFPA 805, Section 2.4.1.2.3, requirements.

Table J-1 V & V Basis for Fire Models / Model Correlations Used in Fire PRA			
Calculation	**Application**	**V & V Basis**	**Discussion**
Main CR Abandonment	Calculation of operator abandonment times in the Main Control Room.	NUREG-1824, Volume 1 NUREG-1824, Volume 5 NIST SP 1026 NIST SP 1041 NIST SP 1086 NUREG/CR-4527, Volume 2 NRL/MR/6180-04-8746	The abandonment time in the MCR is determined by computing the time for the visibility and temperature to reach thresholds as specified in NUREG/CR-6850. CFAST, Version 6.0.5, has been validated for certain configurations in terms of predicting the temperature increase in an enclosure in accordance with NUREG-1824, Volume 5. In addition, NUREG/CR-4527, Volume 2, provides full scale test data of electrical panel fires in control room like structures. These tests are modeled using the CFAST, Version 6.0.10, and the results are documented in report entitled “Evaluation of Unit 1 Control Room Abandonment Times at the Arkansas Nuclear One Facility.” CFAST, Version 6.0.10, is found to provide a reasonable and conservative estimate of both the hot gas layer temperature and visibility as a function of time given the input fire size for a control room like enclosure. This information is documented in Appendix D of CALC-ANO1-FP-09-00011. The MCR abandonment application falls within the non-dimensional parameter space for the NUREG-1824, Volumes 1 and 5, V&V report as estimated using the methods described in NUREG-1934. The application also falls within the model limits as specified in NIST SP 1026 and 1041. Additional V&V documentation is provided in NIST SP 1086 and NRL/MR/6180-04-8746 that expand the validation parameter space from that included in NUREG-1824, Volume 1, including multiple compartment applications.

Table J-1 V & V Basis for Fire Models / Model Correlations Used in Fire PRA

Calculation	Application	V & V Basis	Discussion
Generic Fire Modeling Treatments, Revision 0	Definition of zones of influence about specific classes of ignition sources. Scenario screening for the multi-compartment analysis.	NUREG-1824, Volume 1 NUREG-1824, Volume 3 NUREG-1824, Volume 5 NIST SP 1026 NIST SP 1041 NIST SP 1086 Table J-2	Table J-2 provides a summary of the validation basis for the empirical models used in the "Generic Fire Modeling Treatments" report. The "Generic Fire Modeling Treatments" report uses CFAST, Version 6.0.10, in a simple geometry that minimizes the boundary heat losses given a volume. For the volume postulated, the configuration produces the most adverse result regardless of the actual dimensions used. The application falls within the model limits as specified in NIST SP 1026 and 1041. Except for the global equivalence ratio, the non-dimensional parameters fall within the V&V space of NUREG-1824, Volumes 1 and 5. Although equivalence ratios are considered over a much larger range than addressed by the NUREG-1824, Volume 1, validation tests, the results are based on a single time point based on an equivalence ratio that is close to unity or lower and thus may fall directly within the NUREG-1824, Volume 1, validation parameter space. Additional validation results that consider the higher predictive capability under higher equivalence ratios are provided in NIST SP 1086.
Supplemental Generic Fire Model Treatments: Hot Gas Layer Tables (Supplement 2)	Definition of zones of influence about specific classes of ignition sources for use in the FPRA. Scenario screening for the multi-compartment analysis.	NUREG-1824, Volume 5 NIST SP 1026 NIST SP 1041 NIST SP 1086 NUREG/CR-4527, Volume 2 NRL/MR/6180-04-8746 Table J-2 NUREG/CR-6850 NUREG/CR-7010, Volume 1	The same methods developed in Generic Fire Modeling Treatments, Revision 0, are used to generate additional hot gas layer tables and ZOI definitions. The treatment of secondary combustibles applies to a two tray configuration located above an electrical panel ignition source and used propagation rates recommended by NUREG/CR-6850 and validated for a wide range of cable compositions in NUREG/CR-7010, Volume 1.

Table J-1 V & V Basis for Fire Models / Model Correlations Used in Fire PRA			
Calculation	**Application**	**V & V Basis**	**Discussion**
Supplemental Generic Fire Model Treatments: Transient Ignition Source Strength (Supplement 3)	Characterization of the heat release rate per unit area, fire duration, and flame height for transient ignition sources. Provides revised ZOI tables for transient fuel packages based on the analysis of the transient fire test data.	NUREG-1824, Volume 1 NUREG-1824, Volume 3 NUREG-1824, Volume 5 NIST SP 1026 NIST SP 1041 NIST SP 1086 Table J-2	The supplement provides an analysis of the transient fuel package fire tests in order to better characterize the heat release rate per unit area, the fire duration, and the flame height. These parameters, which are used in the development of the ZOI in the original “Generic Fire Modeling Treatments” report and prior to the development of Supplement 3, were conservatively bounded. Supplement 3 provides the basis for a narrower parameter value range as determined from the actual fire test reports on which the NUREG/CR-6850 conditional probability distribution was established. Revised ZOI tables are developed for transient ignition source fuel packages using the results of the fire test data analysis. The ZOIs are computed using the same processes as the original “Generic Fire Modeling Treatments” report and the V&V basis is therefore the same.
Detailed Fire Scenario Calculations, Revision 1	Calculation of the time the hot gas layer reaches critical temperature thresholds for scenarios involving secondary combustibles (multiple cable trays).	NUREG-1824, Volume 5 NUREG/CR-7010, Volume 1 NIST SP 1026 NIST SP 1041 NIST SP 1086 NRL/MR/6180-04-8746	Detailed evaluations are provided for specific ignition source-secondary combustible configurations involving multiple cable trays. Two fire modeling tools are used in this assessment: the FLASH-CAT calculation method (NUREG/CR-7010, Volume 1) and CFAST, Version 6.1.1 (NIST SP 1041). The FLASH-CAT model is used to compute the temporal heat release rate profiles for specific cable tray arrangements where secondary combustibles are included. CFAST, Version 6.1.1, is used to compute the time the hot gas layer temperature reaches various threshold values given the ignition source and secondary combustible heat release rates. NUREG-1824, Volume 5, provides the verification basis for CFAST. Supplemental verification is provided in PRA-A1-05-011 for the specific CFAST version used. Verification for the FLASH-CAT model is provided in PRA-A1-05-011 via comparisons with NUREG/CR-7010, Volume 1, results. The FLASH-CAT model uses the recommended input parameters of NUREG/CR-7010, Volume 1, and is used to calculate the heat release rate in horizontal cable trays containing cables similar to those tested. Therefore, the application falls within the validated range for FLASH-CAT.

Table J-1 V & V Basis for Fire Models / Model Correlations Used in Fire PRA

Calculation	Application	V & V Basis	Discussion
Thermal Analysis of Concrete Embedded Conduit, Revision 0	Basis for excluding concrete embedded raceways from adjacent fire zones per EC-494.	NRL/MR/6180-04-8746 Technical Report K/CSD/INF-89/4 Technical Report K/CSD/TM-61 Technical Report ORNL/NUREG/CSD-2/V2/R3	The fire resistance of conduit embedded in concrete is calculated using the finite difference model HEATING, Version 7.3 (Technical Report PSR-199) for various concrete cover thicknesses, conduit diameters, and conduit types. The base finite difference model is one-dimensional, but it includes material properties that vary with temperature and boundary conditions that vary with time. Several two-dimensional geometries are evaluated and compared with the one-dimensional counterparts and it is shown that the one-dimensional model is universally conservative in this application. A sensitivity analysis is provided that demonstrates the results are not dependent on material property or boundary condition uncertainty, unless there is sustained flame impingent. NRL/MR/6180-04-8746 provides a verification and validation assessment of HEATING, Version 7.3 (Technical Report PSR-199), as applied to fire exposure configurations using the method recommended by Wickström (Wickström, 1999; Wickström et al. 1999; Pålsson et al., 2000). Other validation and verification studies on older revisions are documented in Technical Report K/CSD/INF-89/4, Technical Report K/CSD/ TM-61, and Technical Report ORNL/NUREG/CSD 2/ V2/R3. A validation case involving a two-dimensional slab exposed to a convection boundary condition as a model application benchmark is provided in the embedded conduit calculation.
Building Separation Analysis, Revision 0	Provides a basis for crediting the separation between the Administration Building and the ANO-1 Turbine Building.	NUREG-1824, Volume 3 SFPE (1999)	The Administration Building and the ANO-1 Turbine Building separation do not meet the NFPA 80A building separation requirements. The building separation analysis (CALC-ANO1-FP-08-00003) provides a radiant heat transfer computation using the Point Source Model and the Solid Flame Model as contained in NUREG-1805 FDT^{S} model (NUREG-1805). This calculation is implicitly used in the FPRA by virtue of excluding the Administration Building from the group of areas in which a fire could affect the plant risk. The radiant heat transfer application described in CALC-ANO1-FP-08-00003 is consistent with the underlying basis for the empirical models. However, the input parameter range falls outside the NUREG-1824, Volume 3, V&V space. In this case, SFPE (1999) provides the additional V&V basis for both the Point Source Model and the Solid Flame Model, and leads to the conclusion that the overall application is conservative.

Table J-2 V & V Basis for Fire Models / Model Correlations Used: Generic Treatments Correlations

Correlation	Location in Generic Fire Modeling Treatment	Original Reference	Application	Original Correlation Range	Subsequent Validation and Verification	Limits in Treatments
Flame Height	Page 18	Heskestad [1981] Heskestad [1984]	Provides a limit on the use of the Zone of Influence (ZOI)	$-5 \lesssim \log_{10}\left[\left[\frac{c_p T_\infty}{g\rho_\infty(\Delta H_{c/r})^3}\right]\frac{\dot{Q}^2}{D^5}\right] \lesssim 5$ In practice, wood and hydrocarbon fuels, momentum or buoyancy dominated, with diameters between 0.05 – 10 m (0.16 – 33 ft).	Directly NUREG 1824, Volume 3 Indirectly NUREG 1824, Volume 5 (Correlation used in CFAST)	$\frac{4\dot{m}\Delta H_C}{\pi D^2} < 3000$
Point Source Model	Page 19	Modak (Thermal Radiation from Pool Fires)	Lateral extent of ZOI – comparison to other methods	Isotropic flame radiation. Compared with data for 0.37 m (1.2 ft) diameter PMMA pool fire and a target located at a R_o/R ratio of 10.	NUREG 1824, Volume 3 SFPE (1999)	Predicted heat flux at target is less than 5 kW/m^2 (0.44 Btu/s-ft^2) per SFPE [(1999).
Method of Shokri and Beyler	Page 19	Shokri et al. (Radiation from Large Pool Fires)	Lateral extent of ZOI – comparison to other methods	Pool aspect ratio less than 2.5. Hydrocarbon fuel in pools with a diameter between 1 – 30 m (3.3 – 98 ft). Vertical target, ground level.	NUREG 1824, Volume 3 SFPE (1999)	Ground based vertical target.
Method of Mudan (and Croce)	Page 20	Mudan (Thermal Radiation Hazards from Hydrocarbon pool Fires)	Lateral extent of ZOI – comparison to other methods	Round pools; Hydrocarbon fuel in pools with a diameter between 0.5 – 80 m (1.64 – 262 ft).	SFPE (1999)	Total energy emitted by thermal radiation less than total heat released.
Method of Shokri and Beyler	Page 20	Shokri et al. (Radiation from Large Pool Fires)	Lateral extent of ZOI	Round pools; Hydrocarbon fuel in pools with a diameter between 1 – 50 m (3.3 – 164 ft).	NUREG 1824, Volume 3 SFPE (1999)	Predicted heat flux at target is greater than 5 kW/m^2 (0.44 Btu/s-ft^2) per SFPE (1999). Shown to produce most conservative heat flux over range of scenarios considered among all methods considered.

Table J-2 V & V Basis for Fire Models / Model Correlations Used: Generic Treatments Correlations

Correlation	Location in Generic Fire Modeling Treatment	Original Reference	Application	Original Correlation Range	Subsequent Validation and Verification	Limits in Treatments
Plume heat fluxes	Page 22	Wakamutsu et al.(2003)	Vertical extent of ZOI	Fires with an aspect ratio of about 1 and having a plan area less than 1 m^2 (0.09 ft^2).	Wakamatsu et al. (2003) (larger fires) SFPE Handbook of Fire Protection Engineering, Section 2-14 (2008)	Area source fires with aspect ratio ~ 1. Used with plume centerline temperature correlation; most severe of the two is used as basis for the ZOI dimension. This is not a constraint in the fire model analysis for the cases evaluated.
Plume centerline temperature	Page 23	Yokoi (Report Number 34) Beyler (Fire Plumes and Ceiling Jets)	Vertical extent of ZOI	Alcohol lamp assumed to effectively be a fire with a diameter ~0.1 m (0.33 ft).	NUREG 1824, Volume 3 SFPE Handbook of Fire Protection Engineering, Section 2–1 (2008)	Area source fires with aspect ratio ~ 1. Used with plume flux correlation; most severe of the two is used as basis for the ZOI dimension.
Hydrocarbon spill fire size	Page 51	SFPE Handbook of Fire Protection Engineering, Section 2-15 (2002)	Determine heat release rate for unconfined hydrocarbon spill fires	Hydrocarbon spill fires on concrete surfaces ranging from ~1 to ~10 m (3.3 – 33 ft) in diameter.	None. Based on limited number of observations.	None. Transition from unconfined spill fire to deep pool burning assumed to be abrupt.
Flame extension	Page 100	SFPE Handbook of Fire Protection Engineering, Section 2–14 (2002)	Determine the fire offset for open panel fires	Corner fires ranging from ~10 to ~1,000 kW (9.5 - 948 Btu/s). Fires included gas burners and hydrocarbon pans.	None. Based on limited number of observations.	None. Offset is assumed equal to the depth of the ceiling jet from the experiments.
Line source flame height	Page 101	Delichatsios (1984)	Determine the vertical extent of the ZOI	Theoretical development.	SFPE Handbook of Fire Protection Engineering, Section 2-14 (2008)	None. Transition to area source assumed for aspect plan ratios less than four. Maximum of area and line source predictions used in this region.

Table J-2 V & V Basis for Fire Models / Model Correlations Used: Generic Treatments Correlations						
Correlation	**Location in Generic Fire Modeling Treatment**	**Original Reference**	**Application**	**Original Correlation Range**	**Subsequent Validation and Verification**	**Limits in Treatments**
Corner flame height	Page 108	SFPE Handbook of Fire Protection Engineering, Section 2-14 (2002)	Determine the vertical extent of the ZOI	Corner fires ranging from ~10 to ~1,000 kW (9.5 - 948 Btu/s). Fires included gas burners and hydrocarbon pans.	None. Correlation form is consistent with other methods; comparison to dataset from SFPE Handbook, Section 2-14 (2002) provides basis.	None.
Air mass flow through opening	Page 140	Kawagoe (1958)	Compare mechanical ventilation and natural ventilation	Small scale, ⅓ scale, and full scale single rooms with concrete and steel boundaries. Vent sizes and thus opening factor varied. Wood crib fuels.	Drysdale (*Fire Dynamics*) SFPE (2004)	None. SFPE (2004) spaces with a wide range of opening factors.
Line fire flame height	Page 210	Yuan et al. (An Experimental Study of Some Line Fires)	Provides a limit on the use of the ZOI Extent of ZOI for cable tray fires	$0.002 < Z/\dot{Q}' < 0.6$ In practice, from the base to several times the flame height based on 0.015 – 0.05 m (0.05 – 0.16 ft) wide gas burners.	None. Correlation form is consistent with other methods; comparison to dataset from Yuan et al. provides basis.	None.
Cable heat release rate per unit area	Page 210	NBSIR 85-3196	Provides assurance that the method used is bounding	Cables with heat release rates per unit area ranging from about 100 – 1000 kW/m^2 (8.8 – 88 Btu/s-ft^2).	None.	Correlation predicts a lower heat release rate than assumed in the treatments and is based on test data.
Line fire plume centerline temperature	Page 212	Yuan et al.	Provides a limit on the use of the ZOI Extent of ZOI for cable tray fires	$0.002 < Z/\dot{Q}' < 0.6$ In practice, from the base to several times the flame height based on 0.015 – 0.05 m (0.05 - 0.16 ft) wide gas burners.	None. Correlation form is consistent with other methods; comparison to dataset from Yuan et al. provides basis.	None.

Table J-2 V & V Basis for Fire Models / Model Correlations Used: Generic Treatments Correlations						
Correlation	**Location in Generic Fire Modeling Treatment**	**Original Reference**	**Application**	**Original Correlation Range**	**Subsequent Validation and Verification**	**Limits in Treatments**
Ventilation limited fire size	Page 283	Babrauskas (Estimating Room Flashover Potential)	Assessing the significance of vent position on the hot gas layer temperature.	Ventilation factors between 0.06 – 7.51. Fire sizes between 11 - 2,800 kW (10 - 2,654 Btu/s) Wood, plastic, and natural gas fuels.	SFPE (2004)	None. Provides depth in the analysis of the selected vent positions. The global equivalence ratio provides an alternate measure of the applicability of the analysis and for reported output is within the validation range of CFAST.

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K. Existing Licensing Action Transition

Licensing Action

Appendix R Exemption 01, FA-N, Not Meeting III.G.2

Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 provides the justification for not meeting the requirement for automatic fire suppression below elevation 354' of the Intake Structure per Section III.G.2.c, which was approved by the NRC in 0CNA038328 based on:

- Low combustible loading in the area
- Fire detection is provided in areas above this elevation
- Normally floor of bays are water covered at this elevation
- Separation between cables

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	N	Unit 1 Intake Structure
	Fire Zone Name	Description
	INTAKE	Intake

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, Safety Evaluation Report (SER), Section 2.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 02, FA-N, Not Meeting III.G.2 Criteria

Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 provides the justification for not meeting the requirement for 20-foot separation and automatic fire suppression system at elevation 354’ of the Intake Structure per Section III.G.2.c, which was approved by the NRC in 0CNA038328 based on:

- Low combustible loading in the area
- Large room volume
- Fire detection is provided in this area
- Separation between cables

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	N	Unit 1 Intake Structure
	Fire Zone Name	Description
	INTAKE	Intake

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 2.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 03, FA-N, Not Meeting III.G.2 Criteria

Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 provides the justification for not meeting the requirement for 20-foot separation and automatic fire suppression system at elevation 366’ of the Intake Structure per Section III.G.2.c, which was approved by the NRC in 0CNA038328 based on:

- Diesel-driven Fire Pump room is separated by 3-hour fire rated barriers from remainder of components on elevation 366’
- Floor drains are installed in the vicinity of each Service Water (SW) pump motor to collect and drain potential lube oil leaks
- Partial-width missile barriers separate the three SW pump motors
- Large room volume
- Sufficient ceiling height above the SW pump motors

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	N	Unit 1 Intake Structure
	Fire Zone Name	Description
	INTAKE	Intake

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 2.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 04, FA-MH04 and FA-MH06, Not Meeting III.G.2 Criteria

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Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 provides the justification for not meeting the requirement for 20-foot separation of Service Water (SW) pump cables, one-hour fire barrier, detection, and automatic fire suppression system in manholes (MH04 and MH06), which was approved by the NRC in 0CNA038328 based on:

- Manholes filled with sand
- Difficulty in accessibility to area results in no potential transient combustibles

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	MH04	Between Aux Building and Intake Structure
	MH06	Between Aux Building and Intake Structure
	Fire Zone Name	Description
	1MH04	Between Aux Building and Intake Structure
	1MH06	Between Aux Building and Intake Structure

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 3.0

Evaluation

This exemption is no longer required under the new licensing basis because the cabling has been modified such that each manhole contains redundant cabling for the swing SW pump.

Licensing Action

Appendix R Exemption 05, FZ 20-Y, Not Meeting III.G.2 Criteria

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Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 provides the justification for not meeting the requirement for full coverage automatic fire suppression system in the Waste Monitor Tank Room where both borated water storage tank (BWST) drop-line valves and associated cables are located, which was approved by the NRC in 0CNA038328 based on:

- Low in-situ fire loading
- Limited personnel access for accumulation of transient combustibles
- Installed detection system
- Partial suppression system in the valve area
- One-hour fire barrier around the conduit for one of the BWST valves
- Portable fire extinguishers and manual hose stations available in the area

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	C	Auxiliary Building 335' Elevation
	Fire Zone Name	Description
	20-Y	Radwaste Processing Room

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 4.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 06, FZ 20-Y, Not Meeting III.G.2 Criteria

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Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 and supplemented by information provided in 0CAN118210 provides the justification for not meeting the requirement for automatic fire suppression system in the make-up pump room and adjacent corridor, which was approved by the NRC in 0CNA038328 based on:

- Partial height walls between the pumps
- One hour fire barriers for trays and conduits associated with power for the pump and suction valve of the swing and one other pump within each individual pump room
- Portable fire extinguishers, manual hose stations, and smoke detectors are located in the area

The exemption was further clarified in 1CAN109704.

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	C	Auxiliary Building 335' Elevation
	Fire Zone Name	Description
	20-Y	Radwaste Processing Room

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 4.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 07, FZ 32-K and FZ 33-K, Not Meeting III.G.2 Criteria

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Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 provides the justification for not meeting the requirement for 20-foot separation of the power cables for the decay heat valves in FZ 32-K from components in FZ 33-K, which was approved by the NRC in 0CNA038328 based on:

- No exposed combustibles are located near the power cable conduits
- Due to limited access there are no transient combustibles during power operations
- Fire stops in cable trays preclude propagation of fire between fire zones
- Smoke detectors, automatic pre-action type suppression systems, hose stations are located throughout the containment building
- The probability that a fire could damage or cause spurious operation of both decay heat valves is low

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	J	Reactor Building
	Fire Zone Name	Description
	32-K	North Side of Reactor Building
	33-K	South Side of Reactor Building

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 5.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 08, FZ 34-Y, Not Meeting III.G.2 Criteria

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Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 provides the justification for not meeting the requirement for an automatic fire suppression system in Fire Zone 34-Y, which was approved by the NRC in 0CNA038328 based on:

- Minimum potential for transient combustibles in the zone
- Negligible in-situ combustibles in the zone; cables are enclosed in conduits
- 1-hour fire-rated barrier provided on 2 of the 3 SW pump power cables
- The probability that a fire could damage or cause spurious operation of both decay heat valves is low
- Decay heat pump power cables separated by greater than 20'

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	C	Auxiliary Building 335' and 354' Elevation
	Fire Zone Name	Description
	34-Y	Pipe Room

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 6.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 09, FZ 40-Y, Not Meeting III.G.2 Criteria

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Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 provides the justification for not meeting the requirement for an automatic fire suppression system in FZ 40-Y, which was approved by the NRC in 0CNA038328 based on:

- No in-situ combustibles in the area
- Low combustible loading in the area
- Access to area is restricted; requires lifting a locked floor hatchway cover plate
- 1-hour fire-rated barrier provided on two of three service water pump power cables
- Fire smoke detectors that alarm in the control room and portable fire extinguishers are provided in the area

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	B-1	Auxiliary Building Extension 335' Elevation
	Fire Zone Name	Description
	40-Y	Pipeway Room (Under ICW Coolers)

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 7.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 10, FZ 53-Y Not Meeting III.G.3 Criteria

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Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 as supplemented by 0CAN118210 provides the justification for not meeting the requirement for a fixed fire suppression system and detection in Fire Zone 53-Y, which was approved by the NRC in 0CNA038328 based on:

- Low combustible loading in the area
- Action to cross-connect is not needed until 1 ½ hour into diesel generator operations due to the available volume in the diesel generator day tanks (alternate shutdown capability)
- Manual fire suppression equipment is available

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.3 fixed fire suppression and smoke detection.

Unit	Fire Area Name	Description
ANO-1	C	Auxiliary Building 335' Elevation
	Fire Zone Name	Description
	53-Y	Lower North Piping Penetration Room

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 9.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 11, FZ 1MH09 and 1MH10, Not Meeting III.G.3 Criteria

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Basis Date: March 22, 1983

Transitioned? No

Basis: Exemption request per 0CAN078202 as supplemented by 0CAN118210 provides the justification for not meeting the requirement for fixed fire suppression system and detection in manholes (MH09 and MH10), which was approved by the NRC in 0CNA038328 based on:

- Low combustible loading in the area
- Action to cross-connect is not needed until 1 ½ hour into diesel generator operations due to the available volume in the diesel generator day tanks (alternate shutdown capability)
- Manual fire suppression equipment is available

Per engineering request ER-ANO-2002-0745-001, a fire in this fire zone is no longer analyzed to cause a loss of offsite power (i.e., the EDGs are not needed for a fire in this area); therefore, this exemption is not transitioned.

Unit	Fire Area Name	Description
ANO-1	MH09	Unit 1 Yard Area Manholes
	MH10	Unit 1 Yard Area Manholes

Fire Zone Name	Description
1MH09	Between Auxiliary Building and Diesel Fuel Vault
1MH10	Between Auxiliary Building and Diesel Fuel Vault

Reference Document

0CNA038328, Exemptions to Certain Requirements of Appendix R to 10 CFR 50, March 22, 1983, Enclosure 2, SER, Section 9.0

Evaluation

This Fire Area was transitioned using updated analyses regarding where a loss of offsite power can occur; therefore, this exemption is no longer required.

Licensing Action

Appendix R Exemption 12, Not Meeting III.L Criteria

Basis Date: May 11, 1983

Transitioned? No

Basis: Exemption request per 0CAN128215 as supplemented by 0CAN028304 provides the justification for not meeting the requirement for the plant to be capable of reaching cold shutdown within 72 hours during a fire event coincident with a loss of offsite power, which was approved by the NRC in 1CNA058303 based on:

- Conservative analysis which assumes no steam void formation in the upper reactor vessel head
- Unlikeliness of events that would require both cold shutdown and the inability to restore offsite power within 72 hours

This exemption is no longer required because NFPA 805 does not require the plant to be capable of reaching cold shutdown within 72 hours during a fire event coincident with a loss of offsite power.

Unit	Fire Area Name	Description
ANO-1	N/A	N/A
	Fire Zone Name	Description
	N/A	N/A

Reference Document

1CNA058303, Exemption from the Specific Requirements of Appendix R, Section III.L, May 11, 1983, SER

Evaluation

This exemption is no longer required because NFPA 805 does not require the plant to be capable of reaching cold shutdown within 72 hours during a fire event coincident with a loss of offsite power.

Licensing Action

Appendix R Exemption 13a, FZ 1-E (formerly part of FA-B), Not Meeting III.G.2.b Criteria

---

Basis Date: October 26, 1988

Transitioned? No

Basis: Exemption request per 0CAN088404 and as supplemented in 0CAN108608 provides the justification for not meeting the requirement for 20-feet of separation free of intervening combustible materials between redundant shutdown related systems in the emergency diesel generator (EDG) room exhaust fan outlet areas, which was approved by the NRC in 1CNA108806 based on:

- Low fire loading and absence of intervening combustibles
- Partial walls separating the redundant EDG room exhaust fans are 3-hour fire rated barriers
- Conduit for exhaust fans associated with north EDG room is routed through hot tool room includes 1-hour wrap and automatic fire suppression
- 3-hour rated fire door installed between redundant EDG exhaust fans
- Power cables to air intake louvers powered from vital power sources

Per engineering request ER-ANO-2002-0745-001, a fire in this fire zone is no longer analyzed to cause a loss of offsite power (i.e., the EDGs are not needed for a fire in this area). Therefore, this exemption is not transitioned.

Unit	Fire Area Name	Description
ANO-1	D	Auxiliary Building 372' and 386' Elevation
	Fire Zone Name	Description
	1-E	North EDG Exhaust Fans

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 2.0

Evaluation

This Fire Area was transitioned using updated analyses on where a loss of offsite power can occur. This exemption is no longer required.

Licensing Action

Appendix R Exemption 13b, FZ 2-E (formerly part of FA-B), Not Meeting III.G.2.b Criteria

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Basis Date: October 26, 1988

Transitioned? No

Basis: Exemption request per 0CAN088404 and as supplemented in 0CAN108608 provides the justification for not meeting the requirement for 20-feet of separation free of intervening combustible materials between redundant shutdown related systems in the emergency diesel generator (EDG) room exhaust fan outlet areas, which was approved by the NRC in 1CNA108806 based on:

- Low fire loading and absence of intervening combustibles
- Partial walls separating the redundant EDG room exhaust fans are 3-hour fire rated barriers
- Conduit for exhaust fans associated with north EDG room is routed through hot tool room includes 1-hour wrap and automatic fire suppression
- 3-hour rated fire door installed between redundant EDG exhaust fans
- Power cables to air intake louvers powered from vital power sources

Per engineering request ER-ANO-2002-0745-001, a fire in this fire zone is no longer analyzed to cause a loss of offsite power (i.e., the EDGs are not needed for a fire in this area). Therefore, this exemption is not transitioned.

Unit	Fire Area Name	Description
ANO-1	H	Auxiliary Building 372' and 386' Elevation
	Fire Zone Name	Description
	2-E	South EDG Exhaust Fans

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 2.0

Evaluation

This Fire Area was transitioned using updated analyses on where a loss of offsite power can occur. This exemption is no longer required.

Licensing Action

Appendix R Exemption 14, FZ 20-Y, Not Meeting III.G.2.b Criteria

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Basis Date: October 26, 1988

Transitioned? No

Basis: Exemption request per 0CAN088404, as supplemented by 0CAN088508 and 0CAN108608, provides the justification for not meeting the requirement for 20 feet of separation free of intervening combustible materials between redundant shutdown related systems, the BWST outlet valves in the radwaste processing area, which was approved by the NRC in 1CNA108806 based on:

- Low fire loading in the area
- Limited personnel access for accumulation of transient combustibles
- Installed detection system
- Partial suppression system in the valve area
- One-hour fire barrier around the conduit for one of the BWST valves
- Portable fire extinguishers and manual hose stations available in the area

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with no intervening combustibles or fire hazards.

Unit	Fire Area Name	Description
ANO-1	C	Auxiliary Building 335’ Elevation
	Fire Zone Name	Description
	20-Y	Radwaste Processing Room

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 3.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 15, FZ 38-Y, Not Meeting III.G.2.b Criteria

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Basis Date: October 26, 1988

Transitioned? No

Basis: Exemption request per 0CAN088404, as supplemented by 0CAN088508, 0CAN108608, 1CAN048708, and 1CAN068706 provides the justification for lack of 20 feet of separation free of intervening combustible materials between redundant shutdown-related systems in the emergency feedwater (EFW) pump room (Fire Area C, Zone 38-Y), which was approved by the NRC in 1CNA108806 based on:

- Combustible loading is low in this area
- Fire detection system combined with the timely response of the fire brigade
- Pumps are separated by a partial height noncombustible shield wall of approximately six feet
- Suppression providing protection to P-7A
- One-hour rated fire barrier on cabling associated with P-7A

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with no intervening combustibles or fire hazards.

Unit	Fire Area Name	Description
ANO-1	C	Auxiliary Building 335’ Elevation
	Fire Zone Name	Description
	38-Y	Emergency Feedwater Pump Room

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 4.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 16, FZ 34-Y, Not Meeting III.G.2.c Criteria

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Basis Date: October 26, 1988

Transitioned? No

Basis: Exemption request per 0CAN088404 and as supplemented by 0CAN088508 and 0CAN108608 provides the justification for not meeting the requirement for automatic fire suppression system to protect redundant shutdown related systems separated by a 1-hour fire barrier and protected by a fire detection system in the pipe area, which was approved by the NRC in 1CNA108806 based on:

- Combustible loading is low in this area
- Fire detection is provided in this area
- 1-hour rated fire wrapping on B-train makeup/high pressure injection pump power cables

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	C	Auxiliary Building 335' Elevation
	Fire Zone Name	Description
	34-Y	Pipe Room

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 5.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

Licensing Action

Appendix R Exemption 17, FZ 4-EE and Yard Area, Not Meeting III.J Criteria

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Basis Date: October 26, 1988

Transitioned? No

Basis: Exemption request per 0CAN088404 as supplemented by 0CAN088508 provides the justification for not meeting the requirement for 8-hour battery powered emergency lighting units on Elevation 317 feet and portions of the access paths to the steam pipe area on Elevation 404 feet, the intake structure, and the diesel fuel storage vault, which was approved by the NRC in 1CNA108806 based on:

- Normal lighting is expected to be restored prior to the time in which Operators would need to access the safe shutdown equipment on Elevation 317'
- Operators can use flashlights to access areas

This exemption is no longer required because NFPA 805 does not require 8-hour battery backed emergency lights.

Unit	Fire Area Name	Description
ANO-1	B-7	Auxiliary Building 317' Elevation
	N/A	Miscellaneous Yard Locations
	Fire Zone Name	Description
	4-EE	General Access Room
	N/A	Miscellaneous Yard Locations

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 6.0

Evaluation

This exemption is no longer required because NFPA 805 does not require 8-hour battery backed emergency lighting.

Licensing Action

Appendix R Exemption 18, Yard Area, Not Meeting III.G.2 Criteria

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Basis Date: October 26, 1988

Transitioned? No

Basis: Exemption request per 0CAN108710 provides the justification for not meeting the requirement for a complete 3-hour fire-rated barrier between redundant level transmitters for the safety grade condensate storage tank (QCST), which was approved by the NRC in 1CNA108806 based on:

- Manual fire suppression capability available for this area
- Physical configuration of the area
- Smoke and hot gas dissipation in open air

The lack of adequate separation of QCST level transmitters / cables in the area is no longer a concern under NFPA 805 criteria due to the Technical Specification required large volume of water that must be maintained during power operation. This area remains deterministically compliant as no fire related plant shutdown is required with the postulated loss of this instrumentation.

Unit	Fire Area Name	Description
ANO-1	N/A	Miscellaneous Yard Locations
	Fire Zone Name	Description
	N/A	Miscellaneous Yard Locations

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 7.0

Evaluation

This Fire Area was found to be deterministically compliant; therefore, this exemption is no longer required under the new licensing basis.

<u>Licensing Action</u>

Appendix R Exemption 19, RCP Oil Collection System, Not Meeting III.O Criteria

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<u>Basis Date</u>: October 26, 1988

<u>Transitioned</u>? Yes

<u>Basis</u>: Exemption request per 0CAN088404 provides the justification for not meeting the requirement for a reactor coolant pump (RCP) oil collection system that is designed to withstand a safe shutdown earthquake (SSE) and sized to hold the oil from all RCPs, which was approved by the NRC in 1CNA108806 based on:

- Oil collection system contains two tanks which are designed to hold lube oil inventory contents from one RCP each, with margin *(see Evaluation discussion below and Attachment T)*
- Lubrication oil systems for RCPs are qualified to remain functional during and after an SSE[1]
- Shielding wall separates heavy concentrations of safe shutdown circuitry in electrical penetration areas from the RCPs and oil collection system, and circuitry is protected by localized automatic suppression and detection capability
- Oil leakage from the remaining pump in each RCS loop will be drained into the appropriate tank, until the tank capacity is reached, and then to an open curbing where it can be safely contained.

Note 1 – The ANO-1 RCP oil collection system, like ANO-2, was not specifically designed to withstand an SSE. The RCP motor lube oil systems are integral with the pump motors. These motors, which are not seismically qualified, i.e., which are not required to function after a SSE, are seismically supported. The RCPs, RCP motors, and the integral lube oil systems contained within those pump motors are all designed, engineered, and installed such that a reasonable assurance of withstanding a SSE has been provided.

Unit	Fire Area Name	Description
ANO-1	J	Reactor Building

Fire Zone Name	Description
32-K	North Side Reactor Building
33-K	South Side Reactor Building

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 8.0

Evaluation

1CNA108806 concludes, "*The existing oil collection system is designed to safely channel the quantity of oil from one pump to a vented closed container, and so conforms with the above staff guidance. On this basis the staff concludes that the licensee's alternate design of the oil collection system provides an equivalent level of fire safety to that achieved by compliance with Section III.0.*" The NRC further concludes: "*…the design of the reactor coolant pump lubricating systems and the oil collection systems meets certain criteria previously determined by the staff to be acceptable for assuring adequate fire safety. Thus the underlying purpose of the rule would be satisfied without requiring the oil collection system to be seismically qualified and capable of holding the oil contained in all of the reactor coolant pumps.*"

As noted above, this exemption was granted in 1988 with respect to the RCP motors installed at the time. Later, RCP "B" motor had been replaced with one having a larger oil capacity. As part of the installation, an "overflow" tank was added to the existing oil collection tank, having an additional capacity of 50 gallons. This was thought to be sufficient to contain the oil contents of one RCP, as previously designed. However, in 2008 an error in the associated calculations was discovered (reference condition report CR-ANO-1-2008-0187). Upon re-assessment, it was determined that the new RCP motor oil capacity would fill both the original collection tank and the installed overflow tank, plus result in 6 gallons of oil contained in the curbed area surrounding the collection system. The evaluation also verified that if all RCPs were replaced with the higher oil capacity motors, the total contents of two RCPs would still be contained within the collection tank, overflow tank, and surrounding curbed area (total contents of two pumps would be 458 gallons with a combined capacity of each of the two oil collection systems and respective curbed area being 488 gallons).

Based on this assessment, Entergy believes the original basis for the above exemption is maintained (i.e., the single difference being that the tanks will not hold the total oil volume from one RCP without minor spillage into the curbed area). See Attachment T.

NFPA 805 Chapter 3 Reference

3.3.12 Reactor Coolant Pumps

Licensing Action

Appendix R Exemption 20, FZ 20-Y and 34-Y, Not Meeting III.G.2.b Criteria

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Basis Date: October 26, 1988

Transitioned? No

Basis: Exemption request per 0CAN088404, as supplemented in 0CAN088508 and 0CAN108608, provides the justification for not meeting the requirement for automatic fire suppression system to protect redundant EFW pump cables, which was approved by the NRC in 1CNA108806 based on:

- Low fire loading
- Spatial separation between redundant cable trains
- Installed ceiling-mounted ionization smoke detectors

The NFPA 805 transition compliance strategy is a performance based approach that is in accordance with Section 4.2.4. This exemption is no longer required and will not be transitioned to the NFPA 805 licensing basis since the compliance strategy of Section 4.2.4 is not based on Appendix R, Section III.G.2 separation with automatic fire suppression and fire detection.

Unit	Fire Area Name	Description
ANO-1	C	Auxiliary Building 335' Elevation
	Fire Zone Name	Description
	20-Y	Radwaste Processing Room
	34-Y	Pipe Room

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 9.0

Evaluation

This Fire Area was transitioned using the performance based approach; therefore, this exemption is no longer required under the new licensing basis.

L. NFPA 805 Chapter 3 Requirements for Approval (10 CFR 50.48(c)(2)(vii))

In accordance with 10 CFR 50.48(c)(2)(vii) Performance-based methods, the fire protection program elements and minimum design requirements of Chapter 3 may be subject to the performance-based methods permitted elsewhere in the standard.

In accordance with NFPA 805, Section 2.2.8, the performance-based approach to satisfy the nuclear safety, radiation release, life safety, and property damage/business interruption performance criteria requires engineering analyses to evaluate whether the performance criteria are satisfied.

In accordance with 10 CFR 50.48(c)(2)(vii), the engineering analysis performed shall determine that the performance-based approach utilized to evaluate a variance from the requirements of NFPA 805 Chapter 3:

(A) Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release;

(B) Maintains safety margins; and

(C) Maintains fire protection defense-in-depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability).

Entergy requests formal approval of performance based exceptions to requirements in Chapter 3 of NFPA 805 as follows.

NFPA 805 Section 3.2.3(1)

NFPA 805, Section 3.2.3(1) states:

> *Procedures shall be 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: Inspection, testing, and maintenance for fire protection systems and features credited by the fire protection program.*

ANO desires the flexibility to utilize performance-based methods to establish the appropriate inspection, testing, and maintenance frequencies for fire protection systems and features required by NFPA 805. Performance-based inspection, testing, and maintenance frequencies guidance is established in Electric Power Research Institute (EPRI) Technical Report TR-1006756, *Fire Protection Equipment Surveillance Optimization and Maintenance Guide,* Final Report, July 2003.

Basis for Request:

NFPA 805 Section 2.6, Monitoring, requires that *"A monitoring program shall be established to ensure that the availability and reliability of the fire protection systems and features are maintained and to assess the performance of the fire protection program in meeting the performance criteria. Monitoring shall ensure that the assumptions in the engineering analysis remain valid."*

NFPA 805 Section 2.6.1, Availability, Reliability, and Performance Levels, requires that *"Acceptable levels of availability, reliability, and performance shall be established."*

NFPA 805 Section 2.6.2, Monitoring Availability, Reliability, and Performance, requires that *"Methods to monitor availability, reliability, and performance shall be established. The methods shall consider the plant operating experience and industry operating experience."*

The scope and frequency of the inspection, testing, and maintenance activities for fire protection systems and features required in the fire protection program have been established at ANO based on the previously approved Technical Specifications / Licensing Basis Documents and appropriate NFPA codes and standards. The *scope* of the aforementioned activities is determined by the required systems review identified in LAR Table 4-3, Summary of NFPA 805 Compliance Basis and Required Fire Protection Systems and Features. This request is specific to the use of EPRI TR-1006756 to establish the appropriate inspection, testing, and maintenance *frequencies* for fire protection systems and features credited by the fire protection program. As stated in EPRI TR-1006756, Section 10.1, *"The goal of a performance-based surveillance program is to adjust test and inspection frequencies commensurate with equipment performance and desired reliability."*

This goal is consistent with the stated requirements of NFPA 805, Section 2.6, Monitoring. EPRI TR-1006756 provides an accepted method to establish appropriate inspection, testing, and maintenance frequencies which ensure the required NFPA 805 availability, reliability, and performance goals are maintained.

Where a performance-based monitoring program is applied, the target tests, inspections, and maintenance will be those activities associated with the NFPA 805 required fire protection systems and features. The reliability and frequency goals associated with the NFPA 805 required fire protection systems and features will be established to ensure the assumptions in the NFPA 805 engineering analysis remain valid. Failure criterion will be established based on the required fire protection systems and features credited functions and will ensure those functions are maintained. Data collection and analysis will follow the guidance contained in EPRI TR-1006756. The failure probability will be determined based on the EPRI TR-1006756 guidance and a 95% confidence level. Performance monitoring will be performed in conjunction with the monitoring program required by NFPA 805, Section 2.6, and will ensure site specific operating experience is considered in the monitoring process. The following flowchart, Figure 10-1 of EPRI TR-1006756, identifies the basic process that will be utilized.

Program Framework

- Identify Target Tests and Inspections
- Establish Reliability and Frequency Goals
- Set Failure Criteria
- Assess Licensing Impact and Other Constraints

Data Collection and Evaluation

- Establish Data Collection Guidelines
- Collect Required Surveillance Data
- Assemble Data in Spreadsheet or Database
- Analyze Data to Indentify Failures

Reliability and Uncertainty Analysis

- Compute Failure Probabilities
- Compute Uncertainty Limits
- Confirm that Reliability Supports Target Frequency

Program Implementation

- Modify Program Documents
- Revise Surveillance Procedures
- Conduct Ongoing Performance Monitoring
- Refine and Modify Frequencies as Appropriate

EPRI TR-1006756 - Figure 10-1

Flowchart for Performance-Based Surveillance Program

ANO requests approval to use the EPRI TR-1006756 guidelines in the future as opportunities arise. ANO does not intend to revise any fire protection surveillance, test, or inspection frequencies until after transition to NFPA 805. Existing fire protection surveillance, test, and inspection procedures will remain consistent with applicable Technical Requirements Manual, Insurer, and NFPA Code requirements. ANO requests the flexibility to evaluate fire protection features using the aforementioned EPRI performance-based methods to provide evidence of equipment performance beyond that achievable under traditional prescriptive maintenance practices to ensure optimal use of resources while maintaining reliability.

Acceptance Criteria Evaluation:

Nuclear Safety and Radiological Release Performance Criteria:

The use of performance-based test frequencies established in accordance with EPRI TR-1006756 methods combined with the NFPA 805, Section 2.6, monitoring program will ensure that the availability and reliability of the fire protection systems and features are maintained at levels assumed in the NFPA 805 engineering analysis. Therefore, the use of the performance-based methods in EPRI TR-1006756 does not result in an adverse impact to Nuclear Safety Performance Criteria.

The radiological release performance criteria are satisfied based on the determination of the limiting radioactive release (refer to LAR Attachment E, NEI 04-02 Radiological Release Transition). Fire protection systems and features are credited as part of the subject evaluation. Development of performance-based test frequencies in accordance with EPRI TR-1006756 methods combined with the NFPA 805, Section 2.6, monitoring program will ensure that the availability and reliability of the fire protection systems and features are maintained at the levels assumed in the NFPA 805 engineering analysis, including assumptions supporting the Radioactive Release performance criteria. Therefore, there is no adverse impact to Radioactive Release performance criteria.

Safety Margin and Defense-in-Depth:

The use of performance-based test frequencies established per EPRI TR-1006756 methods combined with the NFPA 805, Section 2.6, monitoring program will ensure that the availability and reliability of the fire protection systems and features are maintained at the levels assumed in the NFPA 805 engineering analysis, including those assumptions supporting the Fire Risk Evaluation safety margin discussions. In addition, these methods do not invalidate the inherent safety margins contained in the codes and standards used for design and maintenance of fire protection systems and features. Therefore, the safety margin inherent and credited in the analysis has been preserved.

The three echelons of defense-in-depth are: 1) to prevent fires from starting (combustible/hot work controls), 2) rapidly detect, control and extinguish fires that do occur thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans), and 3) provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions).

Echelon 1 is not affected by the use of EPRI TR-1006756 methods. Use of performance-based test frequencies established in accordance with EPRI TR-1006756 combined with the NFPA 805, Section 2.6, monitoring program will ensure that the availability and reliability of the fire protection systems and features credited for defense-in-depth are maintained at the levels assumed in the NFPA 805 engineering analysis. Therefore, there is no adverse impact to echelons 2 and 3 for the defense-in-depth.

Conclusion:

NRC approval is requested to permit the use of performance-based methods contained in EPRI TR-1006756 to establish the appropriate inspection, testing, and maintenance frequencies at ANO for fire protection systems and features required by NFPA 805, where desired.

The engineering analysis performed determined that the performance-based approach utilized to evaluate a variance from the requirements of NFPA 805 Chapter 3:

- Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release
- Maintains Defense in Depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability)
- Maintains Safety Margin

NFPA 805 Section 3.3.3

NFPA 805 Section 3.3.3 states:

"Interior Finishes. 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."

ANO utilizes an epoxy floor coating system that does not meet the exact requirements of NFPA 805, Section 3.3.3.

NFPA 101 requirements for interior floor finishes state that the floor finish shall be characterized by a critical radiant flux not less than 0.45 W / cm^2. In addition, the NRC issued Information Notice (IN) 2007-26 to address the combustibility of epoxy floor coatings at commercial nuclear power plants. Per IN 2007-26, the NRC defined a non-combustible material as:

a. A material which in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat; and

b. Material having a structural base of noncombustible material, as defined in a., above, with a surfacing not over 1/8-inch thick that has a flame spread rating not higher than 50 when measured using the test protocol of American Society for Testing and Materials (ASTM) E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials.

NFPA 805 has re-defined the IN 2007-26 definition of non-combustible material to limited combustible material:

"Material that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg) and either has a structural base of noncombustible material with a surfacing not exceeding a thickness of 1/8 in. (3.2 mm) that has a flame spread rating not greater than 50, or has another material having neither a flame spread rating greater than 25 nor evidence of continued progressive combustion, even on surfaces exposed by cutting through the material on any plane."

NFPA 805 defines non-combustible material as:

"Material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat."

A previous ANO evaluation of the acceptability of the epoxy floor coatings was performed in response to Nuclear Regulatory Commission (NRC) published IN 2007-26, "Combustibility of Epoxy Floor Coatings at Commercial Nuclear Power Plants," August 13, 2007 regarding combustibility of epoxy floor coatings at commercial nuclear facilities. The results are documented in CR-ANO-C-2008-01315 (excerpts below).

ANO evaluated coating samples taken from areas containing safety related equipment to determine the contribution that epoxy floor coating may have to combustible loads in safety related areas of the plant.

> "The energy required to support combustion of the floor coatings used at ANO will not be produced by an incipient stage compartment fire. Direct impingement of flame or heat onto the coatings will not cause propagation of flame beyond the influence zone of the heat source, as exhibited with incidental hot work contact with floor surfaces. Manual or automatic suppression will provide protective cover to preclude floor coating involvement in fire severity should a fire proceed past the incipient stage."
>
> "The epoxy floor coatings currently applied at the ANO site could potentially be considered a slight contributor, typically of less than 3 minutes, to fire severity, only if the compartment progressed to flashover conditions and automatic or manual suppression is never attempted. Considering the epoxy floor materials used and the conditions anticipated, it can be reasonably concluded that the epoxy floor coatings of the type utilized at ANO do not present a primary fire hazard, will not propagate fire from one fire area to another, or exacerbate the severity of a compartment fire."

Based on the review of epoxy floor coatings at ANO, Duochem 9400 was identified to have the highest flame spread index of any floor coating used at ANO. Duochem 9400 properties are provided in the following table:

Dry Film Thickness (inches)	Flame Spread Rating
1/8	31
1/4	57

The review concluded that the majority of the areas have a maximum dry film thickness (DFT) that is less than 1/8-inch. As stated in Enclosure 2 to NRC Generic Letter (GL) 86-10, Section 3.6.2, material with a 1/8-inch DFT and a flame spread rating less than 50 will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. This is consistent with the definition of Limited Combustible (NFPA-805, Section 1.6.36).

Basis for Request:

The request recognizes the possibility for limited areas where the floor coating DFT may approach ¼-inch due to floor smoothness variations that have not been detected. The request to utilize Duochem 9400 bounds the characteristics of other floor coatings used at ANO. In these limited areas, the flame spread rating using Duochem 9400 properties, when averaged over the area, will be less than 50.

The coatings permitted at ANO, with the exception of Duochem 9400, are either NFPA Class A qualified or ASTM E84 tested with a flame spread index less than 50. All epoxy floor coatings have been determined by ANO evaluation to have a negligible contribution with regard to combustible loading. In addition, the epoxy coating is on the floor. The ASTM E84 test is conducted with the material on the ceiling of a tunnel. This configuration would allow the flame to directly impinge on the ceiling surface, enhancing flame spread. With the material on the floor, the heat flux to the surface is much less than would be expected in the ceiling configuration since the convective flame is directing the heat away from the surface. This would mean that the overall flame spread would be expected to be much less, even with a slightly greater thickness.

Acceptance Criteria Evaluation:

Nuclear Safety and Radiological Release Performance Criteria:

The use of epoxy floor coating does not affect nuclear safety as it in general meets the definition of a limited combustible material with isolated thickness excesses. The floor coating materials were evaluated to have a negligible effect on combustibility. Application of epoxy floor coatings is controlled via ANO procedures to ensure that the amount of material does not add appreciable amounts of combustible material to the plant. Therefore, there is no impact on the nuclear safety performance criteria.

The use of epoxy floor coatings has no impact on the radiological release performance criteria. The radiological release review was performed based on the manual fire suppression activities in areas containing or potentially containing radioactive materials and is not dependent on the floor coating materials. The floor coatings do not change the radiological release evaluation performed that potentially contaminated water is contained and smoke monitored. Floor coatings do not add additional radiological materials to the area or challenge systems boundaries that contain such.

Safety Margin and Defense-in-Depth:

The use of epoxy floor coating does not affect safety margin as it in general meets the definition of a limited combustible material with isolated thickness excesses. The floor coating materials were evaluated to have a negligible effect on combustibility. Application of epoxy floor coatings is controlled via ANO procedures.

These precautions and limitations on the use of these materials have been defined by the limitations of the analytical methods (e.g., ignition frequency, heat released) used in the development of the fire probabilistic risk assessment (PRA). The Fire PRA (FPRA) uses historical fires and fire tests as the basis for many inputs, such as the ignition frequencies, the heat released from a fire, how fires will spread, and the probability that a circuit will be damaged in an adverse way. Therefore, the inherent safety margin present in the internal events PRA model and extended to the FPRA methods is reasonable because NRC-accepted methods are used to perform the FPRA. Deviations are evaluated against the methods and criteria for the overall internal events PRA and FPRA model development for consistency, or confirmation of bounding treatment, to confirm that the safety margin inherent in the PRA model is preserved. If the deviation does not change the FPRA, the safety margin inherent in the FPRA is also unchanged.

The epoxy floor coatings of the type utilized at ANO do not present a primary fire hazard, will not propagate fire from one fire area to another, and will not exacerbate the severity of a compartment fire. Thus, their presence has no impact on the analytical methods used in the FPRA to evaluate potential fire scenarios. Therefore, the inherent safety margin in these methods remains unchanged.

The three echelons of defense-in-depth are 1) to prevent fires from starting (combustible/hot work controls), 2) rapidly detect, control and extinguish fires that do occur thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans), and 3) provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions). The use of epoxy floor coatings does not affect echelons 1, 2 and 3. The use of epoxy floor coatings does not directly result in compromising automatic fire suppression functions, manual fire suppression functions, or post-fire safe shutdown capability.

<u>Conclusion:</u>

NRC approval is requested for the use of epoxy floor coatings as a performance-based method that provides an equivalent level of fire protection to NFPA 805, Section 3.3.3.

ANO-1 determined that the performance based approach satisfies the following criteria:

- Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release
- Defense in Depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability)
- Safety Margin

NFPA 805 Section 3.3.5.1

NFPA 805 Section 3.3.5.1 states:

> *"Wiring above suspended ceiling shall be kept to a 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."*

ANO has wiring above suspended ceilings that may not comply with the requirements of this code section.

Suspended ceilings and their supports are non-combustible and combustibles in concealed spaces are minimal.

The majority of ANO areas currently with suspended ceilings inside the NFPA 805 defined power block are office areas in the Turbine and Auxiliary buildings. These areas are not risk significant with the exception of the Control Rooms. The Control Rooms previously identified cabling above the suspended ceiling. The quantity of video/communication cabling above the suspended ceilings in the Control Rooms is very low and results in limited combustible loading. In addition, the existing fire detection capability and/or the Control Room Operators who are continuously present in the area would identify the presence of smoke.

These areas are assumed to have wiring above the suspended ceilings including that needed for power, control, and video/communication/data. Power and control cables at ANO are IEEE-383-1974 or equivalent. FAQ 06-0022 identified acceptable electrical cable construction tests for all areas of the power block and the majority of plant cables meet these requirements.

Video/communication/data cables that have been field routed above suspended ceilings are low voltage. For example, LAN cable (Category 5) is a signal cable that typically runs less than 5 volts at low current (< 0.577 amps per conductor) and can also be used for telephony and video. Analog telephone lines operate at less than 100 volts at low current (20 to 50 mA typical) and include series resistance to limit current in case of shorts. Existing video/communication cabling may not be plenum rated, but is not generally susceptible to shorts that would result in a fire, and meets plant specific requirements documented in plant procedure OP-6030.109, "Installation of Electrical Cable & Wire."

Basis for Request:

The basis for the approval request of this deviation is:

- The NFPA 805 requirement is excessive in that plenum rating should not be applied to wiring above suspended ceilings that are not used as plenum and have stagnant air versus flowing air.
- Only a limited amount of the cable installed above the suspended ceilings in these areas is not rated for plenum use, IEEE-383-1974 equivalent, or routed in conduit.
- The cable is low voltage (less than 480V) and, therefore, less susceptible to self-ignition and electrical shorts that could result in a fire in the enclosed space.
- There are no additional ignition sources in the area above the suspended ceilings.
- For the cables that do not meet the NFPA 805, Section 3.3.5.1 criteria, the majority meet one of the cable qualifications listed within FAQ 06-0022.
- Plant procedure OP-6030.109, "Installation of Electrical Cable & Wire," contains adequate guidance to ensure suitable cable qualification criteria was provided and is maintained.

Acceptance Criteria Evaluation:

<u>Nuclear Safety and Radiological Release Performance Criteria:</u>

The location of wiring above suspended ceilings does not affect nuclear safety. Power and control cables comply with IEEE-383 or equivalent. Other wiring, while it may not be in armored cable, in metallic conduit, or plenum rated, is low voltage cable not susceptible to shorts that would result in a fire. Therefore, there is no impact on the nuclear safety performance criteria.

The location of cables above suspended ceilings has no impact on the radiological release performance criteria. The radiological release review was performed based on the manual fire suppression activities in areas containing or potentially containing radioactive materials and is not dependent on the type of cables or locations of suspended ceilings. The location of cables does not change the radiological release evaluation performed that potentially contaminated water is contained and smoke monitored. The cables do not add additional radiological materials to the area or challenge systems boundaries that contain such.

Safety Margin and Defense-in-Depth:

Power and control cables comply with IEEE-383 or equivalent. The use of these materials has been defined by the limitations of the analytical methods (e.g., ignition frequency, heat released) used in the development of the FPRA. The FPRA uses historical fires and fire tests as the basis for many inputs, such as the ignition frequencies, the heat released from a fire, how fires will spread, and the probability that a circuit will be damaged in an adverse way. Therefore, the inherent safety margin present in the internal events PRA model and extended to the FPRA methods is reasonable because NRC-accepted methods are used to perform the FPRA. Deviations are evaluated against the methods and criteria for the overall internal events PRA and FPRA model development for consistency, or confirmation of bounding treatment, to confirm that the safety margin inherent in the PRA model is preserved. If the deviation does not change the FPRA, the safety margin inherent in the FPRA is also unchanged.

The limited amount of low voltage communications/data cable above suspended ceilings is not susceptible to shorts that would result in a fire. Thus, their presence above suspended ceilings has no impact on the analytical methods used in the FPRA to evaluate potential fire scenarios. Therefore, the inherent safety margin in these methods remains unchanged.

The three echelons of defense-in-depth are 1) to prevent fires from starting (combustible/hot work controls), 2) rapidly detect, control and extinguish fires that do occur thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans), and 3) provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions). The prior introduction of non-listed video/communication/data cables routed above suspended ceilings does not impact fire protection defense-in-depth. Echelon 1 is maintained by the current cable installation procedures documenting the requirements of OP-6030.109. The introduction of cables above suspended ceilings does not affect echelons 2 and 3. The video/communication/data cables routed above suspended ceilings does not result in compromising automatic fire suppression functions, manual fire suppression functions, fire protection for systems and structures, or post-fire safe shutdown capability.

Conclusion:

NRC approval is requested to permit the presence of cable located above the suspended ceiling located in the power block, which do not meet the requirements of NFPA 805, Section 3.3.5.1. The cabling is not enclosed in metal conduit, is not armored, is not enclosed in metal cable trays, and is not plenum rated cable. Adequate controls for such cabling are provided using existing plant procedure OP-6030.109, “Installation of Electrical Cable & Wire.”

ANO-1 determined that the performance based approach satisfies the following criteria:

- Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release
- Defense in Depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability)
- Safety Margin

NFPA 805 Section 3.3.5.2

NFPA 805 Section 3.3.5.2 states:

> *"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."*

Installation of raceway systems is addressed in approved procedures. Cable tray and conduit material is primarily of substantial metal construction. However, use of Schedule 40 PVC is allowed by procedure for underground and embedded applications.

Site procedures state:

> *"Underground concrete encased conduits, sizes three (3) inches and larger shall be of an approved heavywall ABS or Schedule 40 PVC. Slab and wall embedded conduits three (3) inches and larger shall be Schedule 40 PVC or rigid steel as required by the Plant Data Management System. All conduits two (2) inches and smaller and all exposed conduits shall be rigid steel."*

Basis for Request:

The basis for the approval request of this deviation is:

- Access points to embedded conduit are required to be rigid steel. The nonmetallic conduit is used only in concrete embedded applications, thus providing physical protection and separation for the conduit.
- The plastic conduit, while a combustible material, is not subject to flame/heat impingement from an external source which would result in structural failure, contribution to fire load, and/or damage to the circuits contained within where the conduit is embedded in concrete.
- Failure of circuits within the conduit resulting in a fire would not result in damage to external targets.
- The National Electric Code (NEC) allows use of Rigid Nonmetallic Conduit for underground and embedded applications.

Acceptance Criteria Evaluation:

<u>Nuclear Safety and Radiological Release Performance Criteria:</u>

The use of nonmetallic conduit for raceways embedded in concrete is allowed by NFPA 70, National Electric Code, and provides adequate physical and electrical protection for cables. The use of plastic conduit in embedded locations does not affect nuclear safety as the material in which conduits are run within an embedded location are not subject to the failure mechanisms potentially resultant in circuit damage or resultant damage to external targets. Therefore, there is no impact on the nuclear safety performance criteria.

The use of plastic conduit in embedded installations has no impact on the radiological release performance criteria. The radiological release review was performed based on the manual fire suppression activities in areas containing or potentially containing radioactive materials and is not dependent on the type of conduit material. The conduit material does not change the radiological release evaluation performed that potentially contaminated water is contained and smoke monitored. The conduits do not add additional radiological materials to the area or challenge systems boundaries that contain plastic conduits.

Safety Margin and Defense-in-Depth:

The plastic conduit material is embedded in a non-combustible configuration. The use of these materials has been defined by the limitations of the analytical methods (e.g., ignition frequency, heat released) used in the development of the FPRA. The FPRA uses historical fires and fire tests as the basis for many inputs, such as the ignition frequencies, the heat released from a fire, how fires will spread, and the probability that a circuit will be damaged in an adverse way. Therefore, the inherent safety margin present in the internal events PRA model and extended to the FPRA methods is reasonable because NRC-accepted methods are used to perform the FPRA. Deviations are evaluated against the methods and criteria for the overall internal events PRA and FPRA model development for consistency, or confirmation of bounding treatment, to confirm that the safety margin inherent in the PRA model is preserved. If the deviation does not change the FPRA, the safety margin inherent in the FPRA is also unchanged.

The material in which nonmetallic conduits are run within embedded locations is not subject to flame or heat impingement from an external source which would result in structural failure, contribution to fire load, or damage to the circuits. Also, failure of circuits within the embedded conduit resulting in a fire would not result in damage to external targets. Thus, the use of nonmetallic conduit for raceways embedded in concrete has no impact on the analytical methods used in the FPRA to evaluate potential fire scenarios. Therefore, the inherent safety margin in these methods remains unchanged.

The three echelons of defense-in-depth are 1) to prevent fires from starting (combustible/hot work controls), 2) rapidly detect, control and extinguish fires that do occur thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans), and 3) provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions). The use of plastic conduit in embedded installations does not impact fire protection defense-in-depth. The plastic conduit in embedded installations does not affect echelons 1, 2 and 3. The plastic conduits do not directly result in compromising automatic or manual fire suppression functions, fire protection for systems and structures, or post-fire safe shutdown capability.

Conclusion:

NRC approval is requested for the use of nonmetallic conduit for raceways embedded in concrete.

ANO-1 determined that the performance based approach satisfies the following criteria:

- Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release
- Defense in Depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability)
- Safety Margin

NFPA 805 Section 3.3.12 (1)

NFPA 805 Section 3.3.12(1) states:

> *"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."*

The ANO oil collection system is designed and was reviewed in accordance with 10 CFR 50 Appendix R, Section III.O to collect leakage from pressurized and nonpressurized leakage sites in the Reactor Coolant Pump oil system. This may not include collection of oil mist as a result of pump/motor operation. Oil misting is not leakage due to equipment failure, but an inherent occurrence in the operation of large rotating equipment. It is normal for large motors to lose some oil through seals and the oil to potentially become 'atomized' in the ventilation system. This atomized oil mist can then collect on surfaces in the vicinity of the RCP as the pump design is not completely sealed to permit airflow for cooling. The oil mist resulting from normal operation will not adversely impact the ability of a plant to achieve and maintain safe shutdown even if ignition occurred.

In addition, Generic Letter 86-10, Implementation of Fire Protection Requirements, dated April 24, 1986; Question 6.2 (shown below) discussed oil dripping. The response concluded that there was no concern with oil consumption (which is an oil misting phenomena), but that an oil fire started from a pressurized leakage point and/or spilled leakage should be addressed.

> *Question 6.2*
>
> > *It would appear that a literal reading of Section III.0 regarding the oil collection system for the reactor coolant pump could be met by a combination of seismically designed splash shields and a sump with sufficient capacity to contain the entire lube oil system inventory. If the reactor coolant pump is seismically designed and the nearby piping hot surfaces are protected by seismically designed splash shields such that any spilled lube oil would contact only cold surfaces, does this design concept conform to the requirements of the rule?*
>
> *Response*
>
> > *If the reactor coolant pump, including the oil system, is seismically designed and the nearby hot surfaces of piping are protected by seismically designed splash shields such that any spilled lube oil would contact only cold surfaces, and it could be demonstrated by engineering analysis that sump and splash shields would be capable of preventing a fire during normal and design basis accident conditions, the safety objective of Section III.0 would be achieved. Such a design concept would have to be evaluated under the exemption process. The justification for the exemption should provide reasonable assurance that oil from all potential pressurized and unpressurized leakage points would be safely collected and drained to the sump. The sump should be shown capable of safely containing all of the anticipated oil leakage. The analysis should verify that there are no electric sources of ignition.*

The requirement for holding the inventory of the RCP lubricating oil system is not met without tank overflow, but an exemption for this configuration which keeps the overflow oil away from potential ignition sources was previously approved by the NRC for ANO-1.

Correspondence 1CNA108806 includes the following discussion:

8.1 Exemptions Requested

The licensee requested approval of exemptions from the technical requirements of Section III.0 of Appendix R to 10 CFR Part 50 to the extent that it requires the reactor coolant pump (RCP) oil collection system to be sized to hold the contents of the entire lube oil system for all pumps and to be designed to withstand a safe shutdown earthquake (SSE).

8.2 Discussion

The RCP Oil Collection Systems at each unit contains two tanks. These tanks are each designed to hold the contents of one reactor coolant pump's lube oil inventory with margin. Oil leakage from the remaining pump in each RCS loop will be drained into the appropriate tank, until the tank capacity is reached, and then to an open curbing where it can be safely contained. The system is located above the floor of the Containment Building. Safe shutdown circuitry is routed approximately forty feet above that elevation outside the primary shield walls containing the reactor, RCPs, and other primary system components. The shield wall separates the heavy concentrations of safe shutdown circuitry in the electrical penetration areas from the RCPs and the Oil Collection System itself. Additionally, that circuitry is protected by localized automatic fire suppression and detection capability. The Reactor Coolant Pump motor lube oil systems are integral with the pump motors. The licensee stated in the August 15, 1984 submittal, that the lube oil systems are qualified to remain functional during and after a SSE.

8.3 Evaluation

The technical requirements of Section III.O of Appendix R have not been met because the oil collection system for the RCPs has not been sized to hold the oil from all of the pumps and is not seismically designed.

Generic Letter 86-10 states:

> *"Where the RCP lube oil system is capable of withstanding the safe shutdown earthquake (SSE), the analysis should assume that only random oil leaks from the joints could occur during the lifetime of the plant. The oil collection system, therefore, should be designed to safely channel the quantity of oil from one pump to a vented closed container. Under this set of circumstances, the oil collection system would not have to be seismically designed."*

On the basis that the lube oil system at ANO-1 is capable of withstanding the SSE without rupture and that the existing oil collection system will channel random leaks to a vented and closed container, the existing design conforms with the above staff guidance.

8.4 Conclusion

Based on the above evaluation, the licensee's alternative design of the oil collection system provides an equivalent level of safety to that achieved by compliance with Section III.O of Appendix R. Therefore, the licensee's request for exemption is approved.

Historically, there have been no fires attributed to oil misting based on normal operation in the industry. Fires have occurred due to oil leakage from equipment failure such as cracked welds on piping or inadequate collection pan design. ANO does not have a history of significant oil loss from the RCPs as a result of oil misting or oil leakage that is not contained by the properly designed and installed oil leakage collection system.

Basis for Request:

The basis for the approval request of this deviation is:

- The oil collection system is designed to collect leakage from pressurized and nonpressurized leakage sites in the RCP oil system.
- Oil misted from normal operation is not leakage; it is normal motor oil consumption.
- Oil misted from normal operation does not significantly reduce the oil inventory.
- The oil historically released as misting does not account for an appreciable heat release rate or accumulation near potential ignition sources or non-insulated reactor coolant piping.
- RCPs are not required to achieve or maintain fire safe shutdown.

Acceptance Criteria Evaluation:

Nuclear Safety and Radiological Release Performance Criteria:

The oil mist resulting from normal operation will not adversely impact nuclear safety. There are redundant RCPs available as necessary. In addition, the RCPs are not required to achieve and maintain fire safe shutdown. Therefore, there is no impact on the nuclear safety performance criteria.

The potential for oil mist from the RCPs has no impact on the radiological release performance criteria. The radiological release review was performed based on the manual fire suppression activities in areas containing or potentially containing radioactive materials. The entire Containment Building in which the RCPs are located is an environmentally sealed radiological area during power operations. The oil mist does not add additional radiological materials to the area or challenge systems boundaries that contain such.

Safety Margin and Defense-in-Depth:

The oil mist resultant from normal operation will not adversely impact the ability of a plant to achieve and maintain fire safe shutdown even if ignition occurred. There are redundant RCPs, however the RCPs are not required to achieve and maintain fire safe shutdown. The use of this equipment has been defined by the limitations of the analytical methods (e.g. Ignition frequency, heat released) used in the development of the FPRA. The FPRA uses historical fires and fire tests as the basis for many inputs, such as the ignition frequencies, the heat released from a fire, how fires will spread, and the probability that a circuit will be damaged in an adverse way. Therefore, the inherent safety margin present in the internal events PRA model and extended to the FPRA methods is reasonable because NRC-accepted methods are used to perform the FPRA. Deviations are evaluated against the methods and criteria for the overall internal events PRA and FPRA model development for consistency, or confirmation of bounding treatment, to confirm that the safety margin inherent in the PRA model is preserved. If the deviation does not change the FPRA, the safety margin inherent in the FPRA is also unchanged.

The oil mist resultant from normal operation of the RCPs does not account for an appreciable heat release rate or accumulation near potential ignition sources. The RCPs utilize de-misters and oil loss is evaluated each outage per procedure OP-1504.001, "Visual Inspection of the Unit 1 & 2 RCP's Oil Collection System."

The RCP lube oil system is capable of withstanding the safe shutdown earthquake without rupture and the oil collection system will channel random leaks to a vented, closed container, and will keep overflow oil away from potential ignition sources. Also, the RCPs are not required to achieve and maintain fire safe shutdown, nor are they credited in the FPRA. Thus, use of the existing RCP lube oil and oil collection configuration has no impact on the analytical methods used in the FPRA to evaluate potential fire scenarios. Therefore, the inherent safety margin in these methods remains unchanged.

The three echelons of defense-in-depth are 1) to prevent fires from starting (combustible/hot work controls), 2) rapidly detect, control and extinguish fires that do occur thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans), and 3) provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions). The potential for oil mist from RCPs does not impact fire protection defense-in-depth. Echelon 1 is maintained by the oil collection system and RCP design. The introduction of a small amount of oil misting does not affect echelons 2 and 3. The potential for oil mist from the RCPs does not result in compromising automatic fire suppression functions, manual fire suppression functions, fire protection for systems and structures, or post-fire safe shutdown capability.

Conclusion:

NRC approval is requested for the potential of oil misting from the RCPs due to normal motor consumption not captured by the oil collection system designed for pressurized and non-pressurized leakage and spillage.

ANO-1 determined that the performance based approach satisfies the following criteria:

- Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release
- Defense in Depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability)
- Safety Margin

NFPA 805 Section 3.5.3, NFPA 20 (1969) Sections 457, 511c, 626a, 626d.e2 and 626d.e5

NFPA 805 Section 3.5.3 states:

> *"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."*

NFPA 20 (1969) Section 457 states:

Conformance: Motors furnished for centrifugal fire pump use shall be guaranteed to conform to these specifications.

NFPA 20 (1969) Section 511c states:

511c. All controllers shall be specifically approved for fire pump service.

ANO does not meet NFPA 20 Sections 457 or 511c that require the electric fire pump motor and electric fire pump controller to be UL Listed/Approved for fire pump service.

At the time of purchase October 30, 1969, in accordance with the Purchase Order (PO) Specification, the electric drive motor for the electric fire pump was not available as an Underwriters Laboratories, Inc. (UL) listed motor for fire pump service; therefore, the motor could not be purchased as UL listed due to the larger service requirements associated with the fire pump. The PO Specification states that "UL will allow us to use a 350 HP motor for this rating." The 3 phase / 60 cycles / 4160 VAC / 1770 RPM rated at 400 HP motor was ordered to meet the fire pump size requirements; nevertheless, the fire pump motor in use is not UL listed for fire pump service. A similar issue existed for the fire pump controller. However, the fire pump controller was evaluated to meet the design data requirements needed for the size and type for the electrically driven fire pump and drive motor.

NFPA 20 (1969) Section 626a states:

626a.General. 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 seconds rest in 12 consecutive cycles). The fire pump manufacturer shall provide a certification that the battery which was furnished complies with this requirement.

NFPA 20 (1969) 626d.e2 and 626d.e5 states:

Battery Chargers. The rectifier shall be of the semiconductor type, and the charger for the lead acid battery shall be capable of delivering a current within the range of 50 to 100 percent of the 20-hour discharge rate of the battery.

ANO does not meet NFPA 20 Sections 626a, 626d.e2 and 626d.e5 for the Cummins Diesel Engine controller, since vendor documents do not identify a certification for the batteries and do not identify the discharge rate of the lead acid batteries. The vendor manual does identify the battery charger rectifier as being of a semiconductor type (silicone diode rectifier).

The vendor manual and design drawing identify the Cummins Diesel Fire Pump Engine with two lead acid battery banks D08 and D09. The battery charging rectifier function is to automatically adjust its output to the battery's requirement and to the demands of the indicating lamps that draw small amounts of current when in stand-by. Vendor documents do not identify the battery discharge rate for the lead acid batteries.

The vendor manual for the diesel engine fire pump controller states that this equipment is UL Listed and Factory Mutual Research Corporation (FM) Approved for fire service. The vendor's diesel engine fire pump controller is manufactured, inspected, and tested to obtain UL listing and FM approvals for fire pump service. The fire pump controller sub-components (battery charger, relays, and etc.) were certified by the vendor for fire pump service. In addition, a review of historical fire pump testing found no issues identified by maintenance or during the diesel fire pump test, with battery problems related to battery discharge that would impact engine start.

Basis for Request:

The basis for approval request of this deviation is:

- The electrical fire pump configuration required the larger size 4160 VAC fire pump motor and the 4160 VAC fire pump controller, which was not UL Listed/Approved for fire pump service in 1969. In addition, historical evidence and procedural testing requirements have shown that the 4160 VAC electric motor, electric fire pump, and electric fire pump controller configuration used at ANO, while not in explicit agreement with the code requirement for a UL Listing, meets the intent of electrically driven fire pump design size, type, and function (see below for more details).
- The electric driven fire pump and electric pump controller was manufactured in accordance with the NEC.
- The electrical fire pump configuration meets the demands for the fire protection water supply system at ANO.
- In review of ANO documents, no issues were identified in association with past diesel fire pump tests, specifically with battery problems related to the rectifiers or battery discharge that would prevent the engine from starting. The vendor manual for the diesel engine fire pump controller states that this equipment is UL Listed and FM Approved for fire service. The diesel fire pump meets the demands for the fire protection water supply system.

Monthly tests that demonstrate operability of the electrical (P-6A) and diesel (P-6B) fire pumps, along with quarterly vibration tests, are performed in accordance with procedure OP-1104.032, Supplements 1 and 2. The following tests are performed for both fire pumps every 18 months in accordance with OP-1104.032, Supplement 8:

- Functional and Capacity
- Shutoff Head
- 100% Capacity and Valve Setpoint
- 150% Capacity
- Controls and Alarms
- Full Actuation

The following routine maintenance activities are performed at the designated frequency:

Maintenance Activity	Test Procedure	Frequency
P-6A motor oil level check	OP-1107.001 Supplement 7	Bi-Weekly
P-6B engine and gear oil check	OP-1107.001 Supplement 7	Bi-Weekly
P-6B Inspection	OP-1306.027	Semi-annually Annually
P-6B engine surveillance	OP-1307.004	Biannually
P-6A & P-6B Disassembly, Inspection and Reassembly	OP-1402.062	Corrective Maintenance No Frequency
P-6B engine batteries (D08 and D09) and battery charger maintenance	OP-1307.001 Supplement 1 Supplement 2 Supplement 3	Weekly Quarterly 18-Month

Based on a review of condition reports associated with fire pumps P-6A and P-6B, deficiencies such as field related components causing the auto start of a pump; inspection or corrective maintenance task deficiencies, and sub-component (such as gauges, fittings, or piping) failures were noted. However, no applicable operating experience was found that related to a failure of the electrical motor or its controller, or the diesel or the diesel engine battery bank, due to any adverse quality issue with this equipment.

The NFPA 20 code deviation does not degrade the system or equipment and has no adverse impact on the ability of the fire protection water system to perform its function.

Acceptance Criteria Evaluation:

Nuclear Safety and Radiological Release Performance Criteria:

The 4160 VAC fire pump motor and the 4160 VAC electrical fire pump controller were not UL Listed/Approved for fire pump service at the time of purchase in 1969 due to UL not having the high voltage 4160 VAC electric fire pump motor and controller rated for fire service in 1969.

The vendor manual for the diesel engine fire pump controller states that this equipment is UL Listed and FM Approved for fire service. The vendor's diesel engine fire pump controller is manufactured, inspected and tested to obtain UL listing and FM approvals for fire pump service. The fire pump controller sub-components (battery charger, relays, and etc.) were certified by the vendor for fire pump service. In addition, a review of historical fire pump testing found no issues identified by maintenance or during the diesel fire pump test with battery problems related to battery discharge that would impact engine start.

The deviations described above have no impact on the nuclear safety performance criteria.

A radiological release review was performed, as documented in Table G-1, based on the manual fire suppression activities in areas containing, or potentially containing, radioactive materials and is not impacted by the motor driven fire pump and fire pump controller purchased as not UL listed/approved for fire pump service in 1969. Therefore, this deviation has no impact on radiological controlled areas (RCAs) or the radiological release performance criteria.

Safety Margin and Defense-in-Depth:

The fire protection water supply system has redundant capacity to supply the demands of the system. Therefore, the safety margin inherent in the analysis for the fire event has been preserved.

The three echelons of defense-in-depth are to 1) prevent fires from starting (combustible/hot work controls), 2) rapidly detect, control, and extinguish fires that do occur, thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans), and 3) provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions). The pumps (electric fire pump or diesel fire pump), at 100 percent flow rate and pressure, have the excess capacity to supply the demands of the fire protection system in addition to the greatest hose reel demand and, therefore, do not affect echelons 1, 2 and 3.

Conclusion:

NRC approval is requested for the aforementioned deviation to allow the use of 4160 VAC electric fire pump motor and 4160 VAC electric fire pump controller, since the motor and electric fire pump controller were ordered to meet the appropriate electric fire pump size, type, and configuration requirements. However, at the time of purchase in 1969, the fire pump motor and controller were not UL listed for fire pump service.

NRC approval is also requested for the aforementioned deviation related to the diesel engine fire pump vendor documents, which do not list or identify a certification for the batteries and the battery charger discharge rate of the lead acid batteries. The vendor manual for the diesel engine fire pump controller states that this equipment is UL Listed and FM Approved for fire service. The vendor's diesel engine fire pump controller is manufactured, inspected and tested to obtain UL listing and FM approvals for fire pump service. The fire pump controller sub-components (battery charger, relays, and etc.) were certified by the vendor for fire pump service. In addition, a review of historical fire pump testing found no issues identified by maintenance or during the diesel fire pump test with battery problems related to battery discharge that would impact engine start.

Historical evidence and procedural testing requirements have shown that the existing configuration meets the intent of electrically driven fire pump and the diesel fire pump design function for ANO. ANO-1 has determined that the performance-based approach satisfies the following criteria:

- Satisfies the performance, goals performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release
- Defense in Depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability)
- Safety Margin

NFPA 805 Section 3.5.16

NFPA 805 Section 3.5.16 states:

"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."

NFPA 24 (1995) Section 5-7 states:

*"**Domestic Service Use Prohibited.** The use of hydrants and hose for purposes other than fire-related services shall be prohibited."*

The ANO fire protection water supply system is used for installation of a temporary pump to allow both units to supply a protracted and continual supply of cooling water typically during unit outages when the Auxiliary Cooling Water (ACW) system is removed from service. Past practices of allowing use of the Fire Water system for non-fire water demands during outages have been authorized by engineering and incorporated into Operations procedures.

Significant margin exists in the fire protection water supply system above that required for suppression system demands. EC-27142 provides an evaluation that addresses the use of fire water for non-fire issues based on the results of a hydraulic model.

ACW is not essential for the safe shutdown (SSD) of the plant and thus the key safety functions and nuclear safety performance criteria are not impacted upon the loss of ACW cooling capability due to a fire event.

The temporary modification process employed at ANO is highly robust and considers impacts on all interconnecting and, if necessary, surrounding equipment during the evaluation process. This process also requires a Process Applicability Determination (PAD) to ascertain whether an evaluation under 10 CFR 50.59 must be performed prior to establishing any temporary modification in the field. Provided firewater capability remains within limits, the firewater system may be used for temporary support of other components over time (other than ACW).

In light of the above discussion, Entergy requests approval for the use of a temporary pump during both power operations and unit outages providing firewater capability remains within limits as demonstrated through the temporary modification process.

Basis for Request:

The basis for the approval request of this deviation is:

- The fire protection water supply system has excess capacity.
- The use of the fire protection water supply system is procedurally controlled.

The temporary pump and its controls are installed in the ANO-1 intake structure. The pump is configured to take suction from the lake and supply water to the Fire Water System (FWS) via the FWS Test Header.

A check valve is installed at the test header to prevent reverse flow from the fire header if the temporary system should fail. A minimum flow recirculation line, which also contains a manual isolation/throttle valve, is installed in the pump discharge line. A pressure gauge is installed on the pump discharge piping for monitoring pump operation and to allow for proper discharge pressure adjustments.

A combination of flexible hose and/or temporary pipe connects the temporary pump to a section of screen wash system piping. Lake water flows through this pipe to a tee near the FWS test header at the intake structure. Once the FWS test header manifold is removed from the flanged connection, a temporary reducer/check valve assembly is installed. The pump discharge valve is installed at the abandoned screen wash blind flange, and a combination of temporary pipe and a flexible hose section is installed between the screen wash pipe tee and the temporary FWS test header reducer/check valve assembly.

Installation of the temporary pump is procedurally controlled in accordance with OP-1104.032, "Fire Protection Systems." There is no change to the configuration, alignment, or operation of the fire water pumps (P-6A and P-6B) when the temporary pump is installed. The use of the temporary pump avoids unnecessary start and run cycles on fire water pumps P-6A and P-6B.

In accordance with Attachment B of OP-1104.034, "Control Room Air Conditioning," temporary cooling water may be supplied to the normal Control Room Chillers, VCH-2A or VCH 2B. Fire water is routed by hose from a firewater header drain valve on Elevation 404 to the desired inlet Y-Strainer drains (2ACW-29 and 2ACW-34).

Acceptance Criteria Evaluation:

<u>Nuclear Safety and Radiological Release Performance Criteria:</u>

The use of the fire protection water supply system for temporary cooling is evaluated as a temporary modification and controlled by approved procedures. The fire protection water supply system has excess capacity to supply the demands of the system to the greatest hose reel demand as evaluated by EC-27142 using a hydraulic model. Administrative controls consisting of procedural direction or continuously stationed individual ensure that a hose station or hydrant is secured or otherwise made available in the event of a fire. Therefore, use of the fire protection water supply system for temporary cooling has no impact on the nuclear safety performance criteria.

The radiological release review was performed based on the manual fire suppression activities in areas containing or potentially containing radioactive materials and is not dependent on the alternate use of the fire water supply system. Therefore, the use of the fire protection water supply system for non-fire protection uses, including the use of hydrants and hoses for purposes other than fire, has no impact on radiological controlled areas or the radiological release performance criteria.

Safety Margin and Defense-in-Depth:

The fire protection water supply system has excess capacity to supply the demands of the system to the greatest hose reel demand. Therefore, the safety margin inherent in the analysis for the fire event has been preserved.

The three echelons of defense-in-depth are 1) to prevent fires from starting (combustible/hot work controls), 2) rapidly detect, control and extinguish fires that do occur thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans), and 3) provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions). The use of the fire protection water supply system for non-fire protection uses, including the use of hydrants and hoses for purposes other than fire, does not impact fire protection defense-in-depth. Administrative controls consisting of procedural direction or continuously stationed individual ensure that a hose station or hydrant is secured or otherwise made available in the event of a fire. The pumps have the excess capacity to supply the demands of the fire protection system in addition to the greatest hose reel demand and do not affect echelons 1, 2 and 3.

Conclusion:

NRC approval is requested for the use of the ANO fire protection water supply system for purposes other than fire protection water supply.

ANO-1 determined that the performance based approach satisfies the following criteria:

- Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release
- Defense in Depth (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability)
- Safety Margin

M. License Condition Changes

The current ANO-1 fire protection license condition 2.c.(8) is being replaced consistent with the standard license condition in Regulatory Position 3.1 of RG 1.205.

Information currently on affected pages is moved to following pages as required to accommodate the new license condition. Such changes are administrative in nature and have no impact on the technical content of any license condition.

In support of this change, Entergy has developed an ANO-1 specific Fire PRA as described in Sections 4.5 and 4.7.3, and Attachments U, V, and W of the Transition Report (TR). A mark-up of the proposed changes to the Operating License is provided in Enclosure 2 of this letter. A clean, revised copy of the pages is provided in Enclosure 3 of this letter.

License condition 2.c.(9), involving mitigation strategies associated with large fires and explosions (security related), will be maintained as is.

A review was conducted of the ANO-1 Operating License DPR-51 by Entergy Licensing staff and one or more NFPA 805 Transition Team members. The review was performed by performing electronic searches of the docketed correspondence files by using the Entergy Licensing Research System (Autonomy). The system contains site licensing documents, including documents pertaining to the operating license, the Technical Specifications, the fire protection program, the SAR, correspondence sent to the NRC, and correspondence received from the NRC. The correspondence sent to the NRC includes any outstanding license amendment request submittals.

No other license conditions were identified as needing to be revised or superseded.

N. Technical Specification Changes

Technical Specification (TS) 5.4.1.c will be deleted.

5.4.1 Written procedures shall be established, implemented, and maintained covering the following activities:

c. ~~Fire Protection Program implementation; and~~Deleted

The “and” conjunction at the end of Item c is moved to the end of Item b as illustrated in Enclosures 2 and 3.

Entergy determined that this change to the TS is adequate for adoption of the new fire protection licensing basis since the requirement for establishing, implementing, and maintaining fire protection procedures is contained in the regulation (10 CFR 50.48(a) and 50.48(c) NFPA 805 Chapter 3).

A mark-up of the proposed change to the TS is provided in Enclosure 2 of this letter. A clean, revised copy of the page is provided in Enclosure 3 of this letter.

A review was conducted of the ANO-1 TSs and TS Bases by Entergy Licensing staff and one or more NFPA 805 Transition Team members. The review was performed by reading the TSs and performing electronic searches. Outstanding LARs that have been submitted to the NRC were also reviewed for potential impact on the license conditions.

No other TSs or TS Bases were identified as needing to be revised or superseded.

O. Orders and Exemptions

Exemptions

Attachment K includes a detailed listing of exemptions granted against 10 CFR 50, Appendix R. Only one exemption is being retained:

- Appendix R Exemption 19, RCP Oil Collection System, Not Meeting III.O Criteria, NRC approval letter 1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988

This exemption requires clarification due to plant modifications installed since the exemption was granted in 1988. See Attachment T for further detail.

Orders

No Orders need to be superseded or revised.

ANO-1 implemented the following process for making this determination:

- A review of the ANO-1 docketed correspondence was performed by the site Licensing staff and the NFPA 805 Transition Team. The review was performed by performing electronic searches of the docketed correspondence files by using the Entergy Licensing Research System (Autonomy). The system contains site licensing documents, including documents pertaining to the operating license, the Technical Specifications, the fire protection program, the SAR, correspondence sent to the NRC, and correspondence received from the NRC. The correspondence sent to the NRC includes any outstanding license amendment request submittals.

- A specific review was performed of the license amendment that incorporated the mitigation strategies required by Section B.5.b of Commission Order EA-02-026 (TAC No. MD4494) to ensure that any changes being made to ensure compliance with 10 CFR 50.48(c) do not invalidate existing commitments applicable to the plant. The review of this order demonstrated that changes to the fire protection program will not affect measures required by B.5.b.

P. RI-PB Alternatives to NFPA 805 10 CFR 50.48(c)(4)

No risk-informed or performance-based alternatives to compliance with NFPA 805 (per 10 CFR 50.48(c)(4)) were utilized by ANO-1.

Q. No Significant Hazards Evaluations

Pursuant to 10 CFR 50.91, Entergy Operations, Inc. (Entergy) has made the determination that this amendment request involves a "No Significant Hazards Consideration" by applying the standards established by the NRC regulations in 10 CFR 50.92.

To the extent that these conclusions apply to compliance with the requirements in NFPA 805, these conclusions are based on the following NRC statements in the Statements of Consideration accompanying the adoption of alternative fire protection requirements based on NFPA 805.

Criterion 1: The Proposed Change Does Not Involve a Significant Increase in the Probability or Consequences of an Accident Previously Evaluated

Operation of Arkansas Nuclear One, Unit 1 (ANO-1) in accordance with the proposed amendment does not result in a significant increase in the probability or consequences of accidents previously evaluated. The proposed amendment does not affect accident initiators or precursors as described in the ANO-1 Safety Analysis Report (SAR), nor does it adversely alter design assumptions, conditions, or configurations of the facility, and it does not adversely impact the ability of structures, systems, or components (SSCs) to perform their intended function to mitigate the consequences of accidents described and evaluated in the SAR. The proposed changes do not physically alter safety-related systems nor affect the way in which safety-related systems perform their functions as required by the accident analysis. The SSCs required to safely shut down the reactor and to maintain it in a safe shutdown condition will remain capable of performing their design functions.

The purpose of this amendment is to permit ANO-1 to adopt a new risk-informed, performance-based fire protection licensing basis that complies with the requirements in 10 CFR 50.48(a) and 10 CFR 50.48(c), as well as the guidance contained in Regulatory Guide (RG) 1.205. The NRC considers that NFPA 805 provides an acceptable methodology and performance criteria for licensees to identify fire protection requirements that are an acceptable alternative to the 10 CFR Part 50, Appendix R, fire protection features (69 FR 33536; June 16, 2004).

The purpose of the fire protection program is to provide assurance, through defense-in-depth, that the NRC's fire protection objectives are satisfied. These objectives are: (1) preventing fires from starting; (2) rapidly detecting and controlling fires and promptly extinguishing those fires that do occur, thereby limiting fire damage; (3) providing an adequate level of fire protection for SSCs important to safety, so that a fire that is not promptly extinguished will not prevent essential plant safety functions from being performed; and (4) ensuring that fires will not significantly increase the risk of radioactive releases to the environment. In addition, fire protection systems must be designed such that their failure or inadvertent operation does not adversely impact the ability of the SSCs important to safety to perform their safety-related functions.

NFPA 805, taken as a whole, provides an acceptable alternative for satisfying General Design Criterion 3 (GDC 3) of Appendix A to 10 CFR Part 50, meets the underlying intent of the NRC's existing fire protection regulations and guidance, and achieves defense-in-depth along with the goals, performance objectives, and performance criteria specified in NFPA 805, Chapter 1. In addition, if there are any increases in core damage frequency (CDF) or risk as a result of the transition to NFPA 805, the increase will be small, bounded by the delta risk requirements of NFPA 805, and consistent with the intent of the Commission's Safety Goal Policy.

Engineering analyses, which may include engineering evaluations, probabilistic risk assessments, and fire modeling calculations, have been performed to demonstrate that the performance-based requirements of NFPA 805 have been met. The SAR documents the analyses of design basis accidents (DBAs) at ANO-1. All accident analysis acceptance criteria will continue to be met with the proposed amendment. The proposed changes will not affect the source term, containment isolation, or radiological release assumptions used in evaluating the radiological consequences of any accident previously evaluated. The proposed changes will not alter any assumptions or change any mitigation actions for the radiological consequence evaluations in the ANO-1 SAR. In addition, the applicable radiological dose acceptance criteria will continue to be met.

Based on the above, the implementation of this amendment to transition the Fire Protection Plan (FPP) at ANO-1 to one based on NFPA 805, in accordance with 10 CFR 50.48(c), does not result in a significant increase in the probability of any accident previously evaluated. In addition, all equipment required to mitigate an accident remains capable of performing the assumed function. Therefore, the consequences of any accident previously evaluated are not significantly increased with the implementation of this amendment.

Criterion 2: The Proposed Change Does Not Create the Possibility of a New or Different Kind of Accident from Any Accident Previously Evaluated

Operation of ANO-1 in accordance with the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated. Previously analyzed accidents with potential offsite dose consequences were included in the evaluation of the transition to NFPA 805. The proposed amendment does not impact these accident analyses. The proposed change does not alter the requirements or functions for systems required during accident conditions as assumed in the licensing basis analyses and/or DBA radiological consequences evaluations.

Implementation of the new risk-informed, performance-based fire protection licensing basis, which complies with the requirements in 10 CFR 50.48(a) and 10 CFR 50.48(c), as well as the guidance contained in RG 1.205, will not result in new or different kinds of accidents. The NRC considers that NFPA 805 provides an acceptable methodology and performance criteria for licensees to identify fire protection systems and features that are an acceptable alternative to the 10 CFR 50, Appendix R fire protection features (69 FR 33536, June 16, 2004). No new modes of operation are introduced by the proposed amendment, nor will it create any failure mode not bounded by previously evaluated accidents. Further, the impacts of the proposed change are not directly assumed in any safety analysis to initiate an accident sequence.

The requirements in NFPA 805 address only fire protection and the impacts of fire effects on the plant have been evaluated. The proposed fire protection program changes do not involve new failure mechanisms or malfunctions that could initiate a new or different kind of accident beyond those already analyzed in the SAR. Based on this, as well as the discussion above, the implementation of this amendment to transition the FPP at ANO-1 to one based on NFPA 805, in accordance with 10 CFR 50.48(c), does not create the possibility of a new or different kind of accident from any accident previously evaluated.

Criterion 3: The Proposed Change Does Not Involve a Significant Reduction in a Margin of Safety

Operation of ANO-1 in accordance with the proposed amendment does not involve a significant reduction in a margin of safety. The transition to a new risk-informed, performance-based fire protection licensing basis that complies with the requirements in 10 CFR 50.48(a) and 10 CFR 50.48(c) does not alter the manner in which safety limits, limiting safety system settings, or limiting conditions for operation are determined. The safety analysis acceptance criteria are not affected by this change. The proposed amendment does not adversely affect existing plant safety margins or the reliability of equipment assumed in the SAR to mitigate accidents. The proposed change does not adversely impact systems that respond to safely shut down the plant and maintain the plant in a safe shutdown condition. In addition, the proposed amendment will not result in plant operation in a configuration outside the design basis for an unacceptable period of time without implementation of appropriate compensatory measures.

The risk evaluations for plant changes, in part as they relate to the potential for reducing a safety margin, were measured quantitatively for acceptability using the delta risk (i.e., ΔCDF and ΔLERF) criteria from Section 5.3.5, “Acceptance Criteria,” of NEI 04-02, as well as the guidance contained in RG 1.205. Engineering analyses, which may include engineering evaluations, probabilistic safety assessments, and fire modeling calculations, have been performed to demonstrate that the performance-based methods of NFPA 805 do not result in a significant reduction in the margin of safety. As such, the proposed changes are evaluated to ensure that risk and safety margins are kept within acceptable limits. Based on the above, the implementation of this amendment to transition the FPP at ANO-1 to one based on NFPA 805, in accordance with 10 CFR 50.48(c), will not significantly reduce a margin of safety.

NFPA 805 continues to protect public health and safety and the common defense and security because the overall approach of NFPA 805 is consistent with the key principles for evaluating risk-informed licensing basis changes, as described in RG 1.174, is consistent with the defense-in-depth philosophy, and maintains sufficient safety margins. Based on the above discussion, the three standards of 10 CFR 50.92(c) are satisfied. Therefore, the amendment request to transition the FPP at ANO-1 to one based on NFPA 805, in accordance with 10 CFR 50.48(c), involves no significant hazards consideration.

R. Environmental Considerations Evaluation

Entergy Operations, Inc. (Entergy) has evaluated the proposed amendment against the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21. Entergy has determined that the proposed amendment meets the criteria for a categorical exclusion set forth in 10 CFR 51.22(c)(9). This determination is based on the fact that this change is being proposed as an amendment to a license issued pursuant to 10 CFR 50.

The purpose of the proposed amendment is to permit Arkansas Nuclear One, Unit 1, (ANO-1) to adopt a new fire protection licensing basis that complies with the requirements of 10 CFR 50.48(a) and (c) and the guidance in Regulatory Guide 1.205. The NRC considers that NFPA 805 provides an acceptable methodology and appropriate performance criteria for licensees to identify fire protection requirements that are an acceptable alternative to the 10 CFR 50, Appendix R, fire protection features (69 FR 33536, June 16, 2004).

Accordingly, Entergy evaluated the proposed change against the categorical exclusion requirements of 10 CFR 51.22(c)(9), which state that in order for a license amendment to be excluded from the need for an environmental review, it must meet the following criteria:

(i) The amendment involves no significant hazards consideration;

(ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; and

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

As stated in Attachment Q, the proposed amendment does not involve a significant hazards consideration.

Compliance with NFPA 805 explicitly requires the attainment of performance criteria, objectives, and goals for radioactive releases to the environment. The radioactive release goals provide reasonable assurance that a fire will not result in a radiological release that affects the public, plant personnel, or the environment. The NFPA 805 transition has been evaluated based on fire suppression activities, but not involving fuel damage, and does not create any new source terms. Therefore, the proposed amendment will not change the types or amounts of any effluents that may be released offsite.

Furthermore, the proposed change will not significantly alter the types or increase the amount of individual or cumulative occupational radiation exposures based on the results of the evaluation performed regarding fire fighting activities. In addition, the modifications being implemented as a part of the transition to NFPA 805 at ANO-1 will reduce the need for recovery actions within the plant, which may function to lower overall operator occupational exposures in many scenarios.

Therefore, Entergy has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. Entergy has also determined that the amendment involves no significant hazards consideration. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

S. Plant Modifications and Items to be Completed During Implementation

Table S-1, Plant Modifications, provided below includes a description of the modifications along with the following information:

- A problem statement,
- Risk ranking of the modification,
- An indication if the modification is currently included in the FPRA,
- Compensatory measure in place, and
- A risk-informed characterization of the modification and compensatory measure.

The following ranking legend should be used when reviewing the table:

- High = Modification which would have an impact on FPRA and affect multiple Fire Areas.
- Med = Modification which would have an impact on FPRA and affect individual Fire Areas, or include IN 92-18 modifications.
- Low = Modification which would have no or insignificant impact on risk.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-1	High (PRA)	1	New Auxiliary Feedwater (AFW) pump: Due to multiple impacts to the Emergency Feedwater (EFW) system, the need for an additional source of feedwater to the Steam Generators (SGs) was identified. LAR Source: Attachment C, listed as a global modification to reduce risk	ANO plans a modification to install a new AFW pump and associated motor operated valves with diverse power sources and controls independent of the existing EFW pumps. The pump will be capable of feeding either SG The new AFW pump will be designed to meet or exceed the flow requirements of the ANO-1 EFW pump P-7B. The new AFW pump proposed design includes: - The capability to be operated from the ANO-1 Control Room and locally. - Electrical isolation from Control Room functions to prevent a fire in the Control Room from affecting local control of AFW components. - Local controls and monitoring instrumentation to ensure proper operation and water flow to the SG.	Yes	Yes	This AFW modification is credited globally from a PRA perspective to provide a reliable additional source of feedwater. The local control panel modification is also credited from a PRA perspective to provide an alternate means to perform required actions outside the ANO-1 Control Room. Manual actions are credited in fire areas that contain redundant safe shutdown equipment. The modification process will ensure these actions are feasible. Compensatory measures have been established until compliance can be achieved by transitioning to a 10 CFR 50.48(c) licensing basis.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-2	High (PRA)	1	Switchgear A-1: In multiple fire areas, a loss of normal DC control power could result in a loss of switchgear A-1. LAR Source: Attachment C, listed as a global modification to reduce risk	ANO plans a modification to install a redundant DC control power supply to switchgear A-1 to eliminate loss of switchgear due to loss of normal DC control power. In the event the normal DC control power source is lost, a transfer to this alternate DC power source can be performed. The modification for the backup or alternate DC power source will be derived from the local switchgear by use of step down transformers and rectification of the ANO-1 non-1E station battery. Installation of an automatic transfer switch, cables and electrical conduit is proposed.	Yes	Yes	This modification is credited globally from a PRA perspective. Installation of an alternate DC power source reduces the risk of a fire induced circuit failure to the DC power cables feeding A-1 which could preclude loss of offsite power. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-3	High (PRA)	1	Switchgear A-2: In multiple fire areas, a loss of normal DC control power could result in a loss of switchgear A-2 LAR Source: Attachment C, listed as a global modification to reduce risk	ANO plans a modification to install a redundant DC control power supply to switchgear A-2 to eliminate loss of switchgear due to loss of normal DC control power. In the event the normal DC control power source is lost, a transfer to this alternate DC power source can be performed. The modification for the backup or alternate DC power source will be derived from the local switchgear by use of step down transformers and rectification of the ANO-1 non-1E station battery. Installation of an automatic transfer switch, cables and electrical conduit is proposed.	Yes	Yes	This modification is credited globally from a PRA perspective. Installation of an alternate DC power source reduces the risk of a fire induced circuit failure to the DC power cables feeding A-2 which could preclude loss of offsite power. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-4	Med (PRA)	1	Switchgear A-3: In Fire Area I-2, loss of DC control power to 4160kV switchgear A-3 could result in the loss of control functions for Primary Makeup Pump (P-36A), EFW pump (P-7B), Service Water (SW) pump P-4A. LAR Source: Attachment C, Fire Area I-2 Risk Summary, VFDR I2-01-b, VFDR I2-02-a, and VFDR I2-03-c	ANO plans a modification to reroute the DC control power to eliminate Fire Area I-2 impact. Rerouting of selected red train A-3 switchgear room DC power cables from green train A-4 switchgear equipment in Fire Area 99-M is planned. The cable reroute is expected to impact Fire Zones 100-N, 197-X, 160-B, and 161-B.	Yes	Yes	This modification is credited for Fire Area I-2. In conjunction with the modifications described in items S1-2, S1-25, and S1-26, rerouting the DC power source for A-3 reduces the risk of a fire induced circuit failure of the switchgear and the possible loss of control functions to pumps P-36A, P-7B, and P-4A. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-5	High (PRA)	1	Switchgear H-1: In multiple fire areas, the loss of normal DC control power to switchgear H-1 could preclude the Reactor Coolant Pumps (RCPs) from being tripped in the Control Room. LAR Source: Attachment C, listed as a global modification to reduce risk, VFDR B-1@BOFZ-04, VFDR F-02, VFDR I1-04, and VFDR O-01	ANO plans a modification to install a redundant DC control power supply to H-1 switchgear to eliminate loss of switchgear due to loss of normal DC control power. Additionally, ANO plans a modification to remove internal DC jumpers and separately protect H-1 switchgear line and load breaker control power. This will prevent a fire originating in a cubicle from disabling the ability to trip the RCPs due to loss of shared control power.	Yes	Yes	The modification to install a redundant DC control power supply is credited globally from a PRA perspective. The modification to separate line and load breaker control power is only credited in Fire Area B-1@BOFZ. Both modifications reduce the risk of a fire induced circuit failure to the DC power cables feeding switchgear H-1, which could preclude tripping the RCPs from the Control Room. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-6	High (PRA)	1	Switchgear H-2: In multiple fire areas, the loss of normal DC control power to switchgear H-2 could preclude the RCPs from being tripped in the Control Room. LAR Source: Attachment C, listed as a global modification to reduce risk, VFDR B-1@BOFZ-04, VFDR F-02, VFDR I1-04, and VFDR O-01	ANO plans a modification to install a redundant DC control power supply to H-2 switchgear to eliminate loss of switchgear due to loss of normal DC control power. Additionally, ANO plans a modification to remove internal DC jumpers and separately protect H-2 switchgear line and load breaker control power. This will prevent a fire originating in a cubicle from disabling the ability to trip the RCPs due to loss of shared control power.	Yes	Yes	The modification to install a redundant DC control power supply is credited globally from a PRA perspective. The modification to separate line and load breaker control power is only credited in Fire Area B-1@BOFZ. Both modifications reduce the risk of a fire induced circuit failure to the DC power cables feeding switchgear H-2, which could preclude tripping the RCPs from the Control Room. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-7	Med (PRA)	1	A-309, 4160V AC Breaker: In Fire Area B-1@BOFZ, a fire induced fault in the turbine building could result in spurious closing or preclude automatic trip functions at A-309 (vital switchgear A-3 supply breaker from switchgear A-1) that could challenge the automatic start of the credited Emergency Diesel Generator (EDG). LAR Source: Attachment C, Fire Area B-1@BOFZ Risk Summary, VFDR B-1@BOFZ-01	ANO plans a modification to reroute cables, wrap cables, or modify circuits for breaker A-309 to assure the protective features remain intact, i.e., breakers remain tripped and do not impede automatic start of the associated EDG and associated closure of EDG output breaker A-308.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area B-1@BOFZ. Modification to the circuits associated with breaker A-309 is planned to assure the protective features remain intact, i.e., breaker remains tripped and does not impede automatic start of the associated EDG and closure of EDG output breaker (A-308). In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-8	Med (PRA)	1	A-409, 4160V AC Breaker: In Fire Area B-1@BOFZ, a fire induced fault in the turbine building could result in spurious closing or preclude automatic trip functions at A-409 (vital switchgear A-4 supply breaker from switchgear A-2) that could challenge the automatic start of the credited EDG. LAR Source: Attachment C, Fire Area B-1@BOFZ Risk Summary, VFDR B-1@BOFZ-01	ANO plans a modification to reroute cables, wrap cables, or modify circuits for breaker A-409 to assure the protective features remain intact, i.e., breakers remain tripped and do not impede automatic start of the associated EDG and associated closure of EDG output breaker A-408.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area B-1@BOFZ. Modification to the circuits associated with breaker A-409 is planned to assure the protective features remain intact, i.e., breaker remains tripped and does not impede automatic start of the associated EDG and closure of EDG output breaker (A-408). In accordance with station directives, compensatory measures per OP-1003.14 have been established as appropriate.
S1-9	Med (PRA)	1	Control Room Cabinet C20: In Fire Area G, Fire Zone 129-F, PRA determined that the installation of smoke detector(s) in Control Room Cabinet C20 will reduce risk of a fire induced circuit and equipment failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans a modification to install smoke detector(s) in ANO-1 Control Room Cabinet C20 in accordance with the latest edition of NFPA 72, Fire Alarm Detection. The new smoke detector loop will be connected via signal cable to the ANO-1 Control Room Fire Alarm Panel C-463 for trouble and alarm functions.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. The modification to install a smoke detector system in ANO-1 Control Room Cabinet C20 reduces the risk of a fire induced circuit and equipment failure that could result in the loss of Control Room Cabinet C20. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-10	Med (PRA)	1	Air Operated Valve (AOV) CV-1052: In Fire Area G, PRA determined that Quench Tank drain valve CV-1052 control circuit should be modified to preclude spurious operation. CV-1052 control circuit does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans a modification to add an automatic feature to prevent solenoid or electro-pneumatic valve positioner from opening CV-1052 as a result of a fire induced circuit failure in the Control Room.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced AOV circuit failures (hot shorts, open circuits, and short to ground) and can preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-11	Med (PRA)	1	Motor Operated Valve (MOV) CV-1053: In Fire Area G, PRA determined that Quench Tank drain valve CV-1053 should be modified to preclude spurious operation. CV-1053 does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans to modify CV-1053 by adding an “inhibit” circuit which will preclude spurious opening of the MOV due to intercable or intracable hot shorts. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V motor control center (MCC).	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced MOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-12	High (PRA)	1	MOV CV-1221: In Fire Area G, PRA determined that Letdown isolation valve CV-1221 should be modified to meet requirements per IN 92-18. CV-1221 does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary, VFDR G-02-a	ANO plans to modify CV-1221 to meet the requirements of IN 92-18. This modification adds an "inhibit" circuit which will preclude spurious opening of the MOV due to intercable or intracable hot shorts. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. The modification reduces the risk of fire induced MOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-13	High (PRA)	1	MOV CV-1405: In multiple fire areas, PRA determined that Train A Emergency Core Cooling (ECCS) Reactor Building sump suction valve CV-1405 should be modified to meet requirements of IN 92-18. CV-1405 does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, listed as a global modification to reduce risk, VFDR B173-02-b, VFDR B8SEPR-03-b, VFDR C-01-b, and VFDR G-02-c	ANO plans to modify CV-1405 to meet the requirements of IN 92-18. This modification adds an "inhibit" circuit which will preclude spurious opening of the MOV due to intercable or intracable hot shorts. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited globally from a PRA perspective. This modification reduces the risk of fire induced MOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-14	High (PRA)	1	MOV CV-1406: In multiple fire areas, PRA determined that Train B ECCS Reactor Building sump suction valve CV-1406 should be modified to meet requirements of IN 92-18. CV-1406 does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, listed as a global modification to reduce risk, VFDR B-1@120-03-d, VFDR G-02-c, VFDR I1-03-c, and VFDR I3-03-e	ANO plans to modify CV-1406 to meet the requirements of IN 92-18. This modification adds an “inhibit” circuit which will preclude spurious opening of the MOV due to intercable or intracable hot shorts. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited globally from a PRA perspective. This modification reduces the risk of fire induced MOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-15			Not Used				
S1-16	Med (PRA)	1	AOV CV-4400: In Fire Area G, PRA determined that Reactor Building sump drain valve CV-4400 control circuit should be modified to preclude spurious operation. CV-4400 control circuit does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans to modify the control circuit for CV-4400 by adding an “inhibit” circuit which will preclude spurious opening of the AOV due to intercable or intracable hot shorts. The circuit modification plan adds an automatic feature to prevent solenoid or electro-pneumatic valve positioner from opening CV-4400 as a result of a fire induced circuit failure in the Control Room.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced AOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-17	Med (PRA)	1	MOV CV-4446: In Fire Area G, PRA determined that Reactor Building sump drain valve CV-4446 should be modified to preclude spurious operation. CV-4446 does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans to modify CV-4446 by adding an “inhibit” circuit which will preclude spurious opening of the MOV due to intercable or intracable hot shorts. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced MOV circuit failures (hot shorts, open circuits, and short to ground) and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-18	Med (PRA)	1	MOV CV-5611: In Fire Area G, PRA determined that Reactor Building firewater valve CV-5611 should be modified to preclude spurious operation. CV-5611 does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans to modify CV-5611 by adding an “inhibit” circuit which will preclude spurious opening of the MOV due to intercable or intracable hot shorts. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced MOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-19	Med (PRA)	1	MOV CV-5612: In Fire Area G, PRA determined that Reactor Building firewater valve CV-5612 should be modified to preclude spurious operation. CV-5612 does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans to modify CV-5612 by adding an “inhibit” circuit which will preclude spurious opening of the MOV due to intercable or intracable hot shorts. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced MOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-20	Med (PRA)	1	AOV CV-7401: In Fire Area G, PRA determined that Reactor Building purge valve CV-7401 control circuit should be modified to preclude spurious operation. CV-7401 control circuit does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans to modify the control circuit for CV-7401 by adding an “inhibit” circuit which will preclude spurious opening of the AOV due to intercable or intracable hot shorts. The circuit modification plan adds an automatic feature to prevent solenoid or electro-pneumatic valve positioner from opening CV-7401 as a result of a fire induced circuit failure in the Control Room.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced AOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-21	Med (PRA)	1	AOV CV-7402: In Fire Area G, PRA determined that Reactor Building purge valve CV-7402 control circuit should be modified to preclude spurious operation. CV-7402 control circuit does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans to modify the control circuit for CV-7402 by adding an “inhibit” circuit which will preclude spurious opening of the AOV due to intercable or intracable hot shorts. The circuit modification plan adds an automatic feature to prevent solenoid or electro-pneumatic valve positioner from opening CV-7402 as a result of a fire induced circuit failure in the Control Room.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced AOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-22	Med (PRA)	1	AOV CV-7403: In Fire Area G, PRA determined that Reactor Building purge valve CV-7403 control circuit should be modified to preclude spurious operation. CV-7403 control circuit does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans to modify the control circuit for CV-7403 by adding an “inhibit” circuit which will preclude spurious opening of the AOV due to intercable or intracable hot shorts. The circuit modification plan adds an automatic feature to prevent solenoid or electro-pneumatic valve positioner from opening CV-7403 as a result of a fire induced circuit failure in the Control Room.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced AOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-23	Med (PRA)	1	AOV CV-7404: In Fire Area G, PRA determined that Reactor Building purge valve CV-7404 control circuit should be modified to preclude spurious operation. CV-7404 control circuit does not have automatic features via interlocks to preclude spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, Fire Area G Risk Summary	ANO plans to modify the control circuit of CV-7404 by adding an “inhibit” circuit which will preclude spurious operation of the AOV due to intercable or intracable hot shorts. The circuit modification plan adds an automatic feature to prevent solenoid or electro-pneumatic valve positioner from opening AOV valve CV-7404 as a result of a fire induced circuit failure in the Control Room.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area G. This modification reduces the risk of fire induced AOV hot short circuit failure and will preclude spurious operation. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-24	Med (PRA)	1	SW Pump P-4A: In Fire Area I-2 circuit impacts may cause a loss of SW pump P-4A. LAR Source: Attachment C, Fire Area I-2 Risk Summary, VFDR I2-02-a	ANO plans a circuit modification to reroute cables that support remote operation of SW pump P-4A. Circuits are planned to be rerouted to avoid Fire Area I-2 using embedded conduit as available or routed in raceways that already contain other cables that would impact P-4A. Any new raceway needed for these circuits will be installed outside of any zone of influence for postulated fire sources or routed in locations where deterministic compliance can be demonstrated.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area I-2. This modification to reroute cables reduces the risk of a fire induced circuit failure. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-25	Med (PRA)	1	EFW Pump P-7B: In Fire Area I-2 circuit impacts may result in loss of EFW pump P-7B. LAR Source: Attachment C, Fire Area I-2 Risk Summary, VFDR I2-01-b	ANO plans a circuit modification to reroute cables that support remote operation of P-7B. Circuits are planned to be rerouted to avoid Fire Area I-2 using embedded conduit as available or routed in raceways that already contain other cables that would impact P-7B. Any new raceway needed for these circuits will be installed outside of any zone of influence for postulated fire sources or routed in locations where deterministic compliance can be demonstrated.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area I-2. This modification to reroute cables reduces the risk of a fire induced circuit failure. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-26	Med (PRA)	1	Primary Makeup Pump P-36A: In Fire Area I-2 circuit impacts may result in a loss of Primary Makeup pump P-36A. LAR Source: Attachment C, Fire Area I-2 Risk Summary, VFDR I2-03-c	ANO plans a circuit modification to reroute cables that support remote operation of P-36A. Circuits are planned to be rerouted to avoid Fire Area I-2 using embedded conduit as available or routed in raceways that already contain other cables that would impact P-36A. Any new raceway needed for these circuits will be installed outside of any zone of influence for postulated fire sources or routed in locations where deterministic compliance can be demonstrated.	Yes	Yes	This modification is credited from a PRA perspective in Fire Area I-2 This modification to reroute cables reduces the risk of a fire induced circuit failure. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-27	High (PRA)	1	Sluice Gate Valve SG-1: In multiple fire areas, PRA determined that Sluice Gate valve SG-1 should be modified to remove the potential of spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, listed as a global modification to reduce risk, VFDR B-1@120-02-c and VFDR C-03-e	ANO plans a modification for Sluice Gate valve SG-1 to remove the potential for spurious closing as a result of a fire induced circuit failure. The modification is planned to allow SG-1 to remain open in all PRA fire scenarios. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited globally from a PRA perspective. This modification removes the potential of spurious operation to reduce overall plant risk for SG-1 as a result of a fire induced circuit failure. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-28	High (PRA)	1	Sluice Gate Valve SG-2: In multiple fire areas, PRA determined that Sluice Gate valve SG-2 should be modified to remove the potential of spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, listed as a global modification to reduce risk, VFDR G-05-a	ANO plans a modification for Sluice Gate valve SG-2 to remove the potential for spurious closing as a result of a fire induced circuit failure. The modification is planned to allow SG-2 to remain open in all PRA fire scenarios. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited globally from a PRA perspective. This modification removes the potential of spurious operation to reduce overall plant risk for SG-2 as a result of a fire induced circuit failure. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-29	High (PRA)	1	Sluice Gate Valve SG-3: In multiple fire areas, PRA determined that Sluice Gate valve SG-3 should be modified to remove the potential of spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, listed as a global modification to reduce risk	ANO plans a modification for Sluice Gate valve SG-3 to remove the potential for spurious closing as a result of a fire induced circuit failure. The modification is planned to allow SG-3 to remain open in all PRA fire scenarios. The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited globally from a PRA perspective. This modification removes the potential of spurious operation to reduce overall plant risk for SG-3 as a result of a fire induced circuit failure. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-30	High (PRA)	1	Sluice Gate Valve SG-4: In multiple fire areas, PRA determined that Sluice Gate valve SG-4 should be modified to remove the potential of spurious operation to reduce overall plant risk as a result of a fire induced circuit failure. LAR Source: Attachment C, listed as a global modification to reduce risk, VFDR G-05-a	ANO plans a modification for Sluice Gate valve SG-4 to remove the potential for spurious closing as a result of a fire induced circuit failure. The modification is planned to allow SG-4 to remain open in all PRA fire scenarios The circuit modification plan incorporates an available spare cable conductor between the Control Room cabinet and the 480 V MCC.	Yes	Yes	This modification is credited globally from a PRA perspective. This modification removes the potential of spurious operation to reduce overall plant risk for SG-4 as a result of a fire induced circuit failure. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-31	High (PRA)	C	NFPA 805 non-compliance issues were encountered when smaller fire area were defined such that multiple walls, dampers, penetration seals, and doors were credited and used in the Fire PRA model as rated fire barriers in the NRC regulatory basis for NFPA 805. Multiple walls and doors barriers will require upgrading to comply with NFPA 805. LAR Source: Attachment A, Section 3.11.2	ANO plans to provide an adequate-for-the-hazard evaluation and if necessary a modification to upgrade fire barrier walls, dampers, penetration seals, and doors to rated barriers for those barriers credited for deterministic compliance and subsequently credited in the Fire PRA analysis. These fire barriers below have been previously identified as NRC regulatory basis to ensure compliance with NFPA 805 and have compensatory measures established. Fire barriers to be addressed as identified by EC-1956 are: 15-5, 15-4, 39-5, 44-2, 45-2, 46-4, 64-3, 67-4, 70-7, 72-5, 73-5, 75-2, 75-3, 75-4, 76-2, 76-3, 77-2, 78-2, 79-6, 81-4, 81-6, 81-7, 82-2, 88-1, 88-3, 88-5, 89-1, 89-5, 90-2, 90-4, 93-4, 101-5, 103-2, 103-4, 104-2, 105-2, 120-5, 121-1, 122-5, 123-1, 125-1, 143-1, 144-2, 144-3, 144-5, 144-6, 147-4, 149-2, 162-3, 162-4, 162-5, 170-1, 183-4, and 183-5.	Yes	Yes	This modification will be completed to meet NFPA 805 code requirements. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-32	Low (Code)	C	NFPA 50A, Gaseous Hydrogen Systems, code non-compliance issues were identified in the Hydrogen Gas Bottle Storage Room related to inadequate vent piping and room ventilation. The hydrogen storage room light switch was identified as not meeting Article 501 for Class I, Division II locations of the National Electric Code (NEC). LAR Source: Attachment A, Section 3.3.7.1	ANO plans a modification to move the hydrogen bottles and manifold from the Hydrogen Gas Bottle Storage Room to a concrete slab located outside this room and open to atmosphere. This addresses hydrogen ventilation concerns and eliminates the need for electrical upgrades.	No	No	The subject hydrogen gas system bottle storage area is not credited by the PRA. This modification will be completed to meet NFPA 50A code requirements. Compliance with this code is not part of the current licensing basis, therefore, no compensatory measures are needed.
S1-33	Low (Code)	C	NFPA 10, Fire Extinguishers, code non-compliance issues (such as incorrect number of fire extinguishers for travel distance, and incorrect type and size for the hazard area) were identified with ANO portable fire extinguishers. LAR Source: Attachment A, Section 3.7	ANO plans to provide a modification to resolve NFPA 10 deficiencies identified in CALC-ANOC-FP-09-00009. In general, this modification would involve portable fire extinguisher physical relocation, substitution of existing extinguishers, and documentation updates to reflect these plant changes. The results will ensure the proper number of fire extinguishers to meet travel distance requirements in coverage areas, adequately sized fire extinguishers, and the correct type of extinguisher that is rated for the fire hazard in each area.	No	No	The subject fire extinguishers are not credited in the PRA. This modification will be completed to meet NFPA 10 code requirements. Compliance with this code is not part of the current licensing basis, therefore, no compensatory measures are needed.
S1-34			Not used				

Table S-1 Plant Modifications

Item	Rank	Unit	Problem Statement	Proposed Modification	In FPRA	Comp Measure	Risk Informed Characterization
S1-35	Med (92-18)	1	Non Power Operation (NPO) MOVs CV-1050, CV-1410, CV-1404: ANO-1 has no redundancy to the single Reactor Coolant System (RCS) drop line to the Decay Heat Removal (DHR) system with three in-series valves CV-1050, CV-1410, and CV-1404. The NPO assessment determined that any one of the three RCS drop line valves could fail in a closed and unrecoverable position resulting in a loss of DHR. LAR Source: Attachment D, VFDR NPO-RCS-DHR	ANO plans a modification for CV-1404 to meet the requirements of IN 92-18. This modification adds an "inhibit" circuit which will preclude spurious closing of the MOV due to intercable or intracable hot shorts. Procedural changes are planned to secure MOVs CV-1050 and CV-1410 in the open position by opening breakers to remove power. The circuit modification plan incorporates spare cable conductors without the need to install new conduit and cables.	No	Yes	The NPO modification reduces the risk of fire induced MOV circuit failures (hot shorts, open circuits, and short to ground). This MOV modification can prevent a non-recoverable position failure resulting in the loss of DHR. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.
S1-36	High (PRA)	1	NFPA 13, Standard for the Installation of Sprinkler Systems (1971 Edition), code non-compliance issues were identified in CALC-ANO1-FP-09-00007, Rev. 1, Unit 1 Electrical Penetration. These non-compliance issues are allowable sprinkler spacing exceeded and obstructions blocking sprinkler spray patterns located in the Upper (South and North) Electrical Penetration Rooms and Lower (South and North) Electrical Penetration Rooms. LAR Source: Attachment A, Section 3.9.1 (1)	ANO plans to provide a modification to physically relocate/rework existing sprinklers, add sprinklers, add or rework hangers and fire protection branch line piping, and add sprinkler deflectors to resolve non-compliant code issues and meet NFPA 13 requirements.	Yes	Yes	These modifications will be completed to meet NFPA 13 requirements. The Fire PRA model credited the non-compliant sprinkler systems in the fire areas to reduce the risk in the hot gas layer (HGL) and multi-component analysis (MCA) scenarios. The sprinkler systems were not designed or installed for full sprinkler coverage in these fire areas. In accordance with station directives, compensatory measures per OP-1003.014 have been established as appropriate.

Table S-2 items provided below are those items (procedure changes, process updates, and training to affected plant personnel) that will be completed prior to the implementation of new NFPA 805 fire protection program.

Table S-2 Implementation Items

Item	Unit	Description	LAR Section / Source
S2-1	C	Develop a monitoring program required by NFPA 805 that will include a process to monitor and trend the fire protection program based on specific goals established to measure effectiveness.	LAR Section 4.6 and Attachment A, Section 3.2.3 (3)
S2-2	1	Revise or develop fire protection flushing activity to perform fixed water spray system flushing and drainage of underground lead-in connections in accordance with NFPA 15, 1977 Edition Code.	Attachment A, Section 3.9.1 (2)
S2-3	C	Revise appropriate fire protection administrative procedures to include the following: • In accordance with FAQ 06-0020, the term “applicable NFPA Standards” is considered to be equivalent to those NFPA Standards identified in the current licensing basis (CLB) for existing procedures and systems in the fire protection program that are transitioning to NFPA 805. New Fire Protection Systems would be subject to the most current code or standard. • Terminology for zero transient combustibles and changes needed to support Fire PRA assumptions.	Attachment A, Section 3.3.1.2 (5)
S2-4	1	Revise existing procedure(s) or develop new procedure(s) for NPO required to transition to NFPA 805 based upon insights gained from ANO-1 NPO calculation.	Attachment D, VFDR NPO-Procedure
S2-5	1	Revise operator manual action (OMA) procedures/documents to include feasibility criteria in FAQ 07-0030 for the recovery actions listed in Table G-1 of Attachment G, Recovery Action Transition.	Attachment G, Step 4
S2-6	C	Develop or revise technical documents and procedures that relate to new Fire Protection design and licensing basis (e.g., ANO Fire Protection Program, OP-1003.014, Technical Requirements Manual, Design Basis Document, Pre-Fire Plans, Maintenance and Surveillance Procedures, Configuration Control Program, Training and Qualification Guidelines, etc.) as required for implementation of NFPA 805.	LAR Sections 4.7.1, 4.7.2, and 4.7.3, Attachment E Table E-1
S2-7	1	Revise CALC-ANOC-FP-09-00007, Rev. 0, for NFPA 30 to update code report for Oil Tank T-25 dike/berm compliance and perform a civil engineering evaluation for Oil Tank T-26 in tank vault, Fire Area B-1, Fire Zone 187 DD. The air supply duct location in the vault wall near the floor provides a potential oil leakage path via the supply duct outside of the vault.	Attachment A, Section 3.3.8
S2-8	1	Perform an evaluation to determine that Oil Tank T-29 supports are acceptable in accordance with American Petroleum Institute (API) and National Fire Protection Association (NFPA) codes/standards, since T-29 supports documentation from construction is not available.	Attachment A, Section 3.3.8
S2-9	1	Develop or create a PRA review plan of action to revise the PRA model for each modification or implementation item completed that is credited either directly or indirectly by PRA. The PRA review plan will ensure the as-built change-in-risk from each modification or implementation item, including the procedure changes in Implementation Item S2-6, does not exceed the PRA model change-in-risk estimates reported in the LAR. This update will be performed in accordance with Entergy fleet PSA Maintenance procedure EN-DC-151, Section 5.2.	LAR Section 4.8.2

Table S-2 Implementation Items

Item	Unit	Description	LAR Section / Source
S2-10	1	Revise drawings and pre-fire plans for Fire Area I-1, Fire Zone 98-J corridor; since this wall will be credited by PRA as a radiant energy barrier wall with Door 57. PRA requires corridor to be divided or split into two separate fire compartments at C-4 Line wall on EL. 372. This division of the Fire Zone 98-J corridor will reduce the risk in the HGL/MCA scenarios.	Attachment C, Fire Area I-1 Fire Zone 98-J

T. Clarification of Prior NRC Approvals

Introduction

The elements of the pre-transition fire protection program licensing basis for which specific NRC previous approval is uncertain are identified below. Sufficient detail is provided to demonstrate how those elements of the FP CLB meet the requirements in 10 CFR 50.48(c) (RG 1.205, Revision 1, Regulatory Position 2.2.1).

Prior Approval Clarification Request

ANO-1 has four Reactor Coolant Pumps (RCPs, P-32A, B, C, and D). With respect to original design, the RCP oil collection system consists of two oil collection tanks (T-90 and 91), one for each of two pumps, with a curbed area surrounding each tank. One collection tank was capable of holding the lube oil contents of one RCP, while the curbed area surrounding the tank was capable of holding the lube oil contents of the other RCP. In other words, the lube oil volume from P-32A & P-32B can be contained in T-91 and the associated dike area. T-90 and its associated dike area can hold the lube oil volume contained in P-32C and P-32D.

In letter dated October 26, 1988, (1CNA108806) the NRC approved exemptions from the technical requirements of Appendix R to 10 CFR Part 50 for ANO-1, one of which included the aforementioned RCP oil collection system design. As stated in the NRC SER, Section III.0 of Appendix R to 10 CFR Part 50 requires the RCP oil collection system to be sized to hold the contents of the entire lube oil system for all pumps and to be designed to withstand a safe shutdown earthquake (SSE). As stated above, the ANO-1 RCP oil collection system tanks were not designed to hold the lube oil contents of all four RCPs. The NRC granted an exemption, in part, based on the capability of the two RCP oil collection tanks with their associated dikes being capable of containing the lube oil contents of the RCPs.

Following the granting of this exemption, the P-32B motor was replaced with a new motor manufactured by a different vendor. The new motor has a greater lube oil capacity than the previous model. As part of the motor replacement modification, an overflow tank (T-36) was installed along side the original oil collection tank (T-91) to accommodate the additional lube oil volume associated with P-32B. Calculations at the time indicated the additional tank, along with the existing tank, would be capable of holding the lube oil contents of the new RCP motor. However, an error in the calculation was discovered thereafter (reference Condition Report CR-ANO-1-2008-0187). Upon re-assessment, it was determined that the lube oil from the new RCP motor would fill both the original collection tank and the installed overflow tank, plus result in 6 gallons of oil overflowing to the curbed area surrounding the collection system. However, it was also concluded that the collection tanks (T-91 and T-36) combined with the dike area would still accommodate the total inventory for both P-32A and P-32B motors. As a result, Entergy requests clarification that the current plant design continues to meet the intent of the aforementioned exemption granted by the NRC in 1988.

Current Licensing Basis (CLB)

The CLB includes the following exemption:

As requested by Entergy letter dated August 15, 1984 (0CAN088404), an exemption for not meeting the requirement for a RCP oil collection system that is designed to withstand a safe shutdown earthquake (SSE) and sized to hold the oil from all RCPs was approved by the NRC in letter dated October 26, 1988 (1CNA108806).

Background/Basis

Based on a review of the October 26, 1988, NRC SER, the approval of the exemption considered the following design:

- Oil collection system contains two tanks which are designed to hold lube oil inventory contents from one RCP each, with margin
- Lube oil systems for RCPs are qualified to remain functional during and after an SSE

  As discussed in the aforementioned Entergy letter dated August 15, 1984, the ANO-1 RCP oil collection system was not specifically designed to withstand an SSE. The RCP motor lube oil systems are integral with the pump motors. These motors, which are not seismically qualified, i.e., which are not required to function after a SSE, are seismically supported. The RCPs, RCP motors, and the integral lube oil systems contained within those pump motors are all designed, engineered, and installed such that a reasonable assurance of withstanding a SSE has been provided.
- Shielding wall separates heavy concentrations of safe shutdown circuitry in electrical penetration areas from the RCPs and oil collection system, and circuitry is protected by localized automatic suppression and detection capability
- Oil leakage from the remaining pump in each RCS loop will be drained into the appropriate tank, until the tank capacity is reached, and then to an open curbing where it can be safely contained.

Following review, the NRC concluded that:

Generic Letter 86-10 states:

"Where the RCP lube oil system is capable of withstanding the safe shutdown earthquake (SSE), the analysis should assume that only random oil leaks from the joints could occur during the lifetime of the plant. The oil collection system, therefore, should be designed to safely channel the quantity of oil from one pump to a vented closed container. Under this set of circumstances, the oil collection system would not have to be seismically designed."

On the basis that the lube oil system at ANO-1 is capable of withstanding the SSE without rupture and that the existing oil collection system will channel random leaks to a vented and closed container, the existing design conforms with the above staff guidance.

Based on the above evaluation, the licensee's alternate design of the oil collection system provides an equivalent level of safety to that achieved by compliance with Section III.0 of Appendix R. Therefore, the licensee's request for exemption is approved.

The ANO-1 RCP lube oil collection system continues to meet the basis supporting the above exemption with the exception that the oil collection tanks associated with P-32B cannot hold the entire lube oil contents of the P-32B pump motor (i.e., 6 gallons of oil will overflow to the curbed area surrounding the tanks). However, lube oil from the 2nd RCP motor for a given reactor coolant loop was previously assumed to partially fill this curbed area and found to be acceptable. Therefore, Entergy believes the minor increase in oil volume that could be present in the curbed area does not invalidate the original basis for granting the subject exemption.

In addition to the above, Entergy has verified that, given the increased lube oil capacity of the new motor, the total volume of oil from both RCPs in the P-32A/P-32B coolant loop is 367 gallons, well within the 488-gallon combined capacity of the original tank, the overflow tank, and curbed area.

Request

Due to plant design changes with respect to the P-32B motor, Entergy requests NRC agreement that the October 26, 1988 exemption granted for the ANO-1 RCP lube oil collection system remains valid for post-transition to NFPA 805.

Reference Document

1CNA108806, Exemptions from the Technical Requirements of Appendix R to 10 CFR Part 50 – Arkansas Nuclear One, Unit 1 (TAC No. 55669), October 26, 1988, Enclosure 2, SER, Section 8.0

U. Internal Events PRA Quality

In accordance with RG 1.205 position 4.3:

> *"The licensee should submit the documentation described in Section 4.2 of Regulatory Guide 1.200 to address the baseline PRA and application-specific analyses. For PRA Standard "supporting requirements" important to the NFPA 805 risk assessments, the NRC position is that Capability Category II is generally acceptable. Licensees should justify use of Capability Category I for specific supporting requirements in their NFPA 805 risk assessments, if they contend that it is adequate for the application. Licensees should also evaluate whether portions of the PRA need to meet Capability Category III, as described in the PRA Standard."*

The ANO-1 base internal events PRA (ANO-1 PSA Model 4p00) was the starting point for the Fire PRA (FPRA).

The ANO-1 PRA has undergone a Regulatory Guide (RG) 1.200, Revision 1, Peer Review against the American Society of Mechanical Engineers (ASME) / American Nuclear Society (ANS) PRA Standard requirements by a team of knowledgeable industry (vendor and utility) personnel. The review was conducted by the Pressurized Water Reactor (PWR) Owners Group in August of 2009. The conclusion of the review was that the ANO-1 PRA model substantially meets the ASME PRA Standard and is of sufficient quality to support risk-informed applications.

The Peer Review conducted was a full scope and complete review. The ANO-1 PRA substantially meets the ASME PRA Standard at Capability Category (CC) II or better for 79% of the applicable SRs, with 87% met at Capability Category I or better. Overall, the ANO-1 PRA was found to substantially meet the ASME PRA Standard at Capability Category II and can be used to support risk-informed applications.

Table U-1 provides a detailed assessment of each of the Findings identified by the Peer Review team.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
QU-B1	Method specific limitations	Open for Internal Events No impact on FPRA	Method-specific limitations and features that could impact results are not identified. Identify and document the limitations and features of the methodology that could impact the PRA results.	Quantifications were performed with computer codes that have been qualified under the Entergy Software Qualification Process. This finding is a documentation issue that has no impact on the FPRA.
IFEV-A6	Plant specific data for internal flooding initiating event (IE) frequencies	Closed No impact on FPRA	There is no indication of use of plant specific operating experience or initiator information in the determination of IE frequencies. Obtain and integrate plant specific failure information into the calculation of the internal flooding initiating event frequencies.	A review of plant Operating Experience (OE) was performed by reviewing the Condition Report (CR) database for internal flooding related issues. This review was documented in a revision of the internal flood analysis. No plant related OE was found that would affect the generic frequencies used in the internal flood analysis. This finding is related to internal flooding and has no impact on the FPRA as fire-induced flooding is not considered a credible event.
IFEV-A5 IFEV-B1	Internal flooding IE development	Open for Internal Events No impact on FPRA	There is insufficient information to determine that this SR is met. Document the calculation process for internal flooding IEs more thoroughly, accounting for the SRs in ASME/ASN-RA-SA-2009, Section 2-2.1.	This finding is a documentation issue related to calculation of internal flooding IEs. This finding is related to internal flooding IEs. This has no impact on the FPRA as fire-induced flooding is not considered credible.
SY-A4	Modeling as-built, as-operated plant	Open for Internal Events No impact on FPRA	PRA-A1-01-001S11, Rev 1., Section 4.0 documents the plant walkdowns and system engineer discussions for each system. The system engineer discussion is part of the latter. There is no indication in the walkdown/discussion documentation that the modeling was verified to represent the as-built, as operated plant. *(continued)*	This finding is a documentation issue. The text of the finding acknowledges that the walkdowns and discussions were conducted, but that they were not sufficiently documented. This finding has no impact on the FPRA since it is merely a documentation issue.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)				
SR	**Topic**	**Status[1]**	**Finding and Suggested Resolution**	**Disposition**
SY-A4 *(continued)*			Although it is acknowledged that system walkdowns and discussions with system engineers have been conducted and that spatial and environmental hazards were identified, the documentation of these activities does not convey that the model indeed does represent the as-built/as-operated plant. Perform/document additional walkdowns and/or discussions focusing on confirmation that the model represents the as-built, as-operated plant, or document the satisfaction of this requirement if the existing walkdowns and/or discussions have already accomplished this goal.	
SY-B14 SY-A22 AS-B3	Phenomenological conditions associated with each accident sequence	Open for Internal Events No impact on FPRA	There is no purposeful description of the phenomenological conditions associated with each accident sequence, as required by the supporting requirement. Include a description of the phenomenological conditions for each sequence.	This finding remains open only as a documentation issue for the internal events model. This finding has no impact on the FPRA.
IFEV-A3	Internal flooding IE development	Closed No impact on FPRA	Unevaluated scenarios are grouped into similar but analyzed internal events, however, the impact of the flood may not be 'the same as the plant initiating event group already considered in the PRA.' Re-evaluate scenarios that were not considered further based on comparison of IE frequencies alone.	The Internal Flood Analysis has been revised to calculate the CDF and LERF for all scenarios that have been identified. The new revision to the analysis does not screen or subsume any scenarios or zones. The issue in this finding has been addressed in the revision to the internal flood analysis. This finding has no impact on the FPRA as fire-induced flooding is not considered credible.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
QU-D6	Quantification of importance measures	Open for Internal Events No impact on FPRA	The quantification approach which includes modularization of the IE fault trees precludes calculation of importances for events within the modules. Provide discussion or tabulation of significant contributors to CDF from IEs as well as from mitigating systems.	The modularized IE fault trees are not used in the FPRA. IEs in the FPRA are fires with ignition frequencies applied to the reactor/turbine trip initiating event. Thus, this issue has no impact on the FPRA.
QU-E4	Sources of uncertainty	Open for Internal Events No impact on FPRA	This uncertainty 'characterization' has not been performed. Perform a characterization of the sources of uncertainty. It is recommended that the EPRI 1016737/NUREG-1855 approach be applied.	A sensitivity and uncertainty analysis has been performed on the internal events model. The sensitivity analysis characterizes the sources of uncertainty which compare favorably with the issues identified in EPRI 1016737/NUREG-1855. The issue remains open only as a documentation issue. The sources of uncertainty in the FPRA were identified and analyzed for sensitivity in support of the transition to NFPA 805. Thus, this issue has no impact on the FPRA.
QU-D7	Basic event (BE) importance	Open for Internal Events No impact on FPRA	The guideline instructs that reviews include a comparison of the basic event risk importances and system importances in the current model to the previous model. This appears to address the BE review question but there is no explicit discussion of the BE review. It would be helpful for the BE importances to be tabulated to demonstrate that the BEs had been reviewed.	BE reviews were performed. This finding recommends that the BE reviews be tabulated to demonstrate the review. This is a documentation issue and has no impact on the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)				
SR	**Topic**	**Status[1]**	**Finding and Suggested Resolution**	**Disposition**
IFSN-B1	Internal flooding – flow rates/flood levels	Closed No impact on FPRA	Documentation of flood scenarios for the Aux. Building, Turbine Building, and Intake Structure are explained in sufficient detail and organized by subsection under Section 4.2 of PRA-A1-01-002. However, the calculational details of the reported water heights and flow rates reported for the analyzed scenarios were omitted from the documentation. Provide details of the calculated values that support the analyzed flood scenarios reported in Section 4.2 as either an appendix to PRA-A1-01-002 or as a reference to other standalone documents and calculations.	This issue was addressed in a revision of the Internal Flood Analysis. This finding has no impact on the FPRA as fire-induced flooding is not considered credible.
LE-G5	LERF analysis limitations	Open for Internal Events No impact on FPRA	Reviewed PRA-A1-01-001S12, Revision 1. Section 2.1 identifies several limitations of the applicability. However, the noted limitations do not address technical limitations that might impact the use in applications. Document the limitations of the technical aspects of the analysis.	Quantifications were performed with computer codes that have been qualified under the Entergy Software Qualification Process. This finding is a documentation issue that has no impact on the FPRA.
IE-D1	Initiating events fault tree – event calculation method	Open for Internal Events No impact on FPRA	Some basic events (e.g., XMP119BBAF) applied in the calculation of IE frequencies developed for plant-specific fault trees have used calculation method 3 in CAFTA. The use of calculation method 3 (1-e-λt) produces a probability (always < 1) rather than a frequency which can be greater than 1. Calculation method 1 (λt) in CAFTA should be used for those basic events whose result is intended to be a frequency of failure, not a probability of failure. *(continued)*	The internal events IEs are not used in the FPRA. IEs in the FPRA are fires with ignition frequencies applied to the reactor/turbine trip initiating event. Thus, this issue has no impact on the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
IE-D1 *(continued)*			A discussion of the use of this calculation method is not provided, although, during discussion of this issue, the PRA staff indicated that the limitations of the selected approach were understood. Provide a description of the approach taken for calculation of the basic event values within support system initiating event fault trees, and include the limitations of the approach.	
IE-C5	Initiating events– critical years/reactor years	Open for Internal Events No impact on FPRA	Initiating event frequencies are not calculated in the manner required by the IE-C5. The IE units are in critical years versus reactor (calendar) years. Calculate the frequencies in the units specified by SR IE-C5.	The internal events IEs are not used in the FPRA. IEs in the FPRA are fires with ignition frequencies applied to the reactor/turbine trip initiating event. Thus, this issue has no impact on the FPRA.
IE-C8 QU-D6	IEs– critical years/reactor years	Open for Internal Events No impact on FPRA	Section 5.3 of PRA-A1-01-001S06, Revision 2 identifies those initiating events that are quantified by means of a plant specific fault tree. Appendices C, D, E, and F provide additional detail on each of the 4 modeled initiating events. Per Appendices E and F, the PSA logic model is used as the starting point for the IE model; however, a number of modeling simplifications are made as identified in Appendix C. These simplifications may cause the model to fall out of compliance with the SY requirements. Use the system fault tree with necessary data (exposure time) changes to evaluate IEs.	The internal events IEs are not used in the FPRA. IEs in the FPRA are fires with ignition frequencies applied to the reactor/turbine trip initiating event. Thus, this issue has no impact on the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
LE-A4 LE-E1 LE-C7	HFE modeling for LERF	Open for Internal Events No impact on FPRA	Direct linkage of the CDF sequences into the LERF tree assures that system level dependencies (e.g., power and cooling water) can be accounted for. No HRA for human actions is provided. Develop the quantification of human actions embedded in the LERF model using an HRA method consistent with the HRA SRs. The following actions have been noted to be present in the analysis: - Depressurize by opening PZR PORV - Isolate the SG secondary side - “Bump” the RCPs Accounting for dependency in human actions should be accounted for in the analysis. For example, some cutsets contain the following pair of events: NOT_RCS_DEP_NOSBO and RHF1HPIERP. Event NOT_RCS_DEP_NOSBO is in part a human error ‘Split Fraction for No Intentional or Unintentional RCS Depress pre Induced-SGTR for Non-SBOs.’ Ideally, the human and hardware components of Split Fraction for No Intentional or Unintentional RCS Depress pre Induced-SGTR for Non-SBOs should be separated. A joint human error probability analysis can then be included in the result.	The action to isolate the SG secondary side is not modeled so HRA and dependency analysis are not needed for this action. HRA calculations consistent with the SRs have been developed for the HFEs to Depressurize by Opening PZR PORV and to Bump the RCP. These calculations show that the existing values for these actions are appropriate. The actions to Depressurize by Opening PZR PORV and Bump the RCP have a completely different purpose from the Level 1 HFEs, have relatively long time interval from the Level 1 HFEs, and are performed at the direction of the technical support center under the SAMGs (this means that cues are completely different from the Level 1 HFEs). Therefore, the dependency between them and the Level 1 HFEs is zero and dependency analyses are not needed. Since the existing values for these HFEs are appropriate, and dependency analysis is not necessary, this finding has no impact on the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
DA-D4	Data – generic versus plant specific	Open for Internal Events No impact on FPRA	Reviewed PRA-A1-01-001S05_EC15022. Section 3.1.5 provides guidance on checking results for those components where no plant failures have occurred. If the check (operating hours > 0.5*MTTF) fails, the generic data is used. The intent is to guard against undue influence of not statistically significant plant data. Guidance to check results is provided in CE-P-05.07, Rev. 01. Some posterior distributions do not appear reasonable (e.g., RYT P1, T7F D1). Two examples of unreasonable distributions were found. The available guidance may not be sufficiently detailed to provide confidence that bad distributions are detected. Provide additional examples in the guidance of what constitutes "unreasonable" to improve the confidence of detection and correction.	This finding identifies a discrepancy in the determination of particular plant-specific failure rates and distributions. A review of the data found five type codes (ACF L1, MFF E1, MPF L1, RYT P1 and T7F D1) for which the generic and plant-specific data were radically different. Corrected distributions were calculated. This issue impacts the uncertainty parameters with minimal impact on the point estimate value. The plant-specific failure rates and error factors for ACF L1, MFF E1, MPF L1, RYT P1 and T7F D1 were updated in the type code file for the FPRA model and associated basic event probabilities were updated accordingly. Therefore, the issue has been resolved in the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
QU-D4 IE-A1 IE-B3	Spurious Open of SRV	Closed No impact on FPRA	Reviewed cutset file A1_R4_1e-13_rec_M and fault tree A1R4P0EOS and PRA-A1-01-001, Revision 1, Section 6.4. This observation results from comparisons to similar plants. Spurious opening of SRV evaluation needs to be reexamined. Revisit the classification of this event as %T2. Update the initiating event analysis with the proper classification of this event.	Spurious opening of SRV is not classified as a %T2 (loss of feedwater) event. A spurious opening and stuck open ERV is treated in initiating event %IORV, "Inadvertent Open Relief Valve." This event represents an inadvertent opening of the ERV which causes a reduction in primary system pressure, a reactor scram, and loss of RCS inventory. ANO-1 has 3 relief valves (1 ERV and 2 code safeties) on the pressurizer. However, unlike the ERV which can be opened by a high pressure signal, the SRVs are mechanically operated by high RCS pressure. In addition, the plant will trip on high pressure prior to lifting the SRV. Also, the ERV setpoint is lower than the SRV and will lift prior to the RCS reaching the SRV setpoint. The IORV event is considered a small LOCA. The internal events IEs are not used in the FPRA. IEs in the FPRA are fires with ignition frequencies applied to the reactor/turbine trip initiating event. Thus, this issue has no impact on the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
LE-F2 IFQU-A10	LERF reasonableness review	Open for Internal Events No impact on FPRA	Sensitivity studies are performed for important inputs to the analysis. Reviewed PRA-A1-001-S02, Appendix J. No indication that the expert panel reviewed the LERF results. The SR requires a review of contributors for reasonableness. The expert panel report provides this for the CDF results but provides no indication that the LERF results were also reviewed. Include a review of the LERF contributors as part of the expert panel review. Document this review in the expert panel report.	This finding indicates that no LERF cutset review by an expert panel is documented. This finding has no impact on the FPRA.
SC-A2 SC-B3 SC-B4 AS-A9	Use of MAAP for LLOCA	Open for Internal Events No impact on FPRA	MAAP 4.0.5 provides detailed core damage sequences. PRA-A1-01-0015S014-EC14882 Section 4.0 A of the Level 1 Success Criteria Notebook credits the use of MAAP for a LLOCA blowdown phase. Based on current MAAP guidance, MAAP should not be used to model the blowdown and reflood stages of a LLOCA. DBA codes should be used in this case. Following reflood, MAAP can be used for the remainder of the LLOCA. Use a DBA code to determine LLOCA success criteria during the blowdown and reflood stage.	This finding identifies that the success criteria assume that only one CFT is required in order to flood the Reactor after a Large Break LOCA. The basis of this assumption is MAAP. However, MAAP is limited in its ability to model the blowdown phase of a large break LOCA and should not be used to justify success criteria. Large Break LOCAs are outside the scope of the FPRA (fire-induced large LOCAs are not credible). Thus, this finding has no impact on the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
SC-C3 QU-E1 AS-C3 DA-E3 HR-I3 IFEV-B3 IFPP-B3 IFQU-B3 IFSN-B3 IFSO-B3 LE-F3 SY-C3 LE-G4 QU-E4 QU-F4	Modeling uncertainty	Open for Internal Events No impact on FPRA	There is no discussion of identification of issues related to modeling uncertainty. Provide the identification of sources of modeling uncertainty. It is recommended that the process described in EPRI 1016737/NUREG-1855 be incorporated.	A sensitivity and uncertainty analysis has been performed on the internal events model. The sensitivity analysis characterizes the sources of uncertainty which compare favorably with the issues identified in EPRI 1016737/NUREG-1855. The issue remains open only as a documentation issue. The sources of uncertainty in the FPRA were identified and analyzed for sensitivity in support of the transition to NFPA 805. Thus, this issue has no impact on the FPRA.
DA-C10	Data – counting operational demands	Open for Internal Events Negligible impact on FPRA	There is no evidence that surveillance tests have been evaluated to determine if portions of the tests or sub-elements have additional successes that should or should not be counted when estimating operational demands. Perform an assessment of the sub-elements of all surveillance tests to obtain accurate operational demands to be used in the PRA data.	The consideration of demands to determine the probability of failure is limited to those failure rates calculated from plant specific data analysis. This fact limits the number of Type Codes that must be visited to address this F&O. Also, since demands on the major component being tested are counted, additional operational demands within surveillance sub-elements would affect only supporting components, further limiting the affected Type Codes. Potential changes in the random failure probabilities from resolution of this finding would have a very small impact on the FPRA results. FPRA results are typically dominated by fire-induced failures.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
DA-C4 DA-E2	Data – counting failures	Open for Internal Events Negligible impact on FPRA	The primary source of failure data is the Maintenance Rule Database. This database was used to screen the component failures to determine if the Maintenance Rule Functional Failures were also PRA-relevant failures. It is suggested that an additional source of data be reviewed to determine if a failure may have occurred that did not result in a Maintenance Rule Functional Failure. In addition, a suggestion is provided to include a discussion or tabular display of those failures that are excluded from the data. Perform a scrub or review of EPIX, Condition Reports, Issue Reports, and/or plant specific LERs to determine if there are any additional failures that should be considered in the PRA Data Update to supplement the Maintenance Rule Database functional failures.	The consideration of demands to determine the probability of failure is limited to those failure rates calculated from plant specific data analysis. This fact limits the number of Type Codes that must be visited to address this F&O. Potential changes in the random failure probabilities from resolution of this finding would have a very small impact on the FPRA results. FPRA results are typically dominated by fire-induced failures.
DA-C13	Alternate AC (AAC) alignment	Open for Internal Events No impact on FPRA	Interviews with knowledgeable plant personnel are documented in various locations in the PRA Data Analysis in various assumptions and as sources of data to estimate run times, demands, etc. It is not clear that Outage UA has been excluded from the Maintenance rule Data since some Maintenance rule functions may be outage related. There is no consideration for alignment of the AAC during a dual unit SBO. In addition it appears that the SU2 transformer could be credited to support both trains on Unit 2, however it is assumed to be aligned to Unit 1. *(continued)*	The issue of use of outage unavailability data is a documentation issue. This issue has no impact on the FPRA. The effect of AACDG unavailability due to dual unit SBO is negligible compared to AACDG unavailability due to test and maintenance. The potential for a LOSP on both units with failure of 4 emergency diesel generators requiring the shared use of the AACDG is of such low probability that it does not affect results. In addition, the AACDG is sized such that it can carry some critical loads on each unit if required. Thus, this issue has no impact on the FPRA. *(continued)*

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)				
SR	**Topic**	**Status[1]**	**Finding and Suggested Resolution**	**Disposition**
DA-C13 *(continued)*			Model the AAC unavailability to support either unit in the event that both or either unit requires it for LOSP mitigation and provide a documented basis for the flag alignment settings used for the SU2 transformer.	The model does not assume that SU2 is aligned to Unit 1. Logic below gate ELSSU2, "SU2 ALIGNMENT BETWEEN UNITS OVERLOAD" accounts for the fact that SU2 is normally aligned to be shared between the two units. This finding has no impact on the FPRA.
IE-A1	Total loss of Service Water (SW)	Closed No impact on FPRA	Section 4.0 of PRA-A1-01-001S06, Revision 2 describes the process used to identify initiating events. This process considered generic events as well as initiating events modeled in similar plants (TMI and Oconee). It was noted that the loss of Service Water initiator is relatively low significance in the ANO-1 PRA model. %T8, %T9, and %T10 are identified as Loss of Running SW, Loss of SW Loop 1 and Loss of SW Loop 2 respectively. There are no initiators that represent a total loss of all 3 SW Pumps (including common cause of all three to fail). An initiator for Loss of Lake is included in the model but that does not account for SW pump failures. In similar NSSS designs, the loss of SW is a significant contributor to CDF. The process is further prescribed in Fleet engineering guide EN-NE-G-006. Include the total loss of SW in the ANO-1 PRA.	Initiator %T8, "Loss of Running SW" addresses total loss of all three SW pumps, including common cause failure of all three pumps and common cause failure of all three discharge filters. This initiator also considers loss of two pumps and failure of the cross-tie valves to close, since one pump cannot supply both loops by itself. The internal events IEs are not used in the FPRA. IEs in the FPRA are fires with ignition frequencies applied to the reactor/turbine trip initiating event. Thus, this issue has no impact on the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
AS-A5	SGTR modeling	Open for Internal Events No impact on FPRA	The development of the Event Trees appears to be consistent with the plant design/operation. An isolated model error was found related to placement of a Human Action to cooldown and depressurize during a Steam Generator Tube Rupture. The error results in no account for HEP probability to fail to initiate the cooldown process high enough up in the SGTR event tree. An HEP should be place near the top gate to yield simple sequences where an SGTR occurs, no equipment failures occur but the operators fail to cooldown and depressurize. Add an HEP to the SGTR sequence model high enough in the model logic to verify that OPS successfully initiates the SGTR cooldown.	This finding is associated with the SGTR event tree model. Fire-induced SGTRs are not considered in the FPRA model. Thus, this finding has no impact on the FPRA.
IE-C3	IEs – lack of justification for exclusion	Open for Internal Events No impact on FPRA	In Table 3 of PA-A1-001S06, Rev. 2, where screened potential initiating events are considered, two human recovery actions are used to justify not modeling an event as an initiator (i.e., Steam line break and HPI actuation). However, no justification (i.e., training or procedures) was provided. Provide the appropriate training documents or procedures showing these particular human actions.	The internal events IEs are not used in the FPRA. IEs in the FPRA are fires with ignition frequencies applied to the reactor/turbine trip initiating event. Thus, this issue has no impact on the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
IE-A1 IE-C6	Spurious HPI	Open for Internal Events No impact on FPRA	The screening performed in Table 3 of PRA-A1-01-001S06, Rev. 2 generally follows the conditions specified in SR IE-C6. However, the conditions in this SR are not explicitly involved, i.e., the 10e-8 frequency was used with an order-of-magnitude argument to discount the initiator, not criteria (a). As the ASME/ANS PRA Standard is currently written, the screening criteria in IE-C6 need to be used. The calculation for spurious HPI actuation needs to be checked. Add spurious HPI actuation due to spurious ESAS actuation as an additional initiating event.	The internal events IEs are not used in the FPRA. IEs in the FPRA are fires with ignition frequencies applied to the reactor/turbine trip initiating event. Thus, this issue has no impact on the FPRA.
HR-C2	Plant specific pre-initiators	Open for Internal Events No impact on FPRA	The ANO-1 PRA Peer Review road map indicated that the pre-initiator events have been reviewed against plant-specific failures. To be assessed at CC II/III for this SR, a list of existing pre-initiator events at ANO-1 needs to be prepared, and it needs to be compared to the list in Table 2. Events not appearing in Table 2 would need to be added.	An extensive number of pre-initiator HRAs are modeled. These events cover all standby systems and trains. Thus, this finding is just a documentation issue. To obtain CC II/III classification, more thorough documentation of the plant specific input into the pre-initiators could be provided. This issue has no impact on the FPRA.
SC-B5	Success Criteria – comparison to other plants	Open for Internal Events No impact on FPRA	No documentation exists that describes comparisons with similar plants or other plant specific codes to check the reasonableness and acceptability of the results of the thermal/hydraulic, structural, or other supporting engineering bases that support the success criteria. Perform a comparison with other plants and document.	This finding indicates that the documentation of the success criteria should include a comparison with similar plants. This issue has no impact on the FPRA as it is merely a documentation issue.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
IE-C14 QU-A3	ISLOCA modeling	Open for Internal Events Closed for FPRA	There was no reference made to surveillance tests at power, if applicable, in which the ISLOCA pathway configuration would be changed from its routine configuration and alignment, e.g., 2 isolation valves instead of 3. Common cause mechanisms were discussed as not being applicable when they should have been included. Reference testing procedures and their frequency in order to more accurately account for the time when the ISLOCA pathway is in a different configuration (i.e., 2 valve isolation instead of 3). Consider common cause failure mechanisms, which also is related to 'state-of-knowledge' correlation (see QU-A3).	This finding remains open for the internal events model. The FPRA model ISLOCA logic was revised to capture the potential for a human performance error in the restoration of the DHR isolation valve CV-1400/1401. LHF1LPITNA was added to the ISLOCA logic to address this issue. Appendix B of NUREG/CR-5102, "Interfacing Systems LOCA: Pressurized Water Reactors," evaluates the probability of multiple failures and concludes that a CCF event for check valve leakage or rupture is not needed. Also, %FRDH14ASOK, %FRDH14BSOK, %FRDH17SOK, and %FRDH18SOK were added to the FPRA ISLOCA logic to capture shared failure of check valves due to state of knowledge correlation. This F&O has been resolved in the FPRA.
IE-C14	Conservative treatment of secondary piping	Open for Internal Events No impact on FPRA	The capability of secondary system piping appears to be such that once the isolation valves fail, the low pressure piping automatically fails. Since it appears that there was no consideration given to secondary piping capacity, e.g., fragility analysis, this could be a conservative treatment. State that a conservative approach was taken by assuming automatic failure of secondary piping once it is exposed to high pressure, either via leak or rupture.	This finding identifies a conservative assumption that was not documented. Thus, it has no impact on the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
IFEV-A7	Internal flooding – plant specific maintenance	Open for Internal Events No impact on FPRA	The EPRI failure database in TR-1013141 excluded certain events in the calculation of pipe failure frequencies that appear to be related to maintenance activities. See Table C-2, e.g., Crystal River 3 event. Devise a method or process in which the contribution to internal flooding due to plant-specific maintenance activities is estimated and incorporated into the various existing internal flood initiators.	This finding is related to internal flooding and has no impact on the FPRA as fire-induced flooding is not considered a credible event.
SY-B4	Common cause modeling	Open for Internal Events No impact on FPRA	In reviewing the actual fault tree model, it was seen that the CCF terms were incorporated per the system modeling documentation (Supplement 11) and CCF documentation (Supplement 4). However, there was an inconsistency with what was stated in Supplement 4 and what was incorporated in the PRA model. Please resolve discrepancy between what was recommended in the common cause calculation and what was done in the PRA model.	This finding identifies a documentation issue and has no impact on the FPRA. The CCF calculation notes that the documentation of the CCF basic event modeling is provided in the system notebooks, not in the CCF calculation.
IFEV-A8	Internal flooding – initiator screening	Closed No impact on FPRA	In reviewing PRA-A1-01-002, it was noted for several scenario frequencies that they were screened on a strict comparison with the internal events initiating frequency, which does not comport with this particular SR. A few examples may be found in Sections 4.2.1.50, 4.2.1.52, and 4.2.1.36. Re-evaluate those scenario groups that were screened from further evaluation based solely on a comparison of initiating frequencies alone.	This issue has been addressed in a revision to the internal flood analysis. A revision of the scenario write-up and quantification of all scenarios in which a flood frequency exists was performed. This finding is related to internal flooding and has no impact on the FPRA as fire-induced flooding is not considered a credible event.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
IFSN-A6 IFSN-B1	Internal flooding – flood damage classification	Open for Internal Events No impact on FPRA	Upon review of the internal flood document (PRA-A1-01-002) and other supplemental files, it was not explicitly clear as to what specific SSCs within a given flood area were susceptible to a particular flood damage category, e.g., submergence or spray. Provide a listing of the SSCs organized by flood zone and associated scenario with a listing of their susceptibility to flood damage due to both spray and submergence. For RG 1.200, a qualitative assessment involving conservative assumptions regarding the additional flood damage mechanisms under Capability Category III should be considered.	A revision to the Internal Flood Analysis was performed to address the issue identified in this F&O. Information was included in Section 6.4 that provides information relating to the affected SSCs modeled in the PRA, the assumptions regarding spatial information, and flooding affects assumed in the analysis. This risk calculations performed in this revision included all PRA modeled components affected by a flood in each of the zones. This finding is related to internal flooding and has no impact on the FPRA as fire-induced flooding is not considered a credible event.
QU-A3	ISLOCA – state of knowledge correlation	Open for Internal Events Closed for FPRA	The state of knowledge correlation was not accounted for where it would make a significant difference, i.e., the ISLOCA analysis omitted common cause failure of check valves. Document PRA-A1-01-001S08 was reviewed to confirm this. Consider common cause failure mechanisms, which also may be related to 'state-of-knowledge' correlation (see QU-A3).	This finding remains open for the internal events model. Appendix B of NUREG/CR-5102, "Interfacing Systems LOCA: Pressurized Water Reactors," evaluates the probability of multiple failures and concludes that a CCF event for check valve leakage or rupture is not needed. Also, %FRDH14ASOK, %FRDH14BSOK, %FRDH17SOK, and %FRDH18SOK were added to the FPRA ISLOCA logic to capture shared failure of check valves due to state of knowledge correlation. This finding has been resolve in the FPRA.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
QU-F5	Quantification limitations	Open for Internal Events No impact on FPRA	A review of the Integration and Quantification Work Package and the FORTE Qualification Engineering Report did not reveal any documented software or quantification limitations that would impact applications. Document any known quantification limitations, and if none, state that there are no known limitations.	Quantifications were performed with computer codes that have been qualified under the Entergy Software Qualification Process. This finding is a documentation issue that has no impact on the FPRA.
QU-F6 LE-G6	Documentation of risk significant items	Open for Internal Events No impact on FPRA	Attachment E of the Summary Report was found to list significant accident sequences and basic events. Attachment C lists the top 25 cutsets. Provide definitions for risk significant basic events, cutsets, and accident sequences within the Summary Report that comport with those listed in Section 1-2.2 of the ASME Standard.	This finding identifies a documentation issue related to the reporting of risk significances in the summary report and has no impact on the PRA results. This finding is strictly a documentation issue and has no impact on the FPRA.
IFSO-B1 IFSO-A1	Internal flooding documentation	Closed No impact on FPRA	Although flood sources were documented and discussed within Section 4.2 of PRA-A1-01-002, they are not amenable to PRA applications and upgrades. Supplemental Excel spreadsheets were obtained and flood sources were listed by flood zone, but it was confusing as to why different lengths were used for general and major flood scenarios. Also, there was a lack of clarifying information as to why certain pipe lengths that were considered for flood scenarios were excluded from spray scenarios. One method of satisfying this SR would be to provide a tabular listing of water sources organized by flood zone, associated system, pipe diameter, pipe length, and corresponding flood scenario.	The internal flooding analysis has been updated to address this finding. This finding is related to internal flooding and has no impact on the FPRA as fire-induced flooding is not considered a credible event.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
IFEV-B2	Internal flooding documentation	Closed No impact on FPRA	In reviewing the flooding frequencies reported in Section 4.2 of PRA-A1-01-002 for each of the internal flood scenarios, it was not readily apparent how the frequencies were derived. Supplemental Excel spreadsheets were obtained that helped explain how some of these frequencies were derived, but they were not part of the formal documentation. One method of satisfying this SR would be to provide a table of the identified water sources that associates the calculated flood frequencies with each of the postulated internal flood scenarios.	The internal flooding analysis has been updated to address this finding. This finding is related to internal flooding and has no impact on the FPRA as fire-induced flooding is not considered a credible event.
IFQU-B2 IFQU-A5	Internal flooding – flood related HEPs	Closed No impact on FPRA	The documentation in Section 4.2 of PRA-A1-01-002 takes credit for operator actions, e.g., operation of locked valves within a 15 minute time period, without incorporating a corresponding HEP event representing this action in the PRA model. Perform an evaluation of HEPs that were described in Section 4.2 of PRA-A1-01-002, e.g., via the use of the HRA Toolbox, or alternatively, apply temporary screening values as a sensitivity analysis.	The internal flooding analysis has been updated to address this finding. This finding is related to internal flooding and has no impact on the FPRA as fire-induced flooding is not considered a credible event.
IFQU-A4 IFSN-A9	Internal flooding – door failure	Open for Internal Events No impact on FPRA	Although not necessarily considered an SSC, a review of PRA-A1-01-002 did not reveal any additional analysis regarding the water height at which a typical fire door would be considered to fail. Either reference or include within the internal flood report an analysis or relevant assumptions regarding door failure as a function of water height.	This finding is related to internal flooding and has no impact on the FPRA as fire-induced flooding is not considered a credible event.

Table U-1 Internal Events PRA Peer Review – Findings and Observations (F&Os)

SR	Topic	Status[1]	Finding and Suggested Resolution	Disposition
IFSO-A5	Internal flooding documentation	Open for Internal Events No impact on FPRA	Although some source capacities may have been mentioned in Section 4.2 of PRA-A1-01-002 for the description of the internal flood scenarios, there was minimal information regarding internal pressure and temperature of water sources. Provide a table within Section 4 of PRA-A1-01-002 that lists the various water sources considered and their corresponding system capacity, temperature, and pressure.	This is a documentation issue only and does not affect results or conclusions. This finding is related to internal flooding and has no impact on the FPRA as fire-induced flooding is not considered a credible event.

[1] Closed means that the issue raised by the peer review finding has been addressed in the PRA model and documentation.

V. Fire PRA Quality

V.1 ANO-1 Fire PRA Quality Review

In accordance with RG 1.205 Position 4.3:

"The licensee should submit the documentation described in Section 4.2 of Regulatory Guide 1.200 to address the baseline PRA and application-specific analyses. For PRA Standard "supporting requirements" important to the NFPA 805 risk assessments, the NRC position is that Capability Category II is generally acceptable. Licensees should justify use of Capability Category I for specific supporting requirements in their NFPA 805 risk assessments, if they contend that it is adequate for the application. Licensees should also evaluate whether portions of the PRA need to meet Capability Category III, as described in the PRA Standard."

The ANO-1 FPRA has undergone a RG 1.200, Revision 2, Peer Review against the ASME PRA Standard requirements by a team of knowledgeable industry (vendor and utility) personnel. The review was conducted by the Westinghouse Owners Group in October 2009. The conclusion of the review was that the ANO-1 FPRA methodologies being used were appropriate and sufficient to satisfy the ASME/ANS PRA Standard. The review team also noted that the staff appeared to be applying the NUREG/CR-6850 methodologies correctly.

The summary of the peer review findings provided the following statistics for the evaluation of elements to the combined PRA Standard. For the ANO-1 FPRA, about 72% of the Supporting Requirements (SRs) were assessed at Capability Category II or higher, including 10% of the SRs being assessed at Capability Category III. An additional 7% of the ANO-1 FPRA applicable SRs were assessed at Capability Category I. The ANO-1 FPRA does not meet 18% of the applicable SRs, and 3 % of the SRs were not reviewed.

From the 'Summary of Review Results' section of LTR-RAM-II-10-003:

"*Overall the boundaries of the Fire PRA encompass all the relevant areas required to properly characterize the risk due to fire. ANO-1 documented their plant partitioning analysis in a manner that will support applications, reviews and updates.*"

The remainder of Attachment V provides a detailed assessment of each of the findings identified by the Peer Review team. Table V-1 lists each finding and provides the ANO-1 disposition of the issue. Table V-2 addresses each element that was identified to remain below Capability Category II and provides justification that Capability Category I is adequate to support the FPRA goals.

Due to ongoing work in the FPRA development, a second focused scope peer review was conducted on the ANO-1 FPRA effort. This review was conducted by Kleinsorg Group Risk Services and documented in KGRS Report 0021-0022-005. This review was completed in May 2012 using the NEI-07-12 process and the ASME PRA Standard (ASME/ANS RA-Sa-2009) along with NRC clarifications provided in RG 1.200, Revision 2. The scope of the focused peer review included the assessment of the supporting requirements FSS-G3, FSS-G4, FSS-G5, and FSS-G6. The findings and ANO dispositions associated with this review are listed in Table V-1a.

An additional focused scope peer review was conducted in October 2012. The updated analysis to address findings from the May 2012 focused scope review enveloped a larger scope than just the reviewed elements. The completed work required an additional focused scope review to examine additional FSS elements (FSS-A, FSS-C, FSS-D, FSS-E, and FSS-H). The review was conducted by Kazarians & Associates, Inc., and documented in Report 5384.R01.121129. As in the previous review, the effort utilized the NEI-07-12 process and the ASME PRA Standard, along with NRC clarifications provided in RG 1.200, Revision 2. This final review resulted in no Findings (some suggestions are documented in the report however).

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
PP-A1-01	Circuit Failure Probability	Closed	Based on the documentation, it is not clear that all inputs to the evaluation were considered in determining the failure probability. Input parameters include: tray/conduit, CPT/no CPT, cable type, and cable configuration. This finding is being assigned against A1 because the lack of documentation reveals that inputs were appropriately used in all cases.	This F&O is a duplicate to F&O CF-A1-02. Supporting Requirement PP-A1 is associated with defining the global analysis boundary and does not include failure probabilities. See the response to F&O CF-A1-02 for the actions to address this comment.
PP-B2-01	Plant Partitioning – Use of Non-Rated Fire Barriers	Open	As discussed in Section 2.2 of Plant Partitioning and Fire Ignition Frequency, the method used to partition is based upon fire zones contained within the Fire Hazards Analysis. The barriers as described in the Fire Hazards Analysis are both rated and non-rated. Without reviewing each individual fire zone boundary within the Fire Hazard Analysis (FHA), there is no list of credited barriers that are not rated. ANO-1 needs to provide a list of barriers credited for fire compartment boundaries that are not rated and justify the credit for boundaries. This may be done through the evaluation of adequacy included in the multi-compartment analysis.	SR PP-B2 references NUREG/CR-6850, Chapter 1 for the acceptable criteria for justifying non-rated fire barriers. NUREG/CR-6850 discusses the use of fire compartments as “a well-defined enclosed room, not necessarily with fire barriers.” ANO references the FHA as a starting point for plant partitioning and all barriers (both rated and non-rated are defined in the FHA). The Plant Partitioning Task (CALC-08-E-0016-01, R0) assumes that fire protection features will be effective at containing a fire under most conditions. Fire protection features include fire-rated barriers, non-fire-rated barriers, active features such as water curtains, and in some cases spatial separation. The potential failure of a credited partitioning feature is addressed in the multi-compartment analysis (MCA). The ANO FHA does not include any partitioning features, such as partial height walls, that are discussed in NUREG/CR-6850 as barriers that should not be credited. Nevertheless, this SR remains “open”’ as the current analysis only meets Capability Category I and would result in an identical finding upon re-review. The adequacy of the fire barriers is explicitly reviewed as part of the Multi-Compartment and Hot Gas Layer Analysis calculation (PRA-A1-05-009).

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
PP-B3-01	Plant Partitioning – Use of Spatial Separation	Open	Spatial separation is identified as only credited for the Turbine Deck, Fire Zones 197-X and 2200-MM, (Report 0247-06-0006.03, Rev 1, Attachment A, Note 1). The note specifies that 1) no significant PRA components are located in the vicinity of the interface between these fire zones, and 2) the open turbine building and large associated volume will preclude any significant fire spread between these zones. Per NUREG/CR-6850, Volume 2, Pages 1-8, there are several considerations for the basis for using spatial separation as a boundary. The presence of PRA equipment, although important in later portions of the analysis, is not relevant with regard to spatial separation as a boundary. The open and large volume criterion is necessary, but not sufficient. Additional criteria that must be demonstrated include "minimal combustible fuel loads," and "free of ignition sources," among others. Therefore, there is insufficient justification documented to support this SR. In addition, two other fire compartments were identified (159-B and 2151-A) that credit spatial separation as a compartment boundary. The justification for use of spatial separation between these compartments was not explicitly identified in the reports. There is no apparent systematic review of PRA physical analysis units to identify when spatial separation is used or justified. ANO-1 needs to perform a system review of the PRA physical analysis unit to identify and justify when spatial separation.	This finding was not addressed in the partitioning effort; therefore, no change to the partitioning was performed as a result of this finding. The scenario development and MCA associated with these areas concluded that the spatial separation (lack of an actual barrier) did not impact fire results. No fires were judged to credibly breach the spatial separation and no hot gas layer potential exists. ANO has two areas (four total, two for each unit) that are separated into Unit 1 and Unit 2 fire zones that have no fire barrier between the units. The turbine deck is separated into Zones 197-X for Unit 1 and 2200-MM for Unit 2. Also, the Fuel Handling areas are separated into Zones 159-B for Unit 1 and 2151-A for Unit 2. The turbine deck area is very large and a hot gas layer would not develop due to a fire in this area. The MCA performed for ANO turbine deck fire zones screened using the NUREG/CR-6850 process. In the Fuel Handling Area, the area is relatively large and will not create a hot gas layer. The Fuel Handling areas are modeled as full room burn-ups in the scenario calculation and the MCA screens the fire spread to the other area. This SR remains “open”’ as the current analysis only meets Capability Category I and would result in an identical finding upon re-review. While the partitioning element only meets Capability Category I, the scenario and MCA document that this limitation has no impact on results.

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SR	Topic	Status[1]	Finding/Observation	Disposition
PP-B5-01	Active Fire Barriers	Closed	Documentation does not identify the active fire barriers that are credited in compartment separation. Through discussions, the intent of the evaluation is that where active barriers (e.g., fusible-link dampers) are rated as part of an overall rated wall, the barrier itself is justified as an adequate fire compartment boundary. This justification needs to be included in the documentation. Additionally, the identification and justification needs to be provided for active fire barrier components that are part of non-rated barriers. Evidence could not be found that a systematic method to identify/justify active fire barrier components was performed. One method to resolve this item is to provide justification for active fire barrier components that are included within an overall rated barrier and identify all active fire barrier components as part of non-rated barriers and provide justification why barriers are adequate (i.e., barrier configuration is considered during multi-compartment analysis).	Active fire barriers such as fire dampers are credited in the FHA for fire zones and are subsequently included in the physical analysis unit (PAU) definitions. Failure of these active fire barriers is included in the MCA by assuming a failure probability of 0.0074 based on fire door failure. Non-rated barriers are addressed with a failure probability of 1.0 in the MCA.
PP-C3-01	Documentation of Fire Barriers (non-rated barrier)	Open	Documentation is not well developed for the identification and justification of non-rated barriers (see F&O PP-B2-01), spatial separation (see F&O PP-B3-01), and active fire barriers (see F&O PP-B5-01). Also, there is no documentation of the walkdown required in PP-B7 (see F&O PP-B7-01). ANO-1 should satisfy the resolution for F&Os PP-B2-01, PP-B3-01, and PP-B5-01, and document the process and the results.	The issues of non-rated barriers, spatial separation, and active barriers, are discussed above (PP-B2, PP-B3, PP-B5). Walk-downs of all non-NRC or Insurance commitment fire barriers have been performed to document the basis for credit taken for fire zone boundaries. Quantification of MCA probability has conservatively used the door failure probability from NUREG/CR-6850 Table 11-3 as the boundary failure mechanism for all zones without openings to adjacent fire zones. For zones with openings to adjacent zones, the boundary failure probability was set to 1.0 and the volume of the combined zones was used for assessing the time to HGL formation (PRA-A1-05-009).

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
PP-C3-02	Plant Partitioning – Unit Designation	Closed	The fire compartments for ANO (Units 1 and 2) are listed in Table 2-2 of the Plant Partitioning and Fire Ignition Frequency development (ERIN Report 0247060006.01, Rev. 3, 10/2/09). For each fire compartment in the table, it would be useful to identify the unit number or if the compartment is a shared compartment (between the two units). Unit number or shared designation will facilitate Fire PRA applications, upgrades, and peer review. It is recognized that the fire zone numbering generally distinguishes between units, though not in all cases. ANO-1 should clearly identify the unit number or if the compartment is a shared compartment.	A note has been added to Table 2-2 of the Plant Partitioning and Fire Ignition Frequency calculation (CALC-08-E-0016-01, which is the Entergy calculation number for the ERIN Report referenced in the F&O) to indicate that the compartments without unit designators can be identified by the reference drawing number. Those with reference drawings starting with FP-1 are Unit 1 compartments while those with reference drawings starting with FP-2 are Unit 2 compartments.
ES-C1-01	HRA Instrumentation	Closed	The HRA Notebook (Report 0247-06-0006.03-U1, Rev. 0) considers instrumentation in terms of providing cues for Operator actions, and determining feasibility. The instrumentation credited is identified in Appendix A associated with the HRA Basic Event and the related cue. Several different methods for providing operator cues are listed (i.e., different instrumentation sets). Although it is noted if some of the options are not Appendix R instrumentation, it should be clearly indicated which option is the credited instrumentation. See F&O ES-D1-01 and ES-D1-02. Therefore, SR ES-C1 is judged as not met. ANO-1 needs to identify instrumentation relevant to operator actions for HFEs to account for the context of fire scenarios in the Fire PRA to meet SR ES-C1. ANO-1 needs to clearly indicate which option is the credited instrumentation associated with HRA Basic Events.	The Fire PRA HRA Notebook (PRA-A1-05-007, which is the Entergy report referenced in the F&O), Attachment A, provides multiple operator cues for performing the operator actions. These cues show that the operator actions have sufficient diversity so that failure of a single instrument or instrument train will not prevent the operators from performing the action. Attachment B provides a simulator review of the indicators on the control panels and the reliance on instruments. In addition, the major operator actions are driven by the EOPs. EOPs do not list specific instruments for performing the actions.
ES-C2-01	HRA – Undesirable Action Rreview	Closed	There is no evidence that a systematic review of indications that could result in an undesirable operator action were identified and dispositioned. A review of control room instrumentation should be performed to identify possible areas were spurious indications of a single instrument could mislead the operator into performing undesirable actions is needed to meet CC II.	Attachment B of the ANO-1 FPRA HRA Notebook (PRA-A1-05-007) is “Fire PRA Simulator Review – ANO 1.” One of the specific items addressed during the review was to: “Identify critical indicators where fire damage to sensing devices, cables or other loop components could result in misleading information that may cause significant confusion to the operators and thereby degrade their effectiveness in the performance of tasks that are required.”

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
CS-B1-01	Component Selection – Loss of Coordination through Loss of Control Power	Closed	A review of fires that could result in the loss of coordination through the loss of control power (through fire damage to breaker control cables) was performed. No specific analysis for this was performed. However, a review of the circuit design indicates that this is unlikely to exist based upon circuit design (multiple fuses) and cable routing. A specific review of this condition should be performed to confirm control and control power cables do not preclude operation of credited equipment.	Section 4.4 of the Component and Cable Selection Report (PRA-A1-05-003), provides documentation that all circuits and electrical distribution buses credited in the fire PRA have been analyzed for proper over-current coordination and protection. A description of the processes used is included via reference to Upper Level Document ULD-0-TOP-12, “ANO Unit 1 and 2 Electrical Protection/Coordination,” Rev. 3.
PRM-A3-01	Incomplete Fault Tree	Closed	The one-top fire PRA model for ANO-1 was not complete and thus not available for quantification or review. Determining dominant contributors and sequence frequencies beyond the scenario level is problematic without a one-top fire model. Create the one top fire model and benchmark results against the FRANC results for use in quantifications and review.	The ANO-1 fault tree model used for FPRA application has been completed. Section 14 of the Fire Scenarios Report (PRA-A1-05-004) provides a detailed description of the ANO-1 databases utilized to generate, document and quantify the fire PRA model. This section includes reference to the specific fault tree model used.
PRM-B2-01	Internal Events F&Os	Closed	The PRA Peer Review for the ANO-1 internal events PRA was performed the first week of August 2009. As such, there has been insufficient time to reconcile the F&O that could have an impact on the Fire PRA. However, the ANO PRA team has reviewed all of the F&Os from the ANO-1 internal events PRA peer review. They have identified five F&Os that have the potential to impact the fire PRA, and developed action plans for their disposition. The F&Os from the internal events ANO PRA peer review that could impact the Fire PRA have not yet been implemented. ANO-1 needs to implement the action plan that has been developed to reconcile the ANO-1 internal events PRA F&Os that could impact the fire PRA.	The ANO-1 Internal Events Peer Review was performed in August 2009. The ANO-1 Fire PRA Peer Review was performed in late October 2009. Based on the limited time between the peer reviews, ANO did not have time to incorporate internal events F&Os before the Fire PRA review. As stated in this F&O, a limited number of internal events findings were determined to impact the Fire PRA. These F&Os were subsequently incorporated in the FPRA. LAR Attachment U provides details about the internal events F&Os. The details provided in Attachment U include the status of each F&O and each finding’s potential impact on the FPRA model.

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
PRM-B5-01	Addition/Review of Accident Sequences	Closed	There is no evidence of a review the accident sequence models to determine whether sequences need to be added or changed. This SR requires a REVIEW of the corresponding accident sequences and there is no objective evidence that this review was performed, although there does not appear to be any modified accident sequences and the staff confirmed that no sequences were modified. ANO-1 needs to document the review of the corresponding accident sequences for addition or modification.	Section 4.5 of the ANO-1 FPRA Component and Cable Selection Report (PRA-A1-05-003) discusses the Plant Response Model, including a dedicated section discussing success criteria. Appendix D discusses various accident sequence types and how they would or would not apply for the FPRA. Additional comments on the internal events model are discussed in Appendix F. The details provided in the component and cable selection document satisfy the PRM-B5 Supporting Requirement.
FSS-C1-01	Fire Scenario Characteristics – Two Point Scenario Model	Closed	Assignment of characteristics to fire scenarios does not meet CC II. In order to meet CC II, a two-point fire intensity model must be used to assign characteristics to the ignition source. Furthermore, per Note 2 of Table 4-2.6-4 (c) of the ASME/ANS RA-Sa-2009 Standard, CC II requires, as a minimum that the determination of minimum fire intensity capable of causing fire spread and/or damage to at least one member of the target set. Then the two-point fire intensity model is applied to characterize the damaging fires (i.e., fires above the minimum damage intensity). Therefore, this SR is judged to be met at CC I. A two-point fire intensity model must be used to assign characteristics to the ignition source to meet CC II.	Traditional multi-point heat release rate treatment was not applied in the ANO-1 analysis. Rather than the repetitive analysis inherent in a multi-point heat release rate treatment, the Conditional Probability of Propagating Fire factors specified for vented panels provide a multi-point treatment for vented panels based on a split fraction developed from the EPRI Fire Events Database. This split fraction specifies the fraction of fires impacting only the ignition source panel versus those fires which impact targets within the zone of influence of the panels. This approach provides a definitive means of differentiating between significant and limited fires that will not be significantly impacted by potential future refinements in ignition frequency and heat release rate. Section 16 of the Fire Scenarios Report (PRA-A1-05-004) discusses the use of generic fire modeling versus detailed fire modeling and justifies the ANO-1 approach for the FPRA application.

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
FSS-C2-01	Use of Time Dependent Fire Growth	Closed	The generalized models used to support most of the significant fire scenario evaluations use peak heat release rates. For example, 8 of the top 10 fire scenarios listed in the CDF quantification results presented in Appendix A of the Summary Report (Entergy Report 0247060006.06-U1, Rev. 0, 9/11/09) are for "Base Scenarios," which are the equivalent of a fire safe shutdown analysis exposure fire in which everything in the compartment is assumed to fail at the compartment frequency without considering time-dependent fire growth. Time-dependent fire growth is considered on a limited basis, such as for the main control room abandonment scenario and for ventilated cabinets that are located in zones equipped with automatic detection, where credit may be taken for suppression by the fire brigade prior to sustaining external target damage (Fire Scenario report, Entergy Report 0247-06-0006.05-U1, Rev. 0, 9/11/09). Therefore this SR is met at CC I. Time-dependent fire growth should be considered for more of the significant fire scenarios, which are mostly evaluated using peak heat release rates to meet CC II. Expand use of time-dependent fire growth to additional significant fire scenarios as appropriate.	Since the ANO-1 FPRA Peer Review, ANO has made several refinements within the reviewed methodology to remove some conservatism and reduce overall CDF and LERF. These refinements include: - developing more detailed fire scenarios - refining the components failed within the scenario - refining the fire HRA events and JHEPs. The use of fire growth curves are not part of the Generic Fire Modeling Treatments used for ANO-1. Section 16 of the Fire Scenarios Report (PRA-A1-05-004 which is Entergy calculation for ERIN Report 0247-06-0006.05-U1) discusses the use of generic fire modeling versus detailed fire modeling, and justifies the ANO approach for the FPRA application (and only meeting Capability Category I).
FSS-C7-01	Documentation of Modeling/ References	Closed	A multiple suppression path is modeled for the cable spreading room. Proper modeling appears to have been performed for the cable spreading room in the self-assessment for FSS-C7. This information should be formally documented with appropriate references. Documentation of calculation needs to be included in Fire PRA documentation. Document the calculation and include appropriate references.	Section 9.0 of the Fire Scenario Report (PRA-A1-05-004) documents the “Credit for Suppression and Detection Systems” and explicitly outlines how the NSP is calculated for the Cable Spreading Room (including appropriate references). Explicit credit for suppression and detection systems is taken for the Cable Spreading Room fire scenario only.

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
FSS-D1-01	Simplified Modeling for High Risk Areas	Closed	Simplified fire modeling is performed as described in Attachment B of the ANO - Unit 1 Fire Scenario Report (Report 0247-06-0006.05-U1 Revision 0). There has been no further area-specific modeling done with more sophisticated tools to determine if significant risk contributors could be reduced or if the conservative values are bounding for all dominant scenarios. The potential may exist for non-conservative scenarios as well as risk reductions in the significant scenarios. Investigate further into whether or not use of more sophisticated modeling tools would change the results for the dominant fire scenarios in the higher risk areas, such as Fire Zone 99-M.	Section 16 of PRA-A1-05-004, which is the referenced report in the F&O, explains and justifies the ANO use of the Generic Fire Modeling approach instead of a more detailed approach. This approach is based the Zone of Influence (ZOI) dimensions for each heat release rate bin on the value that produced the largest distance. In the absence of specific data, this is a conservative approach.
FSS-D3-01	Cable Tray Fire Growth & HGL	Closed	Fire growth and propagation within cable trays are not explicitly treated in the HGL calculations. Page 34 of ANO-1 Fire PRA Summary Report says: "This approach incorporates conservatisms in the time to HGL impact that, along with the conservatism of the heat release rates used, will envelope impacts due to additional heat release rates introduced by the ignition of cable trays external to the initial ignition source." Fire growth and propagation within the cable trays can add energy to the fire that would affect the HGL calculations. Although conservatisms in the Heat Release Rate (HRR) may envelope this additional added heat, this is only assumed. Quantitatively evaluate fire growth and propagation within cable trays for the HGL calculations.	Section 16 of the Fire Scenarios Report (PRA-A1-05-004) discusses the use of generic fire modeling versus detailed fire modeling and justifies the ANO approach for the FPRA application. This approach ensures ANO meets only the Capability Category I for FSS-D3.

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SR	Topic	Status[1]	Finding/Observation	Disposition
FSS-D7-01	Crediting Fire Watches	Closed	The assessment of unavailability is, in part, based on fire protection program controls for implementing compensatory actions for out of service systems. The types of compensatory measures for out of service detection and suppression systems are given in the TRM. For detection systems (Section 3.3.6 of the TRM), hourly roving fire watches are used when less than 50% of the detectors in a zone are operable. For sprinkler systems (Section 3.7.9 of the TRM), an hourly fire watch is established if detection is operable in the area, otherwise, a continuous fire watch is established. Per NUREG/CR-6850, Appendix P, only continuous fire watches can be used for crediting availability of detection and suppression systems. Consider removing crediting of hourly fire watches and include component-specific unavailability data.	Section 9.0 of the ANO-1 Fire Scenario Report (PRA-A1-05-004) details credit for detection and suppression systems. Explicit credit for suppression and detection systems is taken for the Cable Spreading Room (Fire Zone 97-R) fire scenario only. Per Technical Requirement for Operation (TRO) 3.3.6.B, the failure of a detector in this zone would require the automatic suppression system in this area to be declared inoperable per TRO 3.7.9.A, which requires a continuous fire watch to be established within 1 hour. A review of plant maintenance history shows that limited unplanned maintenance has been performed on this detector in the past 20 years. Therefore the unavailability of this system is very low and is considered to be enveloped by the system unreliability data taken from NUREG/CR-6850. There is no credit taken for hourly fire watch.
FSS-G2-01	20-Minute Limit on Control of Fire to Prevent HGL	Closed	Embedded in the analysis is the assumption that a fire is always controlled within 20 minutes such that a hot gas layer (HGL) will not form beyond 20 minutes. This assumption is based on the concept that the fire brigade would arrive within 20 minutes and successful mitigate the effects of the fire within that time by opening doors or suppressing the fire. This is treated in the model as a 1.0 probability. Issues associated with this assumption include: 1) no evidence is provided that the HGL temperature would not continue to increase following the opening of a door, and 2) this evaluation does not consider the probability distribution of brigade response time coupled with the actions that would be taken such as what is considered in NUREG/CR-6850 and Frequently Asked Question (FAQ) 50. Non-conservative screening methodology that may screen significant compartments. One possible resolution would be to credit a distributed manual suppression probability based upon actual time for hot gas layer development.	The updated Multi-Compartment/Hot Gas Layer Analysis (PRA-A1-05-009) uses a distributed manual suppression probability based on 20-, 30-, 60-minute HGL growth rates. The updated MCA/HGL report develops non-suppression probabilities based on FAQ 08-0050 (FAQ 50) guidance.

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SR	Topic	Status[1]	Finding/Observation	Disposition
FSS-G2-02	Multi-Compartment HGL	Closed	The multi-compartment analysis assumes that for each fire scenario, the only source of heat contributing to the hot gas layer is the heat from the cabinet (based upon a 98% HRR). This does not account for additional heat due to potential fire spread to other combustibles including cable. It is noted that a conservative (98%) HRR rate is used for the cabinet. However, it is not demonstrated that this is bounding (i.e., 1.0 probability) when considering the HRR over time due to fire spread. This could result in non-conservative screening of compartments – this may be compounded by the issue identified by F&O FSS-G2-01. One method to resolve this is to consider the HRR based on generic bounding or compartment specific configuration of cabinets vs. cables and described in NUREG/CR-6850 and FAQ 49.	The updated Multi-Compartment/Hot Gas Layer Analysis (PRA-A1-05-009) uses more detailed methods for analyzing hot gas layer development and growth. The updated methods account for both fire spreading and additional combustibles. The listed details are in Attachment A of the Multi-Compartment and Hot Gas Layer Analysis. The supplemental information relates to additional hot gas layer tables generated for transient fires, specific steady and peak heat release rate values, and scenarios that involve secondary combustibles.
FSS-G2-03	Compartment Boundaries – Analysis of Openings	Closed	The analysis assumes (with the exception of the control room) that all barriers have no openings. Cases were identified where other openings in fire compartment barriers exist, e.g., 73W. A systematic effort is needed to identify these openings so that they can be accounted for in the multi-compartment analysis. This is a follow-on to the issue identified in F&O PP-B3-01. The review indicates that it is likely on few compartments have such openings. Identify these compartments as part of Plant Boundary and Partitioning. Include the openings and impact of openings in the Multi-compartment analysis to justify low significance.	The updated Multi-Compartment and Hot Gas Layer Analysis (PRA-A1-05-009) methodology addresses openings between fire compartments. Openings between fire compartments are identified and their impact evaluated for every fixed ignition source analyzed in the Multi-Compartment Analysis.
FSS-G2-04	HGL – Assumption on Location of Fire	Closed	The hot gas layer analysis is based on an actual fire compartment volume (area of room times height) where the fire modeling used to account for the amount of heat necessary to cause a hot gas layer is based upon the available hot gas layer volume. To evaluate the hot gas layer, it was assumed that the fire was at the floor level. This may result in non-conservative estimates for the amount of heat necessary to result in a hot gas layer. This methodology results in non-conservative heat requirements to cause a hot gas layer. Adjust the assumed room volumes in the screening process based upon the available hot gas layer volume as opposed to the full room volume.	The Multi-Compartment and Hot Gas Layer Analysis has updated the methodology in the following manner. The new approach assumes the ignition source/fire has a base 8 ft off the floor. The new methods also calculate room volume above the source for HGL impact (Attachment A of PRA-A1-05-009).

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SR	Topic	Status[1]	Finding/Observation	Disposition
FSS-H4-01	Documentation of Technical Basis for Fire Model Inputs	Closed	There is no apparent documentation that the technical bases for input values used in the fire modeling were validated by plant walkdowns or other methods. This SR requires documentation of a technical basis to be established for fire modeling tool input values given the context of the fire scenarios being analyzed. This was reported to be performed as part of the walkdowns for scenario development, but not documented. Document that the technical basis for fire modeling input values were validated in the context of the fire scenarios analyzed.	Attachment D of the Fire Scenarios Report (PRA-A1-05-004) is a Walkdown Workbook. This attachment provides the basis for FRANC inputs. Attachment A-2 of the Scenarios Report is the Scenario Development Walkdown Summary. These two attachments (with some additional information in other Scenario Report attachments) contain the details to support that all scenario development inputs were validated by walkdowns.
IGN-A5-01	Ignition Frequencies – Use of Critical Years	Closed	Table 3-2: some IEFs are not calculated on a "per reactor-year" basis. All NUREG/CR-6850 ignition frequencies should be updated with reactor critical years in order to obtain the correct ignition frequencies per this SR. IGN-A5 requires generic fire ignition frequencies or plant-specific fire frequency updates on a reactor-year basis. This is not done for the following ignition frequency bins: 1, 4, 8-10, 12-16c, 17-19, 21, 23, 26, and 30. Update the "all-mode" Ignition Frequencies from NUREG/CR-6850 with critical years as opposed to calendar years.	Fire PRA Plant Partitioning and Fire Ignition Frequency Development calculation (CALC-08-E-0016-01 Table 3-2) has been changed to show that all bins were updated on a reactor-year basis.
IGN-B5-01	Assumptions in Ignition Frequency Calc	Closed	Section 1.1 of Report 0247060006.01 Revision 3 contains only one assumption. However, a text search of the document resulted in a number of additional instances of assumptions buried in the text. One was an assumption that the ignition frequencies were log-normally distributed, one was the assumption that the compartments were assigned in accordance with the generic sources, one was the assumption that junction boxes were uniformly distributed, and a general assumption for a number of the events that they occurred at power. All assumptions pertaining to the ignition frequency calculation should be explicitly captured in Section 1.1, with the possible exception of the "at-power" assumption for individual events. The assumptions should also be reviewed for completeness.	The ANO Fire Probabilistic Risk Assessment - Plant Partitioning and Fire Ignition Frequency Development (CALC-08-E-0016-01) contains an updated section on assumptions.

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SR	Topic	Status[1]	Finding/Observation	Disposition
CF-A1-01	Cable Failures - Inter and Intra Cable Short Probabilities	Closed	The tables in NUREG/CR-6850 were used to determine cable failure probabilities. The most conservative value from this table was chosen. The analysis does not account for the potential for both inter and intra cable short probabilities. For example, item 32-K, LMV101414K was assigned a failure probability of 0.3 for intra cable hot short. This value does not include the potential for inter cable hot short of .03 (total probability of 0.33). Since the highest failure probability in the table is used - this is typically the intra cable failure probability, the impact of excluding the inter cable failure probability is relatively small. Review cables where failure probabilities other than 1.0 are credited and ensure the appropriate inter and intra cable short probabilities are applied.	Section 12.0 of the Fire Scenario Report (PRA-A1-05-004) discusses cable failure probabilities. The section outlines the application of inter and intra cable short probabilities. For a circuit with a CPT, a bounding hot short probability of 0.33 is used which includes both intra- and inter-cable hot shorts. For a non-CPT circuit, a bounding hot short probability of 0.66 is used which includes both intra- and inter-cable hot shorts.
CF-A1-02	Input Parameters include: Tray/Conduit, CPT/no CPT, Cable Type, and Cable Configuration	Closed	Based on the documentation, it is not clear that all inputs to the evaluation were considered in determining the failure probability. Input parameters include: tray/conduit, CPT/no CPT, cable type, and cable configuration. This finding is being assigned against A1 because the lack of documentation reveals that inputs were appropriately used in all cases. Document the specific configuration inputs used in justifying the chosen failure probabilities from NUREG/CR-6850 failure table probability And validate the chosen probabilities.	The NUREG/CR-6850 tables used for hot shorts are Tables 10-1 and 10-2, which are associated with thermoset cables. The remaining tables are associated with thermoplastic cables (Tables 10-3 and 10-4) or armored cables (Table 10-5). Calculation CALC-ANOC-FP-09-00019 identified only 10 thermoplastic cables for ANO with only two of these cables associated with ANO-1. Details about parameters pertaining to cable & circuit failure probabilities are documented in the Fire Scenario Report (PRA-A1-05-004). The cable at ANO is type IEEE-383 and the damage threshold for this type is specified in NUREG/CR-6850 (Section 6 of the Scenario Report). Section 12.0 of the Fire Scenario Report addresses the failure data applied for CPT/non CPT circuits.

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SR	Topic	Status[1]	Finding/Observation	Disposition
HRA-A2-01	Use of a New HRA Event	Closed	To address an excess spray MSO, ANO-1 an HFE, RHF1RCPSXP, was added directly to the model logic. In this logic, RHF1RCPSXP feeds into an AND gate and has a value of "0.0" which in effects kills the entire logic structure. This HFE shows up in the TAGBE file tagged as "N2" which means it is ignored. It does not show up anywhere in the HRA report, the ExcludedEvents file or the AlteredEvents table so there is no definition or characterization that is traceable. Undocumented HFE that appears to be impacting logic. If RHF1RCPSXP is not used, rather than setting its value to 0.0, remove it from the model. If it is a valid HFE, it needs to be identified and fully characterized in the HRA report and the correct value needs to be calculated.	The modeling error has been corrected. The new event (RHF1RCPSXP) has a default value of 1.0. It is only changed if changed in the altered events table (in FRANC) if it is relevant to a specific case. With the default value of 1.0, it is does not disrupt quantification of the other logic in the AND gate for other cases.
HRA-A3-01	Undesirable Operator Action from Spurious Indications	Closed	There is limited direct evidence that a systematic review of fire scenarios was performed to identify undesirable operator action that could result from spurious indications (See F&O ES-C2-01). The evidence in Attachment E of the HRA report is implicit. A review of each fire scenarios is needed to identify undesirable operator action that could result from spurious indications of a single instrument for CC II. Perform a systematic review of fire scenarios to identify undesirable operator action that could result from spurious indications of a single instrument, per SR ES-C2.	Attachment C of the ANO-1 FPRA Human Failure Events Notebook (PRA-A1-05-008) contains the systematic review of fire PRA credited operator actions. The Attachment contains the results of interviews with experienced ANO-1 operations personnel. Experienced operators were asked a series of questions about each HEP credited in the model. The questions included – description of the action, which procedures apply, what instruments/signals are available, time available and/or required to take action, location (inside or outside control room), and if there are any special considerations. The FPRA HRA Notebook (PRA-A1-05-007), Attachment A, provides multiple operator cues for performing the operator actions. These cues show that the operator actions have sufficient diversity so that failure of a single instrument or instrument train will not prevent the operators from performing the action and reduces the likelihood of inadvertent/ undesirable actions.

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
HRA-B3-01	HRA – Development of HEPs Consistent with Internal Events HEPs	Closed	The new human failure events (HFEs) as identified in the FRANC "ALTEREDEVENTS" table are not developed as per HRA-B3 (nor identified in HRA-B2). These HFEs need to be "processed" to (1) determine the viability of the HFE – can it be performed, are there cues, etc., and (2) satisfied the HR supporting requirements (SRs) from Section 2 of the ASME/ANS PRA Standard (internal events). Note that the HFEs identified in HRA-B1 (from the internal events PRA) would have been assessed at CC III. The table in Appendix A of ANO-1 Fire Probabilistic Risk Assessment Human Reliability Analysis (HRA) Notebook (Report 0247060006.03-U1, Revision 0), September 2009 deals with timing and availability of cues. Since the SR HRA-B1 HFEs are from the internal events PRA, the specific procedure guidance and task analysis are contained in the hfe_cr.xls and hfe_cp.xls Excel spreadsheets from the internal events ANO-1 PRA. The HR SRs from Section 2 of the ASME/ANS PRA Standard for the added HFEs have not been performed. The added HFEs need to be "processed" using the same methods that were employed to develop the HFE for the internals event PRA.	The HRA events have been removed from the "Altered Events" table, except for actions that are set to TRUE in a fire scenario where fire prohibits the operator action. The revised FPRA HRA analysis (PRA-A1-05-008 - ANO-1 Fire PRA Human Failure Events) provides detailed HRA evaluations for most of the fire-specific operator actions. Two of the events are left at screening values (QHFSGDEPRES = 0.1 and RHF1ESASRG = 1.0). All events used in the FPRA have been developed and documented using the same methods used for the internal events HEPs.
HRA-C1-01	HRA – Error in HEP Value in Recovery Rule File	Closed	A review of the fire HFE Evaluation and the recovery rules revealed a discrepancy for one HFE. As shown in the ANO-1-Fire HFE Evaluation spreadsheet, the HFE EHF1DGCRKP had a value of 4.98E-03 in the internal events PRA for ANO-1 with a new value of 2.99E-02 calculated based on the fire conditions. The calculation was reviewed and found to match the fire HEP process. However, when reviewing the recovery rule file, Alrul4p00.txt, the replacement event for EHF1DGCRKP, Z1EHFDGCRK, was found to have the original value 4.98E-03. It was determined that the error was a result of an error when copying the values from one file to another. One error was found in a small sampling so the extent of condition may be larger so may impact the results. Correct the value for Z1EHFDGCRK in Alrul4p00.txt and then review the other "single replacement" values against the new values in the ANO-1-Fire HFE Evaluation spreadsheet.	The value Z1EHFDGCRK was corrected in the FPRA rule recovery file (Alrul4p00_FIRE.txt). The recovery rule file was thoroughly reviewed during the HEP document update to ensure the correct values are applied to the events during recovery.

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
HRA-D2-01	HRA – Detailing New HRA Events	Closed	Multiple recovery actions were inserted into the model via the AlteredEvents file. Screening values were used for all of these events so none of them accounted for relevant fire-related effects, including any effects that may preclude a recovery action or alter the manner in which it is accomplished. The values used may be conservative or non-conservative so it is not possible to fully assess the true impact of these recovery actions. ANO-1 plans to determine which of these recovery actions need to be retained after the NFPA 805 Change Evaluation. Once the HFEs to be retained are identified, they need to be fully defined and quantified in accordance with the process used for all the other HFEs.	The HRA events have been removed from the “Altered Events” table, except for actions that are set to TRUE in a fire scenario where fire prohibits the operator action. The revised FPRA HRA analysis (PRA-A1-05-008 - ANO-1 Fire PRA Human Failure Events) provides sufficient detail to meet all HRA-D2 supporting requirements. These changes include new combinations of operator actions for dependency. All events used in the FPRA have been developed and documented using the same methods used for the internal events HEPs.
HRA-E1-01	HRA – Implied Human Actions & Non-Proceduralized Actions	Closed	In the FRANC Altered events file, there are a number of basic events with replacement values of 0.1. These replacement values represent screening values for Operator Recovery Actions to recover the faulted basis event. This is the only place these “operator actions” show up, they are not proceduralized at this time and they are not documented or evaluated beyond the screening evaluation. At this point in time, these new actions are not proceduralized and are considered to be recovery actions. These actions still need to be evaluated for significance. Entergy has indicated that once these actions have been evaluated, the important ones will be incorporated into procedures and quantified in accordance with their standard process. The other actions will be removed. Inclusion of undocumented, unevaluated operator actions in the models can impact the results. Before the fire PRA can be used for applications beyond NFPA 805, the "implied human actions" need to be documented and incorporated in operating procedures. Each such action needs to be clearly identified. Any actions that are not proceduralized need to be removed from the model.	The HRA events have been removed from the “Altered Events” table, except for actions that are set to TRUE in a fire scenario where fire prohibits the operator action. As discusses in the response to HRA-B3-01 and HRA-D2-01, these actions are evaluated in detail using the same HRA methodology used in internal events model.

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
HRA-E1-02	Documentation of Assumptions	Closed	Report 0247060006.03-U1, Rev. 0 documents the HRA for the ANO-1 Fire PRA. Section 3 documents the assumptions used in the Fire PRA HRA. This section contains a total of 2 assumptions. However, a text search of the report on "assume" found five additional assumptions buried in the text. Another text search on "could" and a text search on "may" yielded another three instances of what appeared to be assumptions. This is considered to be a good indication that not all assumptions have been documented. While capturing all assumptions into a common location may not have a significant impact on the base model, there is a concern for future applications. One step in performing a risk-informed application is to review the assumptions to determine if any of them could impact the application and, if so, what would need to be done to compensate for the assumption if it is non-conservative with respect to the application. Review Report 0247060006.03-U1, Rev. 0 to identify additional assumptions and capture them in Section 3. The definition of "assumption' used for the search should be relatively broad so as to capture as may potential assumptions as possible. It is easier to disposition a trivial assumption than it is to address a significant assumption that was not identified as such.	Section 5 of the ANO-1 Fire PRA Human Failure Events report (PRA-A1-05-008) has been expanded and now includes all relevant HRA modeling assumptions. In addition to the general assumptions included in Section 5 of calculation PRA-A1-05-008, each of the detailed post-fire HRA events has assumptions included in the associated evaluation.
FQ-A4-01	Uncertainty	Closed	The uncertainty interval on CDF results was not estimated as required by QU-E3 (LE-F3). An uncertainty analysis has been performed to identify and qualify specific areas of uncertainty. This meets the internal event requirement for QU-E1, QU-E2, and QU-E4. Determine an uncertainty interval based upon the model uncertainties identified in QU-E1 and E2. Provide basis for any non-applicability of any of the requirements under these sections in Part 2.	Calculation PRA-A1-05-006 – ANO-1 Fire PRA Uncertainty/Sensitivity Analysis provides a Monte Carlo evaluation of uncertainty for both the FPRA Core Damage Frequency and the Large Early Release Frequency. The listed uncertainty analysis satisfies the listed Standard requirements (QU-E1, QU-E2, and QU-E3.

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
FQ-A4-02	Errors With Documented Ignition Frequencies	Closed	A spot check of scenario ignition frequencies documented in the FRANC model revealed several errors in the calculations. Based on the number of errors found and the lack of documentation for scenario frequency calculations, this indicates a potentially systemic problem with the scenario ignition frequencies. Review and recalculate scenario ignition frequencies.	The scenario ignition frequencies are calculated in Attachment D of the Fire Scenarios report (PRA-A1-05-004). The calculated scenario ignition frequencies have been verified to be consistent with the calculations performed for the zone frequencies in the Fire Probabilistic Risk Assessment Plant Partitioning and Fire Ignition Frequency Development report (CALC-08-E-0016-01).
FQ-A4-03	Error with New Event Value	Closed	Section 7.4 of Appendix D (MSO Expert Panel Review and Disposition of Open Items) in Report 0247060006.02-U1 describes changes made to the PRA model to account for the potential of an MSO causing a spurious spray event. A review of the model shows that the AND gate FIRE027 that represents this scenario includes an event (RHF1RCPSXP) that is set to 0.0. This will prevent the MSO scenario from being quantified. The model does not accurately quantify an MSO scenario due to a modeling error. Correct the model and review for other potential similar errors.	The modeling error has been corrected. The new event (RHF1RCPSXP) has a default value of 1.0. It is only changed if changed in the altered events table when it is relevant to a specific case. With the default value of 1.0, it is does not disrupt quantification of the other logic in the AND gate for other cases.
FQ-D1-01	Internal Events Model – Unresolved F&Os	Closed	The Fire PRA LERF model is based upon the internal events LERF model. The LERF model uses the Fire PRA plant response model. The frequency for fire-induced LERF is quantified. However, F&Os for element "LE" and other elements were identified in the ANO-1 RG 1.200 peer review of the internal events model, performed in August 2009. These F&Os have not been addressed and limit the LERF modeling capability of the Fire PRA model. Also, comprehensive screening of Interfacing Systems LOCA (ISLOCA) and other significant containment isolation paths for fire scenarios has not been performed. The frequency of different containment failure modes leading to large early release is needed for fire-induced LERF. Resolve internal events model F&Os for element "LE." Comprehensive screening of Interfacing Systems LOCA (ISLOCA) and other potential significant containment failure paths is also needed.	F&Os relating to ANO-1 ISLOCA treatment have all been resolved. A revision to the ISLOCA fault tree was performed following the peer review. This revision included an update to the internal events model (and subsequently the FPRA model). The evaluation of containment isolation paths (potential LERF contribution via breaches in containment) are documented in Appendix G of the Component and Cable Selection Report (PRA-A1-05-003). See Attachment U Dispositions for ISLOCA/LERF findings additional details.

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
FQ-E1-01	Conservatism in CDF/LERF Results	Closed	The ANO-1 Fire PRA results are very conservative for CDF and LERF. There are several important scenarios that are driving the results that have not had detailed modeling performed to reduce the conservatisms. These conservative results may mask other important contributors to the fire risk. This SR requires that significant contributors be identified in accordance with HLR-QU-D. HLR-QU-D6 requires that significant contributors be identified and HLR-QU-D7 requires review of important components and basic events to determine that they make logical sense. This is not possible with overly conservative scenario models. Update model to remove conservatisms.	Since the ANO-1 FPRA Peer Review, ANO has made several refinements within the reviewed methodology to remove some conservatism and reduce overall CDF and LERF. These refinements include: - developing more detailed fire scenarios - refining the components failed within the scenario - refining the fire HRA events and JHEPs. Detailed fire modeling has not been applied to ANO fire scenarios based on the limited benefit in CDF and LERF reduction given conservative input parameters.
FQ-E1-02	Dominant LERF Scenarios	Closed	The ANO-1 Fire PRA Summary Report (ERIN Report 0247060006.06-U1, Rev. 1, 9/'30/09) Appendices A and B provide the quantification results for CDF and LERF. Appendix C presents "INSIGHTS / RECOMMENDATIONS (DOMINANT RISK CONTRIBUTORS)." The significant contributors to LERF were not well identified and results were not clearly traced to inputs and assumptions in the Fire PRA. Therefore the SR is not met. The fire-induced LERF quantification results are not reviewed sufficiently to identify significant contributors to LERF. Presentation of dominant LERF risk contributors in Appendix C should be expanded to fully discuss all dominant contributors and their basis in the inputs and assumptions made in the Fire PRA.	The ANO-1 Fire PRA Summary Report (PRA-A1-05-005) has been updated to include additional result details. Attachments D, E, F, G, & H have been added to provide additional details on results. - Appendix D – Uncertainty and Sensitivity Matrix - Appendix E – Cutsets Comprising the Top 90% of CDF - Appendix F – CDF Importances Report - Appendix G – Cutsets Comprising the Top 90% of LERF - Appendix H – LERF Importances Report Section 4.0 of the Summary Report has been updated to explain results, insights, and dominant risk contributors.

Table V-1 Fire PRA Peer Review – Findings and Observations

SR	Topic	Status[1]	Finding/Observation	Disposition
FQ-F1-01	Quantification Limitations	Closed	There is no discussion of quantification process limitations as required in QU-F5, or significance definitions (basic event, cutsets, and accident sequences) as required by QU-F6. A discussion of the quantification process limitations is required by QU-F5 by reference through FQ-F1. Also, quantitative definitions for significant basic events, cut sets, and accident sequences are required by QU-F6. Provide the required discussions and definitions and document.	Section 4.2 of the ANO-1 Fire PRA Summary Report (PRA-A1-05-005) discusses the limitations of the PRA software used (CAFTA, FORTE, FRANC). Quantitative results and insights for risk significant sequences are also provided in the scenario report. Significance is defined in Section 4.1 of the report as all scenarios included in 90% of the total Fire CDF/LERF. Tables in the report list risk significant scenarios (4-1 for CDF and 4-2 for LERF), cutsets (Appendix E for CDF and Appendix G for LERF), and basic event importance measures (Appendix F for CDF and Appendix H for LERF).
UNC-A1-01	Uncertainty Interval Based on Model Uncertainties	Closed	The uncertainty interval on CDF results was not estimated as required by QU-E3 (LE-F3). An uncertainty analysis has been performed to identify and qualify specific areas of uncertainty. This meets the internal event requirement for HLR-QU-E1, E2, and E4. The uncertainty interval on CDF results was not estimated as required by QU-E3 (LE-F3). Determine an uncertainty interval based upon the model uncertainties identified in QU-E1 and E2. Provide basis for any non-applicability of any of the requirements under these sections in Part 2.	Uncertainty intervals (ones that meet the criteria of QU-E1, E2, and E3) have been developed for both CDF and LERF and are documented in PRA-A1-05-006 – ANO-1 Fire PRA Uncertainty/Sensitivity Analysis. The results of the uncertainty evaluation are also presented in Appendix D of the Summary Report (PRA-A1-05-005).

[1] The Status of Closed indicates that the Peer Review Finding has been addressed in the NFPA 805 evaluation and incorporated into the Fire PRA model and documentation.

Table V-1a Focus Scope Fire PRA Peer Review – Findings and Observations

SR	Topic	Status	Finding/Observation	Disposition
FSS-G3-01	Screening Criteria	Closed	There is no documented basis for the use of screening criteria value of 5E-7/yr. In addition, given that the threshold value is 1E-7, it is not documented in the report if the screening process has considered cumulative risk. Provide a justification for the screening value of 5E-7. The report should discuss how the screening process deals with cumulative risk.	The updated Multi-Compartment and Hot Gas Layer analysis no longer uses screening criteria for HGL (ZOI) and MCA. This is documented in PRA-A1-05-009 - ANO-1 Multi-Compartment/Hot Gas Layer Analysis. All zones now include a HGL and multiple MCA scenarios.
FSS-G3-04	Intervening Combustibles	Closed	The assumption of only two cable trays as intervening combustibles may not be conservative or realistic (i.e. reflect as built conditions) for all the PAU's. Given that the multi compartment analysis relies heavily on screening due to hot gas layer conditions in the PAU, accurate intervening combustible input parameters to the fire modeling analysis is necessary. Conduct walkdowns for identifying the correct package of intervening combustibles to use as input to the fire modeling analysis. Walkdowns should be documented.	Walk-downs to identify scenarios with greater than 2 trays were performed and the results have been incorporated into the FPRA (PRA-A1-05-009).
FSS-G3-05	Manual Suppression Factors	Closed	The use of the manual suppression constant for electrical fires appears to be used for the calculation of all the manual suppression failure probabilities. The manual suppression constant should be applied depending on the specific ignition source/fire that characterizes the fire scenario. In addition, it is not clear in the calculation which time input is used for determining the manual suppression probability values (i.e. at what time hot gas layer is reached?). Based on the response to a question submitted during the peer review process, there are some curves (e.g. the high energy arcing fault) that also could apply to specific PAU's that were not considered. Ensure that the suppression curve selected is bounding and document a technical justification for the selection to be used in the screening process.	The updated ANO-1 Multi-Compartment Analysis (PRA-A1-05-009) contains a discussion of how manual suppression probabilities are determined. This discussion contains the technical details (including justification). The .012 non-suppression curve, when applied, is applied in a bounding condition.

Table V-1a Focus Scope Fire PRA Peer Review – Findings and Observations

SR	Topic	Status	Finding/Observation	Disposition
FSS-G3-06	Insufficient Technical Justification	Closed	There are numerous statements in Table 3-1 under "final disposition" that lack technical justification. Examples include (this F/O is not limited to these examples only): - "The 0.001 applied is a very conservative factor applied to zones over 353 cu ft. A more appropriate NSPms for this scenario is 1E-04 which results in screening the scenario for MCA impacts" – Question: Where does 0.001 come from? Why it is considered conservative? Where does 1E-4 come from? - Why is a factor from FAQ 044 for main feed water pumps (MFWPs) to oil tank rooms used? Are there any other ignition sources other than the pumps in these areas? - Given the large volume of the turbine building, no hot gas layer would be able to form which would preclude the MCA impacts – Question: Is this true for MFWP and large turbine-generator (TG) fires? Can we preclude HGL scenarios for these ignition sources? - The only adjacent zone connected through a door is 2200-MM which will not be impacted due its large volume. Other adjacent zones can use the next worse barrier failure probability for dampers, 0.0027, which lowers the Pmca to 9.94E-08 – Comment: The resulting screening value is barely below the screening criteria. If we are selecting probabilities from a table without considering what is in the boundary in terms of seals and dampers, proper justification for the probabilities are needed. - Crediting a 0.02 NSP for emergency diesel generator (EDG) oil fires from Appendix E screens the scenario without crediting manual suppression – Question: Where is this 0.02 coming from? Where is the reference for the fixed system credited? - There are tray combustibles within the zone; however they are located 10 ft or more above the floor elevation and would not be impacted by a fire in this zone. Screen the scenario for MCA impacts – Question: Why does the statement "would not be impacted by a fire in this zone" apply to these specifically? Clarify these statements in a way that simplify reviews and future updates of this calculation. Some of these will require clear technical justifications.	Table 3-1 (the table in question) has been eliminated. It was removed via the change in screening approach (to address F&O FSS-G3-01). All zones now have an HGL scenario and multiple MCA scenarios and the associated quantification is incorporated into the FPRA model.

Table V-1a Focus Scope Fire PRA Peer Review – Findings and Observations

SR	Topic	Status	Finding/Observation	Disposition
FSS-G4-01	Fire Barrier Confirmation	Closed	It is not documented in the multi compartment report how the requirements of this SR were addressed. For example, the standard requires to "CONFIRM that the allowed credit is consistent with the fire-resistance rating as demonstrated by conformance to applicable test standards". There is no evidence that this confirmation has been conducted. Without a systematic process for identifying barrier types between physical analysis units, ANO-1 will need to ensure that addressing this SR will account for all the different barrier types (walls, barriers, spatial separations, doors, etc). See F/O PP-B3-01. A possible resolution is to list the types of barriers between adjacent PAU's for determining which probabilities are applicable and document if the generic values in Table 11-3 of NUREG/CR-6850 are bounding for ANO-1.	Walk-downs of non-NRC or Insurance commitment fire barriers have been performed to document the basis for credit taken for fire zone boundaries. Quantification of MCA probability has conservatively used the door failure probability from NUREG/CR-6850, Table 11-3, as the boundary failure mechanism for all zones without openings to adjacent fire zones. For zones with openings to adjacent zones, the boundary failure probability was set to 1.0 and the volume of the combined zones was used for assessing the time to HGL formation (PRA-A1-05-009).
FSS-G5-01	Active Fire Barrier Confirmation	Closed	It is not documented in the multi compartment report how the requirements of this SR were addressed. For example, the standard requires to "QUANTIFY the effectiveness, reliability, and availability of the active fire barrier element". There is no evidence that this confirmation has been conducted. Without a systematic process for identifying barrier types between physical analysis units, ANO-1 will need to ensure that addressing this SR will account for all the different barrier types (walls, barriers, spatial separations, doors, etc). See F/O PP-B3-01. A possible resolution is to list the types of barriers between adjacent PAU's for determining which probabilities are applicable and document if the generic values in Table 11-3 of NUREG/CR-6850 are bounding for ANO-1.	Walk-downs of non-NRC or Insurance commitment fire barriers have been performed to document the basis for credit taken for fire zone boundaries. Quantification of MCA probability has conservatively used the door failure probability from NUREG/CR-6850, Table 11-3, as the boundary failure mechanism for all zones without openings to adjacent fire zones. For zones with openings to adjacent zones, the boundary failure probability was set to 1.0 and the volume of the combined zones was used for assessing the time to HGL formation (PRA-A1-05-009).

Table V-2 Fire PRA– Category I Summary

SR	Topic	Status
FSS-C1	Use of Multi-Point Heat Release Rate Treatment	Capability Category 1 is acceptable for the application. While the results are conservative, they are not significantly more so than the also conservative results of more detailed fire modeling. Additionally, some multi-point heat release rate analysis is applied. Section 7.1 of the Fire Scenarios Report outlines the use of a multi-point treatment for vented panels based on a split fraction developed from the EPRI Fire Events Database. This split fraction specifies the fraction of fires impacting only the ignition source panel versus those fires which impact targets within the zone of influence of the panels. Section 16 of the Fire Scenarios Report discusses the use of generic fire modeling versus detailed fire modeling and justifies the ANO approach for the FPRA application.
PP-B2 (Finding PP-B2-01)	Plant Partitioning – Use of Non-Rated Fire Barriers	In limited PAUs, ANO credits non-rated barriers (spatial separation) and does not full meet Capability Category II. The impacts of these barriers are evaluated (no credit for non-rated barrier) in the scenario development and MCA. SR PP-B2 references NUREG/CR-6850, Chapter 1, for the acceptable criteria for justifying non-rated fire barriers. NUREG/CR-6850 discusses the use of fire compartments as “a well-defined enclosed room, not necessarily with fire barriers.” ANO references the FHA as a starting point for plant partitioning and all barriers (both rated and non-rated are defined in the FHA). The Plant Partitioning Task (CALC-08-E-0016-01, R0) assumes that fire protection features will be effective at containing a fire under most conditions. Fire protection features include fire-rated barriers, non-fire-rated barriers, active features such as water curtains, and in some cases spatial separation. The potential failure of a credited partitioning feature is addressed in the MCA. The ANO FHA does not include any partitioning features, such as partial height walls, that are discussed in NUREG/CR-6850 as barriers that should not be credited. The adequacy of the fire barriers is explicitly reviewed as part of the Multi-Compartment and Hot Gas Layer Analysis calculation (PRA-A1-05-009).
PP-B3-01	Plant Partitioning – Use of Spatial Separation	Spatial separation is used in two areas at the site (four total PAUs): the fuel handling area and the turbine deck. Both are very large areas and the development of a hot gas layer is not credited. The spatial separation distance is also sufficiently large such that no fixed or transient sources are capable of impacting the area beyond the separation. While this only meets Capability Category I for partitioning, the follow up tasks (fire scenarios and MCA) show it has no impact on FPRA results or conclusions.

References

1. LTR-RAM-II-10-003, "Fire PRA Peer Review against the Fire PRA Standard Supporting Requirements from Section 4 of the ASME/ANS Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessments for Nuclear Power Plant Applications for the Arkansas Nuclear One, Unit 1 Fire Probabilistic Risk Assessment," January 2010.

2. KGRS-0021-0022-005, "Focused Scope Fire PRA Peer Review for Arkansas Nuclear One Unit 1," performed by Kleinsorg Group, May 2012.

3. 5384.R01.121129 – "Focused Scope Peer Review – ANO-1 Fire PRA, FSS-A, C, D, E and H" Kazarians & Associates, Inc, November 2012.

4. Echelon Calculation PRA-A1-05-004, "Fire Scenarios Report NUREG/CR-6850 Tasks 8 and 11," June 2013.

5. Echelon Calculation PRA-A1-05-003, "ANO-1 Fire Probabilistic Risk Assessment Component and Cable Selection Report," June 2013.

6. Echelon Calculation PRA-A1-05-008, "ANO-1 Fire PRA New Human Failure Events," February 2013

7. Echelon Calculation PRA-A1-05-007, Rev. 2, "ANO-1 Fire Probabilistic Risk Assessment Human Reliability Analysis (HRA) Notebook," June 2013.

8. ANO Calculation CALC-08-E-0016-01, "Fire Probabilistic Risk Assessment Plant Partitioning and Fire Ignition Frequency Development," March 2011.

10. Echelon Calculation PRA-A1-05-009," ANO-1 Multi-Compartment / Hot Gas Layer Analysis," June 2013.

11. Echelon Calculation PRA-A1-05-005, Rev. 0, "Fire Probabilistic Risk Assessment Summary Report, NUREG/CR-6850 Task 16," June 2013.

12. Echelon Calculation PRA-A1-05-006, Rev. 0, "ANO-1 Fire PRA Quantitative Uncertainty / Sensitivity Analysis," July 2013.

13. ASME/ANS RASa-2009 - ASME and ANS Combined PRA Standard "Standard for Level 1 / Large Early Release Frequency Probabilistic Risk Assessment."

14. ANO Calculation CALC-ANOC-FP-09-00019, Rev. 0, "Safe Shutdown Cable Jacket Insulation Types at ANO," July 2009.

15. ANO Fire Hazards Analysis, Revision 11, October 2006.

W. Fire PRA Insights

W.1 Fire PRA (FPRA) Overall Risk Insights

Risk insights were documented as part of the development of the FPRA. The total plant fire CDF/LERF were derived using the NUREG/CR-6850 methodology as guidance for FPRA development and are useful in identifying the areas of the plant where fire risk is greatest. The risk insights generated were useful in identifying areas where specific contributors might be mitigated via modification. A detailed description of significant risk sequences associated with the fire initiating events that represent a 1% contribution of the calculated fire risk for the plant was prepared for the purposes of gaining these insights and an understanding of the risk significance of multiple spurious operation (MSO) combinations. These insights are provided in Table W-1 (Table W-1a for CDF and Table W-1b for LERF).

Fire Scenario Selection

Fire scenarios were selected based on the definition of ‘significant accident sequence’ from RG 1.200, Revision 2:

> *Significant accident sequence: A significant sequence is one of the set of sequences, defined at the functional or systemic level that, when ranked, compose 95% of the CDF or the LERF/LRF, or that individually contribute more than ~1% to the CDF or LERF/LRF.*

The top 51 fire scenarios account for over 90% of the cumulative fire CDF. Of these, 22 scenarios contribute 1% or greater on an individual basis. These 22 scenarios (all scenarios contributing 1% or greater on an individual basis) are presented in Table W-1a. A strong correlation exists between the CDF and LERF. Nineteen LERF scenarios account for 1% or more of the total LERF value. Of these 19 LERF cases, 10 were included in the W-1a CDF table (including 10 of the top 14 LERF scenarios). All LERF scenarios (and the associated risk insights) that account for 1% or more of the total LERF are listed in Table W-1b.

Modifications

Several modifications were identified in the fire risk evaluations (FREs) that contributed to the reduction in plant cumulative ΔCDF and ΔLERF. The risk benefits of these proposed modifications are reflected in the delta risk values presented in Table W-2.

See Attachment S for a complete list of all modifications including additional details of each.

Recovery Actions

Each human action credited in the FPRA model was evaluated in the ANO-1 Fire PRA Human Reliability Analysis Notebook (PRA-A1-05-007). This includes several new actions added to the model during application of the NUREG/CR-6850 methodology.

Safe Shutdown Analysis actions were also reviewed for potential actions adverse to risk. All equipment and components needed to support the recovery action were identified as a ‘variance from deterministic requirements’ (VFDRs). Additionally, recovery actions were reviewed for adverse impact on the FPRA. An analysis of the risk associated with recovery actions was completed (PRA-A1-05-010). The total delta risk of recovery actions is 6.48E-6 (ΔCDF) and 8.66E-07 (ΔLERF).

Given a fire that results in Main Control Room (MCR) abandonment due to environmental conditions, the risk of recovery actions (any actions still available given fire damage) associated with remote shutdown is always beneficial.

<u>Control Power Transformer (CPT) Sensitivity</u>

The values listed in this attachment are the results of a study on removing credit for CPTs. This update is a result of a generic 'request for additional information' (RAI) issued to all NFPA-805 license applicants (ADAMS Accession No. ML122350225, 8-21-12, Item 16). All CPT credit was removed from the FPRA analysis and the CDF, LERF, ΔCDF, and ΔLERF were updated. The full analysis is documented in ANO reports CALC-10-E-0023-04 and PRA-A1-05-014.

<u>Unapproved Analysis Methods</u>

Development of the ANO-1 FPRA did not deviate from the methods outlined in NUREG/CR-6850 (including FAQs documented in Attachment H and other interim guidance documents). No unapproved analysis methods were used or applied in any of the supporting analyses. The CPT sensitivity represents the only method sensitivity analysis included in the documentation. No other method sensitivities are needed due to the FPRA compliance with the approved analysis methods.

<u>Uncertainty</u>

The results presented below represent the combined effort and calculations of several tasks. Uncertainty in the FPRA results occurs because there is both inherent randomness in essentially all of the elements that comprise the FPRA and because there is a lack of, or weaknesses in, the state of knowledge in these elements.

Two types of uncertainty are considered in probabilistic risk assessments, both of which may be modeled with probability distributions:

- Aleatory uncertainty, which characterizes the inherent randomness of a parameter.
- Epistemic uncertainty, which characterizes the state of knowledge about a parameter.

Latin hypercube analysis was used to propagate parametric uncertainties through the ANO-1 FPRA model to generate probability density distributions for CDF and LERF. The parameters used to support this analysis were ignition frequency, circuit failure, non-suppression, human reliability analysis (HRA), and existing internal event PRA failure data.

Uncertainty results are not included in the results presented in this attachment. Individual task uncertainty and collective FPRA uncertainty details are documented in the FPRA Summary Report (PRA-A1-05-005) and the ANO-1 Fire PRA Uncertainty and Sensitivity Analysis (PRA-A1-05-006).

W.2 Risk Change Due to NFPA 805 Transition

The risk change due to the NFPA 805 transition meets the acceptance guidelines of RG 1.205. RG 1.205 requires that the total risk increase should be consistent with the acceptance guidelines in RG 1.174 in accordance with the guidance in Regulatory Position 2.2.4.2 of RG 1.205, Revision 1.

Change in CDF and LERF

There is a net risk benefit as a result of the transition to NFPA 805. The total ΔCDF for this application is calculated to be -1.81E-04 (the sum of the calculated delta risk from Table W-2), which is a decrease in risk. The total decrease in ΔLERF is calculated to be -3.39E-05. These values include credited recovery actions and plant modifications (documented in Attachments G and S, respectively). These changes in the plant CDF and LERF meet the RG 1.174 criteria as the total change in risk associated with the transition to NFPA 805 results in a small risk reduction and the total plant fire risk is below 1E-04 for CDF and 1E-05 for LERF.

The risk results show a reduction in risk associated with the transition to NFPA 805 due to the methodology used in the FREs. The compliant case measures the current plant with all VFDRs protected (corresponding PRA basic events set to TRUE, or protected from failure) in the model quantification. The non-compliant case evaluates the plant at the point of full implementation of NFPA 805. In these cases, the variant components are not protected (corresponding PRA components subject to potential fire damage or random failure). However, the non-compliant case credits plant modifications. Thus, the delta risk evaluations ultimately compare the risk of each individual area at the point of full implementation of NFPA 805 with the risk of the same area of the current plant given an ideal, deterministically compliant arrangement. The large reduction in risk is a result of the risk benefit of the scheduled modifications (documented in Attachments S) having greater impact than the total sum of the risk associated with deterministic non-compliance.

Site Risk from Internal Events

Although RG 1.174 does not require calculation of total CDF and LERF, if the increases are below the ΔCDF and ΔLERF of 1E-06 and 1E-07 respectively, the RG does recommend that, if there is an indication that the CDF is 'considerably higher' than 1E- 04 or if LERF is 'considerably higher' than 1E-05, then the focus should be on finding ways to decrease CDF or LERF.

The total CDF including Fire and Internal events has a value of 6.34E-05 (Internal Events CDF (2.88E-6) + Internal Floods (1.04E-06) + Fire CDF (5.95E-05)), and the total LERF has a value of 5.38E-06 (Internal Events LERF (5.82E-08) + Internal Floods (1.73E-07) + Fire LERF (5.15E-06)). Both values are below the RG 1.174 criteria of 1E-04 (CDF) and 1E-05 (LERF).

The aforementioned total CDF and LERF values do not include contribution from external events. Therefore, the contribution to risk from external events is captured below.

Site Risk from External Events

Seismic – An NRC report ("Generic Issue 199 (GI-199) – Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants," August 2010) provides Seismic CDF estimates for many of the nuclear facilities in the United States. The study uses information from the site Individual Plant Examination of External Events (IPEEE) along with 2008 United States Geological Survey (USGS) Seismic Hazard Curves to estimate the CDF due to seismic events. This document estimates the ANO-1 Seismic CDF to be 4.1E-6.

Flooding and other External Events – High winds, floods, or off-site industry facility accidents do not contribute significantly to ANO site risk. For the external events the CDF is also estimated to be less than 1E-6. This is consistent with the discussions of the events in Sections 2.3 through 2.11 of NUREG-1407.

A bounding estimate of the overall CDF risk due to external events (including seismic, external flooding, and off-site industry facility accidents) is estimated to be less than 1E-5. A total bounding estimate for LERF external events is assumed to be 0.1 of the total CDF, which is less than 1E-6.

Table W-1a – Fire PRA CDF Significant Fire Initiating Events (Individually Representing > 1% of the Calculated CDF)							
Scenario	Description	Contribution		Risk insights	CCDP[1]	IF[2]	CDF[3]
		% of Total	Cumulative				
100-N/A	South Switchgear Room – Base Scenario - Severe Fire	9.3%	9.3%	Fire scenario 100-N is located in the south switchgear room. This scenario represents a severe fire which damages all targets within the zone. The top cutset requires the Control Room to trip the Reactor Coolant Pumps (RCPs) since RCP seal injection is unavailable. High pressure injection (HPI) is available for this scenario when Service Water (SW) pump P-4C is running. The Auxiliary Feedwater (AFW) pump modification is the only source of primary to secondary heat removal credited for this scenario. Green train power to safety bus A-4 is available.	2.42E-03	2.28E-03	5.53E-06
129-F/A	Control Room Abandonment – Base Scenario	7.9%	17.1%	Fire scenario 129-F represents the MCR abandonment scenario. Following MCR abandonment, the operators are required to prevent an RCP seal Loss of Coolant Accident (LOCA) by manually tripping the RCPs at the H1/H2 switchgear in the turbine building. Additional actions are taken to isolate letdown valve CV-1221, de-energize a failed open electromagnetic relief valve (ERV) CV-1000, and trip any spuriously running High Pressure Injection (HPI) pumps to prevent an over pressurization of the Reactor Coolant System (RCS). Actions to manually operate HPI pumps are conservatively not credited in the scenario to mitigate these failure events. Primary to secondary heat removal is available through local control of the AFW pump modification with a dedicated offsite power source. Steam Generator (SG) indication and instrumentation is available as part of the pump modification.	1.08E-01	4.35E-05	4.68E-06
20-Y-A/A	Radwaste Processing Area	5.2%	22.4%	Fire scenario 20-Y-A represents a fire involving the three HPI pumps and associated cooling units. The top dominant cutset requires the MCR to trip the RCPs since RCP seal injection is unavailable. The Operators are required to throttle back or trip spuriously running HPI pumps to prevent an over pressurization of the RCS. The AFW pump modification and the motor driven Emergency Feedwater (EFW) pump P-7B are available for primary to secondary heat removal.	4.68E-03	6.62E-04	3.10E-06
34-Y/A	Pipe Area – Base Scenario	5.0%	27.4%	Fire scenario 34-Y represents a severe fire damaging all components and cables within the zone (Appendix R type fire). The top dominant cutset requires the MCR to trip the RCPs since RCP seal injection is unavailable. Additionally, the Operators are required to throttle back or trip spuriously running HPI pumps to prevent over pressurization should a power-operated relief valve (PORV) randomly fail to open and Pressurizer safety valves (PSVs) are stuck open following liquid release. The AFW pump modification and the steam driven EFW pump P-7A are available for primary to secondary heat removal.	4.75E-03	6.29E-04	2.99E-06

Table W-1a – Fire PRA CDF Significant Fire Initiating Events (Individually Representing > 1% of the Calculated CDF)							
Scenario	Description	Contribution		Risk insights	CCDP[1]	IF[2]	CDF[3]
		% of Total	Cumulative				
32-K/A	North Side Containment Building – Base Scenario	4.6%	31.9%	Fire scenario 32-K impacts all targets within Fire Zone 32-K. The dominant risk contributors are associated with random failure of the operator action to start the new AFW pump, or overriding a false Emergency Feedwater Initiation and Control (EFIC) signal for failure of primary to secondary heat removal. HPI is available in this scenario and feed-and-bleed is credited for cutsets that randomly fail primary to secondary heat removal. The 32-K scenario requires a manual action to isolate letdown by closing CV-1221 to prevent a small LOCA. The MCR is required to throttle the HPI pumps to prevent over pressurization of the RCS.	5.96E-04	4.56E-03	2.72E-06
104-S/A	Electrical Equipment Room – Base Scenario - Severe Fire	4.5%	36.4%	Fire Scenario 104-S is a severe fire in the electrical equipment room. The dominant cutsets include failure of the AFW pump modification, which is the only available source of primary to secondary heat removal. HPI remains available for make-up and feed-and-bleed mitigation efforts, but only when SW pump P-4C is aligned and operating at the time of the fire.	1.73E-03	1.54E-03	2.67E-06
73-W/HGL	Condensate Demineralizer Area – Base Scenario	4.5%	40.9%	Fire scenario 73-W is a hot gas layer (HGL) scenario that starts from any ignition source in Fire Zone 73-W and is not suppressed before a formation of a HGL. As a result, all cables within Fire Zone 73-W are assumed to fail. The AFW pump modification is available in addition to the steam driven EFW pump P-7A for feedwater injection. The risk is driven by the need for the operators to trip the RCPs after assumed loss of Component Cooling Water (CCW).	4.76E-03	5.60E-04	2.67E-06
75-AA/A	Boiler Room – Base Scenario	4.2%	45.2%	Fire scenario 75-AA represents a severe fire damaging all components and cables within the zone (Appendix R type fire). The boiler room scenario fails both vital buses A-1 and A-2 for offsite power feed. Emergency Diesel Generators (EDGs) are required to operate to provide power necessary for shutdown. The top cutset is associated with a common cause failure of both EDGs and the Alternate AC Diesel Generator (AACDG or Station Blackout diesel generator). Fire Zone 75-AA is the proposed location for portions of the AFW pump modification and, therefore, the AFW pump is not credited for secondary to primary heat removal. Steam-driven EFW pump P-7A is available until vital battery bank discharge as the primary source of feedwater supply to the SG for primary to secondary heat removal.	2.83E-04	8.93E-03	2.53E-06

Table W-1a – Fire PRA CDF Significant Fire Initiating Events (Individually Representing > 1% of the Calculated CDF)							
Scenario	Description	Contribution % of Total	Contribution Cumulative	Risk insights	CCDP[1]	IF[2]	CDF[3]
99-M/A	North Switchgear Room – Base Scenario	3.8%	48.9%	Fire scenario 99-M is a severe fire that impacts all targets in the green train switchgear room. The top dominant cutset requires the MCR to trip the RCPs since RCP seal injection is unavailable. HPI is available, but requires the MCR to manually override a false EFIC signal. The fire scenario requires a manual action to isolate SW from the Auxiliary Cooling Water (ACW) system to prevent flow diversion and SW pump run-out when crediting HPI for make-up or feed-and-bleed. The AFW pump modification provides the primary source of primary to secondary heat removal.	1.13E-03	2.00E-03	2.25E-06
197-X-AT/A	Switchgear fire - A-1, A-2, H-1, H-2	3.0%	52.0%	Fire scenario 197-X-AT is a severe fire that impacts the offsite power 4kV switchgears A-1/A-2, and the 6.9kV switchgears H1/H2 in the single fire scenario. Offsite power is unavailable and EDGs K4A and K4B are required for power to the vital safety buses. Feedwater remains available from the AFW pump modification, and the steam driven EFW pump P-7A. The risk for the scenario is driven by the need for the operators to trip the RCPs. HPI is available for injection into the RCS.	3.51E-04	5.12E-03	1.80E-06
129-F-AS/A	Unit 1 Control Room – C20	2.9%	54.9%	Fire scenario 129-F-AS models a fire at panel C20 in the MCR. Smoke detection will be installed as a plant modification to reduce the risk associated with this scenario (see Table S-1, Item S1-9). The dominant cutset requires the MCR to trip the RCPs since seal injection is failed due to a fire in this panel. HPI is available for makeup depending on the running pump at the time of the fire. The AFW pump modification is available and credited as the primary source of feedwater for primary to secondary heat removal. Power is lost to red and green train switchgear as a result of a fire in this panel.	1.84E-02	9.50E-05	1.75E-06
33-K/B	South Side Containment Building – Panel Fire Outside Shield Wall - IGF = (Bin 15&26 contribution)	2.9%	57.8%	Fire scenario 33-K represents a fire that damages the entire contents in the south side of the containment building (Fire Area J-South). The dominant cutsets require an Operator action to close letdown valve CV-1221 to prevent an RCS boundary breach. The AFW pump modification is available as the primary source of feedwater for primary to secondary heat removal. A spurious EFIC signal would require the MCR to manually override additional EFW pumps. HPI is available for feed-and-bleed and RCS inventory make-up.	1.26E-03	1.38E-03	1.74E-06

Table W-1a – Fire PRA CDF Significant Fire Initiating Events (Individually Representing > 1% of the Calculated CDF)							
Scenario	Description	Contribution		Risk insights	CCDP[1]	IF[2]	CDF[3]
		% of Total	Cumulative				
98-J-X/HGL	Access Corridor (Suppression Available)	2.8%	60.6%	Fire scenario 98-J-X represents a HGL scenario in the 98-J access corridor. This fire scenario represents the fraction of fires in which the automatic suppression system does not actuate and the manual suppression does not occur prior to development of a HGL damaging all targets within the zone. This fire scenario damages all targets in Fire Zone 98-J except for the targets located in Room 111. The dominant risk contributing cutsets include Operator actions to mitigate an RCS boundary breach by closing letdown valve CV-1221 and tripping the RCPs from within the MCR. Additionally, the Operators are required to throttle back or trip a spuriously operating HPI pump to prevent over pressurization of the RCS. The AFW modification is the sole source of credited feedwater for primary to secondary heat removal.	5.80E-02	2.85E-05	1.65E-06
73-W-TN4/A	Condensate Demineralizer Area	1.8%	62.4%	Fire scenario 73-W-TN4 is a transient fire scenario in Fire Zone 73-W. The dominant cutset is associated with failing to trip the RCPs since RCP seal injection is unavailable. One train of HPI is available depending on the pre-alignment position of the operating pump and discharge path at the time of the fire. The AFW pump modification and the steam driven EFW pump P-7A are available for primary to secondary heat removal.	4.76E-03	2.23E-04	1.06E-06
73-W-TN5/A	Condensate Demineralizer Area	1.8%	64.2%	Fire scenario 73-W-TN5 is a transient fire scenario in Fire Zone 73-W. The dominant cutset is associated with failing to trip the RCPs since RCP seal injection is unavailable. One train of HPI is available depending on the pre-alignment position of the operating pump and discharge path at the time of the fire. The AFW pump modification and the steam driven EFW pump P-7A are available for primary to secondary heat removal.	4.76E-03	2.23E-04	1.06E-06
73-W-TN6/A	Condensate Demineralizer Area	1.8%	65.9%	Fire scenario 73-W-TN6 is a transient fire scenario in 73-W. The dominant cutset is associated with failing to trip the RCPs since RCP seal injection is unavailable. One train of HPI is available depending on the pre-alignment position of the operating pump and discharge path at the time of the fire. The AFW pump modification and the steam driven EFW pump P-7A are available for primary to secondary heat removal.	4.76E-03	2.23E-04	1.06E-06
73-W-TN9/A	Condensate Demineralizer Area	1.8%	67.7%	Fire scenario 73-W-TN9 is a transient fire scenario in 73-W. The dominant cutset is associated with failing to trip the RCPs since RCP seal injection is unavailable. One train of HPI is available depending on the pre-alignment position of the operating pump and discharge path at the time of the fire. The AFW pump modification and the steam driven EFW pump P-7A are available for primary to secondary heat removal.	4.76E-03	2.23E-04	1.06E-06

Table W-1a – Fire PRA CDF Significant Fire Initiating Events (Individually Representing > 1% of the Calculated CDF)

Scenario	Description	Contribution % of Total	Contribution Cumulative	Risk insights	CCDP[1]	IF[2]	CDF[3]
100-N-E-NS/A	South Switchgear Room -A-3	1.5%	69.2%	Scenario 100-N-E-NS is a non-severe scenario for a fire at vital switchgear A-3 which impacts nearby surrounding conduits. This fire is manually suppressed before the cable trays above are damaged. The result of the fire precludes the use of red train safety equipment, but green train power supply from A-4 remains available. The AFW pump modification is the primary credited source of feedwater for this scenario. See scenario 100-N for additional details.	2.16E-03	4.19E-04	9.05E-07
53-Y/A	Lower North Piping Penetration Area – Base Scenario	1.5%	70.7%	Fire scenario 53-Y, is a base scenario (Appendix R type fire) in the Lower North Piping Penetration Area. The dominant risk contributors for this scenario require the MCR to trip the RCPs since RCP seal injection is failed. An in-MCR action is required to isolate letdown, if automatic isolation of letdown fails to initiate. The AFW pump modification and motor driven EFW pump P-7B are available for primary to secondary heat removal.	3.25E-03	2.74E-04	8.91E-07
110-L/A	South Battery Room – Severe Fire	1.3%	72.0%	Fire scenario 110-L is a base scenario (Appendix R type fire) in the DC battery room. The dominant cutsets require the MCR to trip the RCPs since RCP seal injection is failed. The DC power supply modification provides the redundant control power required for tripping the RCPs within the MCR. The AFW pump modification is the credited source of feedwater for primary to secondary heat removal. An Operator action is also required to throttle back the HPI pumps following spurious actuation of the pumps to prevent over pressurization of the RCS.	3.91E-04	1.92E-03	7.51E-07
98-J-TN3/A	Access Corridor	1.2%	73.2%	98-J-TN3 is a transient fire within the corridor of Fire Zone 98-J. The dominant risk contributing cutsets include Operator actions to mitigate an RCS boundary breach by closing letdown valve CV-1221, and tripping the RCPs from within the MCR. Additionally, the Operators are required to throttle back or trip a spuriously operating HPI pump to prevent over pressurization of the RCS. The AFW modification is the sole source of credited feedwater for primary to secondary heat removal.	5.80E-02	1.24E-05	7.18E-07
128-E/A	Controlled Access Area – Base Scenario	1.1%	74.3%	Fire scenario 128-E is a conservative full room burnout scenario. The AFW pump modification is required for the sole source of feedwater injection into the SGs. The risk is dependent on the Operators to trip the RCPs on assumed loss of CCW. HPI is available and can be initiated by the Operators for injection into the RCS.	1.64E-03	3.97E-04	6.52E-07

Notes:

[1] CCDP – Conditional Core Damage Probability

[2] IF – Ignition Frequency (includes severity factor and probability of non-suppression, where applicable.)

[3] CDF – Core Damage Frequency

Table W-1b – Fire PRA LERF Significant Fire Initiating Events (Individually Representing > 1% of the Calculated LERF)							
Scenario	Description	Contribution		Risk insights	CLERP[1]	IF[2]	LERF[3]
		% of Total	Cumulative				
100-N/A	South Switchgear Room Base Scenario – Severe Fire	13.9%	13.9%	See Table W-1a for risk insights.	3.13E-04	2.28E-03	7.16E-07
129-F/A	Control Room – Abandonment Base Scenario	12.1%	26.0%	See Table W-1a for risk insights.	1.44E-02	4.35E-05	6.26E-07
75-AA/A	Boiler Room – Base Scenario	8.3%	34.4%	See Table W-1a for risk insights.	4.81E-05	8.93E-03	4.30E-07
104-S/A	Electrical Equipment Room – Base Scenario - Severe Fire	6.3%	40.7%	See Table W-1a for risk insights.	2.12E-04	1.54E-03	3.27E-07
97-R-M1/M	Cable Spreading Room and Relay Room Multi-Component Analysis (MCA)	5.4%	46.1%	Fire Scenario 97-R-M1 is a multi-compartment scenario for a fire starting in the Integrated Control System (ICS) relay room (Fire Zone 97-R) with a HGL propagating through the barrier and into the Cable Spreading Room. The containment isolation valves are routed through the Cable Spreading Room and are impacted by fire in the LERF sequences for this scenario. For a fire in the ICS relay room, the top risk cutsets require Operator actions to maintain RCS integrity. RCP seal cooling is assumed unavailable in the analysis, requiring the MCR to trip the RCPs to prevent a seal LOCA. The MCR is also required to take the action to throttle back the HPI pumps following a fire induced spurious start, which if failed, could result in a liquid release and a PSV failing to reclose. A manual action is credited to close PORV block valve CV-1000 to maintain RCS integrity after the ERV is failed open. HPI is not available in the model to mitigate the LOCA sequences due to failure of Borated Water Storage Tank (BWST) level transmitters, LT-1411 and LT-1421, and the analysis conservatively does not credit a manual action to align and operate the pumps. Primary to secondary heat removal is available through the AFW pump modification. Red and Green train safety buses A-3 and A-4 remain available.	4.78E-02	5.80E-06	2.77E-07
99-M/A	North Switchgear Room – Base Scenario	4.9%	51.1%	See Table W-1a for risk insights.	1.28E-04	2.00E-03	2.55E-07

Table W-1b – Fire PRA LERF Significant Fire Initiating Events (Individually Representing > 1% of the Calculated LERF)							
Scenario	Description	Contribution		Risk insights	CLERP[1]	IF[2]	LERF[3]
		% of Total	Cumulative				
129-F-AS/A	Unit 1 Control Room	4.5%	55.6%	See Table W-1a for risk insights.	2.44E-03	9.50E-05	2.32E-07
97-R-M3/M	Cable Spreading Room and Relay Room MCA	4.4%	60.0%	Fire Scenario 97-R-M3 is a multi-compartment scenario for a fire starting in the Cable Spreading Room and propagating a HGL into the MCR. The containment isolation valves are routed through the Cable Spreading Room and are impacted by fire in the LERF sequences for this scenario. The dominant core damage sequences are the same as described for 129-F/A in Table W-1a.	1.08E-01	2.11E-06	2.27E-07
32-K/A	North Side Containment Building – Base Scenario	3.0%	63.0%	See Table W-1a for risk insights.	3.39E-05	4.56E-03	1.55E-07
97-R/A	Cable Spreading Room and Relay Room – Base Scenario	2.6%	65.5%	Fire Scenario 97-R is a transient fire that is not suppressed, and impacts all targets located within Fire Zone 97-R. This scenario requires ex-MCR actions to prevent an RCS boundary breach. These actions include tripping the RCPs to prevent a seal LOCA, de-energizing failed open ERV CV-1000, and preventing over pressurization of the RCS from a spuriously running HPI pump. The AFW pump modification is credited to be operated manually at the pump location as the primary source of feedwater for primary to secondary heat removal. Containment isolation valves are impacted in this scenario.	4.78E-02	2.79E-06	1.33E-07
100-N-E-NS/A	South Switchgear Room A-3	2.4%	67.9%	See Table W-1a for risk insight.	2.91E-04	4.19E-04	1.22E-07
197-X-WHD-TN3/A	Unit 1 Turbine Building 197-X-WHD-TN3	2.1%	70.0%	Fire Scenario 197-X-WHD-TN3 is a transient fire in the west heater deck in the turbine building. The dominant risk contributing sequence consists of failure of the AFW pump modification, which is the sole source of primary secondary heat removal for this scenario. HPI is available for feed-and-bleed and is credited to mitigate sequences with random failure of the AFW pump modification.	4.99E-05	2.12E-03	1.06E-07
33-K/B	South Side Containment Building – Panel Fire Outside Shield Wall (IGF = (Bin 15&26 contribution)	1.9%	71.9%	See Table W-1a for risk insight.	7.02E-05	1.38E-03	9.69E-08

Table W-1b – Fire PRA LERF Significant Fire Initiating Events (Individually Representing > 1% of the Calculated LERF)							
Scenario	Description	Contribution		Risk insights	CLERP[1]	IF[2]	LERF[3]
		% of Total	Cumulative				
98-J-X/HGL	Access Corridor (Suppression Available)	1.5%	73.3%	See Table W-1a for risk insight.	2.68E-03	2.85E-05	7.64E-08
197-X-TN7/A	ANO-1 Turbine Building 197-X-TN7 Transient – Base Scenario	1.4%	74.7%	Fire Scenario 197-X-TN7 is a large transient fire in the turbine building. The RCP trip capability from the MCR is not available and RCP trip from the H1 and H2 switchgear is dominant. Failure to isolate letdown, failure to isolate the PORV and ERV, and failure to trip HPI pumps, as well as failures associated with the AFW pump modification, represent the other dominant cutsets for this fire scenario.	6.09E-06	1.16E-02	7.06E-08
197-X-WHD-TN1/A	ANO-1 Turbine Building 197-X-WHD-TN1	1.2%	75.9%	Fire Scenario 197-X-WHD-TN1 is a transient fire in the west heater deck in the turbine building. The dominant risk contributing sequence consists of failure of the AFW pump modification, which is the sole source of primary secondary heat removal for this scenario. HPI is available for feed-and-bleed and is credited to mitigate sequences with random failure of the AFW pump modification.	2.91E-05	2.12E-03	6.19E-08
197-X-WHD-TN2/A	ANO-1 Turbine Building 197-X-WHD-TN2	1.2%	77.1%	Fire Scenario 197-X-WHD-TN2 is a transient fire in the west heater deck in the turbine building. The dominant risk contributing sequence consists of failure of the AFW pump modification, which is the sole source of primary secondary heat removal for this scenario. HPI is available for feed-and-bleed and is credited to mitigate sequences with random failure of the AFW pump modification.	2.91E-05	2.12E-03	6.19E-08
104-S-M1/M	Electrical Equipment Room MCA	1.2%	78.3%	Fire Scenario 104-S-M1 is a multi-compartment fire that starts in Fire Zone 104-S and exposes Fire Zone 75-AA with a propagated HGL. Fire Zone 75-AA is the proposed installation site for portions of the AFW pump modification. Consequently, the AFW pump is assumed not to be available for primary to secondary heat removal in this scenario. HPI injection remains available for feed-and-bleed and inventory make-up as long as P-36C is initially running.	2.19E-02	2.71E-06	5.95E-08
97-R-M5/M	Cable Spreading Room and Relay Room MCA	1.1%	79.4%	Fire Scenario 97-R-M5 is a multi-compartment scenario for a fire starting in the Cable Spreading Room and exposing corridor 98-J. All cable within the Cable Spreading Room and all targets in Fire Zone 98-J except for the targets located in Room 111 are assumed to be damaged. No manual actions are credited, and the CCDP is dependent on the random failure of the fire barrier failing.	1.00E+00	5.64E-08	5.64E-08

Notes:
1 CLERP – Conditional Large Early Release Probability
2 IF – Ignition Frequency (includes severity factor and probability of non-suppression, where applicable.)
3 LERF – Large Early Release Frequency

Table W-2 – ANO-1 Fire Area Risk Summary

Fire Area	Area Description	NFPA 805 Basis	Fire Area CDF	Fire Area LERF	VFDR[1] (Yes/No)	RAs	Fire Risk Eval ΔCDF	Fire Risk Eval ΔLERF	Additional Risk of RAs (CDF/LERF)
A	10-EE, East Decay Heat Removal Pump Room	4.2.3.2	1.41E-09	7.27E-12	N	n/a	n/a	n/a	n/a
AAC	SBOD, Alternate Diesel Building	4.2.3.2	4.07E-09	7.78E-11	N	n/a	n/a	n/a	n/a
B-1@120-E	120-E, Boric Acid Addition Tank and Pump Room, 125-E, Respirator Storage Room, 128-E, Controlled Access Area, 149-E, Upper North Electrical Penetration Room, Hot Tool Room and Decontamination Room, 79-U, Upper North Piping Penetration Room	4.2.4.2	2.06E-06	1.73E-07	Y	N	-5.94E-06	-1.09E-06	n/a
B-1@170-Z	170-Z, Steam Piping Area	4.2.4.2	9.72E-10	1.12E-10	Y[1]	N	n/a	n/a	n/a
B-1@40-Y	40-Y, Pipe Area	4.2.4.2	6.16E-10	8.05E-12	Y	N	5.65E-10	7.71E-12	n/a
B-1@73-W	73-W, Condensate Demineralizer Area	4.2.4.2	7.75E-06	2.02E-07	Y	N	-1.90E-05	-4.07E-06	n/a
B-1@BOFZ	157-B, Chemical Addition Area, 159-B, Spent Fuel Area, 160-B, Computer Room, 161-B, Ventilation Equipment Area, 163-B, Reactor Building Purge Room, 167-B, Computer Transformer Room, 168-B, Transformer Room, 175-CC, Lube Oil Storage Tank Room, 187-DD, Dirty & Clean Lube Oil Storage Tank Room, 197-X, Unit 1 Turbine Building, 2026-Y, Unit 1 Drumming Station, 75-AA, Boiler Room, 78-BB, Gas Bottle Storage Area	4.2.4.2	5.53E-06	5.78E-07	Y	Y	-4.44E-05	-8.01E-06	2.02E-06 / 1.27E-08
B-1@WHD	197-X, Unit 1 Turbine Building	4.2.4.2	1.34E-06	2.30E-07	Y	N	-1.33E-05	-2.31E-06	n/a

Table W-2 – ANO-1 Fire Area Risk Summary

Fire Area	Area Description	NFPA 805 Basis	Fire Area CDF	Fire Area LERF	VFDR[1] (Yes/No)	RAs	Fire Risk Eval ΔCDF	Fire Risk Eval ΔLERF	Additional Risk of RAs (CDF/LERF)
B-7	12-EE, Tendon Gallery Access Area, 14-EE, West Decay Heat Removal Pump Room, 4-EE, General Access Area	4.2.3.2	2.71E-08	2.63E-10	N	N	n/a	n/a	n/a
B-8@SEPR	104-S, Electrical Equipment Room, 105-T, Lower South Electrical Penetration Room, 144-D, Upper South Electrical Penetration Room, , 76-W, Compressor Room	4.2.4.2	3.89E-06	4.28E-07	Y	N	-2.58E-05	-4.64E-06	n/a
B-8@SPPR	46-Y, Lower South Piping Penetration Area, 77-V, Upper South Piping Penetration Room	4.2.4.2	1.81E-07	3.10E-08	Y[1]	N	n/a	n/a	n/a
B-9	67-U, Lab And Demineralizer Access Area, 68-P, Reactor Coolant Makeup Tank Room, 88-Q, Communications Room, 89-P, Controlled Access Area	4.2.4.2	8.63E-07	7.57E-09	Y[1]	N	n/a	n/a	n/a
B-10	162-A, Stairwell Number 1	4.2.4.2	1.23E-09	8.32E-12	Y	N	1.19E-09	8.03E-12	n/a
C	20-Y, Radwaste Processing Area, 31-Y, Purification Demineralizer Area, 34-Y, Pipe Area, 38-Y, Emergency Feedwater Pump Area, 47-Y, Penetration Ventilation Area, 53-Y, Lower North Piping Penetration Area	4.2.4.2	7.83E-06	1.05E-07	Y	N	-2.55E-05	-4.69E-06	n/a
D	1-E, North Emergency Diesel Generator Exhaust Fans, 86-G, North Diesel Generator Room	4.2.3.2	5.27E-09	1.08E-10	N	n/a	n/a	n/a	n/a
E	100-N, South Switchgear Room	4.2.4.2	6.47E-06	8.39E-07	Y	N	-2.69E-05	-4.93E-06	n/a

Table W-2 – ANO-1 Fire Area Risk Summary

Fire Area	Area Description	NFPA 805 Basis	Fire Area CDF	Fire Area LERF	VFDR[1] (Yes/No)	RAs	Fire Risk Eval ΔCDF	Fire Risk Eval ΔLERF	Additional Risk of RAs (CDF/LERF)
F	110-L, South Battery Room	4.2.4.2	1.08E-06	4.25E-08	Y[1]	N	n/a	n/a	n/a
G	129-F, Unit 1 Control Room, 2098-C, Core Protection Calculator (CPC) Room, 2098-L, Cable Spreading Room, 2119-H, Records Storage, 2136-I, Health Physics, Corridor, 2137-I, Upper South Electrical Penetration Room and Hot Instrument Shop, 2150-C, Core Protection Calculator (CPC) Room, 2199-G, Control Room, 97-R, Cable Spreading Room and Relay Room	4.2.4.2	8.64E-06	1.62E-06	Y	Y	-2.50E-07	1.29E-08	4.45E-06 / 8.53E-07
H	2-E, South Emergency Diesel Generator Exhaust Fans, 87-H, South Diesel Generator Room	4.2.3.2	7.49E-08	7.85E-09	N	n/a	n/a	n/a	n/a
I-1	98-J, Access Corridor	4.2.4.2	5.16E-06	2.69E-07	Y	N	2.31E-07	-5.52E-07	n/a
I-2	99-M, North Switchgear Room	4.2.4.2	2.57E-06	2.65E-07	Y	N	-1.99E-05	-3.59E-06	n/a
I-3	112-I, Lower North Electrical Penetration Room	4.2.4.2	4.88E-07	3.76E-08	Y	N	9.36E-08	1.31E-09	n/a
J-NORTH	32-K, North Side Containment Building	4.2.4.2	2.82E-06	1.61E-07	Y[1]	N	n/a	n/a	n/a
J-SOUTH	33-K, South Side Containment Building	4.2.4.2	1.84E-06	1.02E-07	Y[1]	N	n/a	n/a	n/a
K	16-Y, Clean Waste Receiver Tank Area, 2020-JJ, BMS Holdup Tank Vault	4.2.3.2	1.03E-10	6.83E-13	N	n/a	n/a	n/a	n/a
L	TKVLT, Emergency Diesel Fuel Storage Vault	4.2.3.2	1.35E-08	1.01E-09	N	n/a	n/a	n/a	n/a

Table W-2 – ANO-1 Fire Area Risk Summary

Fire Area	Area Description	NFPA 805 Basis	Fire Area CDF	Fire Area LERF	VFDR[1] (Yes/No)	RAs	Fire Risk Eval ΔCDF	Fire Risk Eval ΔLERF	Additional Risk of RAs (CDF/LERF)
MH01	1MH01, Manholes	4.2.3.2	2.88E-09	1.35E-10	N	n/a	n/a	n/a	n/a
MH02	1MH02, Manholes	4.2.3.2	9.05E-09	7.05E-10	N	n/a	n/a	n/a	n/a
MH03	1MH03, Manholes	4.2.4.2	1.29E-07	1.07E-08	Y	N	1.04E-07	9.22E-09	n/a
MH04	1MH04, Manholes	4.2.3.2	1.42E-07	9.86E-09	N	n/a	n/a	n/a	n/a
MH05	1MH05, Manholes	4.2.4.2	1.34E-07	1.12E-08	Y	N	1.09E-07	9.62E-09	n/a
MH06	1MH06, Manholes	4.2.3.2	1.46E-07	1.01E-08	N	n/a	n/a	n/a	n/a
MH09	1MH09, Manholes	4.2.3.2	5.87E-09	4.41E-10	N	n/a	n/a	n/a	n/a
MH10	1MH10, Manholes	4.2.3.2	5.87E-09	4.41E-10	N	n/a	n/a	n/a	n/a
N	INTAKEU1, Intake Pump House Unit 1	4.2.4.2	1.96E-08	2.79E-10	Y	N	1.49E-08	2.20E-10	n/a
O	95-O, North Battery Room	4.2.4.2	1.52E-08	7.39E-10	Y	N	-2.87E-08	-4.57E-09	n/a
YARD	YARD, Protected Area Outside Plant Inside Fence	4.2.3.2	2.21E-08	1.71E-09	N	n/a	n/a	n/a	n/a
Various	ANO-2 – Specific Fire Areas[2]	4.2.3.2	2.72E-07	8.06E-09	N	n/a	n/a	n/a	n/a
	Total		**5.95E-05**	**5.15E-06**			**-1.81E-04**	**-3.39E-05**	**6.48E-06 / 8.66E-07**

[1] In several areas, VFDRs exist, but are not linked to PRA components or basic events. In these cases no delta risk calculation was performed (as there is no delta to evaluate). An example of this may be heating, ventilation, and air conditioning (HVAC) components. In the deterministic realm the loss of HVAC to both trains of safe shutdown (SSD) equipment would be considered a VFDR. However, in a realistic PRA it may be shown that loss of HVAC does not prevent the equipment from performing its function during the mission time of the analysis, and therefore the HVAC components would not be modeled in the PRA. Another example of this is equipment required for the transition to cold shutdown. Such items may have VFDRs associated with them, but are outside the scope of PRA as cold shutdown is beyond the 24-hour mission time.

[2] ANO-2 specific fire areas were conservatively assessed to contribute to the ANO-1 CDF/LERF from fires originating in areas that are not associated with ANO-1 or are not considered common areas. Fires in these areas typically do not impact circuits for ANO-1 components and are not expected to cause, or require, an ANO-1 plant trip. However, since the two units are adjacent, there is the potential that cables for shared components or ANO-1 cables with unknown routing are routed through ANO-2 specific fire areas. Therefore, the fire risk in each of the ANO-2 specific fire areas was quantified to assess the impact of loss of cabling in these areas on ANO-1 and the results were summed to provide the values. The risk values were calculated with the conservative assumption that a fire in each of these areas would result in a trip of ANO-1. Fires in the ANO-2 specific fire zones within Fire Area G (2098-C, 2098-L, 2119-H, 2136-I, 2137-I, 2150-C, and 2199-G) are not included in this value since these are included in the Fire Area G results.

Entergy Operations, Inc.
Arkansas Nuclear One – Unit 1

Enclosure 2 to
1CAN011401

Transition to 10 CFR 50.48(c) - NFPA 805

Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition

Proposed Operating License and Technical Specification Changes
(mark-up)

January 27, 2014

(8) <u>Fire Protection</u>

EOI shall implement and maintain in effect all provisions of the approved f~~F~~ire p~~P~~rotection p~~P~~rogram ~~as described in Appendix 9A to the SAR and as approved in the Safety Evaluation dated March 31, 1992, subject to the following provision:~~that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the licensee amendment request dated ___________ (and supplements dated ___________) and as approved in the safety evaluation report dated ___________. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c), and provided no other regulation, technical specification, license condition or requirement would require prior NRC approval,

~~1. AP&L[1] may proceed with and is required to complete the modifications identified in Paragraphs 3.1 through 3.19 of the NRC's Fire Protection Safety Evaluation on the facility dated August 22, 1978, and supplements thereto. These modifications shall be completed as specified in Table 3.1 of the Safety Evaluation Report or supplements thereto. In addition, the licensee may proceed with and is required to complete the modifications identified in Supplement 1 to the Fire Protection Safety Evaluation Report, and any future supplements. These modifications shall be completed by the dates identified in the supplement.~~

~~2. T~~the licensee may make changes to the ~~approved~~ f~~F~~ire p~~P~~rotection p~~P~~rogram without prior approval of the Commission ~~only~~ if those changes satisfy the provisions set forth in 10 CFR 50.48(a) and 10 CFR 50.48(c), the change does not require a change to a technical specification or a license condition, and the criteria listed below are satisfied~~would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire~~.

<u>Risk-Informed Changes that may be Made Without Prior NRC Approval</u>

A risk assessment of the change must demonstrate that the acceptance criteria below are met. The risk assessment approach, methods, and data shall be acceptable to the NRC and shall be appropriate for the nature and scope of the change being evaluated; be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant. Acceptable methods to assess the risk of the change may include methods that have been used in the peer-reviewed fire PRA model, methods that have been approved by NRC through a plant-specific license amendment or NRC approval of generic methods specifically for use in NFPA 805 risk assessments, or methods that have been demonstrated to bound the risk impact.

~~[1] The Original licensee authorized to possess, use, and operate the facility was AP&L. Consequently, certain historical references to AP&L remain in the license conditions.~~

1. Prior NRC review and approval is not required for changes that clearly result in a decrease in risk. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

2. Prior NRC review and approval is not required for individual changes that result in a risk increase less than 1×10^{-7}/year (yr) for CDF and less than 1×10^{-8}/yr for LERF. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

Moved to Page 7

(9) Mitigation Strategies

The licensee shall develop and maintain strategies for addressing large fires and explosions that include the following key areas:

1. Fire fighting response strategy with the following elements:

   (a) Pre-defined coordinated fire response strategy and guidance
   (b) Assessment of mutual aid fire fighting assets
   (c) Designated staging areas for equipment and materials
   (d) Command and control
   (e) Training of response personnel

2. Operations to mitigate fuel damage considering the following:

   (a) Protection and use of personnel assets
   (b) Communications
   (c) Minimizing fire spread
   (d) Procedures for implementing integrated fire response strategy
   (e) Identification of readily-available pre-staged equipment
   (f) Training on integrated fire response strategy
   (g) Spent fuel pool mitigation measures

3. Actions to minimize release to include consideration of:

   (a) Water spray scrubbing
   (b) Dose to onsite responders

~~[1] The Original licensee authorized to possess, use, and operate the facility was AP&L. Consequently, certain historical references to AP&L remain in the license conditions.~~

Other Changes that may be Made Without Prior NRC Approval

1. Changes to NFPA 805, Chapter 3, Fundamental Fire Protection Program

   Prior NRC review and approval are not required for changes to the NFPA 805, Chapter 3, fundamental fire protection program elements and design requirements for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is functionally equivalent or adequate for the hazard. The licensee may use an engineering evaluation to demonstrate that a change to NFPA 805, Chapter 3 element is functionally equivalent to the corresponding technical requirement. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

   The licensee may use an engineering evaluation to demonstrate that changes to certain NFPA 805, Chapter 3 elements are acceptable because the alternative is "adequate for the hazard." Prior NRC review and approval would not be required for alternatives to four specific sections of NFPA 805, Chapter 3, for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is adequate for the hazard. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard. The four specific sections of NFPA 805, Chapter 3, are as follows:

   - Fire Alarm and Detection Systems (Section 3.8);
   - Automatic and Manual Water-Based Fire Suppression Systems (Section 3.9);
   - Gaseous Fire Suppression Systems (Section 3.10); and,
   - Passive Fire Protection Features (Section 3.11).

2. Fire Protection Program Changes that have No More than Minimal Risk Impact

   Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC safety evaluation report dated ____________ to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

Moved to Page 8

(10) Upon implementation of Amendment 239 adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3.7.9.4, in accordance with Specifications 5.5.5.c.(i), 5.5.5.c.(ii), and 5.5.5.d, shall be considered met. Following implementation:

1. The first performance of SR 3.7.9.4, in accordance with Specification 5.5.5.c.(i), shall be within 15 months of the approval of TSTF-448. SR 3.0.2 will not be applicable to this first performance.

2. The first performance of the periodic assessment of CRE habitability, Specification 5.5.5.c.(ii), shall be within 15 months of the approval of TSTF-448. SR 3.0.2 will not be applicable to this first performance.

3. The first performance of the periodic measurement of CRE pressure, Specification 5.5.5.d, shall be within 15 months of the approval of TSTF-448. SR 3.0.2 will not be applicable to this first performance.

3. This renewed license is effective as of the date of issuance and shall expire at midnight, May 20, 2034.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed by:
Jon R. Johnson

Jon R. Johnson, Acting Director
Office of Nuclear Reactor Regulation

Attachment:
Appendix A - Technical Specifications and
Technical Specifications Bases (ML011710071 and ML011710100)

Date of Issuance: June 20, 2001

Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the modifications described in the January 27, 2014, submittal of the ANO-1 NFPA 805 Transition Report, Table S-1, "Plant Modifications Committed," to complete the transition to full compliance with 10 CFR 50.48(c) prior to startup from the second ANO-2 refueling outage following SER issuance.

3. The licensee shall maintain appropriate compensatory measures in place until completion of the modifications delineated above.

From Page 5

(9) Mitigation Strategies

The licensee shall develop and maintain strategies for addressing large fires and explosions that include the following key areas:

1. Fire fighting response strategy with the following elements:

   (a) Pre-defined coordinated fire response strategy and guidance
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   (c) Designated staging areas for equipment and materials
   (d) Command and control
   (e) Training of response personnel

2. Operations to mitigate fuel damage considering the following:

   (a) Protection and use of personnel assets
   (b) Communications
   (c) Minimizing fire spread
   (d) Procedures for implementing integrated fire response strategy
   (e) Identification of readily-available pre-staged equipment
   (f) Training on integrated fire response strategy
   (g) Spent fuel pool mitigation measures

3. Actions to minimize release to include consideration of:

   (a) Water spray scrubbing
   (b) Dose to onsite responders

From
Page 6

(10) Upon implementation of Amendment 239 adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3.7.9.4, in accordance with Specifications 5.5.5.c.(i), 5.5.5.c.(ii), and 5.5.5.d, shall be considered met. Following implementation:

1. The first performance of SR 3.7.9.4, in accordance with Specification 5.5.5.c.(i), shall be within 15 months of the approval of TSTF-448. SR 3.0.2 will not be applicable to this first performance.

2. The first performance of the periodic assessment of CRE habitability, Specification 5.5.5.c.(ii), shall be within 15 months of the approval of TSTF-448. SR 3.0.2 will not be applicable to this first performance.

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FOR THE NUCLEAR REGULATORY COMMISSION

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Jon R. Johnson

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Attachment:
Appendix A - Technical Specifications and
Technical Specifications Bases (ML011710071 and ML011710100)

Date of Issuance: June 20, 2001

5.0 ADMINSTRATIVE CONTROLS

5.4 Procedures

5.4.1 Written procedures shall be established, implemented, and maintained covering the following activities:

a. The applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978;

b. The emergency operating procedures required to implement the requirements of NUREG-0737 and NUREG-0737, Supplement 1, as stated in Section 7.1 of Generic Letter 82-33; and

c. ~~Fire Protection Program implementation; and~~Deleted

d. All programs specified in Specification 5.5.

Entergy Operations, Inc.
Arkansas Nuclear One – Unit 1

Enclosure 3 to
1CAN011401

Transition to 10 CFR 50.48(c) - NFPA 805

Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition

Revised Operating License and Technical Specification Pages

January 27, 2014

(8) Fire Protection

EOI shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the licensee amendment request dated ___________ (and supplements dated ___________) and as approved in the safety evaluation report dated ___________. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c), and provided no other regulation, technical specification, license condition or requirement would require prior NRC approval, the licensee may make changes to the fire protection program without prior approval of the Commission if those changes satisfy the provisions set forth in 10 CFR 50.48(a) and 10 CFR 50.48(c), the change does not require a change to a technical specification or a license condition, and the criteria listed below are satisfied.

Risk-Informed Changes that may be Made Without Prior NRC Approval

A risk assessment of the change must demonstrate that the acceptance criteria below are met. The risk assessment approach, methods, and data shall be acceptable to the NRC and shall be appropriate for the nature and scope of the change being evaluated; be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant. Acceptable methods to assess the risk of the change may include methods that have been used in the peer-reviewed fire PRA model, methods that have been approved by NRC through a plant-specific license amendment or NRC approval of generic methods specifically for use in NFPA 805 risk assessments, or methods that have been demonstrated to bound the risk impact.

1. Prior NRC review and approval is not required for changes that clearly result in a decrease in risk. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

2. Prior NRC review and approval is not required for individual changes that result in a risk increase less than 1×10^{-7}/year (yr) for CDF and less than 1×10^{-8}/yr for LERF. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

<u>Other Changes that may be Made Without Prior NRC Approval</u>

1. Changes to NFPA 805, Chapter 3, Fundamental Fire Protection Program

   Prior NRC review and approval are not required for changes to the NFPA 805, Chapter 3, fundamental fire protection program elements and design requirements for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is functionally equivalent or adequate for the hazard. The licensee may use an engineering evaluation to demonstrate that a change to NFPA 805, Chapter 3 element is functionally equivalent to the corresponding technical requirement. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

   The licensee may use an engineering evaluation to demonstrate that changes to certain NFPA 805, Chapter 3 elements are acceptable because the alternative is "adequate for the hazard." Prior NRC review and approval would not be required for alternatives to four specific sections of NFPA 805, Chapter 3, for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is adequate for the hazard. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard. The four specific sections of NFPA 805, Chapter 3, are as follows:

   - Fire Alarm and Detection Systems (Section 3.8);
   - Automatic and Manual Water-Based Fire Suppression Systems (Section 3.9);
   - Gaseous Fire Suppression Systems (Section 3.10); and,
   - Passive Fire Protection Features (Section 3.11).

2. Fire Protection Program Changes that have No More than Minimal Risk Impact

   Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC safety evaluation report dated ___________ to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the modifications described in the January 27, 2014, submittal of the ANO-1 NFPA 805 Transition Report, Table S-1, "Plant Modifications Committed," to complete the transition to full compliance with 10 CFR 50.48(c) prior to startup from the second ANO-2 refueling outage following SER issuance.

3. The licensee shall maintain appropriate compensatory measures in place until completion of the modifications delineated above.

(9) Mitigation Strategies

The licensee shall develop and maintain strategies for addressing large fires and explosions that include the following key areas:

1. Fire fighting response strategy with the following elements:

   (a) Pre-defined coordinated fire response strategy and guidance
   (b) Assessment of mutual aid fire fighting assets
   (c) Designated staging areas for equipment and materials
   (d) Command and control
   (e) Training of response personnel

2. Operations to mitigate fuel damage considering the following:

   (a) Protection and use of personnel assets
   (b) Communications
   (c) Minimizing fire spread
   (d) Procedures for implementing integrated fire response strategy
   (e) Identification of readily-available pre-staged equipment
   (f) Training on integrated fire response strategy
   (g) Spent fuel pool mitigation measures

3. Actions to minimize release to include consideration of:

   (a) Water spray scrubbing
   (b) Dose to onsite responders

(10) Upon implementation of Amendment 239 adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3.7.9.4, in accordance with Specifications 5.5.5.c.(i), 5.5.5.c.(ii), and 5.5.5.d, shall be considered met. Following implementation:

1. The first performance of SR 3.7.9.4, in accordance with Specification 5.5.5.c.(i), shall be within 15 months of the approval of TSTF-448. SR 3.0.2 will not be applicable to this first performance.

2. The first performance of the periodic assessment of CRE habitability, Specification 5.5.5.c.(ii), shall be within 15 months of the approval of TSTF-448. SR 3.0.2 will not be applicable to this first performance.

3. The first performance of the periodic measurement of CRE pressure, Specification 5.5.5.d, shall be within 15 months of the approval of TSTF-448. SR 3.0.2 will not be applicable to this first performance.

3. This renewed license is effective as of the date of issuance and shall expire at midnight, May 20, 2034.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed by:
Jon R. Johnson

Jon R. Johnson, Acting Director
Office of Nuclear Reactor Regulation

Attachment:
Appendix A - Technical Specifications and
Technical Specifications Bases (ML011710071 and ML011710100)

Date of Issuance: June 20, 2001

5.0 ADMINSTRATIVE CONTROLS

5.4 Procedures

5.4.1 Written procedures shall be established, implemented, and maintained covering the following activities:

a. The applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978;

b. The emergency operating procedures required to implement the requirements of NUREG-0737 and NUREG-0737, Supplement 1, as stated in Section 7.1 of Generic Letter 82-33; and

c. Deleted

d. All programs specified in Specification 5.5.

Entergy Operations, Inc.
Arkansas Nuclear One – Unit 1

Enclosure 4 to
1CAN011401

Transition to 10 CFR 50.48(c) - NFPA 805

Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, 2001 Edition

Entergy®

List of Regulatory Commitments

January 27, 2014

LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Entergy will complete implementation of the modifications identified in Table S-1 of Attachment S	✓		Prior to startup from the second ANO-1 refueling outage following SER issuance
Entergy will complete implementation of procedure changes, process updates, and training of affected plant personnel identified in Table S-2 of Attachment S	✓		Within six months following SER issuance