

August 16, 2005

Mr. L. M. Stinson
Vice President - Farley Project
Southern Nuclear Operating
Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2, EXEMPTION FROM
THE REQUIREMENTS OF 10 CFR PART 50, APPENDIX R (TAC NOS.
MC0627 AND MC0628)

Dear Mr. Stinson:

The Nuclear Regulatory Commission (NRC) has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix R, for the Joseph M. Farley Nuclear Plant, Units 1 and 2. This action is in response to your letters dated August 28, 2003, December 28, 2004, and June 9, 2005, that requested revisions to the exemptions from certain Appendix R requirements for Fire Area 72 that were granted in the NRC's letter dated December 29, 1986.

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Robert E. Martin, Senior Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

Enclosure: Exemption

cc w/encl: See next page

Joseph M. Farley Nuclear Plant, Units 1 & 2

cc:

Mr. J. R. Johnson
General Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 470
Ashford, AL 36312

Mr. B. D. McKinney, Licensing Manager
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

Mr. M. Stanford Blanton
Balch and Bingham Law Firm
P.O. Box 306
1710 Sixth Avenue North
Birmingham, AL 35201

Mr. J. Gasser
Executive Vice President
Southern Nuclear Operating Company, Inc.
P.O. Box 1295
Birmingham, AL 35201

State Health Officer
Alabama Department of Public Health
434 Monroe St.
Montgomery, AL 36130-1701

Chairman
Houston County Commission
P.O. Box 6406
Dothan, AL 36302

Resident Inspector
U.S. Nuclear Regulatory Commission
7388 N. State Highway 95
Columbia, AL 36319

William D. Oldfield
SAER Supervisor
Southern Nuclear Operating Company, Inc.
P.O. Box 470
Ashford, AL 36312

August 16, 2005

Mr. L. M. Stinson
Vice President - Farley Project
Southern Nuclear Operating
Company, Inc.
P.O. Box 1295
Birmingham, AL 35201-1295

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2, EXEMPTION FROM
THE REQUIREMENTS OF 10 CFR PART 50, APPENDIX R (TAC NOS.
MC0627 AND MC0628)

Dear Mr. Stinson:

The Nuclear Regulatory Commission (NRC) has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix R, for the Joseph M. Farley Nuclear Plant, Units 1 and 2. This action is in response to your letters dated August 28, 2003, December 28, 2004, and June 9, 2005, that requested revisions to the exemptions from certain Appendix R requirements for Fire Area 72 that were granted in the NRC's letter dated December 29, 1986.

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Robert E. Martin, Senior Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

Enclosure: Exemption

cc w/encl: See next page

Distribution: See next page

ADAMS Accession No.: ML052280324

NRR-048

| Office | PDII-1/PM | PDII-1/LA | SPLB/SC | PDII-1/SC | OGC | PDII/D | DLPM/D |
|--------|------------|------------|------------|------------|------------|------------|------------|
| Name | RMartin | CHawes | SWeerakody | EMarinos | MDuffy | EHackett | LMarsh |
| Date | 08/ 05 /05 | 08/ 05 /05 | 07/ 25 /05 | 08/ 08 /05 | 08/ 04 /05 | 08/ 09 /05 | 08/ 16 /05 |

OFFICIAL RECORD COPY

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2, EXEMPTION
FROM THE REQUIREMENTS OF 10 CFR PART 50, APPENDIX R
(TAC NOS. MC0627 AND MC0628)

DATED: August 16, 2005

Distribution:

PUBLIC

PDII-1 r/f

RidsNrrDlpmLpdii

RidsNrrDlpmLpdii1

RidsNrrPMRMartin

RidsNrrLACHawes

RidsOgcRp

RidsAcrcAcnwMailCenter

AKlein

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
SOUTHERN NUCLEAR OPERATING COMPANY
JOSEPH M. FARLEY NUCLEAR POWER PLANT, UNITS 1 AND 2
DOCKET NOS. 50-348 AND 50-364
EXEMPTION

1.0 BACKGROUND

The Southern Nuclear Operating Company (SNC, the licensee) is the holder of Renewed Facility Operating License Nos. NPF-2 and NPF-8 which authorizes operation of Joseph M. Farley Nuclear Power Plant (FNP), Units 1 and 2. The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of two pressurized-water reactors located in Houston County, Alabama.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.48, "Fire Protection," requires that each operating nuclear power plant have a fire protection plan that satisfies General Design Criterion (GDC) 3, "Fire Protection," of Appendix A to Part 50. Section 50.48(b) also references Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to Part 50, which establishes fire protection features required to satisfy GDC 3 with respect to certain generic issues for nuclear power plants licensed to operate before January 1, 1979. On December 29, 1986, the NRC staff granted

SNC Exemption Request 1-3, "Service Water Intake Structure - Fire Area 72," from certain requirements of Appendix R, Section III.G.2.c that requires fire detection and fire suppression capabilities and the enclosure of cables, equipment and associated non-safety circuits of one redundant train of safe shutdown equipment in a one-hour rated fire barrier. The Exemption issued on December 29, 1986, listed a total of ten items specific to Fire Area 72 that were part of Exemption Request 1-3. Exemption Request 1-3 was included in SNC's request, dated March 13, 1985, as supplemented, and is applicable to Fire Area 72 for the Service Water Intake Structure (SWIS) which is common to FNP, Units 1 and 2.

By letters dated August 28, 2003, December 28, 2004, and June 9, 2005, SNC submitted a proposed revision to Exemption Request 1-3. SNC stated in its August 28, 2003, letter that the proposed revisions to Exemption Request 1-3 would clarify FNP's fire protection licensing basis, delete unnecessary attributes of the prior approved exemption, and revise the remaining prior exemption attributes to remove references to one-hour Kaowool fire barrier material. SNC also stated that the proposed revision to Exemption Request 1-3 is part of SNC's comprehensive plan to respond to concerns about Kaowool fire barrier material. SNC's August 28, 2003, letter re-listed the Exemption Request 1-3 items and numbered them as 1 through 9 and "Addendum to Request" for ease of reference. The August 28, 2003, letter also added an item designated as "Other" that was not explicitly addressed in the December 29, 1986, NRC Safety Evaluation. Therefore, a total of 11 items (1 through 9, "Addendum to Request", and "Other") comprise the revised exemption request in SNC's August 28, 2003, letter.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, "Specific Exemptions," the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the

requirements of 10 CFR Part 50 when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. These special circumstances are described in 10 CFR 50(a)(2)(ii), in that the application of these regulations in this circumstance is not necessary to achieve the underlying purpose of the regulations.

The underlying purpose of Appendix R, Section III.G, "Fire protection of safe shutdown capability," is to provide features capable of limiting fire damage so that: (1) one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and (2) systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours.

In SNC's letter dated August 28, 2003, SNC stated that they recognize FNP, Unit 1 was licensed to operate prior to January 1, 1979, is subject to Appendix R to 10 CFR Part 50 and requires an exemption for any deviation to the rule, but that FNP, Unit 2 was licensed to operate after January 1, 1979, and would require a deviation from any commitment to comply with the rule. SNC stated that they did not distinguish between an exemption request and deviation request (license amendment) in their August 28, 2003, letter for the two units because the subject matter of the original Exemption Request 1-3 and this revised exemption is located in an area of the plant that services both units, and because the original Exemption Request 1-3 did not separately provide for a deviation (license amendment).

Overview of Approach Used by Licensee

For this specific fire protection application, SNC proposes plant and fire protection program modifications under FNP's current license conditions, and has performed deterministic

re-analyses and a risk-informed, performance-based evaluation to revise existing Exemption Request 1-3 for the SWIS Fire Area 72.

The changes proposed by SNC to Exemption Request 1-3 will (1) remove some conditions in the 1986 Exemption Request 1-3; (2) eliminate some manual actions; (3) define new fire areas; (4) modify the success criterion for the ability to remove decay heat and safely shutdown in the event of a fire in the SWIS; and (5) remove reliance on FNP, Unit 1 lube and cooling water pumps associated with the service water pumps.

As reflected in 10 CFR 50.48(c), the NRC has adopted National Fire Protection Association Standard 805, 2001 Edition (NFPA 805), with a few exceptions, as a risk-informed, performance-based alternative to NRC fire protection requirements in 10 CFR 50.48(b) and as an optional new licensing basis for plants licensed after 1979. Licensees who propose to maintain a complete fire protection program that complies with 10 CFR 50.48(c) as an alternative to 10 CFR 50.40(b) must complete their implementation of the methodology outlined in NFPA 805 for the entire plant and submit a application for a license amendment in accordance with the regulations. Although SNC has not proposed to revise its complete FNP fire protection program in accordance with 10 CFR 50.48(c) and NFPA 805, SNC has used the methodology of NFPA 805 for certain specific issues in its proposed revision to Exemption Request 1-3, as discussed below. The NRC had also previously issued Regulatory Guide (RG) 1.174 (Revision 1), "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis". SNC has used risk-informed, performance-based analysis tools and has used RG 1.174 for the risk acceptance criteria.

In general, SNC conducted a review of the SWIS which included deterministic re-analyses and an analysis using the risk-informed, performance-based methods. SNC concluded that the review and analysis showed that some of the conditions in existing

Exemption Request 1-3 were unnecessary, that the licensee would no longer rely upon some conditions in the exemption by upgrading a dividing wall and defining new fire areas, by modifying lubrication and cooling support for Service Water pumps and other program changes, and that, by plant modifications and re-analysis, show that by performing the above modifications, removal of the reliance on Kaowool would maintain or enhance safety while reducing unnecessary regulatory burden. The review and analysis conducted by SNC reflected a combination of planned modifications to FNP, deterministic re-analyses, and combined risk-informed and fire modeling analyses.

Area Description

The SWIS structure is located outside of the nuclear main power block and its support buildings. It is common to FNP, Units 1 and 2 and contains cables, pumps, valves, and other equipment necessary for the service water system. The SWIS supplies cooling water from the Service Water pond to the various essential components in both the nuclear main power block and balance of plant systems which require heat removal for proper operation during normal and accident conditions including the cooling certain plant equipment needed to achieve and maintain safe shutdown in the event of a fire. Each reactor unit has five pumps, two each in redundant Trains A and B, and a swing pump that can be aligned to either train. These pumps are spaced between five and six feet apart, on centers, and are protected by automatic fire suppression and detection systems. Redundant Train A and Train B cables supply power and controls to the pumps and support equipment. These cables are in close proximity where they enter the SWIS in the northeast corner of the building. Motor operated valves located in the strainer pit direct the pump flow for Trains A and B. These valves are horizontally separated 6 feet 6 inches on center on the FNP, Unit 1 side and 5 feet on center on the FNP, Unit 2 side of the strainer pit.

In its letter dated August 28, 2003, SNC stated that power cables in the SWIS are contained in conduit and all cables in the SWIS are qualified to the Institute of Electrical and Electronics Engineers (IEEE) 383 standard. In its letter dated December 28, 2004, SNC further stated that power and control cables have jacket and insulation materials that are qualified to the IEEE-383 standard and utilize thermoset materials. SNC stated that nearly all cables in the SWIS have thermoset plastic jacket and insulation material. SNC identified eight low-voltage polyvinyl chloride (PVC) PVC/PVC cables in a tray along the north and west wall that are thermoplastic. These cables are not located in trays and SNC stated that portions of the cable will be removed to meet the fire model analysis.

SNC will upgrade the nominal 18 inch concrete wall between Fire Zone 72A and Fire Zones 72B, C, D and E to meet the requirements of FNP's Fire Protection Program for a minimum 3-hour fire area boundary. The upgrade to the wall includes sealing penetrations and replacing un-rated doors with 3-hour rated fire doors. Three new fire areas will be defined, 72A, 72B/72C and 72D/72E. These changes will improve fire safety and defense-in-depth by reducing potential fire propagation paths between the pump deck and switchgear rooms, as well as between redundant switchgear rooms.

Fire Areas 73 and 74 remain unchanged with respect to this exemption request revision. On the FNP, Unit 1 side of the SWIS pump deck, floor curbs are located between the B- and C-Pumps and the C- and D-Pumps. SNC will provide a new floor curb to be located between the FNP, Unit 1 E-Pump and the east wall of the SWIS. On the FNP, Unit 2 side of the SWIS pump deck, floor curbs are located between the B- and C-Pumps and the C- and D-Pumps. These floor curbs and the slope of the floor help to confine a lubricant spill from one of the Service Water pumps and limit fire damage to adjacent pumps.

A concrete wall from floor to ceiling is located between the FNP, Unit 1 and FNP, Unit 2 Service Water pumps at the pump deck level. Radiant heat shields are provided on each side of the FNP, Unit 1 and FNP, Unit 2 swing Service Water pumps (C-Pump) to provide radiant heat shielding to and from adjacent Service Water pumps.

Fire Protection Equipment

The SWIS is provided with an area-wide smoke detection system located in all areas of the SWIS including the pump motor area, under the pump motor deck, in the battery rooms, in the stairways, and in the strainer area. The smoke detection system provides a local alarm and annunciates in the control room. In addition, activation of any smoke detector trips the clappers for all three preaction sprinkler systems. Tripping the clappers charges the preaction sprinkler systems with fire water.

The SWIS is also protected by automatic preaction sprinkler systems. Two preaction systems provide coverage to the entire pump deck, the area in the strainer pit beneath the pump deck, and to safety-related cabling in the upper northeast corner of the Service Water pump room. In addition, a third preaction 'spray' system for local application protects the Service Water pumps. Local carbon dioxide fire suppression systems are provided in the switchgear and transfer switch panels in Fire Zones 72B, 72C, 72D and 72E.

Upon receipt of an alarm, the Control Room would dispatch the Fire Brigade to the SWIS. Manual fire fighting equipment consisting of hose stations and portable fire extinguishers is available inside the SWIS. In addition, two fire hose/hydrant houses are located directly outside of the SWIS within the security fence. Therefore, all areas of the SWIS can be reached with an effective hose stream.

Operability and surveillance requirements for fire protection systems, including those provided for the SWIS are provided by the FNP Final Safety Analysis Report . The operability of the SWIS fire protection systems will continue to ensure defense-in-depth is maintained.

Combustible Controls

Processes and procedures are in place at FNP to address housekeeping and control of combustible loading throughout the plant. This includes housekeeping and combustible loading control in the SWIS. The procedures provide guidance for bringing combustibles into a fire area for any plant activity including guidance for determining the amount and type of fire extinguishing equipment in the event of temporary increases in potential fire loading.

SNC will implement additional specific transient combustible controls to restrict transient combustibles from being stored/located in the northeast corner and in the vicinity of the Service Water pumps. Configuration control will be maintained (from a fire protection program perspective) over the type and quantity of lubrication oil used in the Service Water pump motors. SNC will implement precautions to limit the amount of lubricant in the vicinity of the Service Water pumps during lubricant changes by removing the drained lubricant from the area prior to bringing the new (unused) lubricant into the area.

This will provide additional assurance that the conditions of the risk-informed, performance based evaluation are met and that defense-in-depth is maintained in the area.

Fire Modeling

SNC's evaluation uses the concepts from NFPA 805 for fire modeling. NFPA 805 presents two concepts, the maximum expected fire scenario (MEFS) and limiting fire scenario (LFS). The MEFSs or worst case credible scenarios are identified by considering the fire types that have a reasonable likelihood of occurrence. The LFSs are developed by altering one or more input parameters to MEFSs to determine the threshold at which a target would exceed the

critical temperature or radiant heat flux. The purpose of determining an LFS was to perform a sensitivity analysis and demonstrate adequate margin between parameters when determining MEFS and LFS.

Three scenarios were evaluated by the licensee, 1) transient combustible material fire in the northeast corner of the SWIS, 2) FNP, Unit 1 Service Water pump fire, and 3) FNP, Unit 2 Service Water pump fire. These scenarios were chosen since they were believed to be the most likely to affect multiple trains of systems. Consolidated Model of Fire Growth and Smoke Transport (CFAST) (Peacock *et al.*, 2004), HEATING Version 7.3 (Childs, 1998), and empirical correlations (thermal plume and radiant heat flux) were used to model the fires. The hot gas layer temperature and radiant heat flux exposure to the safety-related cable trays and junction boxes were determined for the MEFSs. The licensee evaluated other fire scenarios such as smaller quantities of lubricant oil, motor windings, and other cable trays and concluded that the MEFS for these fire scenarios would not have resulted in target damage.

The preaction sprinkler system actuation was evaluated for each fire scenario although sprinkler actuation was not directly credited in the fire modeling analysis except for defense-in-depth considerations.

In Scenario 1, transient combustible material fire in the northeast corner of the SWIS (Item 4 and Item "Other" of the revised Exemption Request 1-3), CFAST was used to calculate the maximum hot gas layer temperature and layer height above the floor. Localized target exposure temperatures to cable tray targets (Train A and Train B cables in the northeast corner) were calculated using thermal plume correlations. This simulation assumed there was no Kaowool fire barrier protecting the Train A or B cable trays. The results of the CFAST fire simulation for an MEFS indicate that the maximum hot gas layer temperature would be below the cable damage temperature and that there would be no significant radiant exposure to

targets located in the SWIS. Based on the fire modeling results, SNC concluded that the modeled SWIS targets would not be adversely impacted by an MEFS.

In Scenario 2, FNP, Unit 1 pump fire scenario (Item 9 of the revised Exemption Request 1-3), the effects of a lubricant oil pool fire, located between the FNP, Unit 1 Service Water pumps and the south wall of the SWIS were modeled. CFAST was used to calculate the maximum hot gas layer temperature and layer height above the floor, and thermal radiation heat transfer correlations were used to calculate target exposure to radiant heat flux. The targets evaluated in this scenario are cable trays (Train-A), using hot gas layer information from CFAST and pump motor junction boxes using thermal radiation from the heat transfer correlations. The results of the CFAST fire simulation indicate that the local targets on the Pump Deck would be immersed by the hot gas layer. However, the calculated hot gas layer temperature is lower than the damage temperature of the cable. The radiation heat transfer calculation shows that the fire originating from a lubricating oil spill could cause the incident heat flux at a second tier pump (i.e., pump adjacent to the pump where the spill occurs) or the Train A cable trays along the east wall to exceed critical heat flux levels; however, the duration of the fire is not sufficient for the flux to cause the target surface temperature to exceed the critical cable temperature based on the analysis using the HEATING7 model. Therefore, based on this analysis at least one Service Water pump would not be adversely impacted by this fire scenario.

In Scenario 3, FNP, Unit 2 pump fire scenario (Item 9 of the revised Exemption Request 1-3), the effects of a lubricant oil pool fire, located between the FNP, Unit 2 Service Water pumps and the south wall of the SWIS were modeled. The targets evaluated in this scenario are pump motor junction boxes. There are no cable tray targets modeled in this fire scenario. Scenario 3 is bounded by Scenario 2 because the pumps on FNP, Unit 2 contain less oil and

would define a fire of shorter duration than in Scenario 2. Therefore, based on this analysis at least one Service Water pump would not be adversely impacted by this fire scenario.

A sensitivity analysis was performed for Scenarios 1, 2, and 3 to demonstrate the sensitivity of the results of the calculations to variations in the MEFSS input parameters. The sensitivity analysis of the results to the assumptions regarding the composition of the transient fuel package and the impact of ventilation conditions in the SWIS was examined. The results clarify the degree of conservatism inherent in the calculation and the margin between the MEFSS and the LFS. The calculations were compared over a parameter spread that included conditions that would result in failure of the target. The licensee concluded that the sensitivity analysis demonstrates that the results and conclusions would not change with the exception of adjacent pump motor junction box targets. As a result, these targets are assumed to fail in the analysis.

Risk Assessment

RG 1.174 specifies that the risk associated with a plant change be determined by considering the change in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) that result from the plant change. These changes in CDF and LERF are calculated by comparing the CDF and LERF values for the pre- and post-change locations within the fire area that will be affected by the change to ensure that all contributors to risk are included. Thus, the fire risk analysis focused only on elements of the SWIS that had been or were proposed to be changed from SNC's current licensing basis. These elements were associated with pump/motor lubricant fires (one for each pump or ten cases in all).

The FNP plant-specific Level 1 and Level 2 Probabilistic Risk Assessment (PRA) Model was used, with modifications, to evaluate the impacts on plant risk of postulated fires originating in the SWIS. The modifications involved two changes that are summarized below. The

analysis did not add any fire specific operator actions or recoveries to the base plant PRA Model.

The scope of analyses that were performed by SNC for the changes to Exemption Request 1-3 included a re-analysis of the service water system performance. SNC's re-analysis concluded that a single service water pump per unit was sufficient to satisfy the system performance requirements for fire protection safe shutdown. The re-analysis results were incorporated into the PRA Model by lowering the number of Service Water pumps per train required for system success from two to one. The total plant CDF from internal events that is reported below reflects this change in the success criterion.

The licensee modified the plant PRA model to take advantage of recent vendor data related to reactor coolant pump (RCP) seal performance. The specific data is related to seal performance given loss of motor bearing cooling. The licensee stated their model assumed increased seal leakage will begin at 15 minutes after loss of all RCP seal cooling based on information in WCAP-16141, "RCP Seal Leakage PRA Model Implementation Guidelines for Westinghouse PWRs" and that they credit recovery of RCP seal injection using the standby train of Component Cooling Water and charging through operator action done by procedures and performed from the main control room. Leakage due to loss of motor bearing cooling is an additional contribution to CDF with respect to the RCP seal loss-of-coolant accident (LOCA) PRA model. When these two leakage models are combined, the resultant CDF contribution slightly exceeds that from an equivalent application via the Rhodes RCP seal LOCA model, i.e., it is conservative. The total plant CDF from internal events that is reported below reflects this change in the success criterion.

The performance of the PRA quantifications with the changes described above applied the same techniques and processes as used for the Fire IPEEE. This basically involved the

setting of certain model basic events to 'TRUE' by translating the fire modeling results for the MEFS into plant equipment damage states. SNC developed a fire ignition frequency for each fire scenario by partitioning the generic fire frequencies from the Electric Power Research Institute Fire Events Database. The resulting CDF for each of the fire scenarios was aggregated to obtain the cumulative risk for the proposed change. A separate calculation for the "baseline" CDF was not developed. Instead, the CDF for the changed configuration was taken as a conservative surrogate for the increase in risk.

The total plant CDF from internal events for FNP, Unit 1 and 2 is $3.86E-05/\text{yr}$ and $5.81E-05/\text{yr}$, respectively based on one Service Water pump as the success criterion. A comparison of the Fire IPEEE results with the internal events PRA results that were applicable at that time shows that the FNP, Unit 1 Fire CDF was approximately 20 percent higher than the corresponding FNP, Unit 1 internal events CDF. This would result in an estimated total plant risk of $8.5E-05/\text{yr}$.

The FNP, Unit 2 Fire CDF was approximately 10 percent less than the corresponding Unit 2 internal events CDF. This would result in an estimated total plant risk for FNP, Unit 2 of $1.1E-04/\text{yr}$.

The CDF and LERF for the changed configuration was taken as a conservative surrogate for the increase in risk, i.e. the baseline CDF and LERF was assumed to be zero such that delta CDF and LERF was conservatively estimated as the total CDF and total LERF for the changed contribution (no subtraction of baseline value). As a result, the licensee's risk analysis determined that a conservative estimate of the CDF associated with the ten cases would be approximately $6.5E-07/\text{yr}$ per unit. The licensee reports that the CDF for the cases ranged from $2.08E-08/\text{yr}$ per unit to $1.34E-07/\text{yr}$ per unit with no one case dominating as a

contributor relative to the rest. Based on the estimate for total CDF, this places the proposed change in Region III of the RG 1.174 acceptance criteria for CDF.

In order to gain further insights, the fire areas that were the dominant contributors to risk from the Fire IPEEE were requantified using the current plant PRA model. This re-quantification of dominant fire areas provided a cumulative CDF of $4.98E-05/\text{yr}$ and $5.87E-05/\text{yr}$ for FNP, Units 1 and 2, respectively. Using these updated values, the estimated total plant risk for FNP, Units 1 and 2 is $8.84E-05/\text{yr}$ and $1.17E-04/\text{yr}$, respectively.

The licensee stated that the contribution to LERF from a SWIS fire is the result of core damage combined with failure of containment isolation. The conditional probability of containment isolation failure (crediting only check valves and fail closed air-operated valves) is $2.13E-4$. The licensee stated that this resulted in a total LERF contribution from the seven SWIS fire scenarios analyzed for FNP, Unit 1 of $1.38E-10/\text{yr}$ per unit. This indicates the same LERF for FNP, Unit 2 since both units have the same CDF. SNC concluded that the LERF associated with the proposed change is negligible given the acceptance criteria of RG 1.174. RG 1.174, Section 2 also requires consideration of five key principles that the change is expected to meet. SNC concluded that all of the five principles have been met.

Defense-in-Depth

10 CFR Part 50, Appendix R, section II states that a licensee's fire protection program extend the concept of defense-in-depth to fire protection with the following objectives:

- I. To prevent fires from starting,
- II. To detect rapidly, control, and extinguish promptly those fires that do occur, and
- III. To provide protection for structures, systems and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant.

RG1.174 also identifies factors to be considered when evaluating defense-in-depth for a risk-informed change.

SNC has evaluated defense-in-depth and stated the following:

Fire prevention is strengthened by SNC's commitment to enhance the transient combustible control program in the SWIS northeast corner and in the vicinity of the Service Water pumps.

SNC proposes no changes to the existing fire detection and automatic fire suppression systems in the SWIS and will continue to control these systems to maintain defense-in-depth.

Protection for structures, systems and components is weakened by the elimination of the reliance on the Kaowool fire barrier in the northeast corner of the SWIS and the strainer pit. However, the elimination of the reliance on Kaowool has been evaluated by SNC in accordance with RG 1.174 or by deterministic re-analysis. Protection for structures, systems and components is strengthened by reducing the population of equipment requiring protection due to deterministic re-analyses (i.e., single Service Water pump and motor operated valve circuit analysis) and plant modifications (FNP, Unit 2 elimination of lube and cooling pumps); and by modifying the existing barriers between the pump deck and switchgear rooms and between disconnect switch rooms to 3-hour fire rated barriers; and by installing a floor curb on the FNP, Unit 1 side of the pump deck to limit fire exposure to the Train A cables along the east wall.

Safety Margins

RG 1.174 provides acceptable guidelines to ensure sufficient safety margins are maintained. RG 1.174 states that the proposed change provide sufficient margin to account for analysis and data uncertainty. The licensee concluded that for Scenario 1, a heat release rate to four times that modeled in the MEFS is needed to reach the LFS; for Scenario 2 an increase in combustible oil lubricant volume of 75 percent for a C-pump fire scenario and an increase four times the volume of combustible oil lubricant for an A-,B-,D- or E-pump fire scenario are

needed to reach the LFS; and for Scenario 3 a minimum increase five times the volume of combustible oil lubricant to reach the LFS.

SNC addressed uncertainty for Exemption Request 1-3, Item 9 and Item "Other" by considering the degree to which the fire models/calculations used bound the uncertainty in the input parameters. The licensee conducted an evaluation on the input parameters and concluded that the models/calculations that were used bounded the uncertainty except for the limiting oxygen index (LOI) parameter. However, the licensee concluded that the LOI assumption below a certain threshold is not possible for the temperatures predicted and is therefore not credible.

Uncertainty was further addressed by determining an LFS for each fire scenario. The LFS was determined by increasing one or more of the parameters that characterize the fire used for the MEFS until a failure condition is attained.

A sensitivity analysis was also conducted to determine that the conclusions would not be altered. In the case of the SWIS fire scenarios, sensitivity was conducted on the natural and forced ventilation conditions, the composition of the transient Class A fuel package (for Scenario 1) and the absorptance of the targets. As a result of the sensitivity analysis, SNC determined that some adjacent pump motor targets could be heated to the critical temperature. SNC then conservatively concluded that these targets would fail despite the results of the MEFS to the contrary. SNC concluded that other targets were not affected.

Evaluation of Exemption Request 1-3 Items

The NRC staff examined the licensee's submittals to determine if the revised Exemption Request 1-3 in Fire Area 72 of the SWIS would meet the underlying purpose of the 10 CFR Part 50, Appendix R rule.

The NRC staff has evaluated each of the revised items of Exemption Request 1-3 on a case by case basis by ensuring adherence to the fire modeling approach discussed in NFPA 805, ensuring that RG 1.174 criteria are met, assessing that a reasonable balance among the elements of defense-in-depth is maintained, and ensuring safety margins are maintained, where appropriate.

Item 1

SNC proposes to implement modifications to each of the five FNP, Unit 2 service water pumps by December 2006 that will result in removing the need for the redundant lubricating oil and coolant pumps, valves and control stations for FNP, Unit 2. The licensee concluded that modifications will eliminate the need to consider fire-induced impacts from a fire on the FNP, Unit 2 lubricating oil and coolant pumps, valves and their control stations as well as removing these pumps as ignition sources and combustible loadings. Based on the plant modifications, SNC concluded that the conditions of Exemption Request 1-3, Item 1 will no longer be applicable following completion of those plant modifications. On these bases, the NRC staff concludes that, upon completion of the modifications to the pumps as discussed above, there will be no further need for the exemption provided in the first paragraph of Section 2.3 of the NRC staff's December 29, 1986, exemption and, accordingly, it would be deleted.

Item 2: FNP, Unit 2 side of strainer pit

For the strainer inlet valves and swing pump discharge valves in the FNP, Unit 2 side of the strainer pit, SNC stated in its December 28, 2004, response to question 26 and in its June 9, 2005, response to question 2, that it had performed a deterministic re-analysis on the cables for these valves. SNC's review of the circuitry located in the strainer pit determined that spurious operation of the valves could not result if the power cables to the valve motors and control cables to the valve position switches were subjected to hot shorts, open circuits, or

shorts to ground. SNC stated that power is removed during normal operation from swing service water pump discharge valves Q2P16V507-A and Q2P16V506-B and that spurious operation of the valves due to a 3-phase hot short does not require evaluation in accordance with the guidance in Generic Letter 86-10, Section 5.3.1. SNC stated that the main and control power to strainer inlet valves Q2P16V511-A and Q2P16V508-B is not isolated during normal operation and that open circuits or short circuits will not result in spurious operation of the valves and that a 3-phase hot short does not require evaluation in accordance with the guidance in Generic Letter 86-10, Section 5.3.1. The licensee further states that for the control cables to limit switches, hot shorts, open circuits or shorts to ground could not result in spurious operation because the cables do not contain the conductors necessary to energize the motor starters due to open control room switch contacts. Based on SNC's analysis, SNC concluded that reliance on Kaowool as part of the basis for Exemption Request 1-3, Item 2 is no longer necessary. The NRC staff concludes that on the basis of SNC's deterministic-based findings that the valves will not be repositioned due to a fire, the fire detection and suppression features for Fire Area 72 A and the defense-in-depth measures as discussed above, that a continued exemption from the requirements of Appendix R, Section III.G.2.c for this item is acceptable.

Item 3: FNP, Unit 1 side of strainer pit

For the strainer inlet valves and swing pump discharge valves in the FNP, Unit 1 side of the strainer pit, SNC stated in its December 28, 2004, response to question 26 and in its June 9, 2005, response to question 2, that it had performed a deterministic re-analysis on the cables for these valves. SNC's review of the circuitry located in the strainer pit determined that spurious operation of the valves could not result if the power cables to the valve motors and control cables to the valve position switches were subjected to hot shorts, open circuits, or shorts to ground. SNC stated that power is removed during normal operation from swing

service water pump discharge valves Q1P16V507-A and Q1P16V506-B and that spurious operation of the valves due to a 3-phase hot short does not require evaluation in accordance with the guidance in Generic Letter 86-10, Section 5.3.1. SNC stated that the main and control power to strainer inlet valves Q1P16V511-A and Q1P16V508-B is not isolated during normal operation and that open circuits or short circuits will not result in spurious operation of the valves and that a 3-phase hot short does not require evaluation in accordance with the guidance in Generic Letter 86-10, Section 5.3.1. The licensee further states that for the control cables to limit switches, hot shorts, open circuits or shorts to ground could not result in spurious operation because the cables do not contain the conductors necessary to energize the motor starters due to open control room switch contacts. Based on SNC's analysis, SNC concluded that reliance on Kaowool as part of the basis for Exemption Request 1-3, Item 3 is no longer necessary. The NRC staff concludes that on the basis of SNC's deterministic-based findings that the valves will not be repositioned due to a fire, the fire detection and suppression features for Fire Area 72 A and the defense-in-depth measures as discussed above, that a continued exemption from the requirements of Appendix R, Section III.G.2.c for this item is acceptable.

Item 4: Discharge valves to wet pit and storage pond flume

For Fire Zone 72A, SNC performed a deterministic re-analysis on the redundant safe shutdown service water Train A and Train B cables, associated with service water discharge to the wet pit and storage pond flume, shared by Unit 1 and Unit 2. The December 29, 1986, exemption, page 11, first paragraph, reflected SNC's original finding that there was a potential for these valves to be mis-positioned by fire effects and that this could be acceptably dealt with by manually realigning the valves, if needed, within a required 24-hour period. SNC's submittals, specifically its June 9, 2005, submittal states that the main and control power to valves QSP16V505-A, QSP16V507-A, QSP16V506-B and QSP16V508-B is not isolated during

normal operation and that open circuits or short circuits will not result in spurious operation of the valves and that a 3-phase hot short does not require evaluation in accordance with the guidance in Generic Letter 86-10, Section 5.3.1. SNC further states that for the control cables to limit switches, hot shorts, open circuits or shorts to ground could not result in spurious operation because the cables do not contain the conductors necessary to energize the motor starters due to open control room switch contacts. For the control cables to control room switches and other interlocks, the licensee concluded from its deterministic analysis that hot shorts could result in spurious operation of the valves. However, the licensee used fire modeling, as discussed in the section above on the modeling of fire scenarios, to demonstrate that fire induced cable damage from a fire could not result in spurious operation of both trains of valves and that there would not be a need to perform the long-term manual operator actions previously relied upon. Based on SNC's analysis, SNC concluded that reliance on Kaowool as part of the basis for Exemption Request 1-3, Item 4 is no longer necessary. The NRC staff concludes that on the basis of SNC's deterministic and fire modeling analysis results as discussed above, the fire detection and suppression features for Fire Area 72, defense-in-depth measures as discussed above, and enhanced combustible controls, that a continued exemption from the requirements of Appendix R, Section III.G.2.c for this item is acceptable.

Item 5 and 6: Swing service water pumps

SNC's compliance strategy is unchanged for these two items. Therefore, the previous portion of the exemption issued on page 11, paragraphs two and three, of the December 29, 1986, exemption is unchanged and remains in effect. Accordingly, there is no further consideration in this Safety Evaluation for this item.

Item 7: Swing service water pump cables in Fire Zones 72D and 72E

SNC states in its August 28, 2003, submittal that the current exemption and its bases (included on page 11, last paragraph, and page 12, first paragraph of the December 29, 2005, exemption) remain unchanged because they do not involve Kaowool. The previous conditions for this item discussed in the NRC letter dated December 29, 1986, remain unchanged and there is no further consideration in this safety evaluation of those conditions. However, SNC has committed to implement plant modifications that will upgrade certain fire barriers to 3-hour fire ratings as previously discussed in this exemption. The creation of the three hour fire barriers will enhance the overall defense-in-depth of the SWIS.

Item 8: Swing service water pump cables in Fire Zones 72B and 72C

SNC states in its August 28, 2003, submittal that the current exemption and its bases (included on page 12, second paragraph, of the December 29, 2005, exemption) remain unchanged because they do not involve Kaowool. The previous condition for this item discussed in the NRC letter dated December 29, 1986, remains unchanged and there is no further consideration in this safety evaluation of those conditions. However, SNC has committed to implement plant modifications that will upgrade certain fire barriers to 3-hour fire ratings as previously discussed in this exemption. The creation of the 3-hour fire barriers will enhance the overall defense-in-depth of the SWIS.

Item 9: Raceways for Train A Service Water pumps

The exemption for service water pumps that was included on page 12, third paragraph of the December 29, 1986, exemption was based, in part, on the raceways servicing the Train A service water pumps for both units being protected with a Kaowool blanket fire barrier. SNC performed an evaluation for these raceways using a combined fire modeling and risk assessment analysis approach to revise the conditions for Exemption Request 1-3, Item 9. This approach does not take any credit for the Kaowool fire barrier and is addressed in the

above Fire Modeling section discussion of scenarios 2 and 3. Based on SNC's Fire Modeling analysis, SNC concluded that at least one service water pump would not be adversely impacted by this fire scenario. As discussed in the above Risk Assessment section, SNC has also concluded that a single service water pump per unit is sufficient to satisfy the system performance requirements for fire protection. The NRC staff concludes that on the basis of SNC's deterministic and fire modeling analysis results as discussed above, the fire detection and suppression features for Fire Area 72, defense-in-depth measures as discussed above, and enhanced combustible controls, that a continued exemption from the requirements of Appendix R, Section III.G.2.c for this item is acceptable.

Addendum to Exemption Request 1-3, Fire Area 72

SNC included an Addendum to Exemption Request 1-3 in its October 18, 1985, submittal wherein SNC noted that adequate coordination was not provided between certain safe shutdown and non-safe shutdown circuits. The December 29, 1986, exemption noted that a design change had been initiated to improve breaker coordination, which would eliminate the concern. SNC's August 28, 2003, submittal stated that the design change had been completed. Accordingly, the NRC staff finds that the conditions requiring the exemption item that begins with the last paragraph of page 12 of the December 29, 1986, exemption are no longer present and, accordingly, this part of the exemption is no longer necessary.

SWIS Northeast Corner raceways

SNC stated in its August 23, 2003, submittal that in addition to the nine situations that were addressed in the exemption issued on December 29, 1986, that it had also considered the FNP, Units 1 and 2 redundant Train A and Train B cables near the ceiling of the northeast corner of the SWIS. The northeast corner of the SWIS includes a "pinch-point" where FNP,

Units 1 and 2 Train A and Train B cables approach each other as they run along perpendicular walls from the corner. The cables are 20 feet above the strainer pit floor. SNC performed an evaluation using fire modeling as discussed in the above Fire Modeling section, scenario one, to support the addition of this condition to the exemptions for Fire Area 72. Based on the fire modeling results, SNC concluded that the cables would not be adversely impacted by an SNC's analysis to support this exemption item and SNC's program modifications, SNC concluded that it is unlikely the cables of interest would be damaged by a maximum expected fire scenario.

The NRC staff concludes that on the basis of SNC's fire modeling analysis results as discussed above, the fire detection and suppression features for Fire Area 72, defense-in-depth measures as discussed above, and enhanced combustible controls, that an exemption from the requirements of Appendix R, Section III.G.2.c for this item is acceptable.

Modifications

SNC will implement programmatic and design modifications as outlined in letters dated August 28, 2003, and December 28, 2004. These modifications include: (1) modification of the FNP, Unit 2 service water pumps to eliminate their reliance on lubrication and cooling support pumps, (2) upgrading of the nominal 18-inch concrete wall between Fire Zone 72A and Fire Zones 72B, C, D and E to meet the requirements of FNP's Fire Protection Program for a minimum 3-hour fire area boundary. Penetrations will be sealed, un-rated doors will be replaced by 3-hour rated fire doors, and three new fire areas will be defined, 72A, 72B/72C and 72D/72E. In addition, the scope of the barrier surveillance program will be enhanced to ensure that the conditions of the risk-informed, performance-based assessment are maintained, (3) installation of a new floor curb on the FNP, Unit 1 pump deck to prevent liquid spill fires associated with the FNP, Unit 1 pumps from pooling beneath the Train A cable tray located near the east wall, (4) specific transient combustible controls will be implemented to restrict

transient combustibles from being stored or located in the SWIS northeast corner and in the vicinity of the service water pumps. Configuration control will be maintained (from a fire protection program perspective) over the type and quantity of lubrication oil used in the service water pump motors. Precautions will be implemented to limit the amount of lubricant in the vicinity of the service water pumps during lubricant changes by removing the drained lubricant from the area prior to bringing the new (unused) lubricant into Fire Zone 72A. Transient fuel packages associated with maintenance activities will be controlled via procedural changes, and (5) SNC identified eight low-voltage PVC/PVC cables in a tray along the north and west wall that are thermoplastic. SNC stated that portions of the cable will be removed to meet the fire model analysis.

The evaluation that SNC prepared assesses the impact of the change. This evaluation uses a combination of risk-insights and deterministic methods to show that sufficient safety margins and defense-in-depth are maintained.

The results of the risk-informed portions of the analysis are consistent with a change that would be acceptable when compared to the acceptance criteria described in RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 1.

The NRC staff examined SNC's rationale to support the changes to Exemption Request 1-3 and concludes that adequate defense in depth and safety margins exist and that the underlying purpose of Appendix R, Section III.G.2.c is met. Fire modeling demonstrates that it is unlikely that the cables of interest in the northeast corner will be damaged by a fire and that at least one service water pump for each unit will not be damaged by a fire. Also, fire detection and automatic fire suppression systems in the areas of interest remain to provide defense-in-depth. Based upon the above considerations, the NRC staff concludes that the revisions to

Exemption Request 1-3 meet the underlying purpose of the rule. Therefore, the NRC staff concludes that pursuant to 10 CFR 50.12(a)(2) this exemption is acceptable.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the changes to Exemption Request 1-3 are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants SNC a revised exemption 1-3 from the requirements of Appendix R, Section III.G.2.c to 10 CFR Part 50 to provide 1-hour fire separation in Fire Area 72 for the FNP, Units 1 and 2, subject to the full implementation of the programmatic and plant design modifications discussed above.

Acceptance of this revised Exemption Request 1-3 is based on the programmatic and plant design modifications, the deterministic re-analyses, the risk-informed plant change evaluation and its results specific to the SWIS, enhanced controls on transient combustibles, the existing fire detection and automatic fire suppression capability to maintain defense-in-depth, and the availability of manual fire fighting and associated fire fighting equipment.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (70 FR 46892).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 16th day of August 2005.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Ledyard B. Marsh, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation