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May 25, 2004

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Document Control Desk

Subject: Oconee Nuclear Station
Docket Numbers 50-269, 270 and 287
License Amendment Request associated with the Application of Leak-Before-Break for Unit 3 Passive Low Pressure Injection Cross Connect Modification, TSC Number 2004-04

Pursuant to 10 CFR 50.90, Duke Energy Corporation (Duke) requests an amendment to Facility Operating License (FOL) No. DPR-55 for Oconee Nuclear Station (ONS) Unit 3 to revise the licensing basis associated with a selected portion of the Core Flood (CF) and Low Pressure Injection (LPI)/Decay Heat Removal (DHR) piping to allow the exclusion of dynamic effects associated with postulated pipe rupture of that piping by application of leak-before-break (LBB) technology for Oconee Unit 3. Duke made a similar request for Unit 1 that was approved by Amendment Nos. 335, 335, and 336 issued by NRC letter dated September 29, 2003 and for Unit 2 that was approved by Amendment No. 338 issued by NRC letter dated February 5, 2004. Amendment 335, 335, and 336 also revised the licensing basis for selected portions of the LPI/DHR piping to adopt Standard Review Plan (SRP), Section 3.6.2, Branch Technical Position (BTP) MEB 3-1 design requirements and added Technical Specification (TS) requirements for the passive LPI cross connect for all three Oconee Units. With this implementation of the modification on Unit 3, the modification will be complete on all three Oconee Units. As such, Duke also proposes to amend Appendix A, Technical Specifications, for FOLs DPR-38, DPR-47 and DPR-55 for ONS, Units 1, 2, and 3 to remove obsolete Technical Specification requirements that will no longer be applicable.

Duke has placed a high priority on initiatives and modifications that result in reducing operator actions. The passive LPI cross connect modification will reduce reliance on operators performing time critical functions outside the

A001
A053

control room to mitigate certain single failures during a postulated core flood line break. This modification also improves defense-in-depth associated with intersystem Loss of Coolant Accidents (LOCAs) in that an additional check valve is added to each LPI/CF line. A licensing basis change is required to support implementation of the modification on Unit 3.

General Design Criteria 4 (GDC-4) of Appendix A to 10 CFR Part 50, allows the dynamic effects associated with postulated pipe ruptures in nuclear power units to be excluded from the design basis when analyses demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping. GDC-4 requires that these analyses be submitted to the Nuclear Regulatory Commission (NRC) for review and approval. Duke requests that the NRC review and approve the LBB analysis provided in Attachment 8 so that it may be incorporated into the Oconee licensing basis for Oconee Unit 3. The analysis justifies the use of LBB technology to eliminate the dynamic effects of postulated pipe breaks associated with a selected portion of the CF and LPI piping. Duke is currently not requesting LBB application to eliminate postulated breaks at the CF/ Reactor Vessel (RV) nozzle due to recently identified NRC generic concerns regarding the effect of Alloy 600 material on the LBB analysis. Duke plans to install rupture restraints on Oconee Unit 3 as part of the described modification to absorb the dynamic effects resulting from a break at the Reactor Vessel. As part of the proposed LAR, a revision to the Oconee UFSAR is provided to reflect the approved LBB analysis for the selected portions of piping.

The revised UFSAR pages are included in Attachment 1. Attachment 2 contains the markup of the current UFSAR pages. The revised TS pages are included in Attachment 3. Attachment 4 contains the markup of the current TS pages. The Technical Justification for the amendment request is included in Attachment 5. Attachments 6 and 7 contain the No Significant Hazards Consideration Evaluation and the Environmental Impact Analysis, respectively. Attachment 8 provides a copy of the LBB analysis performed for Unit 3 by Framatome Advanced Nuclear Power (FANP), Inc.

The proposed changes have been reviewed and approved by the Plant Operations Review Committee and Nuclear Safety Review Board.

Duke plans to implement this modification during the upcoming Steam Generator (SG) replacement outage for Unit 3 during the Fall 2004 refueling outage. Approval of this proposed LAR is requested by September, 2004 to support this implementation schedule.

Implementation of these changes will not result in an undue risk to the health and safety of the public.

Other sections of the UFSAR affected by the submittal may be revised, as necessary, to reflect approval of this submittal. If so, the changes will be made in accordance with 10CFR50.71(e).

Pursuant to 10 CFR 50.91, a copy of this proposed amendment is being sent to the South Carolina Department of Health and Environmental Control for review, and as deemed necessary and appropriate, subsequent consultation with the NRC staff.

If there are any additional questions, please contact Boyd Shingleton at (864) 885-4716.

Very truly yours,

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R. A. Jones, being duly sworn, states that he is Vice President, Oconee Nuclear Site, Duke Energy Corporation, that he is authorized on the part of said Company to sign and file with the U. S. Nuclear Regulatory Commission this revision to the Renewed Facility Operating License Nos. DPR-38, DPR-47, DPR-55; and that all the statements and matters set forth herein are true and correct to the best of his knowledge.

R. A. Jones, Vice President
Oconee Nuclear Site

Subscribed and sworn to before me this 25th day of May, 2004

Sheila A. Smith
Notary Public

My Commission Expires:
6/12/2013

ATTACHMENT 3

RETYPED TECHNICAL SPECIFICATION PAGES

Remove Page	Insert Page
3.4.14-1	3.4.14-1
3.5.3-1	3.5.3-1
3.5.3-2	3.5.3-2
3.5.3-3	3.5.3-3
B 3.4.14-2	B 3.4.14-2
B 3.4.14-3	B 3.4.14-3
B 3.5.3-1 to 10	B 3.5.3-1 to 9

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.14 RCS Pressure Isolation Valve (PIV) Leakage

LCO 3.4.14 Leakage from the following RCS PIV shall be within limits:

a. CF-12,
b. CF-14,
c. LP-47,
d. LP-48,
e. LP-176, and
f. LP-177

-----NOTES-----
1. The limits of LP-47 and LP-48 are not applicable except as stated in Note 2 below.
2. The limits of both LP-47 and LP-48 may be met in lieu of either LP-176 or LP-177 limits.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 except valves in the decay heat removal (DHR) flow path when in, or during the transition to or from, the DHR mode of operation.

ACTIONS

-----NOTES-----
1. Separate Condition entry is allowed for each flow path.
2. Enter applicable Conditions and Required Actions for systems made inoperable by an inoperable PIV.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more flow paths with leakage from one or more required RCS PIVs not within limit.	-----NOTE----- Each valve used to satisfy Required Action A.1 and Required Action A.2 must have been verified to meet SR 3.4.14.1 and be on the RCS pressure boundary or the high pressure portion of the system. -----	

(continued)

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.3 Low Pressure Injection (LPI)

LCO 3.5.3 Two LPI trains shall be OPERABLE.

---NOTES---

1. Only one LPI train is required to be OPERABLE in MODE 4.
2. In MODE 4, an LPI train may be considered OPERABLE during alignment, when aligned or when operating for decay heat removal (DHR) if capable of being manually realigned to the LPI mode of operation.
3. In MODES 1, 2, and 3, the LPI discharge header crossover valves inside containment shall be open.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One LPI train inoperable in MODE 1, 2, or 3.	A.1 Restore LPI train to OPERABLE status.	7 days
B. One or more LPI discharge header crossover valve(s) inside containment not open in MODE 1, 2, or 3.	B.1 Open LPI discharge header crossover valve(s) inside containment.	7 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 4.	12 hours 60 hours
D. One required LPI train inoperable in MODE 4.	D.1 Initiate action to restore required LPI train to OPERABLE status. AND D.2 ----------NOTE----------- Only required if DHR loop is OPERABLE. ---------------------------- Be in MODE 5.	Immediately 24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.3.1	Verify each LPI manual and non-automatic power operated valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.3.2	------------------------NOTE------------------------ Not applicable to operating LPI pump(s). --- Vent each LPI pump casing.	 31 days
SR 3.5.3.3	Verify each LPI pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.5.3.4	Verify each LPI automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.5.3.5	Verify each LPI pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.5.3.6	Verify, by visual inspection, each LPI train reactor building sump suction inlet is not restricted by debris and suction inlet trash racks and screens show no evidence of structural distress or abnormal corrosion.	18 months

BASES

BACKGROUND (continued)

Violation of this LCO could result in continued degradation of a PIV, which could lead to overpressurization of a low pressure system and the loss of the integrity of a fission product barrier.

APPLICABLE SAFETY ANALYSES

Reference 4 identified potential intersystem LOCAs as a significant contributor to the risk of core melt. The dominant accident sequence in the intersystem LOCA category is the failure of the low pressure portion of the LPI System outside of containment. The accident is the result of a postulated failure of the PIVs, which are part of the reactor coolant pressure boundary (RCPB), and the subsequent pressurization of the LPI System downstream of the PIVs from the RCS. Because the low pressure portion of the LPI System is designed for pressures significantly less than RCS pressure, overpressurization failure of the LPI low pressure line would result in a LOCA outside containment and subsequent risk of core melt.

Reference 5 evaluated various PIV configurations, leakage testing of the valves, and operational changes to determine the effect on the probability of intersystem LOCAs. This study concluded that periodic leakage testing of the PIVs can substantially reduce the probability of an intersystem LOCA.

RCS PIV leakage satisfies Criterion 2 of 10 CFR 50.36 (Ref. 6).

LCO

RCS PIV leakage is identified LEAKAGE into closed low pressure systems connected to the RCS. PIV leakage is usually on the order of drops per minute. Leakage that increases significantly suggests that something is operationally wrong and corrective action must be taken.

The PIV leakage limit for specified valves is 0.5 gpm per nominal inch of valve size with a maximum limit of 5 gpm. A study concluded a leakage rate limit based on valve size was superior to a single allowable value.

Reference 7 permits leakage testing at a lower pressure differential than between the specified maximum RCS pressure and the normal pressure of the connected system during RCS operation (the maximum pressure differential) in those types of valves in which the higher service pressure will tend to diminish the overall leakage channel opening. In such cases, the observed rate may be adjusted to the maximum pressure differential by assuming leakage is directly proportional to the pressure differential to the one half power.

BASES

LCO (continued)

The LCO is modified by two Notes. Note 1 indicates that the limits for LP-47 and LP-48 are not applicable except as stated in Note 2. Note 2 indicates that the limits of both LP-47 and LP-48 may be met in lieu of either LP-176 or LP-177 limits. If either LP-176 or LP-177 limits are not met both LP-47 and LP-48 limits must be met.

APPLICABILITY

In MODES 1, 2, 3, and 4, this LCO applies because the PIV leakage potential is greatest when the RCS is pressurized. In MODE 4, valves in the DHR flow path are not required to meet the requirements of this LCO when in, or during the transition to or from, the DHR mode of operation.

In MODES 5 and 6, leakage limits are not provided because the lower reactor coolant pressure results in a reduced potential for leakage and for a LOCA outside the containment.

ACTIONS

The ACTIONS are modified by two Notes. Note 1 is added to provide clarification that each flow path allows separate entry into a Condition. This is allowed based upon the functional independence of the flow path. Note 2 requires an evaluation of affected systems if a PIV is inoperable. The leakage may have affected system OPERABILITY, or isolation of a leaking flow path with an alternate valve may have degraded the ability of the interconnected system to perform its safety function.

A.1 and A.2

The flow path with leakage must be isolated by two valves. Required Actions A.1 and A.2 are modified by a Note that the valves used for isolation must meet the same leakage requirements as the PIVs and must be on the RCS pressure boundary or the high pressure portion of the system.

Required Action A.1 requires that the isolation with one valve must be performed within 4 hours. Four hours provides time to reduce leakage in excess of the allowable limit and to isolate the affected system if leakage cannot be reduced. The 4 hours allows the actions and restricts the operation with leaking isolation valves.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.3 Low Pressure Injection (LPI)

BASES

BACKGROUND

The function of the ECCS is to provide core cooling to ensure that the reactor core is protected after any of the following accidents:

a. Loss of coolant accident (LOCA);

b. Rod ejection accident (REA);

c. Steam generator tube rupture (SGTR); and

d. Main steam line break (MSLB).

There are two phases of ECCS operation: injection and recirculation. In the injection phase, all injection is initially added to the Reactor Coolant System (RCS) via the cold legs or Core Flood Tank (CFT) lines to the reactor vessel. After the borated water storage tank (BWST) has been depleted, the recirculation phase is entered as the suction is transferred to the reactor building sump.

Two redundant low pressure injection (LPI) trains are provided. The LPI trains consist of piping, valves, instruments, controls, heat exchangers, and pumps, such that water from the borated water storage tank (BWST) can be injected into the Reactor Coolant System (RCS). In MODES 1, 2 and 3, both trains of LPI must be OPERABLE. This ensures that 100% of the core cooling requirements can be provided even in the event of a single active failure. The LPI discharge header manual crossover valves inside containment must be maintained administratively open in MODE 1, 2, and 3 to assure abundant, long term cooling. Only one LPI train is required for MODE 4.

A suction header supplies water from the BWST or the reactor building sump to the LPI pumps. LPI discharges into each of the two core flood nozzles on the reactor vessel that discharge into the vessel downcomer area.

BASES

BACKGROUND (continued)

The LPI pumps are capable of discharging to the RCS at an RCS pressure of approximately 200 psia. When the BWST has been nearly emptied, the suction for the LPI pumps is manually transferred to the reactor building sump.

In the long term cooling period, flow paths in the LPI System are established to preclude the possibility of boric acid in the core region reaching an unacceptably high concentration. Two gravity flow paths are available by means of a drain line from the hot leg to the Reactor Building sump which draws coolant from the top of the core, thereby inducing core circulation. The system is designed with redundant drain lines.

During a large break LOCA, RCS pressure will rapidly decrease. The LPI System is actuated upon receipt of an ESPS signal. If offsite power is available, the safeguard loads start immediately. If offsite power is not available, the Engineered Safeguards (ES) buses are connected to the Keowee Hydro Units. The time delay (38 seconds) associated with Keowee Hydro Unit startup and LPI pump starting determines the time required before pumped flow is available to the core following a LOCA. Full LPI flow is not available until the LPI header isolation valve strokes full open. The ES signal has been removed from LP-21 and LP-22. These valves shall be open when automatic initiation of the LPI system is required. If either one is closed during this time, the associated LPI and RBS train is inoperable.

The LPI and HPI (LCO 3.5.2, "High Pressure Injection (HPI)"), along with the passive CFTs and the BWST covered in LCO 3.5.1, "Core Flood Tanks (CFTs)," and LCO 3.5.4, "Borated Water Storage Tank (BWST)," provide the cooling water necessary to meet 10 CFR 50.46 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The LCO helps to ensure that the following acceptance criteria for the ECCS, established by 10 CFR 50.46 (Ref. 1), will be met following a LOCA:

a. Maximum fuel element cladding temperature is ≤ 2200°F;

b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation;

c. Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react;

d. Core is maintained in a coolable geometry; and

BASES

APPLICABLE SAFETY ANALYSES (continued)

e. Adequate long term core cooling capability is maintained.

The LCO also helps ensure that reactor building temperature limits are met.

The LPI System is assumed to provide injection in the large break LOCA analysis at full power (Ref. 2). This analysis establishes a minimum required flow for the LPI pumps, as well as the minimum required response time for their actuation.

The large break LOCA event assumes a loss of offsite power and a single failure (loss of the CT-4 transformer). For analysis purposes, the loss of offsite power assumption may be conservatively inconsistent with the assumed operation of some equipment, such as reactor coolant pumps (Ref. 3). During the blowdown stage of a LOCA, the RCS depressurizes as primary coolant is ejected through the break into the reactor building. The nuclear reaction is terminated by moderator voiding during large breaks. Following depressurization, emergency cooling water is injected into the reactor vessel core flood nozzles, then flows into the downcomer, fills the lower plenum, and refloods the core.

In the event of a Core Flood line break which results in a LOCA, with a concurrent single failure on the unaffected LPI train opposite the Core Flood line break, the system is fitted with flow restricting devices in each injection leg and an upstream cross-connect pipe. These serve to limit the ECCS spillage through the faulted header and ensure that flow is diverted from the faulted header to the intact header at lower pressures. These flow restricting devices also provide LPI pump run-out protection during LBLOCAs.

The safety analyses show that an LPI train will deliver sufficient water to match decay heat boiloff rates for a large break LOCA.

In the large break LOCA analyses, full LPI is not credited until 74 seconds after actuation of the ESPS signal. This is based on a loss of offsite power and the associated time delays in Keowee Hydro Unit startup, valve opening and pump start. Further, LPI flow is not credited until RCS pressure drops below the pump's shutoff head. For a large break LOCA, HPI is not credited at all.

The LPI trains satisfy Criterion 3 of 10 CFR 50.36 (Ref. 4).

BASES (continued)

LCO

In MODES 1, 2, and 3, two independent (and redundant) LPI trains are required to ensure that at least one LPI train is available, assuming a single failure in the other train. Additionally, individual components within the LPI trains may be called upon to mitigate the consequences of other transients and accidents. Each LPI train includes the piping, instruments, pumps, valves, heat exchangers and controls to ensure an OPERABLE flow path capable of taking suction from the BWST upon an ES signal and the capability to manually (remotely) transfer suction to the reactor building sump. The safety grade flow indicator of an LPI train is required to support OPERABILITY of the LPI and RBS trains to preclude NPSH or runout problems. RBS flow is hydraulically maintained by system resistance, and throttling of RBS flow is not required. Therefore, RBS flow indication is not required to support LPI or RBS train OPERABILITY. However, TS 3.3.8, Required Action F.1 requires the affected RBS train to be declared inoperable when an RBS flow instrument is inoperable. A license amendment is being processed to eliminate this requirement. The safety grade flow indicator associated with LPSW flow to an LPI cooler is required to be OPERABLE to support LPI train OPERABILITY.

LPI BWST Suction Valves, LP-21 and LP-22 do not have an ES signal to open. These valves shall be open when automatic initiation of the LPI and the RBS system is required to be OPERABLE. If either one is closed during this time, the associated LPI and RBS train is inoperable.

In MODE 4, one of the two LPI trains is required to ensure sufficient LPI flow is available to the core.

During an event requiring LPI injection, a flow path is required to provide an abundant supply of water from the BWST to the RCS, via the LPI pumps and their respective supply headers, to the reactor vessel. In the long term, this flow path may be switched to take its supply from the reactor building sump.

This LCO is modified by three Notes. Note 1 changes the LCO requirement when in MODE 4 for the number of OPERABLE trains from two to one. Note 2 allows an LPI train to be considered OPERABLE during alignment, when aligned or when operating for decay heat removal if capable of being manually (remotely) realigned to the LPI mode of operation. This provision is necessary because of the dual requirements of the components that comprise the LPI and decay heat removal modes of the LPI System. Note 3 requires the LPI discharge header crossover valves inside containment to be open in MODES 1, 2, and 3. If one of these valves is closed, then the system will be unable to sustain a single failure.

BASES

LCO (continued)

The flow path for each train must maintain its designed independence outside containment to ensure that no single failure can disable both LPI trains. If train separation is not maintained outside containment then only one LPI train is considered OPERABLE.

APPLICABILITY

In MODES 1, 2 and 3, the LPI train OPERABILITY requirements for the Design Basis Accident, a large break LOCA, are based on full power operation. The position requirements of the LPI discharge crossover valves inside containment for the CFT line break are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES.

In MODE 4, one OPERABLE LPI train is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

In MODES 5 and 6, unit conditions are such that the probability of an event requiring LPI injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops–MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops–MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.4, "DHR and Coolant Circulation–High Water Level," and LCO 3.9.5, "DHR and Coolant Circulation–Low Water Level."

ACTIONS

A.1

With one LPI train inoperable in MODES 1, 2 or 3, the inoperable train must be returned to OPERABLE status within 7 days. The 7 day Completion Time is based on the findings of the deterministic and probabilistic analysis in Reference 7. Reference 7 concluded that extending the Completion Time to 7 days for an inoperable LPI train improves plant operational flexibility while simultaneously reducing overall plant risk. Specifically, the risk incurred by having the LPI train unavailable for a longer time at power will be substantially offset by the benefits associated with avoiding unnecessary plant transitions and by reducing risk during shutdown operations.

BASES

ACTIONS (continued)

B.1

With one or more required LPI discharge header manual crossover valves inside containment closed, the closed valve(s) must be opened within 7 days. The 7 day Completion Time is based on the findings of the deterministic and probabilistic analysis in Reference 7.

C.1

If the Required Action and associated Completion Time of Condition A or B are not met, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and MODE 4 within 60 hours. The allowed Completion Times are reasonable, based on operating experience, reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

D.1

With one required LPI train inoperable in MODE 4, the unit is not prepared to respond to an event requiring low pressure injection and may not be prepared to continue cooldown using the LPI pumps and LPI heat exchangers. The Completion Time of immediately, which would initiate action to restore at least one LPI train to OPERABLE status, ensures that prompt action is taken to restore the required LPI capacity. Normally, in MODE 4, reactor decay heat must be removed by a decay heat removal (DHR) loop operating with suction from the RCS. If no LPI train is OPERABLE for this function, reactor decay heat must be removed by some alternate method, such as use of the steam generator(s).

The alternate means of heat removal must continue until one of the inoperable LPI trains can be restored to operation so that continuation of decay heat removal (DHR) is provided.

With the LPI pumps (including the non ES pump) and LPI heat exchangers inoperable, it would be unwise to require the unit to go to MODE 5, where the only available heat removal system is the LPI trains operating in the DHR mode. Therefore, the appropriate action is to initiate measures to restore one LPI train and to continue the actions until the subsystem is restored to OPERABLE status.

BASES

ACTIONS

D.2 (continued)

Required Action D.2 requires that the unit be placed in MODE 5 within 24 hours. This Required Action is modified by a Note that states that the Required Action is only required to be performed if a DHR loop is OPERABLE. This Required Action provides for those circumstances where the LPI trains may be inoperable but otherwise capable of providing the necessary decay heat removal. Under this circumstance, the prudent action is to remove the unit from the Applicability of the LCO and place the unit in a stable condition in MODE 5. The Completion Time of 24 hours is reasonable, based on operating experience, to reach MODE 5 in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.5.3.1

Verifying the correct alignment for manual and non-automatic power operated valves in the LPI flow paths provides assurance that the proper flow paths will exist for LPI operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. Similarly, this SR does not apply to automatic valves since automatic valves actuate to their required position upon an accident signal. This Surveillance does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position. The 31 day Frequency is appropriate because the valves are operated under administrative control, and an inoperable valve position would only affect a single train. This Frequency has been shown to be acceptable through operating experience.

When in MODE 4 an LPI train may be considered OPERABLE during alignment, when aligned or when operating for decay heat removal if capable of being manually realigned to the LPI mode of operation.

Therefore, for this condition, the SR verifies that LPI is capable of being manually realigned to the LPI mode of operation.

SR 3.5.3.2

With the exception of systems in operation, the LPI pumps are normally in a standby, non-operating mode. As such, the flow path piping has the potential to develop voids and pockets of entrained gases. Venting the LPI pump casings periodically reduces the potential that such voids and pockets of entrained gases can adversely affect operation of the LPI System. This will also minimize the potential for water hammer, pump

BASES

SURVEILLANCE REQUIREMENTS

SR 3.5.3.2 (continued)

cavitation, and pumping of noncondensible gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an ESPS signal or during shutdown cooling. This Surveillance is modified by a Note that indicates it is not applicable to operating LPI pump(s). The 31 day Frequency takes into consideration the gradual nature of gas accumulation in the LPI piping and the existence of procedural controls governing system operation.

SR 3.5.3.3

Periodic surveillance testing of LPI pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by Section XI of the ASME Code (Ref. 6). SRs are specified in the Inservice Testing Program, which encompasses Section XI of the ASME Code.

SR 3.5.3.4 and SR 3.5.3.5

These SRs demonstrate that each automatic LPI valve actuates to the required position on an actual or simulated ESPS signal and that each LPI pump starts on receipt of an actual or simulated ESPS signal. This SR is not required for valves that are locked, sealed, or otherwise secured in position under administrative controls. The test will be considered satisfactory if control board indication verifies that all components have responded to the ESPS actuation signal properly (all appropriate ESPS actuated pump breakers have opened or closed and all ESPS actuated valves have completed their travel). The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. The 18 month Frequency is also acceptable based on consideration of the design reliability (and confirming operating experience) of the equipment.

The actuation logic is tested as part of the ESPS testing, and equipment performance is monitored as part of the Inservice Testing Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.3.6

to the location, and on the potential for an unplanned transient if the Surveillance were performed with the reactor at power. This Frequency has been found to be sufficient to detect abnormal degradation and has been confirmed by operating experience.

REFERENCES

1. 10 CFR 50.46.
2. UFSAR, Section 15.14.3.3.6.
3. UFSAR, Section 15.14.3.3.5.
4. 10 CFR 50.36.
5. NRC Memorandum to V. Stello, Jr., from R.L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975.
6. ASME, Boiler and Pressure Vessel Code, Section XI, Inservice Inspection, Article IWV-3400.
7. NRC Safety Evaluation of Babcock & Wilcox Owners Group (B&WOG) Topical Report BAW-2295, Revision 1, "Justification for the Extension of Allowed Outage Time for Low Pressure Injection and Reactor Building Spray systems," (TAC No. MA3807) dated June 30, 1999.

ATTACHMENT 4

MARKUP OF TECHNICAL SPECIFICATIONS

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.14 RCS Pressure Isolation Valve (PIV) Leakage

LCO 3.4.14 Leakage from the following RCS PIV shall be within limits:

a. CF-12,
b. CF-14,
c. LP-47,
d. LP-48,
e. LP-176, and
f. LP-177

----------NOTES----------

1. Prior to completion of the LPI passive cross connect modification on each Unit, the limits for LP-176 and LP-177 are not applicable.
2. After completion of the LPI passive cross connect modification on each Unit, the limits for LP-47 and LP-48 are not applicable except as stated in Note 3 below.
3. After completion of the LPI passive cross connect modification on each Unit, the limits of both LP-47 and LP-48 may be met in lieu of either LP-176 and LP-177 limits.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 except valves in the decay heat removal (DHR) flow path when in, or during the transition to or from, the DHR mode of operation.

ACTIONS

----------NOTES----------

1. Separate Condition entry is allowed for each flow path.
2. Enter applicable Conditions and Required Actions for systems made inoperable by an inoperable PIV.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more flow paths with leakage from one or more required RCS PIVs not within limit.	----NOTE---- Each valve used to satisfy Required Action A.1 and Required Action A.2 must have been verified to meet SR 3.4.14.1 and be on the RCS pressure boundary or the high pressure portion of the system. ----	

(continued)

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.3 Low Pressure Injection (LPI)

LCO 3.5.3 Two LPI trains shall be OPERABLE.

-----NOTES-----

1. Only one LPI train is required to be OPERABLE in MODE 4.
2. In MODE 4, an LPI train may be considered OPERABLE during alignment, when aligned or when operating for decay heat removal (DHR) if capable of being manually realigned to the LPI mode of operation.
3. In MODES 1, 2, and 3, the LPI discharge header crossover valves outside containment shall be manually OPERABLE to open on each Unit until after completion of the passive LPI cross connect modification on the respective unit.
4. In MODES 1, 2, and 3, the LPI discharge header crossover valves inside containment shall be open on each Unit after completion of the passive LPI cross connect modification on the respective unit.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One LPI train inoperable in MODE 1, 2, or 3.	A.1 Restore LPI train to OPERABLE status.	7 days
B. One or more required LPI discharge header crossover valve(s) outside containment manually inoperable to open in MODE 1, 2, or 3.	B.1 Restore LPI discharge header crossover valve(s) outside containment to OPERABLE status.	7 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
~~C~~ B One or more ~~required~~ LPI discharge header crossover valve(s) inside containment not open in MODE 1, 2, or 3.	~~C~~ B.1	Open LPI discharge header crossover valve(s) inside containment.	7 days
~~D~~ C Required Action and associated Completion Time of Condition A, ~~B,~~ or ~~C~~ B not met.	~~D~~ C.1	Be in MODE 3.	12 hours
	AND		
	~~D~~ C.2	Be in MODE 4.	60 hours
~~E~~ D One required LPI train inoperable in MODE 4.	~~E~~ D.1	Initiate action to restore required LPI train to OPERABLE status.	Immediately
	AND		
	~~E~~ D.2	----------NOTE----------- Only required if DHR loop is OPERABLE. --------------------------- Be in MODE 5.	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.3.1	Verify each LPI manual and non-automatic power operated valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days

(continued)

ACTIONS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.3.2	-----------------------NOTE----------------------- Not applicable to operating LPI pump(s). --- Vent each LPI pump casing.	31 days
SR 3.5.3.3	Verify each LPI pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.5.3.4	Verify each LPI automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.5.3.5	Verify each LPI pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.5.3.6	Verify, by visual inspection, each LPI train reactor building sump suction inlet is not restricted by debris and suction inlet trash racks and screens show no evidence of structural distress or abnormal corrosion.	18 months
SR 3.5.3.7	-----------------------NOTE----------------------- Not applicable after completion of the passive LPI cross connect modification on each Unit. --- Cycle each LPI discharge header crossover valve outside containment, LPI cooler outlet throttle valve, and LPI header isolation valve open manually.	18 months

BASES

BACKGROUND (continued)

Violation of this LCO could result in continued degradation of a PIV, which could lead to overpressurization of a low pressure system and the loss of the integrity of a fission product barrier.

APPLICABLE SAFETY ANALYSES

Reference 4 identified potential intersystem LOCAs as a significant contributor to the risk of core melt. The dominant accident sequence in the intersystem LOCA category is the failure of the low pressure portion of the LPI System outside of containment. The accident is the result of a postulated failure of the PIVs, which are part of the reactor coolant pressure boundary (RCPB), and the subsequent pressurization of the LPI System downstream of the PIVs from the RCS. Because the low pressure portion of the LPI System is designed for pressures significantly less than RCS pressure, overpressurization failure of the LPI low pressure line would result in a LOCA outside containment and subsequent risk of core melt.

Reference 5 evaluated various PIV configurations, leakage testing of the valves, and operational changes to determine the effect on the probability of intersystem LOCAs. This study concluded that periodic leakage testing of the PIVs can substantially reduce the probability of an intersystem LOCA.

RCS PIV leakage satisfies Criterion 2 of 10 CFR 50.36 (Ref. 6).

LCO

RCS PIV leakage is identified LEAKAGE into closed low pressure systems connected to the RCS. PIV leakage is usually on the order of drops per minute. Leakage that increases significantly suggests that something is operationally wrong and corrective action must be taken.

The PIV leakage limit for specified valves is 0.5 gpm per nominal inch of valve size with a maximum limit of 5 gpm. A study concluded a leakage rate limit based on valve size was superior to a single allowable value.

Reference 7 permits leakage testing at a lower pressure differential than between the specified maximum RCS pressure and the normal pressure of the connected system during RCS operation (the maximum pressure differential) in those types of valves in which the higher service pressure will tend to diminish the overall leakage channel opening. In such cases, the observed rate may be adjusted to the maximum pressure differential by assuming leakage is directly proportional to the pressure differential to the one half power.

two

The LCO is modified by ~~three~~ Notes. ~~These Notes exclude RCS PIVs that are required to meet the LCO requirement based on the status of the~~

1

BASES

LCO (continued)

passive LPI cross connect modification for each Unit. Note 1 indicates that prior to completion of the passive LPI cross connect modification, the limits for LP-176 and LP-177 are not applicable. Note 2 indicates that after completion of the passive LPI cross connect modification, the limits for LP-47 and LP-48 are not applicable except as stated in Note 3. Note 3 indicates that after completion of the LPI passive cross connect modification on each Unit the limits of both LP-47 and LP-48 may be met in lieu of either LP-176 and LP-177 limits. If either LP-176 or LP-177 limits are not met both LP-47 and LP-48 limits must be met.

2

or

APPLICABILITY

In MODES 1, 2, 3, and 4, this LCO applies because the PIV leakage potential is greatest when the RCS is pressurized. In MODE 4, valves in the DHR flow path are not required to meet the requirements of this LCO when in, or during the transition to or from, the DHR mode of operation.

In MODES 5 and 6, leakage limits are not provided because the lower reactor coolant pressure results in a reduced potential for leakage and for a LOCA outside the containment.

ACTIONS

The ACTIONS are modified by two Notes. Note 1 is added to provide clarification that each flow path allows separate entry into a Condition. This is allowed based upon the functional independence of the flow path. Note 2 requires an evaluation of affected systems if a PIV is inoperable. The leakage may have affected system OPERABILITY, or isolation of a leaking flow path with an alternate valve may have degraded the ability of the interconnected system to perform its safety function.

A.1 and A.2

The flow path with leakage must be isolated by two valves. Required Actions A.1 and A.2 are modified by a Note that the valves used for isolation must meet the same leakage requirements as the PIVs and must be on the RCS pressure boundary or the high pressure portion of the system.

Required Action A.1 requires that the isolation with one valve must be performed within 4 hours. Four hours provides time to reduce leakage in excess of the allowable limit and to isolate the affected system if leakage cannot be reduced. The 4 hours allows the actions and restricts the operation with leaking isolation valves.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.3 Low Pressure Injection (LPI)

BASES

BACKGROUND

The function of the ECCS is to provide core cooling to ensure that the reactor core is protected after any of the following accidents:

a. Loss of coolant accident (LOCA);

b. Rod ejection accident (REA);

c. Steam generator tube rupture (SGTR); and

d. Main steam line break (MSLB).

There are two phases of ECCS operation: injection and recirculation. In the injection phase, all injection is initially added to the Reactor Coolant System (RCS) via the cold legs or Core Flood Tank (CFT) lines to the reactor vessel. After the borated water storage tank (BWST) has been depleted, the recirculation phase is entered as the suction is transferred to the reactor building sump.

Two redundant low pressure injection (LPI) trains are provided. The LPI trains consist of piping, valves, instruments, controls, heat exchangers, and pumps, such that water from the borated water storage tank (BWST) can be injected into the Reactor Coolant System (RCS). In MODES 1, 2 and 3, both trains of LPI must be OPERABLE. This ensures that 100% of the core cooling requirements can be provided even in the event of a single active failure. For Unit(s) in which the passive LPI cross connect modification has been completed, the LPI discharge header manual crossover valves inside containment must be maintained administratively open in MODE 1, 2, and 3 to assure abundant, long term cooling. For Unit(s) in which the passive LPI cross connect modification has not been completed, the LPI discharge header crossover valves outside containment must be manually (locally and remotely) OPERABLE in MODE 1, 2, and 3 to assure abundant, long term core cooling. Only one LPI train is required for MODE 4.

A suction header supplies water from the BWST or the reactor building sump to the LPI pumps. LPI discharges into each of the two core flood nozzles on the reactor vessel that discharge into the vessel downcomer area.

Amendment Nos.

BASES

BACKGROUND (continued)

The LPI pumps are capable of discharging to the RCS at an RCS pressure of approximately 200 psia. When the BWST has been nearly emptied, the suction for the LPI pumps is manually transferred to the reactor building sump.

In the long term cooling period, flow paths in the LPI System are established to preclude the possibility of boric acid in the core region reaching an unacceptably high concentration. Two gravity flow paths are available by means of a drain line from the hot leg to the Reactor Building sump which draws coolant from the top of the core, thereby inducing core circulation. The system is designed with redundant drain lines.

During a large break LOCA, RCS pressure will rapidly decrease. The LPI System is actuated upon receipt of an ESPS signal. If offsite power is available, the safeguard loads start immediately. If offsite power is not available, the Engineered Safeguards (ES) buses are connected to the Keowee Hydro Units. The time delay (38 seconds) associated with Keowee Hydro Unit startup and LPI pump starting determines the time required before pumped flow is available to the core following a LOCA. Full LPI flow is not available until the LPI header isolation valve strokes full open. The ES signal has been removed from LP-21 and LP-22. These valves shall be open when automatic initiation of the LPI system is required. If either one is closed during this time, the associated LPI and RBS train is inoperable.

The LPI and HPI (LCO 3.5.2, "High Pressure Injection (HPI)"), along with the passive CFTs and the BWST covered in LCO 3.5.1, "Core Flood Tanks (CFTs)," and LCO 3.5.4, "Borated Water Storage Tank (BWST)," provide the cooling water necessary to meet 10 CFR 50.46 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The LCO helps to ensure that the following acceptance criteria for the ECCS, established by 10 CFR 50.46 (Ref. 1), will be met following a LOCA:

a. *Maximum fuel element cladding temperature is* ≤ 2200°F;

b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation;

c. Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react;

d. Core is maintained in a coolable geometry; and

BASES

APPLICABLE SAFETY ANALYSES (continued)

e. Adequate long term core cooling capability is maintained.

The LCO also helps ensure that reactor building temperature limits are met.

The LPI System is assumed to provide injection in the large break LOCA analysis at full power (Ref. 2). This analysis establishes a minimum required flow for the LPI pumps, as well as the minimum required response time for their actuation.

The large break LOCA event assumes a loss of offsite power and a single failure (loss of the CT-4 transformer). For analysis purposes, the loss of offsite power assumption may be conservatively inconsistent with the assumed operation of some equipment, such as reactor coolant pumps (Ref. 3). During the blowdown stage of a LOCA, the RCS depressurizes as primary coolant is ejected through the break into the reactor building. The nuclear reaction is terminated by moderator voiding during large breaks. Following depressurization, emergency cooling water is injected into the reactor vessel core flood nozzles, then flows into the downcomer, fills the lower plenum, and refloods the core.

In the event of a Core Flood line break which results in a LOCA, with a concurrent single failure on the unaffected LPI train opposite the Core Flood line break, for Unit(s) in which the passive LPI cross connect modification is complete, the system is fitted with flow restricting devices in each injection leg and an upstream cross-connect pipe. These serve to limit the ECCS spillage through the faulted header and ensure that flow is diverted from the faulted header to the intact header at lower pressures. These flow restricting devices also provide LPI pump run-out protection during LBLOCAs. For Unit(s) in which the passive LPI cross connect modification is not complete, the LPI discharge header crossover valves (LP-9 and LP-10) outside containment must be capable of being manually (locally and remotely) opened and the LPI cooler outlet throttle valves and LPI header isolation valves must be capable of being manually opened to provide assurance that flow can be established in a timely manner even if the capability to operate them from the control room is lost. For Unit(s) in which the passive LPI cross connect modification is not complete, these manual actions will allow cross-connection of the LPI pump discharge to the intact LPI/Core Flood tank header to provide abundant emergency core cooling.

The safety analyses show that an LPI train will deliver sufficient water to match decay heat boiloff rates for a large break LOCA.

In the large break LOCA analyses, full LPI is not credited until 74 seconds after actuation of the ESPS signal. This is based on a loss of offsite power and the associated time delays in Keowee Hydro Unit startup, valve

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BASES

APPLICABLE SAFETY ANALYSES (continued)

opening and pump start. Further, LPI flow is not credited until RCS pressure drops below the pump's shutoff head. For a large break LOCA, HPI is not credited at all.

The LPI trains satisfy Criterion 3 of 10 CFR 50.36 (Ref. 4).

LCO

In MODES 1, 2, and 3, two independent (and redundant) LPI trains are required to ensure that at least one LPI train is available, assuming a single failure in the other train. Additionally, individual components within the LPI trains may be called upon to mitigate the consequences of other transients and accidents. Each LPI train includes the piping, instruments, pumps, valves, heat exchangers and controls to ensure an OPERABLE flow path capable of taking suction from the BWST upon an ES signal and the capability to manually (remotely) transfer suction to the reactor building sump. The safety grade flow indicator of an LPI train is required to support OPERABILITY of the LPI and RBS trains to preclude NPSH or runout problems. RBS flow is hydraulically maintained by system resistance, and throttling of RBS flow is not required. Therefore, RBS flow indication is not required to support LPI or RBS train OPERABILITY. However, TS 3.3.8, Required Action F.1 requires the affected RBS train to be declared inoperable when an RBS flow instrument is inoperable. A license amendment is being processed to eliminate this requirement. The safety grade flow indicator associated with LPSW flow to an LPI cooler is required to be OPERABLE to support LPI train OPERABILITY.

LPI BWST Suction Valves, LP-21 and LP-22 do not have an ES signal to open. These valves shall be open when automatic initiation of the LPI and the RBS system is required to be OPERABLE. If either one is closed during this time, the associated LPI and RBS train is inoperable.

In MODE 4, one of the two LPI trains is required to ensure sufficient LPI flow is available to the core.

During an event requiring LPI injection, a flow path is required to provide an abundant supply of water from the BWST to the RCS, via the LPI pumps and their respective supply headers, to the reactor vessel. In the long term, this flow path may be switched to take its supply from the reactor building sump.

three

This LCO is modified by ~~four~~ Notes. Note 1 changes the LCO requirement when in MODE 4 for the number of OPERABLE trains from two to one. Note 2 allows an LPI train to be considered OPERABLE during alignment, when aligned or when operating for decay heat removal if capable of being manually (remotely) realigned to the LPI mode of operation. This provision is necessary because of the dual requirements of the components that comprise the LPI and decay heat removal modes of the LPI System.

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BASES

LCO (continued)

Note 3 requires the LPI discharge header crossover valves (LP-9 and LP-10) outside containment to be OPERABLE in MODES 1, 2, and 3 until after completion of the passive LPI cross connect modification on the respective Unit. Note 4 requires the LPI discharge header crossover valves inside containment to be open in MODES 1, 2, and 3 after completion of the passive LPI cross connect modification modification on the respective Unit. If one of these valves is closed, then the system will be unable to sustain a single failure discharge header crossover valves (LP-9 and LP-10) are simultaneously open then only one LPI train is considered OPERABLE.

The flow path for each train must maintain its designed independence outside containment to ensure that no single failure can disable both LPI trains. If train separation is not maintained outside containment then only one LPI train is considered OPERABLE.

APPLICABILITY

In MODES 1, 2 and 3, the LPI train OPERABILITY requirements for the Design Basis Accident, a large break LOCA, are based on full power operation. Prior to completion of the passive LPI cross connect modification, the LPI discharge crossover valve OPERABILITY requirements for CFT line break are based on full power operation. After the completion of the passive LPI cross connect modification, the position requirements of the LPI discharge crossover valves inside containment for the CFT line break are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES.

In MODE 4, one OPERABLE LPI train is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

In MODES 5 and 6, unit conditions are such that the probability of an event requiring LPI injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops–MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops–MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.4, "DHR and Coolant Circulation–High Water Level," and LCO 3.9.5, "DHR and Coolant Circulation–Low Water Level."

ACTIONS

A.1

With one LPI train inoperable in MODES 1, 2 or 3, the inoperable train must be returned to OPERABLE status within 7 days. The 7 day Completion Time is based on the findings of the deterministic and probabilistic analysis

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BASES

ACTIONS

A.1 (continued)

in Reference 7. Reference 7 concluded that extending the Completion Time to 7 days for an inoperable LPI train improves plant operational flexibility while simultaneously reducing overall plant risk. Specifically, the risk incurred by having the LPI train unavailable for a longer time at power will be substantially offset by the benefits associated with avoiding unnecessary plant transitions and by reducing risk during shutdown operations.

B.1

With one or more LPI discharge crossover valves inoperable, the inoperable valve(s) must be returned to OPERABLE status within 72 hours. The 72 hour Completion Time is based on NRC recommendations (Ref. 5) that are based on a risk evaluation and is a reasonable time for many repairs.

C.1

With one or more required LPI discharge header manual crossover valves inside containment closed, the closed valve(s) must be opened within 7 days. The 7 day Completion Time is based on the findings of the deterministic and probabilistic analysis in Reference 7.

C

D.1

If the Required Action and associated Completion Time of Condition A, B, or C are not met, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and MODE 4 within 60 hours. The allowed Completion Times are reasonable, based on operating experience, reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

B

D

E.1

With one required LPI train inoperable in MODE 4, the unit is not prepared to respond to an event requiring low pressure injection and may not be prepared to continue cooldown using the LPI pumps and LPI heat exchangers. The Completion Time of immediately, which would initiate action to restore at least one LPI train to OPERABLE status, ensures that prompt action is taken to restore the required LPI capacity. Normally, in MODE 4, reactor decay heat must be removed by a decay heat removal (DHR) loop operating with suction from the RCS. If no LPI train is OPERABLE for this function, reactor decay heat must be removed by some alternate method, such as use of the steam generator(s).

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BASES

ACTIONS

D

E.1 (continued)

The alternate means of heat removal must continue until one of the inoperable LPI trains can be restored to operation so that continuation of decay heat removal (DHR) is provided.

With the LPI pumps (including the non ES pump) and LPI heat exchangers inoperable, it would be unwise to require the unit to go to MODE 5, where the only available heat removal system is the LPI trains operating in the DHR mode. Therefore, the appropriate action is to initiate measures to restore one LPI train and to continue the actions until the subsystem is restored to OPERABLE status.

E.2

Required Action E.2 requires that the unit be placed in MODE 5 within 24 hours. This Required Action is modified by a Note that states that the Required Action is only required to be performed if a DHR loop is OPERABLE. This Required Action provides for those circumstances where the LPI trains may be inoperable but otherwise capable of providing the necessary decay heat removal. Under this circumstance, the prudent action is to remove the unit from the Applicability of the LCO and place the unit in a stable condition in MODE 5. The Completion Time of 24 hours is reasonable, based on operating experience, to reach MODE 5 in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.5.3.1

Verifying the correct alignment for manual and non-automatic power operated valves in the LPI flow paths provides assurance that the proper flow paths will exist for LPI operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. Similarly, this SR does not apply to automatic valves since automatic valves actuate to their required position upon an accident signal. This Surveillance does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position. The 31 day Frequency is appropriate because the valves are operated under administrative control, and an inoperable valve position would only affect a single train. This Frequency has been shown to be acceptable through operating experience.

When in MODE 4 an LPI train may be considered OPERABLE during alignment, when aligned or when operating for decay heat removal if capable of being manually realigned to the LPI mode of operation.

Amendment Nos.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.5.3.1 (continued)

Therefore, for this condition, the SR verifies that LPI is capable of being manually realigned to the LPI mode of operation.

SR 3.5.3.2

With the exception of systems in operation, the LPI pumps are normally in a standby, non-operating mode. As such, the flow path piping has the potential to develop voids and pockets of entrained gases. Venting the LPI pump casings periodically reduces the potential that such voids and pockets of entrained gases can adversely affect operation of the LPI System. This will also minimize the potential for water hammer, pump cavitation, and pumping of noncondensible gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an ESPS signal or during shutdown cooling. This Surveillance is modified by a Note that indicates it is not applicable to operating LPI pump(s). The 31 day Frequency takes into consideration the gradual nature of gas accumulation in the LPI piping and the existence of procedural controls governing system operation.

SR 3.5.3.3

Periodic surveillance testing of LPI pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by Section XI of the ASME Code (Ref. 6). SRs are specified in the Inservice Testing Program, which encompasses Section XI of the ASME Code.

SR 3.5.3.4 and SR 3.5.3.5

These SRs demonstrate that each automatic LPI valve actuates to the required position on an actual or simulated ESPS signal and that each LPI pump starts on receipt of an actual or simulated ESPS signal. This SR is not required for valves that are locked, sealed, or otherwise secured in position under administrative controls. The test will be considered satisfactory if control board indication verifies that all components have responded to the ESPS actuation signal properly (all appropriate ESPS actuated pump breakers have opened or closed and all ESPS actuated valves have completed their travel). The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. The 18 month Frequency is also acceptable based on consideration of the design reliability (and confirming operating experience) of the equipment.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.5.3.4 and SR 3.5.3.5 (continued)

The actuation logic is tested as part of the ESPS testing, and equipment performance is monitored as part of the Inservice Testing Program.

SR 3.5.3.6

Periodic inspections of the reactor building sump suction inlet ensure that it is unrestricted and stays in proper operating condition. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage, on the need to preserve access to the location, and on the potential for an unplanned transient if the Surveillance were performed with the reactor at power. This Frequency has been found to be sufficient to detect abnormal degradation and has been confirmed by operating experience.

SR 3.5.3.7

The function of the required LPI discharge header crossover valves (LP-9, LP-10) outside containment is to open and allow a cross-connection between LPI trains. The LPI cooler outlet throttle valves (LP-12, LP-14) and LPI header isolation valves (LP-17, LP-18) must be capable of being manually opened to provide assurance that flow can be established in a timely manner even if the capability to operate them from the control room is lost. Manually cycling each valve open demonstrates the ability to fulfill this function. This test is performed on an 18 month Frequency. Operating experience has shown that these components usually pass the Surveillance when performed at this Frequency. Therefore, the Frequency is acceptable from a reliability standpoint. The Surveillance is modified by a note indicating that it is not applicable after completion of the passive LPI cross connect modification on each Unit.

REFERENCES

1. 10 CFR 50.46.
2. UFSAR, Section 15.14.3.3.6.
3. UFSAR, Section 15.14.3.3.5.
4. 10 CFR 50.36.
5. NRC Memorandum to V. Stello, Jr., from R.L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975.

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BASES

REFERENCES (continued)

6. ASME, Boiler and Pressure Vessel Code, Section XI, Inservice Inspection, Article IWV-3400.

7. NRC Safety Evaluation of Babcock & Wilcox Owners Group (B&WOG) Topical Report BAW-2295, Revision 1, "Justification for the Extension of Allowed Outage Time for Low Pressure Injection and Reactor Building Spray systems," (TAC No. MA3807) dated June 30, 1999.

Attachment 5

Technical Justification

Attachment 5
Technical Justification

Overview

The proposed License Amendment Request (LAR) revises the licensing basis associated with a selected portion of the Core Flood (CF) and Low Pressure Injection (LPI)/Decay Heat Removal (DHR) piping to allow the exclusion of dynamic effects associated with postulated pipe rupture of that piping by application of leak-before-break (LBB) technology for Oconee Unit 3. Duke made a similar request for Unit 1 that was approved by Amendment Nos. 335, 335, and 336 issued by NRC letter dated September 29, 2003 and for Unit 2 that was approved by Amendment No. 338 issued by NRC letter dated February 5, 2004. Amendment 335, 335, and 336 also revised the licensing basis for selected portions of the LPI/DHR piping to adopt Standard Review Plan (SRP), Section 3.6.2, Branch Technical Position (BTP) MEB 3-1 design requirements and added Technical Specification (TS) requirements for the passive LPI cross connect for all three Oconee Units. With this implementation of the modification on Unit 3, the modification will be complete on all three Oconee Units. As such, Duke also proposes to remove obsolete TS requirements that will no longer be applicable.

Duke has placed a high priority on initiatives and modifications that reduce operator actions. As such, Duke plans to install an LPI cross connect with flow restrictors inside containment on each Oconee Unit to reduce reliance on time critical operator actions outside the control room to mitigate certain single failures. With the current LPI piping configuration, operators must manually open LPI discharge header valves to mitigate certain single failures including failures during a postulated core flood line break (CFLB). The passive LPI cross connect modification will allow the LPI trains to be continuously cross connected, thus eliminating the need for these time critical operator actions.

Duke plans to implement the modification during the upcoming Steam Generator (SG) replacement outage for Unit 3 during the Fall 2004 refueling outage. This licensing basis change is needed to support implementation of the modification. The Unit 2 modification has been implemented in the current

Spring 2004 outage. The Unit 1 modification was implemented in the Fall 2003 refueling outage.

Modification Details

Description

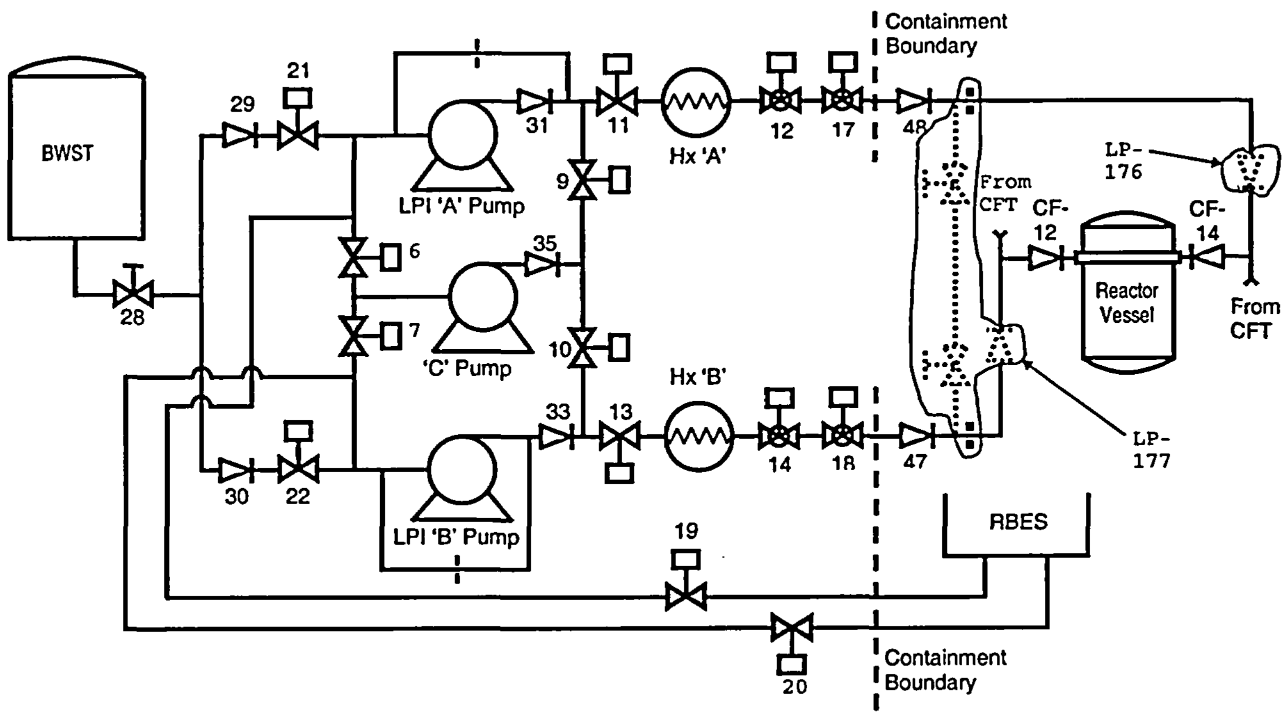
This modification will cross connect the LPI trains at a location inside containment downstream of check valves LP-47 and LP-48 (See Figure 1). It also adds new check valves (LP-176 and LP-177) downstream of the cross connect piping to prevent the blowdown of both Core Flood Tanks (CFTs) out a CFLB. Flow restricting devices will be designed and installed to limit LPI flow under low back-pressure conditions for LPI pump Net Positive Suction Head available (NPSHa) concerns and also to divert sufficient flow to the intact header during a postulated Core Flood Line Break (CFLB). These devices are also sized to ensure sufficient flow in the event of a Large Break Loss of Coolant Accident (LBLOCA) as well as sufficient cool down capacity during a unit shutdown.

The cross connect piping will be installed in the lower portion of the Containment structure and behind the secondary shield wall such that the potential for interaction with high energy piping is minimized. All new piping will be Duke Class B even though a fault of this piping will not result in a Condition III or IV loss of reactor coolant event.

Pipe rupture design requirements will be met by adoption of SRP MEB 3-1 rules for postulation of break and crack locations, by use of LBB technology, and by the construction of rupture restraint devices. SRP MEB 3-1 rules for postulation of break and crack locations are to be adopted for the piping upstream of the new check valves LP-176 and LP-177. LBB technology will be used to eliminate the dynamic effects associated with the postulation of full flow area circumferential or longitudinal breaks in the piping downstream of the new check valves up to but not including the bi-metallic (Alloy 600) welds connecting the CF piping to the Reactor Vessel (RV) nozzles. To protect the system from postulated breaks at the CF/RV nozzles, rupture restraint devices will be installed as part of the modification.

The flow-restricting devices will be designed for minimal cavitation for worst case hydraulic conditions; namely, Reactor Building Emergency Sump (RBES) conditions following a Hot Leg break accident.

Figure 1
Passive LPI Cross Connect Modification



Passive LPI Cross connect with Check Valves Downstream of LP-47 and 48

Reason for Modification

The modification design ensures that the LPI System can deliver flow to the core during a LOCA (including a CFLB assuming a pump or other train-related failure) without the need to open the discharge crossover valves (LP-9 and LP-10) or both LPI injection valves (LP-17 and LP-18). The modification also reduces operator burden associated with these events.

Refer to Duke letter dated March 20, 2003 (License Amendment Request associated with the Passive Low Pressure Injection Cross Connect Modification, TSC 2003-02) for additional details.

Technical Justification for excluding the dynamic effects associated with postulated pipe rupture

The following technical justification is the same as that provided for the Unit 1 LBB application in Duke letter dated March 20, 2003 (TSC 2003-02) and the Unit 2 LBB application in Duke letter dated October 28, 2003 (TSC 2003-13). The Unit 1 LBB application was approved by NRC letter dated September 29, 2003 (Amendment Nos. 335, 335, and 336). The Unit 2 LBB application was approved by NRC letter dated February 5, 2004 (Amendment No. 338).

Selected portions of the CF and LPI/DHR piping design were reviewed against the limiting criteria specified in 10 CFR 50 General Design Criterion 4 (GDC-4), SRP 3.6.3 and NUREG 1061 to determine if LBB technology could be used as a basis for excluding the dynamic effects associated with a high energy pipe rupture. The selected portion of piping is the 14 inch CF line connecting the CF tanks to CF-12 and CF-14 and the 10 inch LPI/DHR line downstream of the new check valves 3LP-176 and 3LP-177 to be installed as part of the LPI Cross Connect Modification. See Figure 1.

Attachment 8 provides the detailed LBB analysis performed for Oconee Nuclear Station Unit 3 by Framatome Advanced Nuclear Power (FANP), Inc. to support the proposed change to the licensing basis. The FANP analysis concludes that LBB technology is applicable to the described portions of CF and LPI/DHR piping. A summary of the analyses is as follows:

- The CF and LPI/DHR piping were reviewed against limiting criteria specified in 10 CFR 50 GDC-4, SRP 3.6.3 and NUREG-1061 and it was determined that LBB was applicable.
- As a result of primary water stress corrosion cracking (PWSCC) concerns at the Alloy 82/182 weld between the CF nozzle at the Reactor Vessel and safe end nozzle, these welds at the "A" and "B" nozzles are excluded from this LBB analysis.
- The Alloy 82/182 welds at the "A" and "B" CF Tank nozzles and safe ends are included within the LBB analysis. At these locations, PWSCC is not a concern because of the low temperature of the tank and piping fluid.
- The mechanical properties of the base metal materials of the piping were obtained through review of the Certified Material Test Reports (CMTRs) and applicable experimental data.
- Normal and faulted loads were used from the latest I & E Bulletin 79-14 piping stress analysis with the LPI Cross Connection modification included, to calculate the highest stress locations.
- The leak detection systems used in the plant were reviewed to demonstrate that a 1 gallon per minute leak can be identified within one hour. A factor of 10 was applied to this value giving a minimum detectable leak rate of 10 gallons per minute as required by SRP 3.6.3.
- The crack opening area was determined using the GE/EPRI method for a given circumferential crack and the Paris-Tada method for a given longitudinal crack based on normal operating loads. This analysis used normal operating loads and normal operating fluid conditions to determine the leakage size crack (LSC); i.e. the crack that gives a leak flow rate of 10 gallons per minute.
- SRP 3.6.3 requires that the critical crack length (CCL) have a margin of 2.0 against the LSC when using the absolute sum method of combining faulted loads. This required margin was demonstrated through the tearing instability analysis method using a J versus T diagram.

LBB technology will not be used to eliminate the dynamic effects resulting from postulated breaks at the CF/RV nozzle safe end welds. Rupture restraints will be installed as part of the LPI Cross Connect modification on the CF lines adjacent to the nozzles to absorb the energy released from these postulated breaks. ANSI 58.2, "Design Basis for Protection of Light Water Nuclear Power Plants Against the Effect of Postulated Pipe Rupture," will be used in the determination of jet force magnitudes. The methods used to develop the pipe reaction loads meet the requirements of paragraph III.2.C of SRP 3.6.2 (July 1981).

Duke's Request for Additional Information (RAI) responses related to the Unit 1 LBB analysis provided by letters dated July 22 and August 5, 2003 are applicable to the Unit 2 and 3 LBB analyses. The Amendment associated with the Unit 1 LBB application was issued on September 29, 2003.

Description of UFSAR Change and Technical Justification

The proposed UFSAR change revises Sections 5.2.1.9 and 5.2.4 to describe the LBB break application proposed by this LAR for selected portions of CF and LPI piping proposed by this LAR.

UFSAR 5.2.1.9

This section is modified to indicate that there are three applications of LBB at Oconee with the third application being to eliminate the need to analyze for specific pipe ruptures in the CF/LPI/DH Systems for Unit 3.

UFSAR 5.2.4

The reference section is modified to add appropriate references for the new LBB application for Unit 3.

Description of Technical Specification change and Technical Justification

The proposed Technical Specification (TS) change revises TS 3.4.14 and TS 3.5.3, and their associated Bases to remove obsolete requirements associated with the LPI discharge header crossover valves outside containment.

LCO 3.4.14, Note 1, which states that the limits of LP-176 and LP-177 are not applicable prior to completion of the LPI cross connect modification, is no longer required since the modification will be complete on all three units and is deleted. The subsequent Notes are renumbered accordingly.

LCO 3.4.14, Note 2 states: "After completion of the LPI passive cross connect modification on each Unit, the limits for LP-47 and LP-48 are not applicable except as stated in Note 3 below." This note is renumbered as Note 1 and revised to state: "The limits for LP-47 and LP-48 are not applicable except as stated in Note 2 below." The qualifier regarding the status of the LPI cross connect modification will no longer be required with the completion of the LPI cross connect modification on Unit 3 in the Fall 2004 Outage.

LCO 3.4.14, Note 3 states: "After completion of the LPI passive cross connect modification on each Unit, the limits of both LP-47 and LP-48 may be met in lieu of either LP-176 and LP-177 limits." This note is renumbered as Note 2 and is revised to state: "The limits of both LP-47 and LP-48 may be met in lieu of either LP-176 or LP-177 limits" The qualifier regarding the status of the LPI cross connect modification will no longer be required with the completion of the LPI cross connect modification on Unit 3 in the Fall 2004 Outage. The "and" between "LP-176 and LP-177" was changed to an "or" to make the sentence grammatically correct. This correction does not change the requirement which the TS Bases clarified as meaning either LP-176 or LP-177 limits.

LCO 3.5.3 Note 3 which requires the LPI discharge header crossover valves outside containment to be manually OPERABLE to open on each Unit until after completion of the passive LPI cross connect modification in MODES 1, 2, and 3 is deleted since it is no longer applicable and the subsequent Note is renumbered accordingly.

LCO 3.5.3 Note 4 reads:

"In MODES 1, 2, and 3, the LPI discharge header crossover valves inside containment shall be open on each Unit after completion of the passive LPI cross connect modification on the respective unit."

This note is revised to remove the qualifier "on each Unit after completion of the passive LPI cross connect modification on the respective unit." Since Note 3 is deleted, Note 4 is renumbered Note 3

The Action Table is revised to delete Action B and re-letter subsequent Actions. Action B is no longer applicable since the LPI cross connect modification will be complete on all three Oconee Units after the Unit 3 Fall 2004 Outage. The new Condition B is revised to delete the word "required" since this modifier is no longer needed with the completion of the LPI cross connect modification on all three Units.

The Surveillance Table is revised to delete SR 3.5.3.7 since it is no longer applicable with the completion of the LPI cross connect modification on all three Oconee Units in the Fall 2004 Outage.

ATTACHMENT 6

NO SIGNIFICANT HAZARDS CONSIDERATION

Attachment 6
No Significant Hazards Consideration

Pursuant to 10 CFR 50.91, Duke Power Company (Duke) has made the determination that this amendment request involves a No Significant Hazards Consideration by applying the standards established by the NRC regulations in 10 CFR 50.92. This ensures that operation of the facility in accordance with the proposed amendment would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated:

The proposed License Amendment Request (LAR) modifies the Unit 3 licensing basis to allow the dynamic effects associated with postulated pipe rupture of selected portions of the Unit 3 Low Pressure Injection (LPI)/Core Flood (CF) piping to be excluded from the design basis. The proposed LAR also removes Technical Specifications that are no longer applicable due to the completion of the LPI cross connect modification on all three Oconee Units. The proposed design allowances for these selected portions of piping continue to allow the LPI system design to meet General Design Criteria (GDC) 4 requirements related to environmental and dynamic effects. The proposed LAR will continue to ensure that ONS can meet design basis requirements associated with the LPI safety function. The addition of the crossover line will enhance the ability of the control room operator to mitigate the consequences of specific events for which LPI is credited. Therefore, the proposed LAR does not involve a significant increase in the probability or consequences of an accident previously evaluated.

(2) Create the possibility of a new or different kind of accident from any kind of accident previously evaluated:

The proposed LAR modifies the Unit 3 licensing basis to allow the dynamic effects associated with postulated pipe rupture of selected portions of Unit 3 LPI/CF piping to be excluded from the design basis and removes TS requirements that are no longer applicable due to the completion of the LPI cross connect modification on all three Oconee Units. The proposed design allowances for these selected portions of piping continue to allow the LPI system design to meet GDC 4 requirements related to environmental and dynamic effects. The systems affected by the changes are used to mitigate the consequences of an accident that has already occurred. The proposed licensing basis change does not affect the mitigating function of these systems. Consequently, these changes do not alter the nature of events postulated in the Safety Analysis Report nor do they introduce any unique precursor mechanisms. Therefore, the proposed amendment will not create the possibility of a new or different kind of accident from any accident previously evaluated.

(3) Involve a significant reduction in a margin of safety.

The proposed licensing basis and TS changes do not unfavorably affect any plant safety limits, set points, or design parameters. The changes also do not unfavorably affect the fuel, fuel cladding, RCS, or containment integrity. Therefore, the proposed changes, which add new design allowances associated with the passive LPI cross connect modification and remove obsolete TS requirements, do not involve a significant reduction in the margin of safety.

Duke has concluded, based on the above, that there are no significant hazards considerations involved in this amendment request.

ATTACHMENT 7

ENVIRONMENTAL ASSESSMENT

ATTACHMENT 7

Environmental Assessment

Pursuant to 10 CFR 51.22(b), an evaluation of the license amendment request (LAR) has been performed to determine whether or not it meets the criteria for categorical exclusion set forth in 10 CFR 51.22(c)9 of the regulations. The LAR does not involve:

1) A significant hazards consideration.

   This conclusion is supported by the determination of no significant hazards contained in Attachment 6.

2) A significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

   This LAR will not change the types or amounts of any effluents that may be released offsite.

3) A significant increase in the individual or cumulative occupational radiation exposure.

   This LAR will not significantly increase the individual or cumulative occupational radiation exposure.

In summary, this LAR meets the criteria set forth in 10 CFR 51.22 (c)9 of the regulations for categorical exclusion from an environmental impact statement.

ATTACHMENT 8

Leak Before Break Analysis for Unit 3 CF/LPI Piping