FENOC

FirstEnergy Nuclear Operating Company

Perry Nuclear Power Plant
10 Center Road
Perry, Ohio 44081

William R. Kanda
Vice President - Nuclear

440-280-5579
Fax 440-280-8029

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PY-CEI/NRR-2659L

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Perry Nuclear Power Plant
Docket No. 50-440
Supplement to License Amendment Request Pursuant to 10 CFR 50.90: Inclined Fuel Transfer System (TAC NO. MB4694)

Ladies and Gentlemen:

This letter provides responses to the Nuclear Regulatory Commission Request for Additional Information dated August 27, 2002 pertaining to the Perry Nuclear Power Plant (PNPP) License Amendment Request (LAR) submitted on March 14, 2002 (PY-CEI/NRR-2614L). This risk-informed LAR supplements Amendment 100 and will permit removal of the Inclined Fuel Transfer System (IFTS) blind flange while Primary Containment operability is required during plant operation, startup, or hot shutdown conditions. A supplemental letter to this LAR was submitted on July 17, 2002 (PY-CEI/NRR-2649L).

The proposed LAR is required to support the installation of a modification to upgrade the IFTS controls. This modification will support the PNPP's next refuel outage. Contract personnel with the expertise necessary to install this modification have been hired to complete this work in October 2002. Therefore, to support this planned activity, it is requested that the proposed LAR be approved no later than October 28, 2002.

The Significant Hazards Consideration provided with the March 14, 2002 letter remains unchanged by this supplemental letter. One new regulatory commitment is contained in Attachment 2.

If you have questions or require additional information, please contact Mr. Gregory A. Dunn, Manager - Regulatory Affairs, at (440) 280-5305.

Very truly yours,

Attachments:

1. Notarized Affidavit
2. Response to Request for Additional Information
3. USAR Table 9.1-4

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III
State of Ohio

A001

I, William R. Kanda, hereby affirm that (1) I am Vice President – Perry, of the FirstEnergy Nuclear Operating Company, (2) I am duly authorized to execute and file this certification as the duly authorized agent for The Cleveland Electric Illuminating Company, Toledo Edison Company, Ohio Edison Company, and Pennsylvania Power Company, and (3) the statements set forth herein are true and correct to the best of my knowledge, information and belief.

William R. Kanda

Subscribed to and affirmed before me, the 12th day of September, 2002

Jane E Mott

JANE E. MOTT
Notary Public, State of Ohio
My Commission Expires Feb. 20, 2005
(Recorded in Lake County)

The following Nuclear Regulatory Commission (NRC) questions were received by letter dated August 27, 2002, regarding the risk-informed License Amendment Request (LAR) submitted by the Perry Nuclear Power Plant (PNPP), which supplements Amendment 100 to allow the removal of the Inclined Fuel Transfer System (IFTS) blind flange while Primary Containment operability is required during plant operation, startup, or hot shutdown conditions. The questions and their responses are provided below.

NRC QUESTION

1. Based on the discussion in page 7 of Attachment 2, there will be sufficient water inventory for the suppression pool makeup system without taking credit of the water in the IFTS upper pool after the upper pool IFTS gate is installed. Page 6 of Attachment 2, indicates that an increase in lower-pool water level can be used indirectly to monitor the upper IFTS pool water level when the IFTS is in service and the lower pool gates must be removed. Why must the lower-pool gates be removed and the upper IFTS pool water level be monitored?

   Removing the lower gates accelerates IFTS water leakage, and depletion of water from the IFTS creates a potential containment bypass. Does the procedure of removing lower-pool gates worsen the problem of water leakage? If not, explain why.

RESPONSE

The first portion of this question asks "Why must the lower-pool gates be removed and the upper IFTS pool water level be monitored?" There are three reasons why the lower pool gates should be removed (not installed) when the IFTS blind flange is not installed in MODES 1, 2 or 3:

- To provide water level indication for the entire lower Fuel Handling Building pool area,
- To ensure the lower Fuel Transfer pool area is not capable of being drained, and
- To provide monitoring of upper IFTS pool water level.

Water level indication: Currently, the lower Fuel Handling Building gates are not installed, since the normal plant configuration is with the gates removed. The lower pool gates are normally left out to provide water level indication for the entire Fuel Handling Building lower pools, including the lower Fuel Transfer pool. The lower Fuel Transfer pool, which is the middle of the three lower pools, does not have its own level instrumentation, but the adjoining "Fuel Preparation And Storage" and "Spent Fuel" pools do have level instrumentation. The configuration with the lower gates removed (not installed) simply ensures the alarms in the adjacent pools can quickly assist in water level monitoring of the lower Fuel Transfer pool, thereby detecting a level increase, perhaps due to an unexpected water inventory leak through the IFTS transfer tube, or a water level decrease, due to a water loss from the lower pools themselves.

Ensure the Fuel Transfer pool is not drained: Per Amendment 100 and Technical Specification (TS) Surveillance Requirement (SR) 3.6.1.3.4, when the IFTS blind flange is removed in MODES 1, 2 or 3, the lower pools (Fuel Handling Building Transfer pool) must be maintained ≥ 40 feet. Ensuring that the lower pool gates are removed is one way to implement these TS controls. Per the Updated Safety Analysis Report (USAR) Section 9.1.4.2.3.11, Page 9.1-47, the lower pool gates are installed to allow drainage of the Transfer pool area for maintenance and/or removal of the IFTS tube components. Installing the gates and draining the lower Fuel Transfer pool area when the blind flange is removed would violate the 40 foot TS requirement. Also, installing the gates would remove the normal method of monitoring the water level in the lower Fuel Transfer pool (as described in the previous paragraph), and would require dependence solely on periodic personnel observations to ensure the pool remained above the TS limit of ≥ 40 feet. Although this would be acceptable since the TS limit is more than 3 ½ feet below the normal pool level and would be immediately detectable by observation, it is not the desired configuration.

Monitor upper IFTS pool water level: As noted in the first sentence of the question, the required Suppression Pool Make-Up (SPMU) system inventory is protected due to the proposed TS requirement to install the upper IFTS pool gate. Also, as noted in the previous submittals, flooding of the lower pools due to a leak from the upper IFTS pool is not a concern. Therefore, it is not critical that the upper IFTS pool water level be monitored when the upper IFTS pool gate is installed. However, the commitment to ensure the lower Fuel Handling Building pool gates are not installed was made as a voluntary conservative measure to ensure level indication is available for the lower Fuel Handling pools, which could detect gross leakage from the upper pool.

In summary for the first portion of Question 1, the lower pool gates are removed primarily to provide water level indication for the lower IFTS Transfer pool, and to ensure the lower IFTS pool is not drained. Although it is not critical that the upper IFTS pool level be monitored, not installing the lower pool gates could allow detection of gross leakage from the upper IFTS pool.

The second portion of Question 1 asks whether the procedure of removing the lower pool gates worsens the "problem" of water leakage, and implies that depletion of water from the IFTS creates a potential Containment bypass. Removing the lower gates does not accelerate any IFTS leakage, and depletion of water from IFTS (i.e., a leak of upper pool water down to the lower pools) does not create a Containment bypass concern.

Accelerate leakage: As noted above, the normal configuration is with the gates removed, with all three lower pools being maintained at the same level. Since the IFTS tube extends deep down into the lower pools, there is a significant height of water above the bottom of the tube and the bottom valve. Therefore, with the gates removed and the pools filled, there is more back pressure against the bottom valve, i.e., less differential pressure across the valve, than if the gates were to be installed and the lower Fuel Transfer pool were to be drained (a situation which is prohibited by the Note in TS SR 3.6.1.3.4).

Also, as previously noted, based on the proposed TS control to ensure the upper IFTS pool gate is installed, leakage from the upper IFTS pool is no longer a concern.

Containment bypass: Since the IFTS tube terminates deep within the lower pools, the head of water in the lower Fuel Handling Building pools fills the IFTS tube all the way up to the height of these pools. The normal lower pool level provides a seal, which holds Containment pressures up to approximately 10.8 psig, which is significantly greater than the peak calculated post Loss Of Coolant Accident (LOCA) Containment pressure of 6.4 psig. Even if the lower pools were to be at the TS water level limit (more than 3 ½ feet lower than normal, which would be extremely unusual), the seal on IFTS provided by the lower pool holds Containment pressures up to 9.4 psig. In other words, as long as the lower pool gates are removed and the lower Fuel Transfer pool is full of water, any leakage from the upper IFTS pool would simply drain to the lower pools, and such leakage cannot deplete the IFTS water seal, which is passively provided by the lower pool height. No credit was taken in the LAR for water in the IFTS tube any higher than the level of the lower pools.

For all of the reasons presented, it is desired and appropriate to keep the lower Fuel Handling Building pool gates removed when the IFTS blind flange is removed during MODES 1, 2 or 3.

NRC QUESTION

2. Following a loss-of-coolant accident inside the containment with IFTS flange removed, the staff believes that it is important to hold the water seal in the IFTS as long as it could to avoid a containment bypass. Page 6 of Attachment 2, indicates that the water leakage can be detected in the control room by high-water-level annunciation for the fuel handling building. Following the leakage detection, what are the procedures and corrective actions for the operators to stop the leakage and mitigate the accident?

RESPONSE

The issue of water leakage from the IFTS following a LOCA is not a concern for maintaining the water seal, since following a LOCA the lowest that the IFTS tube can drain down to is the height of the lower Fuel Handling Building pools, which is normally maintained at 619'-4" to 619'-6". The bottom of the IFTS tube is at 593'-3". Therefore, the lowest the tube could normally drain down to still maintains a water seal of approximately 26 feet, which provides protection for Containment pressures up to approximately 10.8 psig.

The peak calculated primary Containment internal pressure for the design basis LOCA is 6.4 psig. This is known as "P_a," as defined in 10 CFR 50, Appendix J. However, per Amendment 112 the P_a used for testing at PNPP was kept at 7.8 psig for conservatism [reference Technical Specification (TS) 5.5.12]. Therefore, in the event of a design basis LOCA, the water seal is maintained regardless of leakage past any IFTS components. For a postulated beyond design basis event, credit was not taken for any water in the IFTS tube above the level of the lower Fuel Handing Building pools to support the proposed risk-informed LAR. The concerns with water leakage from IFTS were mainly with respect to flooding and the impact to the SPMU system, and these concerns have been adequately addressed. Therefore, following a LOCA inside Containment, there is no need for the operators to take actions to stop any leakage that may develop.

NRC QUESTION

3. Page 10 of Attachment 2, indicates that there is a commitment established related to Amendment 88 requiring an assessment of drywell bypass leak tightness once per cycle. If the leak rate is exceeded, further investigation is required to ensure that the drywell integrity has not degraded. The acceptance criterion for this assessment is less than 1 percent of the design allowable drywell bypass leakage value of approximately 58,000 scfm. Please clarify the limit of 58,000 scfm. Is it the same as the limit specified in the Perry Nuclear Power Plant technical specifications?

   If the leak rate is exceeded, what are the actions that will be required and procedures that will be followed in the "further investigation?" Are there any procedures to alert warn the operators before opening the IFTS flange that higher risks may be associated with the high drywell leakage?

RESPONSE

The maximum design Drywell bypass leakage limit is determined through evaluation of a small break LOCA with one Containment spray loop initiated and passive Containment heat sinks credited (reference September 24, 1997 NRC Safety Evaluation for PNPP Amendment 88, TAC NO. M94493). This value (approximately 58,000 scfm) is the maximum design Drywell bypass leakage limit and is not the same as the acceptance criteria for Technical Specification (TS) Surveillance Requirement (SR) 3.6.5.1.1, which is ≤ 10% of this value or approximately ≤ 5800 scfm.

Testing per USAR Appendix 1B Commitment 18 is performed at least once per operating cycle. This testing is performed per Surveillance Instruction SVI-T23-T0401, "Drywell Integrity Verification Test," to ensure that the Drywell bypass leakage rate is within the TS allowable limit. Testing is conducted by pressurizing the Drywell using airflow from the Combustible Gas Control system compressor that has a flow capacity of 500 scfm. A calculation is then performed to determine if the measured leak rate is within the test acceptance limit of 400 scfm. If the leakage rate exceeds the acceptance limit, then an investigation by the Responsible System Engineer is required. Note, that the current acceptance criteria of 400 scfm for the USAR Appendix 1B testing is only 7% of the TS allowable limit and less than 1% of the design allowable limit. As long as the TS allowable limit (10% of the design limit) is maintained, then the post-small break LOCA pressures will be substantially less than the water seal capability provided by the lower fuel pools, and no air leakage through the IFTS tube is possible. In order for the plant to restart following a USAR Appendix 1B test failure, it would be necessary to confirm that the TS allowable limit is being met, e.g., by performance of the full TS bypass leakage surveillance, or by repairs to the Drywell and re-performance of SVI-T23-T0401.

Therefore, because Drywell leakage is being maintained at such a low value, there is no perceived need to warn operators about any higher risks that may be associated with high Drywell leakage.

NRC QUESTION

4. In order to assess the structural capability of the IFTS in beyond-design-basis events, please provide the following information:

   a. the safety class, design pressure, and estimated ultimate pressure capacity of the structures and components comprising the IFTS pressure boundary, specifically, the transfer tube, bellows, upper and bottom gate valves (1F42-F002 and 1F42-F004), drain line, and drain line isolation valves (1F42-F003 and 1G41-F607),

   b. clarification regarding the seismic qualification of the IFTS components (Note: on page 5 of 18 it is stated that the IFTS components (including IFTS tube, bottom valve, fill valve, vent tube, and drain valve) have been seismically-qualified, but on page 7 of 18 it is stated that these components are non-seismic),

   c. the fragility curves (probability of failure as a function of containment pressure) for the major containment structures and penetrations (including the drywell, containment cylinder and dome, personnel airlocks, equipment hatches, and IFTS),

   d. the composite fragility curve for the containment for the cases with the blind flange installed and the blind flange removed,

   e. the seismic fragilities (e.g., the high confidence in low probability of failure values) of the IFTS-related structures (transfer tube, bellows, drain line, sheave box, and connected valves) and a comparison to the fragilities of the containment structure and penetrations, and

   f. confirmation that the IFTS tube and connected components (including the bellows and lower gate valve) will have a greater ultimate pressure capacity than the containment even when the hydrostatic head of water on the IFTS tube is taken into consideration.

RESPONSE

a. The safety classes of the IFTS components are described in USAR Table 9.1-4, which has been included for reference as Attachment 3.

Design Pressure

The normal Containment isolation components, such as the upper bellows assembly, are designed to withstand the Containment design pressure (15 psig).

During refueling or at power, with the blind flange removed, the static head varies from 43 feet of water (approximately 18.7 psig @ 39.2°F) at the bottom of the upper IFTS Pool to 100 feet (approximately 43.4 psig @ 39.2°F) of water inside the transfer tube at the bottom valve.

With the IFTS blind removed during MODES 1, 2 and 3, and the bottom gate valve closed and the flap valve open, i.e., the IFTS tube full, the Containment pressure and static water head would be applied internally to the tube down to the closed bottom gate valve. The Containment pressure and static water head would also be applied to the four inch drain line. PNPP engineering calculations use a pressure of 100 psig in the analysis of the IFTS tube, and for the drain line, which is at a higher elevation than the bottom valve, resulting in a lower static water head. Note, that 100 psig is roughly 50 psig over the static head pressure. Thus, Containment pressure would have to exceed 50 psig to exceed the IFTS tube pressure used in the PNPP engineering calculations. Note, that Plant Emergency Instruction (PEI)-T23, "Containment and Drywell Pressure Control," specifies that preparation for venting the Containment be initiated at a pressure of 15 psig, and venting is required if pressure cannot be maintained below the Primary Containment Limit, which is never greater than 40 psig.

Ultimate Pressure capacity

The discussion below of each component is offered to provide the reviewer with a level of confidence as to the margin of the component with respect to anticipated pressure. Ultimate pressure capacity calculations could show more margin, but there is no need to perform such calculations.

The dimensions of the transfer tube are Diameter (D) = 24 inch and thickness (t) = 0.5 inch. The hoop stress resulting from 100 psig (P) is 2400 psi (PD/2t), which is relatively small, compared to the normal allowable stress, which is greater than 15,000 psi.

The dimensions of the drain pipe are D = 4 inch, t = .237 inch. The hoop stress for the smaller pipe is 850 psi. This stress is a smaller percentage of the allowable stress, which is also greater than 15,000 psi.

The upper and lower gate valves (1F42F002 and 1F42F004) are 24-inch double disk flanged gate valves constructed of A351-CF8M material. The valves both have 24-inch 150 lb. flanges per ANSI B16.5. Primary service rating for the valves is 75 lb. Per the design drawing, both valves received a hydrostatic shell pressure test of 113 psig. The upper gate valve (1F42F002) is irrelevant to the arguments presented for the proposed LAR, since it is a manual valve located inside the Containment and would not be considered accessible following an accident. Therefore, the upper gate valve was not credited for the proposed LAR.

The bellows assemblies are not exposed to the IFTS tube inner pressures. The upper and lower bellows are not impacted by the proposed LAR. However, the maximum external pressure on the upper bellows would be peak Containment pressure, which it is designed to withstand.

The motor operated drain line isolation valve (1F42F003) is a four-inch, 90°, rotating ball valve, with a 150 lb. ANSI B16.5 primary service rating, and flanged ends. The manual drain line isolation valve (1G41F0607) is not credited for the proposed LAR. However, this valve is a four-inch manual gate valve with a 150 lb. ANSI B16.5 primary service rating.

b. Page 7 of 18 of the March 14, 2002 letter, correctly states that the upper IFTS tube components (e.g., sheave box, fill valve, flap valve, cable enclosures, and vent pipe) are non-safety and non-seismic. The upper IFTS tube components (e.g., sheave box and appurtenances) are non-safety and not included in the dynamic model of the fuel transfer tube. The fill valve, cable enclosures and vent pipe all connect into the sheave box assembly. Therefore, the words on Page 5 of 18, which state that the sheave box was not seismically qualified, was intended to include these appurtenances. The point of the paragraph on Page 5 was simply to introduce the concept that a non-safety, non-seismic component in the upper IFTS pool could be postulated to fail and result in draining some water to the Fuel Handling Building lower pool. For the proposed LAR, a leakage failure for the sheave box was assumed.

c., d., and e. In accordance with the PNPP response submitted on November 4, 1995 for Generic Letter 88-20, Supplement 5, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," a fragility analysis for the PNPP was determined to not be necessary. This is because in accordance with NUREG-1407, "Procedural and Submittal Guidance for Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities," a rigorous fragility analysis for Containment penetrations is only necessary for plants at review levels greater than 0.3g. As required by NUREG-1407, since the PNPP is designated as a focused-scope plant, the Review Level Earthquake (RLE) was set at 0.3g. Note, the seismic event assumptions for the supporting Probability Safety Assessment (PSA) analysis submitted in the March 14, 2002 LAR, e.g., an RLE of 0.3g, are consistent with the PNPP response to Generic Letter 88-20, Supplement 5. Therefore, use of an RLE of 0.3g remains applicable to the PNPP and the composite fragility curves as a function of Containment pressure and the seismic fragilities for the Containment and its major structures and penetrations, including the IFTS-related structures have been determined to not be necessary based on the appropriate regulatory guidance.

f. As discussed in the response to Qustion 4.a, the Containment pressure would have to exceed 50 psig to exceed the IFTS tube pressure used in the PNPP engineering calculations. The service rating pressures of the drain pipe and drain valves are greater than the ultimate pressure capacity of the Containment even when the hydrostatic head of water on the IFTS tube is taken into consideration. The lower gate valve is constructed of stainless steel and has been tested at a hydrostatic shell pressure of 113 psig. The bellows assemblies are not exposed to the tube inner pressures. However, the maximum external pressure on the upper bellows would be peak Containment pressure. Therefore, as previously discussed in the response to Question 4.a, the IFTS tube and connected components are designed to withstand peak accident pressures in combination with hydrostatic pressure loads.

NRC QUESTION

5. Provide separately for the IFTS bottom gate valve, the IFTS drain valves, and the flap valve, an estimate of the number of hours that each valve is expected to be open during the period while the blind flange is removed. Indicate how this time is apportioned: (a) among the major IFTS operations (e.g., system testing and maintenance, training of operating crews, and transferring new fuel into the containment storage pool prior to start of refueling outages, if applicable), and (b) over the proposed 60 day period when the blind flange is removed.

RESPONSE

The IFTS component configurations expected in this current operating cycle during MODES 1, 2 or 3 when the blind flange is removed are out of the ordinary since in addition to the normal durations for preparation testing and operator training for refueling operations, a modification is planned to upgrade the system controls. For this cycle, it is conservatively estimated by the IFTS Project Manager that the total duration the carriage will be in the lower position, the bottom valve and the drain valve will be open, and the flap valve will be closed is a maximum of 160 hours. This configuration is equivalent to about 6 ½ days. Additionally, when the carriage is in the upper position, the bottom valve and drain valve will be closed, and the flap valve will be open for a maximum duration of approximately 356 hours or about 15 days. Note, these component configurations are controlled per the IFTS design. Also, subsequent to this cycle, when the IFTS is normally being tested or maintained and operating crews are being trained in MODES 1, 2 or 3, the configuration of the carriage and valves should be bounded by these conservative durations.

The installing contractor for the modification and site operator's workweek will normally consist of four 10 hour days. Per the IFTS operating procedure, during non-working hours when the IFTS is placed in long term shutdown, the carriage will be stored in Containment (in the upper position), so the bottom gate valve and the drain valve will be closed. Therefore, since the IFTS operating times are consistent with the working hours of the operating crews, i.e., 40 hours per week, the majority of the time the IFTS will be in this secured configuration. Note the proposed LAR does not allow movement of new fuel in MODES 1, 2 or 3.

Additionally, the supporting PSA analysis assumed that during the 60 day IFTS operational period, the IFTS carriage will be in the up position with the flap valve open on average 50 of the 60 days per year of IFTS operation while in MODES 1, 2 or 3. When the plant is in this configuration the drain valve and bottom valves are closed. Also, the PSA analysis assumed that the IFTS carriage will be in the lower position with the bottom valve and drain valve open on average 10 of the 60 days per year of IFTS operation while in MODES 1, 2 or 3. Therefore, the PSA analysis assumptions bound the expected times for the actual IFTS component configurations for this operating cycle and for future cycles.

NRC QUESTION

6. Although the proposed license amendment request does not provide for the movement of fuel, the flooding analysis discussion indicates that the bottom gate valve may be opened while the blind flange is removed. It is possible that the IFTS bottom gate valve would be open at the onset of a severe accident, with the fuel transfer carriage or cables part way through the open valve. Justify that an open bottom gate valve would be promptly closed in risk-significant events, thereby restoring containment leak-tight integrity. In this regard please provide the following:

   a. identify systems required to move the fuel transfer carriage and close the IFTS bottom gate valve, and discuss the availability of these systems (or manual back-up systems) in frequency-dominant sequences,

   b. provide an estimate of the core damage frequency (CDF) for those events that involve loss of systems needed to operate the carriage or close the valve, based on the latest probabilistic safety assessment (PSA),

   c. confirm whether and how the carriage can be moved and the open valve can be closed in the frequency-dominant core damage events at Perry, including events that involve loss of power to the carriage or valve and loss of lighting, and

   d. identify any plant procedures that would govern such actions.

RESPONSE

The Probabilistic Safety Assessment (PSA) evaluation used to support IFTS operation assumed that a large early release could result only if the designated individual failed to manually close the IFTS motor operated drain valve following a core damage accident. Support systems to operate Motor Operated Valves (MOVs) or the carriage were assumed to be unavailable for the supporting PSA evaluation. If the IFTS bottom gate valve is open during a postulated event, the PSA assumed the valve would not be closed. This is an appropriate assumption, since a power loss would require personnel to remain inside the Containment during the accident to manually winch the IFTS carriage up in order to close the bottom valve. Assuming the bottom valve is open does not result in a large early release concern because of the water seal or the water scrubbing provided by the lower pools. Therefore, the information requested in Questions 6.a, 6.c and 6.d are not pertinent to the PSA analysis to support the proposed LAR.

With respect to Question 6.b, the only IFTS support system modeled in the PNPP PSA is the electrical distribution system. Failure of IFTS or failure of the individual IFTS components are not modeled since the availability of IFTS has no impact on core damage. Therefore, the Core Damage Frequency (CDF) that involves the loss of systems needed to operate the carriage or close the valve is bounded by the CDF for a loss of power event. The total CDF based on the latest PNPP PSA model is 5.9E-06/year. Approximately 75 percent of these sequences are associated with a loss of power. A worst case scenario would be to assume that all of the loss of power events would impact the operation of the IFTS carriage and the ability to close the bottom valve if it was open. A bounding CDF for events that involve loss of systems needed to operate the carriage or close the valve is 4.4E-06/year (5.9E-06/year X 0.75). This number needs to be adjusted to consider the time frame that the bottom valve might be open, i.e., during the 10 days of IFTS operation with the bottom valve open. The probability of an event causing core damage and resulting in the loss of the systems required to operate the carriage or close the valve is 1.22E-07 (4.4E-06/year X 10 days of IFTS operation X 1 year/ 365 days).

NRC QUESTION

7. In the flooding analysis, failure of the sheave box was "conservatively" modeled by postulating a circular opening equivalent to a hole of approximately 3 inches in diameter. Please explain why a 3-inch diameter opening is considered conservative given that spurious actuation of the flap valve would result in a much larger flow area. Discuss the impact on the flooding analysis (including operator actions) if the flow rate is based on spurious actuation of the flap valve rather than a 3 inch diameter opening.

RESPONSE

The only reason a 3 inch opening in the sheave box was modeled was to determine the time it would take to drain the IFTS pool with a reasonable size leakage crack by conservatively assuming no flow resistance. The end result of the flooding analysis (maximum flood height of less than 8 inches) is the same even if a larger flow rate were to be postulated. This is because the total flood height in the March 14, 2002 LAR letter was maximized by transferring the entire available upper IFTS pool inventory to the lower Fuel Handling Building with no leakage assumed to escape into adjoining buildings. Therefore, the specific component modeled for failure is inconsequential to the resulting maximum flood height in the Fuel Handling Building. The maximum flood height was analyzed to be acceptable for safe shutdown components in the area.

Regarding the flap valve, safety interlocks prevent opening the transfer tube bottom valve when the flap valve is open, and vice versa, to prevent drainage of the upper pool to the lower pool. This interlock control system has dual channel logic, which provides redundancy by supplying a backup sensor for each required sensor. In addition to these interlocks, the IFTS design imparts a physical barrier to the flap valve spuriously opening. When the IFTS tube begins draining, the normal force holding the flapper closed from the water pressure in the upper pool is far greater than the flapper's hydraulic actuator's capability.

Therefore, because of the IFTS system barriers that prevent the flapper from spuriously opening (safety interlocks and water pressure), it was determined that for the flooding analysis, failure of the sheave box via a postulated crack or hole as opposed to a "spurious actuation" of the flap valve was the most credible scenario.

In addition, it was determined that with the postulated leak, the tasks of the designated individual credited in Amendment 100 are not challenged. This is because the duties of the designated individual, i.e., to travel to the drain line isolation valve and ensure it is closed, takes less than 5 minutes. After 5 minutes with the postulated opening, the resulting flood height in the Fuel Handling Building is estimated to be insignificant since the water volume will not be enough to overflow the lower pools.

NRC QUESTION

8. With the blind flange removed there is typically only a single barrier to fission product release (not including the water seal, which would clear in many beyond-design-basis events), and the plant is more susceptible to upper pool drain down and uncontrolled releases. A commitment to maintain the IFTS upper gate valve and both IFTS drain line valves closed during periods when the IFTS is not operating (such as nights and weekends) would enhance defense-in-depth with regard to containment integrity. Please address the merits and rationale for not incorporating such a commitment.

RESPONSE

As mentioned in the response to Question 5, per the IFTS system operating procedure, during long term periods when the IFTS is not in use, the IFTS carriage must be stored in the Containment (raised position). With the IFTS carriage in this raised position, it is located above the upper gate valve, but still extends through the IFTS sheave box and open flap valve. Since the flap valve is open, the IFTS system interlocks prevent opening of the IFTS bottom gate valve to prevent the creation of a drain pathway from the upper Containment pools via IFTS into the lower pools. Interlocks also exist that prevent the IFTS bottom valve from opening when the IFTS tube is flooded, using head pressure of the water column above the bottom gate valve to operate a blocking valve in the bottom valve hydraulics. This ensures the bottom valve will remain closed when the system is not in use. Although the PSA analysis assumed a failure of the IFTS bottom gate valve via excessive leakage or spurious operation when the IFTS tube is full and the flap valve is open, this is a very conservative assumption due to the existence of the blocking valve in the bottom valve's hydraulic system. Therefore, a commitment to maintain the upper gate valve closed is not deemed necessary. However, consideration was given to committing to close the manual drain line isolation valve (G41F0607) during periods when the IFTS is not operating. Unlike the automatic motor operated drain line isolation valve (F42F003), which is remotely actuated and is accessible at floor level, the manual drain line isolation valve is approximately 12 feet off the floor and requires a ladder and/or scaffold and repeated entry into an area posted as a high radiation area to close and then re-open the valve. Because this activity is not considered desirable from a personnel safety and dose standpoint, other options to provide defense-in-depth for isolation of the IFTS drain line when the system was placed in standby and unmanned were explored. As a result, it was determined that the best approach was to remove the fuses to the motor operated drain valve after it had been verified closed, since these fuses are located in an easily accessible and low dose area.

Therefore, the following commitment will be established:

To enhance defense-in-depth when the IFTS blind flange is removed in MODES 1, 2 or 3, once verified closed, the power supply fuses for the IFTS drain line motor operated isolation valve (F42F003) will be removed when the IFTS is placed in standby and not manned for extended periods (such as nights and weekends).

NRC QUESTION

9. Please discuss the support systems required to ensure the availability of the fuel handling building area exhaust system, and whether these systems would be available in the frequency dominant core damage sequences, including loss of offsite power and station blackout events.

RESPONSE

The Fuel Handling Building Area Exhaust system is not credited for the prevention of Core Damage or the mitigation of offsite releases in the PNPP PSA model. Therefore, the availability of this safety-related exhaust system is not pertinent to the PSA analysis supporting the proposed LAR. The regulatory commitment made in the proposed LAR requires Fuel Handling Building closure to be in effect during periods when the IFTS blind flange is removed. This commitment is a conservative voluntary measure to ensure mitigation systems are available to limit a potential offsite release in the event of an improbable beyond-design-basis accident concurrent with an open bottom valve and pressures greater than 10 psig. The necessary support system is electrical power. The system's electrical power supply is emergency diesel backed and therefore would be available in a loss of offsite power event.

NRC QUESTION

10. Please provide and discuss the accident frequency on which the increase in CDF of 3.0E-9 per reactor-year (on page 13 of 18) is based.

RESPONSE

The only impact that IFTS operation would have on the CDF is a potential degradation of the SPMU system. A loss of water from the upper Containment pool through IFTS could result in the failure of SPMU to provide sufficient makeup to the suppression pool under some accident scenarios. A reduced suppression pool inventory could lead to an increase in the suppression pool temperature and a subsequent loss of suction pressure for the Emergency Core Cooling Systems (ECCS). This could adversely impact some of the Anticipated Transients Without Scram (ATWS) scenarios. Note that SPMU is not required for success during LOCA scenarios in the PNPP PSA.

The increase in the CDF due to the impact that IFTS operation could have on ATWS events was evaluated. A proposed failure (excessive leakage or spurious operation) of the IFTS bottom gate valve or IFTS drain valve was considered during the time that the flap valve is open. These failure mechanisms were added to the SPMU fault tree. In order to show some impact on CDF, no credit was taken for the administrative control which will ensure that the upper IFTS pool gate is installed. If credit were taken for the upper IFTS pool gate installation, the quantified effect of the Containment upper IFTS pool drainage on the CDF would be insignificant.

Failure of either the IFTS drain valve or bottom gate valve was assumed to drain the upper Containment pools. This drainage is assumed to degrade the performance of SPMU and the ECCS systems that take suction from the suppression pool. Closing the manual drain line valve downstream from the MOV drain valve, was not credited for this analysis. The failure rate for spurious operation of the IFTS valves was set equal to 5.0E-07/hr. Note that NUREG/CR-2728, "Interim Reliability Evaluation Program Procedures Guide" (January 1983), suggests a failure rate for spurious operation of a motor operated valve to be about 1.0E-07/hr. Conservatively assuming that the flap valve will be open for 50 of the 60 days, the failure probability for each valve during those 50 days is 6.0E-04 (5.0E-07/hr x 50 days x 24 hr/days).

It was also assumed that gross leakage with the flap valve closed, and the bottom gate valve or drain valve open, would sufficiently drain the upper pools to degrade SPMU. Again a conservative failure rate of 5.0E-07/hr was assumed with an exposure time of 10 days for this configuration. Adding the above failure mechanisms to the SPMU fault tree, and quantifying the full WinNupra PSA model, results in a CDF of 5.907E-06/rx-yr. The baseline CDF is 5.904E-06/rx-yr. Therefore, the quantified increase in CDF due to the proposed LAR, assuming 60 days of IFTS operation per year, is 3.0E-09/rx-yr (5.907E-06/rx-yr – 5.904E-06/rx-yr).

TABLE 9.1-4

FUEL TRANSFER SYSTEM COMPONENTS

Component No.	Identification	Essential Classification(1)	Safety Classification(2)	Quality Group(3)	Seismic Category(4)
1	Winch	NE	0	E	NA
2	Hydraulic power supply	NE	0	E	NA
3	Fluid stop	NE	0	E	NA
4	Vent pipe	NE	0	D	NA
5	Cable enclosures	NE	0	D	NA
6	Top horiz. guide arms	NE	0	E	NA
7	Upper pool upender	NE	0	E	NA
8	Trunnion box	NE	0	D	NA
9	Hydraulic cylinder	NE	0	E	NA
10	Upper pool framing	NE	0	E	NA
11	Sheave box cover	NE	0	D	NA
12	Hydraulic cylinder	NE	0	E	NA
13	Fill valve	NE	0	D	NA
14	Sheave box	NE	0	D	NA
15	Sheave pipe	NE	0	D	I

TABLE 9.1-4 (Continued)

Component No.	Identification	Essential Classification[1]	Safety Classification[2]	Quality Group[3]	Seismic Category[4]
16	Hydraulic cylinder	NE	0	E	NA
17	Manual gate valve	NE	0	D	I
18	Containment isolation[5]	PE	2	B	I
19	Containment bellows[5]	PE	2	B	I
20	Transfer tube[6]	NE	0	D	I
21	Hydraulic power supply	NE	0	E	NA[4]
22	Mid-support	NE	0	D	I
23	Wire rope (cables)	NE	0	E	NA
24	Carriage	NE	0	E	NA
24A	Tilt tube	NE	0	E	NA
24B	Follower	NE	0	E	NA
25	Gate valve	NE	0	D	I
26	Bellows	NE	0	D	NA
27	Drain valve[6]	NE	0	D	I
28	Horizontal guide arms	NE	0	E	NA
29	Valve support structure	NE	0	D	I

TABLE 9.1-4 (Continued)

Component No.	Identification	Essential Classification(1)	Safety Classification(2)	Quality Group(3)	Seismic Category(4)
30	Lower pool framing	NE	0	E	NA
31	Lower pool upender	NE	0	E	NA
32	Pivot arm framing	NE	0	E	NA
33	Control system	NE	0	I	NA
34	Local leak rate test valve(6)	NE	0	D	I
35	Drain pipe(6)	NE	0	D	I

NOTES:

1. NE - Non-essential
   PE - Passive essential

2. O - Not Safety Class 1, 2, or 3

3. B - ASME Code Section NAI, Class 2
   D - ANSI B31.1
   E - Industrial code applies
   I - Electrical codes apply

4. NA - Not applicable
   I - Seismic Category I

TABLE 9.1-4 (Continued)

NOTES. (Continued)

5. Will be subject to the pertinent provisions of 10 CFR 50, Appendix B, during the operations phase.

6. Will be subject to the pertinent provisions of 10 CFR 50, Appendix B, during the operations phase, if the containment isolation blind flange (Component No. 18) is removed. In this case: these components are necessary to provide and maintain containment integrity.