July 31, 2003

Mr. Lew W. Myers
Chief Operating Officer
FirstEnergy Nuclear Operating Company
Davis-Besse Nuclear Power Station
5501 North State Route 2
Oak Harbor, OH 43449-9760

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION - DAVIS-BESSE NUCLEAR POWER STATION (TAC NO. MB8953)

Dear Mr. Myers:

By letter dated May 14, 2003, you submitted a request for amendment to the Davis-Besse Nuclear Power Station Operating License, NPF-3, which would modify the Technical Specifications by allowing entry into Mode 3 operation during the current outage only with neither high pressure injection (HPI) pump capable of taking suction from the low pressure injection system trains when aligned for containment sump recirculation. The HPI system will otherwise be operable.

The NRC staff has been reviewing your request and finds that it needs additional information in order to complete its review. The NRC staff developed the enclosed questions and forwarded them to your staff on June 25, 2003. These questions were discussed with your staff at Framatome in Lynchburg, VA, during the week of July 14, 2003. Additionally, the NRC staff had a telecon with your staff on July 24, 2003, to provide further clarification of the questions.

The attached questions contain preliminary responses that were provided to the NRC staff at Lynchburg, VA. Also, the NRC staff has decided that some questions do not need to be answered and they are identified as such. Please provide responses to the rest of the questions by August 4, 2003.

Sincerely,

/RA/

Jon B. Hopkins, Sr. Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-346

Enclosure: As stated

cc w/enclosure: See enclosure

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REQUEST FOR ADDITIONAL INFORMATION
DAVIS-BESSE NUCLEAR POWER STATION
DOCKET NO. 50-346

The following two questions are deleted because FENOC provided sufficient information to establish bounding behavior in its response to Question 36.

1. **A complete RELAP 5 LOCA deck (program and input) for subcritical, low decay heat conditions that has been demonstrated to achieve steady state conditions as an initiation point for LOCA calculations**

2. **The equivalent of Item 1 for full power operations. Documentation supporting preparation of the input data should be provided for this deck.**

The following questions are deleted:

7. **What will be the control range of steam generator water inventory per steam generator (in pounds of water)?**

   FENOC estimated there would be about 42000 lbs. of water with about a 10-foot elevation of water in each SG. However, the question is of little relevance because of the low decay heat generation rate and it was withdrawn.

31. **ANP Page 23 states that allowing HPI pumps to continue to operate with a possibility of failure "is not recommended (because the operators have little if any control of the RCS evolution" yet acceptable 50.46 consequences result. Why is the state of operator control a concern if 50.46 is met? And realistically, is it correct to conclude operators will have little control?**

    Deleted because the response would not affect any conclusion regarding the FENOC request.

34. **ANP Page 38 states that "a CLPS (cold leg pump suction) break location will not result in any direct bypass of the pumped injection." Is this correct if there is a bubble in the upper elevation of the hot leg?**

    Deleted because of the response to Question 33.

35. **ANP Page 38 states that "if the break is on the RCS side of any check valves in the CFT (core flood tank) line...all the HPI injected reaches the core." We do not understand why some of the injected HPI water cannot flow directly from thc CL nozzle to the CFT line and be lost. Please explain.**

    Deleted because the response would not affect any conclusion regarding the FENOC request.

The following list provides questions for which FENOC needs to confirm the response. Each NRC question is followed by a preliminary FENOC response.

2. **The FENOC request identifies potential concern with leakage at the reactor vessel incore monitoring instrumentation (IMI) nozzles. It does not address the other end of the incore monitoring tubes where the instrumentation transits from the reactor coolant system (RCS) pressure to containment pressure. Are these seal regions to be evaluated for potential leaks?**

   The Restart Test Plan referenced in the FENOC May 14, 2003, submittal (DBNPS Letter Serial Number 2950) requires testing of the RCS, including components within the reactor coolant pressure boundary (RCPB) and associated piping exposed to full RCS pressure, to ensure integrity following replacement of the reactor vessel pressure head and maintenance of RCS piping and components. DBNPS procedure DB-PF-03010, RCS Leakage Test, is used for inspections of the RCPB and requires inspection of this portion of the RCS pressure boundary.

3. **FENOC is generally silent regarding Mode 4 operation where pressurization beyond the low pressure injection (LPI) pump injection capability is possible. What RCS water makeup capability will be provided during Mode 4 and how will this capability be reasonably assured?**

   The DBNPS Technical Specifications (TS) do not require HPI pump operability in MODE 4. The proposed change to the TS affects the requirements in Mode 3 only. Therefore, there is no impact on the current Mode 4 requirements as a result of the proposed license amendment.

   The DBNPS safe shutdown state defined by the current license basis is Mode 3. DBNPS relies on non-safety grade components to transition between Mode 3 and Mode 5. Sources of RCS makeup (various combinations of MU pumps and HPI pumps) are maintained available in order to reduce risks associated with shutdown operation in accordance with FENOC procedure NOP-OP-1005. One makeup pump operates to provide reactor coolant pump (RCP) seal injection and RCS makeup and would be available to inject water into the RCS. This makeup pump is placed in service prior to entry into Mode 4. The second makeup pump will also be available to supply RCS makeup. In addition, both HPI pumps will be available (i.e., capable of being placed in service within the time they are required).

4. **Will the HPI pumps be available for use in a piggy-back configuration if a decision is made to operate them in that configuration?**

   The HPI pumps will be available (i.e., capable of being placed in service within the time they are required) for use in a piggy-back configuration when ECCS is aligned for containment emergency sump recirculation as a defense-in-depth measure.

6. With respect to makeup (MU) pumps:

a. Can MU pumps be operated with power from the emergency diesel generators?

The MU pumps are both essentially powered from redundant buses as described in USAR Section 9.3.4.2.1, and thus are supplied from the emergency diesel generators. These are the same essential buses used to power the HPI and LPI pumps. However, the MU pump room ventilation is not essentially powered, limiting the duration of time that the pumps could operate under loss of offsite power conditions without other compensatory measures.

b. Please address MU pump operation if an LOCA or other accident were to occur that would typically require HPI injection.

The operator is instructed to maximize MU flow by starting both MU pumps, if not already operating, if pressurizer level has decreased to less than 40 inches, or subcooling margin is lost. The operating MU pump(s) are automatically stopped upon detection of a bus undervoltage on the associated essential 4160 V bus with a Safety Features Actuation System (SFAS) Level 3 actuation signal (on high containment pressure of 18.7 psia, or low-low RCS pressure of 470 psig) present unless the associated LPI pump was manually started, or manually by the operator if an SFAS Reactor Coolant pressure < 450 psig Channel Trip (5-1-D) is received. If subcooling margin is not adequate and LPI flow to the RCS does not exist, the operator is directed to open the LPI piggy-back valves, placing the MU pumps in the piggy-back mode. For those LOCAs that do not result in receipt of an SFAS Level 3 actuation signal, or a Reactor Coolant pressure < 450 psig Channel Trip, the operator is directed to continue MU pump flow until the LPI suction is aligned to the containment emergency sump. At this time, the MU pump suction is transferred to the MU tank and flow is maintained until the LPI flow criteria are met for stopping MU/HPI.

As discussed on page 36 of the FANP report attached to FENOC letter Serial Number 2950, dated May 14, 2003, ECCS throttling should begin with the MU pumps if they are in operation at two hours after break initiation. Over the next hour the MU pumps should be terminated. If the RCS pressure is still elevated, the guidance continues with instructions for throttling the HPI pumps.

c. FENOC indicates MU pumps cannot be used when BWST inventory has been depleted. Is it not possible or practical to transfer water from the containment emergency sump to the BWST where it would be available to the makeup pumps? (4.2, page 12)

MU pumps not analyzed for sump particulates. By letter dated October 27, 1987, (DBNPS Letter Serial Number 1433) the DBNPS submitted proposed license amendment requests to support enhanced feed and bleed modifications. This submittal stated that the MU system is not intended to circulate fluid from the containment emergency sump; pump suction is restricted to either the MU tank or the BWST. The DBNPS committed to ensuring that pump suction is restricted to the MU tank and the BWST by modifying the appropriate procedures. Transferring water from the containment emergency sump to the BWST is expected to result in transferring debris to the BWST. Refilling the BWST is addressed in the response to Question 20. The MU tank can be filled from the Boric Acid Addition Tanks (BAATs), the Condensate Storage Tank, or the Clean Radioactive Waste System.

d. Do MU pumps trip upon ECCS initiation? The Framatome ANP Inc. 51-5026803-00 (referred to hereinafter as ANP) discussion appears to be mixed. Much of the discussion appears to exclude MU pump operation, yet Page 36 and other locations indicate they are running. If they are running, please discuss the RCS pressure response predictions since the predictions appear to be based on no MU and one HPI in operation.

Please see the FENOC response to Question 6.b and Question 32. In some places the Framatome Report is discussing design-basis response and in other places the report is discussing procedural implementation.

8. Near the end of Section 2.0, FENOC states that multiple Mode 3 entries may be necessary but then makes an exception following any corrective action if the IMI nozzle leakage is discovered. Please discuss the reasoning that underlies these potential actions.

FENOC does not suspect that IMI nozzles leaks exist, therefore, the leakage test is confirmatory in nature. The intent of the statement is to allow multiple entries in the event other RCS leakage is detected or equipment conditions occur that require depressurizing to repair. Should leakage be found through the IMI nozzles, DBNPS will not enter Mode 3 until after repairs to the IMI nozzle(s) have been made, issues with sump debris have been resolved, and the HPI pumps have been declared operable such that the exception does not apply.

9. Natural circulation is discussed in Section 4.1.1, but boiler-condenser operation is not mentioned. Omission of boiler-condenser operation also appears to apply to the ANP discussion. Please address the influence of boiler-condenser operation.

Boiler condenser mode (BCM) of operation is a key phenomenon in certain SBLOCA analyses. BCM heat removal may be required whenever the break energy discharge cannot meet or exceed the net system energy addition rates (core decay heat generation, RCP energy addition, ECCS energy addition, etc.). For this low power Mode 3 test the decay heat is met with any break size that could be characterized as an LOCA.

In order for BCM to occur, the RCS level must be at or below the AFW injection elevation within the SG tube region and the AFW injection on the secondary side must be flowing (high elevation BCM). Alternatively, if AFW is not flowing, the RCS level must be below the secondary side pool level (pool BCM). For BCM to occur the primary side pressure must be above the secondary side pressure. When the core power is significant, BCM is critical for controlling RCS pressure during a SBLOCA. However, when there is virtually no core power, there is little potential for anything other than a very brief period of BCM heat removal. BCM cannot be continuously supported because there is insufficient steam generated on the primary side. In this case the primary and secondary side pressures will quickly approach each other and BCM will be lost.

10. Do conditions exist that are unique to the FENOC request that would exacerbate the Hot leg LOCA issue discussed in BAW -2374?

The loss of HPI during the sump recirculation phase does not exacerbate the hot leg LOCA issue. Nonetheless, the lower decay heat for this Mode 3 test would allow the ECCS to cool the tubes quicker than if there were some core power. The estimated decrease is in the order of 20 to 40 °F's, however, the SG shell would be cooler during this Mode 3 test by roughly 25 °F over the full power shell temperature. This lower shell temperature would reduce the shell-to-tube temperature difference and would cause the results to be approximately 15 °F higher than the 374 °F calculated at the full power conditions. This variation is a generic issue for any plant with lower core power levels and is not unique to the FENOC request.

11. We need additional information in regard to RCS heat loss. The following apply:

d. Please address the trade-off of running reactor coolant pumps (RCPs) versus tripped RCPs and RCS depressurization with consideration given to RCS heat rate loss.

The RCPs will remain in operation unless offsite power is lost or the operators trip the pumps. Typical LOCA applications consider the loss of offsite power at the time of turbine trip following the LOCA because of the perturbation of the grid when the plant trips. For this Mode 3 scenario, the plant is not producing any power and reactor trip will not cause the grid to be perturbed. In this case the operators should let the RCPs run unless subcooling margin is lost. When the RCPs are in operation, the steam generators can be used to cool and depressurize the entire RCS. If subcooling margin is lost the pumps must be tripped within two minutes following a LSCM to prevent continuous RCS liquid discharge out of the break. RCP operation while the RCS is saturated is not permitted and is not endorsed for this test.

e. We do not understand the ANP Page 28 discussion that "there is insufficient decay heat to create substantial natural circulation flow rates that can cool the bulk of the RCS fluid." Please explain.

Robust natural circulation in the B&W-designed plant is created by thermal gradients produced by the core heat generation and steam generator heat removal. With extremely low decay heat levels, the break energy discharge will remove all the core heat generation and steam generator heat removal is not needed. Therefore, significant natural circulation flows will not be obtained. The heat addition rates that do occur will result in low natural convection rates that may not result in sufficient flow to push cold water out of the CLPS piping regions. Therefore, there may be pockets of hot and cold liquid in the RV and RCS piping that are not easily cooled uniformly.

12. On a realistic basis, please address availability of turbine-driven auxiliary feedwater pumps from the viewpoint of available RCS thermal energy.

The steam generator is the typical core heat sink. In this case the core power is so low that RCS heat losses are sufficient to remove the core power. Following a SBLOCA, there is little need for steam generator heat removal when the core decay heat level is low. In addition, see the response to Question 11.a.

20. What is the practical long-term borated water makeup capability to the BWST?

The DBNPS currently has procedures in place that describe the ability to add borated water to the BWST from the Boric Acid Addition Tank (BAAT), Clean Liquid Radioactive

Waste Receiving Tanks (CWRTs), Clean Liquid Radioactive Waste Monitor Tanks (CWMTs), and Spent Fuel Pool (SFP). Approximate flow rates, and times to place in service are as provided below.

Source	Flow Rate*	Time*
BAAT	40 gpm	~30 minutes
CWRT	120 gpm	~1 hour
CWMT	120 gpm	~1 hour
SFP	100 gpm	~1 hour

*Flow rates and times are estimates per DBNPS Operations and have not been verified by walkdown.

Additions from the BAAT also require additions from demineralized water due to the high boron concentration of BAAT. Additions from these sources require local valve manipulations in the Auxiliary Building. Volumes available from each source will vary, depending on the DBNPS operational activities.

22. If the only available steam generator has a steam generator tube rupture, why can't it be used for cooldown? (4.2, Page 13)

Non-reliance on the ruptured SG was described in the discussions of the risk analysis. Relying on the ruptured steam generator could result in a release to the environment. In addition, this would result in additional "negative training" for the operator.

23. Item 2 of the No Significant Hazards Consideration asks "Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?" The FENOC response addresses accident initiators, but does not address differences in accident progress. Please clarify. (5.1, Page 18)

Normally, postulated accidents are analyzed to occur from full power conditions with bounding decay heat. In the Mode 3 evaluation performed for this license amendment request, although different operator actions are required to be credited, similar to those assumed in the present DBNPS USAR, either no clad temperature excursion is predicted to occur due to no core uncovery, or the excursion is bounded by the Mode 1 cases previously analyzed.

26. The proposed footnote to TS Section 3.5.2 states "Under this exception, neither HPI train is required to be capable of taking suction from the LPI trains when aligned for containment sump recirculation." This appears to imply that the HPI trains may not be aligned for piggy-back operation and may not be capable of such an alignment. Please explain why FENOC does not provide wording consistent with requiring that HPI will be capable of being aligned and operated in the piggy-back configuration while recognizing that operability is not ensured.

An exception to the operability requirements, as provided in the proposed license amendment, is considered to be less confusing to the TS user than a discussion requiring the piggy-back capability while recognizing that operability is not ensured. However, as stated in response to NRC Question 4, the HPI pumps will be available for use in a piggy-back configuration as a defense-in-depth measure.

27. Note 1 of Table 3-1 of ANP states that SG heat removal can be accomplished with non-safety grade equipment. Does this mean SG heat removal cannot be accomplished with only safety grade equipment?

The DBNPS can be maintained in the safe shutdown state (i.e., Mode 3) using only safety-grade equipment. However, operations to cooldown and depressurize the plant by means of SG heat removal require the use of non-safety grade equipment.

28. We believe ANP Section 3.2.2 states that the normalized power due to 1.2 times realistic decay heat is 0.00021 and, for the ANS 1971 standard, it is stated to be 0.00089. (Both values are assuming the full core has been irradiated.) We do not understand the factor of four difference in these values. Please explain.

The difference is in the assumptions for the operating life times. Using the infinite operation required by Appendix K, the decay heat fraction was calculated as 0.00089. Based on a more realistic 800-day operating history, the decay heat is much lower or a normalized fraction of 0.00021.

30. Please discuss mitigation of an RCS leak that is within the makeup capacity of the charging pumps from the viewpoint of the BWST inventory depletion and the unique conditions that may exist during the proposed operation.

A leak within MU capacity is one that at NOP is < 250 gpm. The direction provided in DB-OP-02522, Small RCS Leaks, will address this situation. Leak isolation would be attempted and a plant cooldown/depressurization commenced. Greater than 30 hours would be available before the BWST would be depleted (based on BWST volume of 500,000 gallons). Additionally, the leakrate will decrease as RCS pressure is reduced. The plant would cooldown and depressurize to establish DHR operation or establish LPI sump recirc if DHR operation is not possible.

33. Do instructions to open any RCS venting paths to accomplish depressurization include opening RCS letdown? If so, please discuss the effect on RCS inventory.

Not recommended because RCS inventory will be passed outside containment into MU tank.

36. The ANP Page 38 discussion of the IMI nozzle break appears to assume one break cannot cause subsequent breaks in other IMI lines due to impingement effects. Is this correct? If so, please substantiate the assumption.

Multiple IMI nozzle breaks were not explicitly considered. The ECCS flow can mitigate an equivalent break area of more than one nozzle with the flow through the inside of the incore nozzle tube. Impingement has not been evaluated at this time.

37. In several locations, ANP states that adequate core cooling is assured once LPI flow is established following throttling of HPI flow to achieve RCS depressurization to below LPI flow initiation pressure. Please discuss this conclusion with respect to having to throttle flow to reduce pressure, but then a potential increase in flow rate is not a pressure problem.

RCS repressurization can occur if the energy addition rate (core decay heat plus ECCS injection) into the system exceeds the break energy discharge. At the DBNPS low core decay heat level, any break size that is an LOCA will easily remove all the core generated energy. As the LPI flow begins to flow, the system will approach a quasi-steady pressure when the energy flows remain in balance.

39. Page 1 of the commitment list states that "if IMI nozzle leakage is discovered, the proposed exception would not be utilized for Mode 3 entry following corrective action." Does this mean the HPI hardware problem would be resolved prior to Mode 3 entry? Please also address Mode 4 entry.

Please see the responses to Question 3 and Question 8.

40. Page 2 of the commitment list indicates a cooldown to at least Mode 4 in case of equipment inoperability. Does this mean there is no potential need for ECCS in Mode 4? Please discuss.

The DBNPS TS 3/4.5.2 is applicable only in Modes 1, 2, and 3. The DBNPS TS do not currently require HPI operability in Mode 4. Lacking this commitment, the DBNPS would be allowed to remain in Mode 3, using the exception, with inoperable systems and components that are important in reducing the risk associated with the inability of the HPI pumps to maintain suction from the containment emergency sump (via the LPI pumps), provided the appropriate corrective actions are taken as provided in the TS associated with the inoperable equipment. The commitment would result in removing the unit from the mode of applicability in which the exception is necessary. Transitions from the DBNPS safe shutdown state (Mode 3) to Mode 5 are performed using non-safety grade components. In addition, for this limited exception the affected component will be restored or the plant will be placed in Cold Shutdown within 24 hours following entry into Mode 4.

The following list is of NRC questions where FENOC will provide additional information. In some cases, a preliminary partial response is provided.

1. In effect, FENOC states on page 2 of its cover letter that operation of the high pressure injection (HPI) pumps prior to piggy-back mode is not of concern. Has FENOC addressed the cleanliness of the borated water storage tank (BWST) water and the potential for stirring up debris in the borated water storage tank during initial HPI pump operation, such as due to return of bypass water to the tank? If so, please describe FENOC’s assessment. If not, please provide an assessment of the cleanliness of the BWST water with respect to potential debris that may be of concern to HPI pump operability.

During injection the total inflow to the BWST is about ~100 gpm with an outflow of roughly 12,000 gpm. The suction is 4" above the bottom of the tank so there is not a cleaning of the bottom for debris.

Integrated SFAS is performed with suction on BWST. During SFAS test 4300 gpm is returned and drawn from the BWST. This would be the most turbulent operation. Integrated SFAS testing is currently scheduled to be performed prior to the first Mode 3.

5. Have all locations where debris is of potential concern in the HPI trains been confirmed to be free of all debris? In the LPI trains and the cross-over piping leading to the HPI pump suctions? In the containment emergency sump? Please provide information relative to confirming that there is no identifiable debris in containment or in the sump immediately prior to leaving Mode 5 to progress to Mode 3.

The lines from the BWST to the BWST or the RCS have been placed in service at various times during 13RFO. The cross connects, recirc, normal to the RCS, and test lines have all been used from the RCS. FME inspections were conducted for the HPI pump and piping (Train 1).

(Train 1 FME was performed due to cap screw issue by borescope. Test that result in flow through system include: DB-SP-3212, DB-PF-4207/4208, DB-PF-3407, DB-PF-3207/3208, DB-SP-10030, DB-SP-3136/3137, & DB-SP-3218/3219)

DBNPS Technical Specification (TS) Surveillance Requirement (SR) 4.5.2.c requires a visual inspection which verifies that no loose debris (rags, trash, clothing, etc.) is present in the containment which could be transported to the containment emergency sump and cause restriction of the pump suction during LOCA conditions. This visual inspection is required to be performed prior to establishing containment integrity for all accessible areas of containment and at least once daily while work is ongoing for all areas affected by a containment entry and again during the final exit after completion of work (during containment closeout). This SR is implemented by DBNPS procedure DB-OP-06900, Plant Heatup. In addition, TS SR 4.5.2.d.2.a requires a visual inspection of the containment emergency sump which verifies that the subsystem suction inlets are not restricted by debris and that the sump components (trash racks, screens, etc.) show no evidence of structural distress or corrosion at least once each refueling interval. This SR is implemented by DBNPS procedure DB-SP-03134, Containment Sump Visual Inspection. These surveillances are performed during plant heatup prior to entering Mode 3.

11. We need additional information in regard to RCS heat loss. The following apply:

a. Please estimate the RCS heat loss rate assuming the RCS water is at 532 °F. Include a breakdown by major RCS components.

b. FENOC, in 4.1.3 on Page 10, states "Due to this low reactor core decay heat generation rate, the combination of core inlet subcooling and heat losses through the core barrel wall and other structures should be sufficient to prevent the core boron concentration from exceeding the solubility limit." Why isn't a more definitive statement provided? And if heat is escaping from the core via the core barrel, what is the subcooling at the core entrance and what is the heat loss from the RV?

No explicit boron concentration control analyses have been performed for this Mode 3 low decay heat test so a more definitive statement was not provided. The actual core decay heat level is extremely low from the long shutdown period and heat losses may limit core boiling such that core concentrations would never reach the solubility limit at any RCS pressure. Boron can concentrate in the core following a relatively large LOCA in the CLPD region. There is insufficient boron in the RCS and BWST for the core to reach the solubility limit at pressures above 92 psia. At these pressures there will be high LPI flows that will enter the downcomer, mix with any RVVV steam, absorb heat added to the downcomer fluid from the core barrel or RV shell before spilling out of the large hole in the CLPD piping. With little or no core decay heat, the LPI injection temperature will quickly approach the component cooling water temperature of roughly 120 °F. This liquid temperature will provide a temperature gradient of roughly 100 °F or more across the core barrel wall that will remove heat from the core region.

c. The analyses apparently do not include RCS heat loss rate. If this is correct, please assess the influence of heat loss on the conclusions.

Heat losses are traditionally not credited in short term 10 CFR 50.46 analyses because they are small in comparison to the core power. The heat losses were also not included in the post LOCA boron precipitation analyses because they are a benefit. Credit for the benefit would contribute little for full power analyses but is significant for these low power conditions.

13. Please address the range of IMI breaks that cannot be mitigated under full power conditions. Under the conditions representative of the FENOC request.

The DBNPS can mitigate the consequences of a 0.0085 ft^2 break from a core power of 1.02 times 2966 MWt (power uprate level) with typical LOCA assumptions and the most limiting single failure. This includes no credit for operator initiated secondary side depressurization. Under Mode 3 conditions, the break size that could be mitigated is similar to that for the size that can be mitigated under full power conditions.

14. Is the completion of paper work the only thing keeping the pilot-operated relief valve (PORV) from being safety-related? (4.1.3, Page 8)

15. FENOC has proposed changing the emergency operating procedures (EOPs) to allow terminating HPI (and presumably MU) to accomplish RCS depressurization when subcooling margin (SCM) does not exist. This is a reversal of the fundamental EOP philosophy that injection shall continue under lack-of-SCM conditions. Consequently, please contrast the benefits and weaknesses of the FENOC approach with the existing EOPs where injection would be required. Specifically, the staff requests a comparison of using the HPI pumps to fulfill the injection requirements as contrasted to FENOC's approach of throttling or terminating HPI with a philosophy that HPI could be restarted if the desired results were not obtained. Please also address the potential for future misunderstanding in applying EOPs when the SCM requirement will apply. A similar comparison should be provided regarding the temporary change in LPI flow rate that would allow termination of HPI.

For small RCS break sizes (such as an IMI nozzle break or partial crack), the HPI will be able to meet and exceed the break flow rate once activated. The excess HPI will refill the RCS liquid inventory lost before the ECCS injection began and once refilled will repressurize the RCS until the break and HPI flow are in equilibrium. This equilibrium will not be perturbed if the ECCS injection rate is not decreased. Throttling the HPI flow to reduce RCS pressure to the LPI pressure range is an action unique to this test because there is a reduced period of time that the HPI pumps will be credited.

Prior to the NOP test, operators will be trained on the throttling and termination of HPI. Following completion of the NOP test, the operators will be retrained on not throttling and terminating HPI (i.e., return to the prior EOP philosophy).

16. Are RCS vents safety grade? Fully operable under the proposed Mode 3 conditions?

The vent on each hot leg is controlled by two solenoid-operated valves. The valves are Nuclear Class 1 and are seismically and environmentally qualified. The valves are powered from Class 1E power supplies. The RCS vents are not of sufficient size to reduce the RCS pressure if HPI exceeds the break flow rate.

17. With respect to auxiliary spray:

a. FENOC identifies that LPI flow through the APS line is an available redundant flow path to provide water to the RCS. Please provide an estimate of when such flow would be initiated, when water would begin to reach the RV, and when any core heatup would be effectively addressed. Provide maximum temperatures for this scenario. (4.1.3, Page 10)

Initiation should begin immediately if ECCS injection is only going to one location. LPI cross-tie is preferred if possible. If not HPI should be kept running if possible. If no HPI is available, the LPI could also be injected into the pressurizer through the APS line or into the CLPD through an inoperable HPI pump. No calculations have been performed to determine the available APS line flow rates. If the APS flow was 40 gpm, the core cooling would begin after the pressurizer was filled (~ five hours). Core heat up would be dependent upon the scenario.

If LPI flow loss is a problem, then the break must be in the core flood line. The intact CFT flow and the HPI flow during the BWST draining period should refill the RV to the break elevation. In this case there should be 6.5 ft of water between the CFT nozzle and the top of the core at the time of sump switchover. The fluid flow area in the RV in the core region is roughly 100 ft^2. The flow area is slightly larger above the core region, however using 100 ft^2 is conservative. The liquid mass in the 650 ft^3 above the top of the core is 38900 lbm (650 ft^3 / 0.016719 ft^3/lbm) at saturated conditions at 14.7 psia. This liquid could absorb 37700000 Btu (38900 lbm * 970.3 Btu/lbm) in being boiled off to steam. For a decay heat level of 1360 Btu/s the liquid could support 7.7 hours (37700000 Btu / 1360 Btu/s / 3600 s/hr) before the core would uncover without any ECCS injection.

b. Is it possible that APS would be in use at the same time the pressurizer PORV is open? Or for the case of a pressurizer break? If so, please discuss the effectiveness of APS.

The APS should not be initiated when the PORV is open because it can bypass the APS flow.

If the PORV is open or if the break is in the pressurizer, there is a single pass cooling arrangement that allows the ECCS to flow through the core and out the break. Core exit subcooling will be restored and no actively initiated post-LOCA boron concentration control is needed.

18. The discussion of boron precipitation control (BPC) during long-term cooling does not address certain phenomena that are of concern to the staff. Specifically, in a boiling system, there will be a temperature gradient due to elevation and precipitation that can occur at the top of the liquid prior to occurrence at lower elevations. Further, if there is significant concentration where credit is taken for the increased boric acid solubility due to elevated temperature, how is the RCS later cooled down without a precipitation concern? Please address these concerns (4.1.3, Page 10)

Simple calculations were performed to estimate how long it would take to boil a sufficient amount of liquid to concentrate the boron in the core. Without heat losses it would take roughly one week of the current decay heat to provide that integrated power to achieve the solubility limit at 14.7 psia. It takes much longer if the RCS is repressurized.

19. What are the environmental conditions and estimated times associated with opening the LPI cross-tie line and with respect to initiating LPI flow through the auxiliary pressurizer spray line? (4.1.3, Page 11)

LPI train cross-connects are opened from the control room. HPI piggy-back valves are opened from the control room. Auxiliary pressurizer spray is operated from the control room.

21. What is the equilibrium pressure with the PORV open and LPI injection ongoing?

24. FENOC discusses maximizing the availability of plant systems and components. It also states that required surveillance testing will continue to be performed and that activities in the offsite power switchyard and electrical switchgear rooms will be limited to those of an essential nature. Please address the specific activities that would still be conducted and explain why they cannot be eliminated by planning. (5.2, Page 19)

25. FENOC states that an additional dedicated licensed operator (above the minimum TS manning requirement) will be on shift in the control room. What is the normal complement in the control room when progressing from Mode 5 into the upper operating temperature and pressure typically associated with Mode 3? (5.2, Page 19)

The DBNPS TS require that for operation in Mode 4 and above, the minimum shift crew composition consists of two licensed Senior Reactor Operators, two licensed Reactor Operators, and the Shift Technical Advisor (who may be one of the two licensed Senior Reactor Operators.

29. We note the ANP correction for inert fuel is to multiply the decay heat by 101/177. Since the fuel being removed probably has the highest irradiation, does this result in an under-prediction of the decay heat generation rate? If so, by how much?

The radial power distributions for three different assumed previous reloads (Cycle 13) shown below for a 72-feed batch size. The information on the assumed peaking and contributions suggest that at least the fuel in the third burn is effectively at the nominal core power. The second burn fuel could provide an increased contribution because it operated at a higher RPD, however, it also has the shortest exposure. This limits the fission product decay terms and the actinide contributions. The 120 percent decay heat factor likely compensates for the higher RPD of the second burned fuel.

	First Cycle	Second Cycle	Third Cycle
Radial Power Distribution	1.25	1.02	0.41
Number of Assemblies	72	72	33
Core Power Fraction*	0.508	0.415	0.076
Radial Power Distribution	1.135	1.135	0.41
Number of Assemblies	72	72	33
Core Power Fraction*	0.462	0.462	0.076
Radial Power Distribution	1.2	1.07	0.41
Number of Assemblies	72	72	33
Core Power Fraction*	0.488	0.435	0.076
[*This is the predicted decay heat contribution as calculated in the licensing basis at the time of shutdown. Several distributions were assumed to obtain preliminary insights.]			

32. The ANP discussion appears to focus on one train of ECCS (or one HPI) being in operation. (See, for example, the last line of Page 25, although there are many examples in the following pages.) Is this correct? If so, do two trains exacerbate the potential concern? See also our question pertaining to MU pump operation.

38. The ANP Page 44 discussion indicates a 3.5 percent head reduction was assumed for HPI flow rate. Is this a conservative assumption when the concern involves HPI flow causing RCS pressure to remain high?

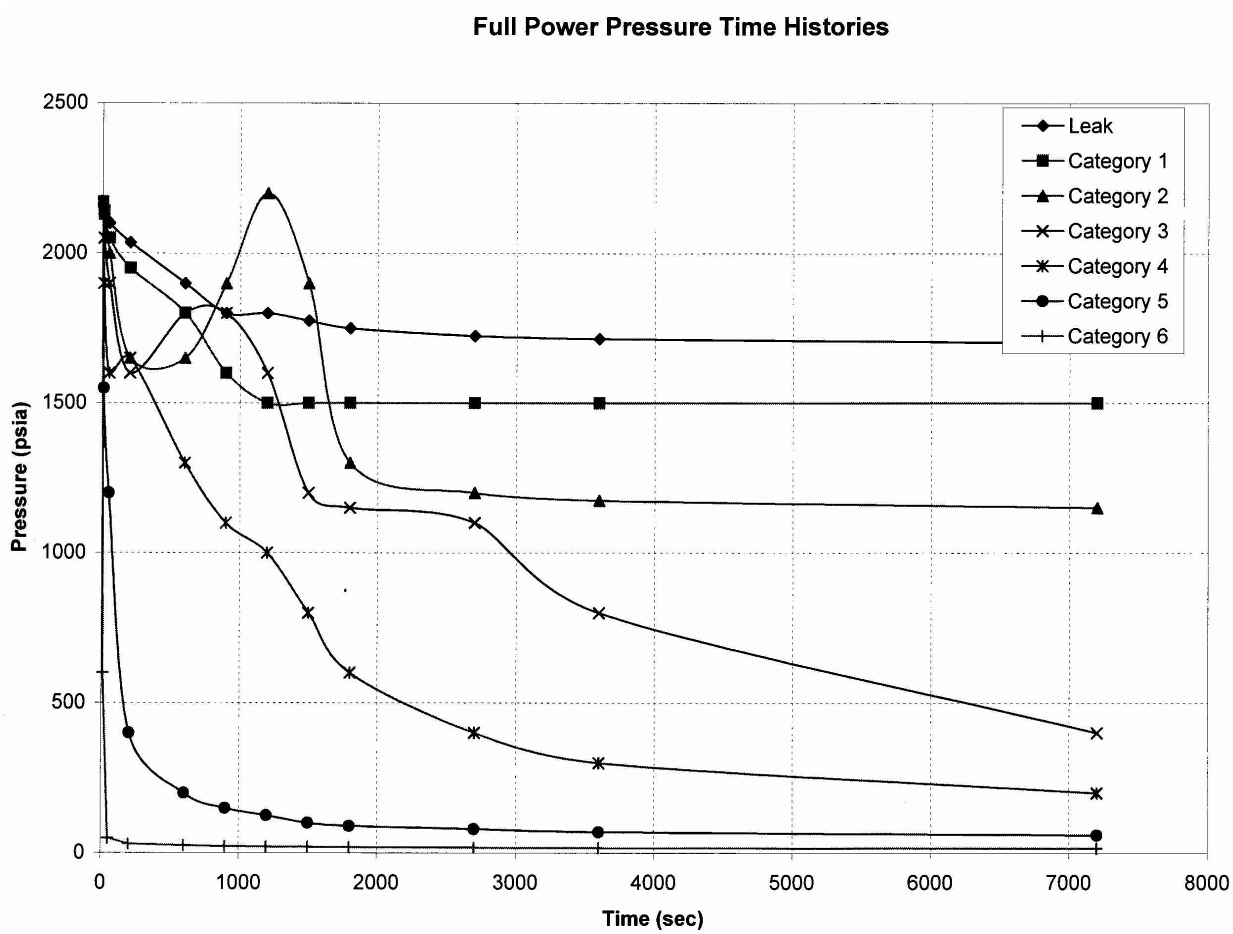
The following list provides questions that were posed during the week of July 14, 2003:

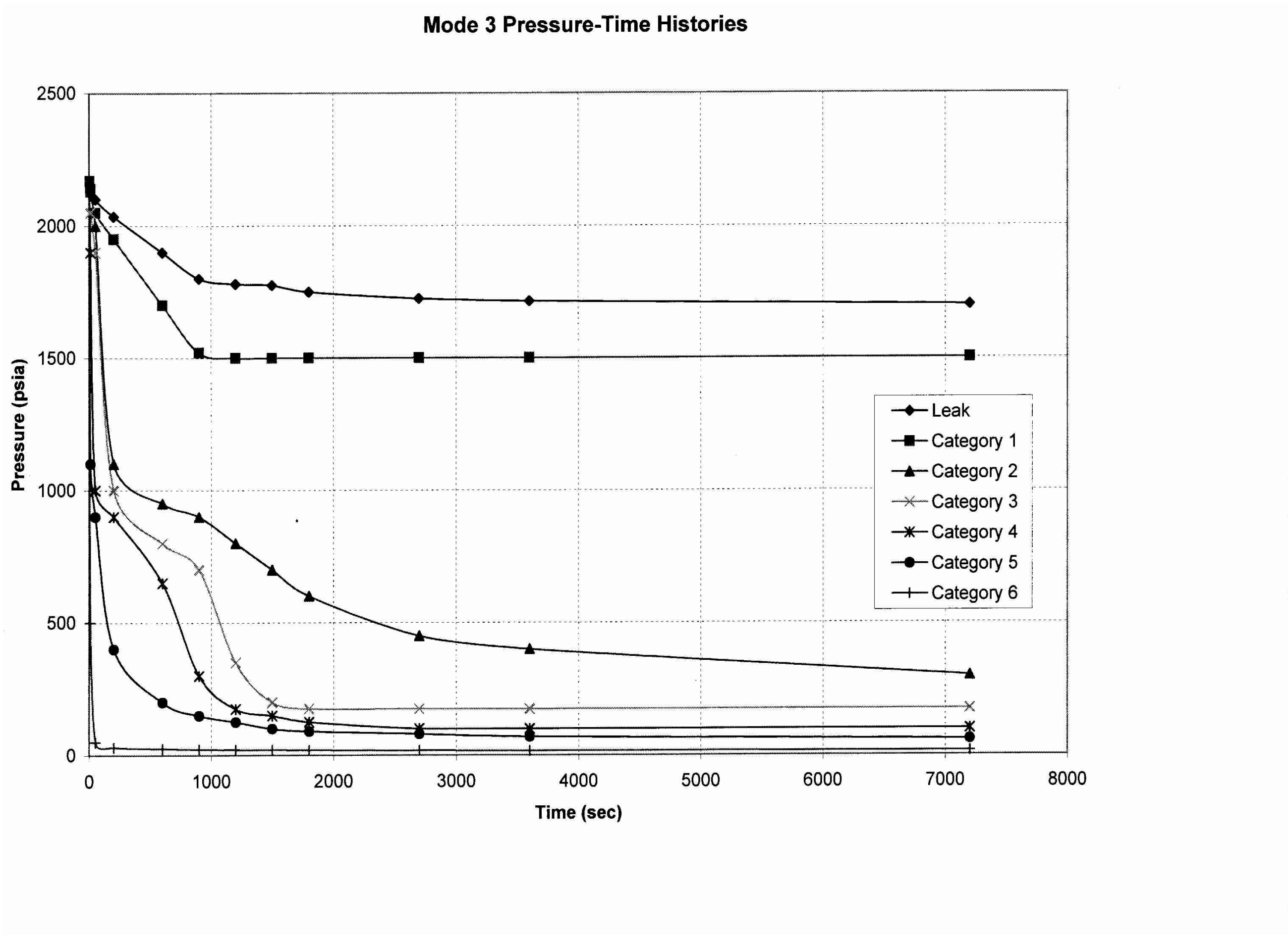
41. Please address training of the affected Technical Support Center staff with respect to the Emergency Operating Procedure changes relative to this limited exception.

42. Provide a summary of Emergency Operating Procedure changes that will be made relative to this limited exception.

43. Provide docketed copy of the RCS pressure/time histories (full power as well as Mode 3) as supplied by FANP.

The following preliminary copies of LOCA response were provided at Lynchburg, VA:


Full Power Pressure Time Histories
Leak
Category 1
Category 2
Category 3
Category 4
Category 5
Category 6
Pressure (psia)
2500
2000
1500
1000
500
0
0
1000
2000
3000
4000
5000
6000
7000
8000
Time (sec)


Mode 3 Pressure-Time Histories
Pressure (psia)
2500
2000
1500
1000
500
0
0
1000
2000
3000
4000
5000
6000
7000
8000
Time (sec)
Leak
Category 1
Category 2
Category 3
Category 4
Category 5
Category 6

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