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NINE MILE POINT
NUCLEAR STATION

April 16, 2010

U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

ATTENTION: Document Control Desk

SUBJECT: Nine Mile Point Nuclear Station
Unit No. 2; Docket No. 50-410

Response to Request for Additional Information Regarding Nine Mile Point Nuclear Station, Unit No. 2 – Re: The License Amendment Request for Extended Power Uprate Operation (TAC No. ME1476)

REFERENCES:

(a) Letter from K. J. Polson (NMPNS) to Document Control Desk (NRC), dated May 27, 2009, License Amendment Request (LAR) Pursuant to 10 CFR 50.90: Extended Power Uprate

(b) Letter from R. V. Guzman (NRC) to S. L. Belcher (NMPNS), dated March 10, 2010, Request for Additional Information Regarding Nine Mile Point Nuclear Station, Unit No. 2 – Re: The License Amendment Request for Extended Power Uprate Operation (TAC No. ME1476)

(c) Email from R. Guzman (NRC) to T. H. Darling (NMPNS), dated March 10, 2010, Containment & Ventilation Additional RAIs

Nine Mile Point Nuclear Station, LLC (NMPNS) hereby transmits revised and supplemental information in support of a previously submitted request for amendment to Nine Mile Point Unit 2 (NMP2) Renewed Operating License (OL) NPF-69. The request, dated May 27, 2009 (Reference a), proposed an amendment to increase the power level authorized by OL Section 2.C.(1), Maximum Power Level, from 3467 megawatts-thermal (MWt) to 3988 MWt. By letter dated March 10, 2010 (Reference b), the NRC staff determined that additional information was needed to support its review. Additionally, in response to Reference (c), NMPNS is providing supplemental information related to previously submitted responses to requests for additional information (RAIs). The attached information is provided to address the above-referenced RAIs and provide supplemental information.

A001
NRR

Should you have any questions regarding the information in this submittal, please contact T. F. Syrell, Licensing Director, at (315) 349-5219.

Very truly yours,

STATE OF NEW YORK :
: **TO WIT:**
COUNTY OF OSWEGO :

I, Sam Belcher, being duly sworn, state that I am the Vice President-Nine Mile Point, and that I am duly authorized to execute and file this response on behalf of Nine Mile Point Nuclear Station, LLC. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other Nine Mile Point employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

Subscribed and sworn before me, a Notary Public in and for the State of New York and County of Oswego, this 16 day of April, 2010.

WITNESS my Hand and Notarial Seal:

Notary Public

My Commission Expires:

9/12/2013
Date

Lisa M. Doran
Notary Public in the State of New York
Oswego County Reg. No. 01DO6029220
My Commission Expires 9/12/2013

SB/JJD

Attachment: Response to Request for Additional Information Regarding License Amendment Request for Extended Power Uprate Operation

cc: NRC Regional Administrator, Region I
NRC Resident Inspector
NRC Project Manager
A. L. Peterson, NYSERDA

ATTACHMENT

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST FOR EXTENDED POWER UPRATE OPERATION

Nine Mile Point Nuclear Station, LLC
April 16, 2010

ATTACHMENT

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST FOR EXTENDED POWER UPRATE OPERATION

By letter dated May 27, 2009, as supplemented on August 28, 2009, December 23, 2009 and February 19, 2010, Nine Mile Point Nuclear Station, LLC (NMPNS) submitted for Nuclear Regulatory Commission (NRC) review and approval, a proposed license amendment requesting an increase in the maximum steady-state power level from 3467 megawatts thermal (MWt) to 3988 MWt for Nine Mile Point Unit 2 (NMP2). This attachment provides supplemental information in response to NRC requests for additional information (RAIs) March 10, 2010. The NRC request is repeated (in italics), followed by the NMPNS response.

Mechanical & Civil Engineering

EMCB-1

The NRC staff requests that the licensee update Table 1-2, which contains information on plant parameters for current licensed thermal power (CLTP) and EPU, by adding a column for original licensed thermal power (OLTP). Please include design and maximum temperatures and pressures for the vessel inlet and outlet reactor recirculation system (RRS) nozzles, feedwater (FW) inlet and main steam (MS) outlet and core spray (CS) inlet.

NMPNS Response EMCB-1

The requested information is shown below:

Plant Operating Conditions	**OLTP**	**CLTP**	**EPU**
Thermal Power (MWt)	3323	3467	3988
Vessel Steam Flow (Mlb/hr)	14.27	15.002	17.636
Full Power Core Flow Range			
Mlb/hr	94.4 to 113.9	86.8 to 113.9	107.4 to 113.9
% Rated	87.0 to 105.0	80.0 to 105.0	99.0 to 105.0
Maximum Normal Dome Pressure (psia)	1020	1035	1035
Maximum Normal Dome Temperature (°F)	547	548.8	548.8
Pressure Upstream of TSV (psia)	991	1003	991
Full Power Feedwater			
Flow (Mlb/hr)	14.24	14.970	17.604
Temperature (°F)	420	425.1	440.5
Core Inlet Enthalpy (Btu/lb)	527.5	529.2	528.9

Reactor Nozzle	OLTP	CLTP	EPU
RRS Outlet Design Temperature	575°F	No Change	No Change
RRS Outlet Maximum Temperature [1]	547°F	549°F	No Change
RRS Inlet Design Temperature	575°F	No Change	No Change
RRS Inlet Maximum Temperature [1]	547°F	549°F	No Change
FW Nozzle Design Temperature	575°F	No Change	No Change
FW Nozzle Maximum Temperature [2]	422°F	427°F	443°F
MS Nozzle Design Temperature	575°F	No Change	No Change
MS Nozzle Maximum Temperature[3]	547°F	549°F	No Change
CS Nozzle Design Temperature	575°F	No Change	No Change
CS Nozzle Maximum Temperature[4]	547°F	549°F	No Change

NOTES

1. RRS maximum temperature values correspond to maximum nominal dome temperatures above.
2. FW maximum temperature values are based on 102% rated power conditions.
3. MS maximum temperature values correspond to maximum nominal dome temperatures above.
4. CS has no flow under normal operating conditions and the maximum temperature values correspond to the maximum nominal dome temperatures above. However, maximum thermal cycle diagram Region B temperatures applicable to the core spray nozzle reach 552°F during the "Hot Standby" transient.

Pressure

All nozzle maximum pressures are the same as the maximum normal dome pressure above and the design pressure, 1250 psig, remains unchanged from OLTP to EPU.

EMCB-2

Confirm whether the determination of postulated pipe break and crack locations for EPU are in accordance with the criteria found in Standard Review Plan (SRP) Section 3.6.2, BTP MEB 3-1, and explain the method of evaluation that was performed at EPU conditions

NMPNS Response EMCB-2

The determination of postulated pipe break and crack locations used for EPU analysis is in accordance with Section 3.6.2, BTP MEB 3-1. The method of evaluation that was performed at EPU conditions consists of applying the applicable factor provided in Power Uprate Safety Analysis Report (PUSAR) Tables 2.2-2a and 2.2-2b (Attachment 11 of the LAR) to the applicable stresses/cumulative usage factors listed in the original calculations, resulting in the EPU stresses. These new stresses/cumulative usage factors are then compared against allowables to determine if a new break needs to be postulated. The evaluation showed that no new break locations needed to be postulated in these systems.

A qualitative evaluation was performed for moderate energy lines crack locations. A review was performed for changes in operating/design pressure and temperature due to EPU. The review confirmed that no new crack locations are required for EPU.

EMCB-3

Provide a list of high energy (HE) systems and a list of moderate energy (ME) systems which have experienced increases in pipe stresses and cumulative usage factors (CUFs), where applicable, due to EPU.

NMPNS Response EMCB-3

The HE systems inside containment identified below meet the definition of a HE system given in Section 3.6A.2.1.1 of the NMP2 Updated Safety Analysis Report (USAR). These systems were evaluated for HE line breaks in Section 2.2.1 of the PUSAR. The evaluation showed that no new break or crack locations needed to be postulated in these systems. The following HE systems inside of containment experience increases in pipe stresses and cumulative usage factors due to EPU (Main Steam Drain Lines (MSDL), Reactor Core Isolation Cooling (RCIC) and Safety Relief Valves (SRVs) are shown as affected as they are connected to Main Steam):

1. FWS - Feedwater System
2. MSS - Main Steam System
3. MSV - Main Steam Vent
4. MSDL - Main Steam Drain Lines
5. RCIC - Reactor Core Isolation Cooling
6. SRV - Safety Relief Valve Piping
7. RCS - Reactor Coolant (Recirculation) System

The HE systems outside containment identified below meet the definition of a HE system given in Section 3.6A.2.1.1 of the USAR. Of the HE systems identified below with pipe stress increases, Table 3.6A-73 of the USAR only identifies the Main Steam (MS), Feedwater (FW) and Reactor Water Cleanup (WCS) Systems as HE systems whose failure could impact essential systems/components/equipment. These systems were evaluated for HE line breaks in Section 2.2.1 of the PUSAR. The evaluation showed that no new break or crack locations needed to be postulated in these systems. The following HE systems outside of containment experience increases in pipe stresses due to EPU:

1. MSS - Main Steam System
2. FWS - Feedwater System
3. WCS - Reactor Water Cleanup (Bounded by analysis of record)
4. ESS - Extraction Steam System
5. ASR - Radwaste Auxiliary Steam (Bounded by analysis of record)
6. FWR - Feedwater Pump Recirculation Balance Drum Leakoff

7. CNM - Condensate
8. TME - Turbine Generator Gland Seal and Exhaust System
9. DSM - Moisture Separator Vents and Drains
10. DSR - Moisture Separator Reheater Vents and Drains
11. HDL - Low Pressure Feedwater Heater Drains
12. HDH - High Pressure Feedwater Heater Drains
13. ASS - Auxiliary Steam (Bounded by analysis of record)
14. FWP - Feedwater Pump Seals and Leakoff
15. DTM - Turbine Plant Miscellaneous Drains
16. ARC - Condenser Air Removal
17. OFG - Off Gas
18. SVH - Feedwater Heater Relief Vents and Drains
19. CNA - Auxiliary Condensate
20. CNS - Condensate Makeup and Draw-off
21. ZIP - Zinc Injection
22. HRS - Hot Reheat System
23. RDS - Control Rod Drive Hydraulics

The following ME systems outside of containment experience increases in pipe stresses due to EPU:

1. CWS - Circulating Water
2. CCS - Turbine Building Closed Loop Cooling Water System
3. CND - Condensate Demineralizers

EMCB-4

The Safety Analysis Report for Nine Mile Point Nuclear Station Unit 2 Constant Pressure Power Uprate (PUSAR) does not contain an assessment for postulated failures in ME lines which is recommended by the constant pressure power uprate licensing topical report (CLTR). Provide an evaluation which shows that postulated pipe failures and their associated effects on the ME lines have been assessed for EPU.

NMPNS Response EMCB-4

The effect of the postulated failures in the ME lines has been assessed for EPU conditions. The PUSAR contains evaluations for ME line postulated failures; see Sections 2.5.1.1 and 2.5.1.3.

EMCB-5

Guidance of SRP Section 3.6.1 (Table 3.6.1-2) lists the condensate (CND) system as a potential HE system. Please provide the maximum operating temperature and pressure for the CND system. The PUSAR states that the thermal expansion of the condensate increases by 17.6 percent for EPU. Has the condensate system been evaluated for postulated pipe failures and their associated effects on the plant systems, structures, and components (SSCs)?

NMPNS Response EMCB-5

The maximum operating temperature and pressure for the condensate system (CNM) is 378.2 °F and 560.7 psia at 100% EPU power. Note: pressure is higher at lower power.

Please note that the acronym for the condensate system at NMP2 is CNM. The acronym, CND at NMP2 refers to the condensate demineralizer system.

Table 3.6A-73 of the USAR identifies high energy piping systems. Pipe failure in these systems could impact essential systems/components/equipment. The condensate system is not included in Table 3.6A-73. As identified in Section 3.6A.2.1.5 of the USAR, "Breaks are not postulated in high-energy piping at locations that are isolated or physically remote from essential equipment, structures, and the containment." A break in the condensate system does not affect essential equipment, structures, and containment. Therefore, the condensate system has not been evaluated for postulated pipe failures.

EMCB-6

Page 2-26 of the PUSAR indicates that the HE steam lines, steam line vents and drains, FW, main steam relief valve (MSRV) piping, and water cleanup system (WCS) are affected by the proposed EPU. In a number of places in the PUSAR, the following statement is made: "No new break or crack locations are required to be postulated, as a result of the increased piping stresses associated with EPU." Provide a justification and describe the work performed that resulted in this blanket statement conclusion. Include the method of evaluation for postulated pipe failures. Explain whether existing data were scaled up (list systems) or new analyses were performed to derive new values for comparison to existing pipe break/crack allowable values.

NMPNS Response EMCB-6

All systems in which stresses change as a result of EPU were evaluated to determine if new break or crack locations are required to be postulated (See the response to RAI EMCB-3 for a list of systems). The determination of postulated pipe break and crack locations used for EPU analysis is in accordance with Section 3.6.2, BTP MEB 3-1. The method of evaluation that was performed for EPU conditions consists of applying the applicable factor provided in PUSAR Tables 2.2-2a and 2.2-2b to the applicable stresses/cumulative usage factors listed in the original calculations, resulting in the EPU stresses (i.e, the data were scaled up). These new stresses/cumulative usage factors are then compared against allowables to determine if a new break needs to be postulated. The evaluation showed that no new break locations needed to be postulated in these systems.

A qualitative evaluation was performed for moderate energy lines crack locations. A review was performed for changes in operating/design pressure and temperature due to EPU. The review confirmed that no new crack locations are required for EPU.

EMCB-7

For piping systems that will experience an increase in loads due to EPU, provide a quantitative summary which shows that the dynamic effects of pipe whip and jet impingement have been evaluated and show comparison of results to acceptable limits. Include the FW and WCS.

NMPNS Response EMCB-7

NMP2 has the following large bore pipe lines with HE line breaks: RCS, MS, RCIC, FW, WCS, Residual Heat Removal (RHR), Low-Pressure Coolant Injection (LPCI), Low-Pressure Core Spray (LPCS) and High-Pressure Core Spray (HPCS)), and several smaller diameter HE pipe lines (Standby Liquid Control (SLC) and Control Rod Drive (CRD)). Section 10.1 of NEDC-33004P-A, Constant Pressure Power Uprate Licensing Topical Report, concludes that there is no effect on steam line break flows because steam conditions at the postulated break locations are bounded by the current analysis. Therefore, no additional evaluation of the Main Steam System, steam line vents and drains, Safety/Relief Valve (SRV) piping or impacted segments of RCIC piping was required. Additionally, CRD system piping operating conditions are unaffected by EPU. As such, no further evaluation of postulated CRD breaks was required. NMP2 USAR Section 3C.2.11.2, "Standby Liquid Control System (SLC)," states that the SLC injection line branches off the HPCS line in the Primary Containment. The high-energy portion of this system runs straight to a normally closed check valve. EPU has no impact on the physical configuration of the SLC piping. As such, there is no impact on the original disposition of this piping as reported in the USAR.

The remaining high-energy piping segments, including FW, RCS, HPCS, LPCS, WCS, RHR (shutdown cooling) and LPCI, required plant specific reviews to evaluate EPU impacts. EPU impact on the blowdown forces used to determine pipe whip and jet impingement loads has been evaluated for the existing break locations in these pipe lines. There were no new identified break locations resulting from the EPU conditions.

EPU blowdown forces are based on the methods provided in ANSI 58.2-1980. Blowdown forces are a function of line pressure, temperature, and size, as well as proximity to relatively constant pressure sources connected to the line, and the effect of friction or line area restrictions between the break and the constant pressure source. The blowdown forces at EPU conditions are unchanged or negligibly impacted, or the resulting EPU blowdown forces are bounded by the licensing basis blowdown forces calculated at 100% CLTP (3467 MWth) for all lines in the RCS, HPCS, LPCS, RHR (shutdown cooling) and LPCI systems. For WCS, the maximum system pressure increase is 2 psi and the temperature decreases by 0.3 °F compared to the existing analyzed conditions. Therefore, the impact of EPU on the results of the WCS load calculations due to blowdown from a line break is negligible. The FW line break jet impingement loads inside the containment increase by approximately 12%. Evaluation of this increase concluded that all affected targets will continue to function so that the safe shutdown function is unaffected, as described in the following table.

Pipe whip restraint loads depend not only on the blowdown force, but also on the restraint gap that exists prior to developing the restraint force. For Main Steam (including all connected systems/piping), RCIC, RCS, RHR/LPCI, WCS, LPCS, HPCS, SLC, and CRD, EPU has no significant impact on these gaps, since the analyzed temperatures exceed EPU temperatures. Consequently, the resulting whip restraint loads for these systems are bounded by the CLTP whip restraint loads. The impact of EPU on FW pipe whip restraint loads was determined to be negligible (analyzed gap exceeded by less than 0.3%).

Jet Impingement Targets Inside Containment – FW Lines

Piping Line Number	Break Point	Break Location		Break Type	Targets[1]	Justification[2]
		EL	AZ			
2FWS-012-33-1	14B	308’-0 5/8”	309°	C	2RHS*PRR020	F
2FWS-024-60-1	18	292’-8”	340°	C	Prim. Cont. Liner	M
					2FWS*PRR014	M
				L	Prim. Cont. Liner	M
2FWS-024-32-1	20	266’-3 3/4”	345.5°	C	2MSS*PRR006	V
					2MSS*PRR018	V
					Structural Steel	V, M
					2FWS*PRR017	V
2FWS-012-34-1	33B	307’-7 5/16”	46°	C	2FWS*PRS029	V
					2RHS*PRR013	F
2FWS-024-61-1	36	292’-8”	19°	C	Prim. Cont. Liner	M
					2FWS*PRR033	M
					2FWS*PRR048	M
				L	Prim. Cont. Liner	M
2FWS-024-31-1	38	266’-3 3/4”	14.5°	C	Structural Steel	V, M
					2FWS*PRR035	V
					2MSS*PRR026	V
					2MSS*PRR037	V
					2MSS*PRR035A	M
					2MSS*PRR024A	M
					2FWS*PRR033	M

Notes:

1. Targets identified as “PRR” or “PRS” are Safety-Related supports.
2. F – Target or associated line is currently assumed to fail, no additional impact.
   V – Target only impacted by a vessel side break, which is unaffected by EPU.
   M – Significant margin remains with EPU load increase. Margin available from target structural capacity or current analysis of a larger, bounding load.

Conclusion:

EPU conditions have a negligible impact on pipe whip and jet impingement loads on the majority of analyzed breaks. For the increased FW jet impingement loads inside containment, either a comparison of the EPU loads to existing analyzed loads indicated that the existing loads remain bounding, or existing stress ratios (actual to allowable) were less than 25%.

EMCB-8

Indicate whether the FW lines have been structurally analyzed for any flow instabilities and loads due to water hammer or other flow transients, and whether reanalysis has considered the EPU higher flows for these transients in evaluating pipe stresses, pipe breaks, and pipe supports.

NMPNS Response EMCB-8

The FW lines have been analyzed to consider loads for water hammer due to control valve closure and feed pump trip in evaluating pipe stress, pipe breaks, and pipe supports. The loads considered the higher EPU flows. The load increase is accounted for in the factors provided in PUSAR Tables 2.2-2a and 2.2-2b. No modifications are required for FW piping and supports to accommodate higher flows due to EPU.

EMCB-9

In reference to safety-related thermowells and sample probes, page 2-30 of the PUSAR states that:

> *"The total vibratory stress was calculated by using the square root of the sum of the squares (SRSS) of the oscillating lift and drag forces."*

a) *Do the stresses shown account for the direct force of the incident flow? If not, provide a justification.*

b) *Are the stresses shown under the EPU value column of the table on page 2-30 of the PUSAR calculated at the instrument sockolet to pipe weld and how have they been accounted for in the total Code pipe stresses at that location?*

c) *Show how the allowables, listed on pp 2-30 of the PUSAR, have been derived.*

d) *The PUSAR stated that the forces that produce the shown stresses for the thermowells and probes are the oscillating lift and drag forces. If Section III, Appendix N, Equation 69 of N-1321 is utilized for the vortex shedding oscillating lift forcing function, discuss how the vortex shedding drag forces have been accounted for.*

e) *The PUSAR also states that:*

> *"To calculate the structural response, a non-dimensional parameter, termed reduced damping (N-1324.1 Equation 76), was calculated:*
>
> *For off-resonance (non-lock-in) conditions, the structural response is ordinarily small and was calculated using the standard method (N-1324.2, first paragraph)."*

However, the PUSAR does not state that resonance or "lock-in" conditions do not exist in any of the safety-related thermowells and sample probes. Were there any cases where resonance or lock-in could not be avoided? Discuss how these cases were evaluated.

NMPNS Response EMCB-9

a) No. The vibratory stresses are calculated for fatigue considerations arising from fluid induced vibrations. The stress caused by the direct force of the incident flow (steady force) does not contribute to fatigue. In addition, it is very small (about 2176 psi for MS thermowell and 662.72 psi for FW thermowell).

b) No. The stresses shown under the EPU value column of the table on page 2-30 of the PUSAR are at the base of the thermowell or sample probe. The loads acting on the thermowell/sample probe contribute little stress at the sockolet or weld to which they are attached.

c) The allowables are based on ASME III Appendix I fatigue curves; i.e. Figures I-9.1& I-9.2.2.

d) The vortex shedding drag force is considered as 1/10 of the lift force and it is SRSS with the lift force to produce the alternating stress for fatigue concern.

e) There are no resonance conditions (lock-in) under EPU conditions.

EMCB-10

NMP2 EPU LAR Attachment 10, Section 2.0, "Susceptibility And Monitoring," states that:

> *"[T]he vibration levels of the MSS and FWS piping are expected to increase by approximately 38% based on a steam flow increase of 17.6%."*

It also indicates that these systems will be monitored and tested:

> *"Walkdowns of the systems impacted by EPU flow increases will be performed to identify if there are any additional potentially susceptible small bore line configurations."*

The NRC staff requests that the licensee consider revising Section 2.0 to be in accordance with the generic CLTR evaluation, in that if the tested vibration levels in the main piping in the FW and MS systems are found to be significant (as specified in the CLTR), then an engineering evaluation of the attached branch piping connections (small bore and large bore) will be performed to ensure that the steady state stresses are within the endurance limits, and that any necessary small bore or large bore line modifications will be made prior to the EPU.

NMPNS Response EMCB-10

Because small bore branch piping can be more susceptible to vibration-induced fatigue than large bore piping, NMPNS is evaluating small bore branch piping on impacted systems for vibration susceptibility prior to EPU power ascension. Large bore branch piping not included in the piping models used to generate the vibration acceptance criteria will also be included in the evaluations. This approach is being used so that potential concerns can be identified and corrected, as applicable, before EPU power ascension, rather than waiting until EPU power ascension is underway. Depending on the results of the pre-EPU evaluations, the measured vibration amplitudes at specific locations during EPU power ascension may trigger additional evaluations of attached branch piping. The evaluation criteria, if needed, would be based on location-dependent characteristics, as opposed to the generic 50% criterion that may not be applicable to most locations (see additional discussion in response to RAI EMCB-12).

NRC Question EMCB-11

Provide a justification for not having completed the base line vibration monitoring for selected systems and components. Also, please provide the schedule of completion and whether Attachment 10 will be revised accordingly.

NMPNS Response EMCB-11

As documented in LAR Attachment 10, "Flow Induced Vibration – Piping / Component Evaluation," power ascension vibration data from initial plant startup was reviewed and extrapolated to EPU conditions. The results of the review indicate that vibration levels are expected to remain within acceptable limits at EPU conditions. The initial startup baseline vibration results, EPU vibration acceptance criteria analyses, and projected margins at EPU conditions form the technical basis for the vibration monitoring to be performed during EPU power ascension. New baseline vibration data will be obtained and evaluated with respect to the established acceptance criteria during power ascension to EPU conditions, according to the requirements of the power ascension test plan. Therefore, LAR Attachment 10 will not be revised after collection of the EPU power ascension baseline vibration data.

EMCB-12

In Attachment 10, two locations on the MS have been predicted to be above the 50% criterion. One is projected at 59% of the acceptance criterion and the other at 82%. Have contingency evaluations been performed for branch lines in the vicinity of these locations?

a) *Provide a discussion of the evaluation results or a justification for not having these evaluations in place. Only one of these locations has been chosen for monitoring.*

b) *Provide a justification for not planning to monitor location "2-MSS-026-45-1/124-Z" which shows an EPU-projected vibration of 82% of the acceptance criterion.*

NMPNS Response EMCB-12

a) As discussed in the response to RAI EMCB-10, NMPNS is not using the generic 50% criterion. The projected results for the two MS locations in question provide good examples of why the 50% criterion is not applicable in many cases. As shown in Table 3-1 of LAR Attachment 10, "Flow Induced Vibration – Piping / Component Evaluation," the projected EPU vibration levels at the two locations are 8 and 11 mils pk-pk, and the projected vibration increases from initial startup to EPU are 3 and 4 mils pk-pk. These vibration levels and increases are small and similar to or less than the projected vibration levels and increases at many of the locations documented in Tables 3-1 and 3-2 in

LAR Attachment 10 (which have projected levels of less than 50% of the acceptance criteria), and generally would not be cause for concern in regards to vibrations of nearby attached branch lines. The projected percent of the acceptance criteria is related to the large bore piping configuration in the vicinity of the monitoring locations, and is not necessarily an indicator of the potential impacts on attached branch piping.

As discussed in the response to RAI EMCB-10, NMPNS will perform branch piping evaluations prior to EPU power ascension. It is noted that a representative small bore branch line on the MS piping inside containment is already included in the EPU vibration monitoring scope (MS monitoring location 126 in Table 3-1 of LAR Attachment 10). Both of the MS locations where projected EPU vibrations are greater than 50% of the acceptance criteria are also, in essence, included in the EPU vibration monitoring scope, as discussed in b).

b) As stated in Note 1 to Table 3-1 of LAR Attachment 10, some of the initial startup locations were moved to more appropriate locations for EPU vibration monitoring due to configuration changes and based on the results of the EPU vibration acceptance criteria analyses. MS Location 124 on line MSS-026-45-1 was moved approximately three (3) feet, which corresponds to MS Location 1124 in Table 4-1 of LAR Attachment 10.

EMCB-13

EPU LAR Attachment 10, Section 4.2.1 states that:

> *"Allowable displacement (mils pk-pk) and acceleration (g's-pk) limits at the selected measurement locations were calculated based on the analysis results and ASME Code fatigue stress limits for steady state vibration per ASME O&M Standards and Guidelines (S/G) Part 3 [2007 Edition]."*

a) Is the 2007 Edition of the ASME OM Code Part 3 the design-basis OM Part 3 for NMP2? If not, provide your technical justification for using a different Code year than your design basis.

b) Provide a more detailed explanation of how the allowable displacements and accelerations have been derived. Provide a column for Tables 3-1 and 3-2 which shows the acceptance criteria values. Currently, the tables only show OLTP measured and EPU projected values.

NMPNS Response EMCB-13

a) The vibration acceptance criteria developed for initial plant startup testing at NMP2 were based on the 1982 Edition of OM-3. However, the fatigue stress limits in the 1982 and 2007 Editions of OM-3 are the same. Therefore, using the 2007 OM-3 stress limits has no impact on the EPU vibration acceptance criteria.

b) A detailed description of the methodology used to determine the MS and FW vibration limits is provided in Section 4.2.1 of LAR Attachment 10, "Flow Induced Vibration – Piping / Component Evaluation." In brief, force time histories are developed and applied axially to pipe legs in piping structural models to obtain piping dynamic responses indicative of steady-state vibration responses. The analysis results are scaled such that the maximum pipe stress is equal to the allowable vibration stress. The corresponding displacements and accelerations at the selected monitoring locations are the acceptance limits. For the condensate, heater drain and extraction steam piping in the turbine building, allowable vibration limits are calculated using simple beam models. The allowable displacements and accelerations correspond to the maximum stress in the piping span being equal to the allowable vibration stress.

Tables 3-1 and 3-2, (LAR Attachment 10), are updated below to show the EPU acceptance criteria values.

Table 3-1 (Revised)
OLTP Results and EPU Projections for Drywell Monitoring Locations

System	Piping Segment	Monitoring Location-Direction	OLTP Measured Vibration (mils pk-pk)	EPU Projected Vibration (mils pk-pk)	EPU Acceptance Criteria (mils pk-pk)	Projected % of EPU Acceptance Criteria[1]
MSS	2-MSS-026-43-	18-X	5	7.65	27	28
MSS	2-MSS-026-43-	18-Y	5	7.65	13	59
MSS	2-MSS-026-43-	18-Z	4	6.12	32	19
MSS	2-MSS-026-43-	42-X	5	7.65	43	18
MSS	2-MSS-026-43-	42-Y	7	10.72	40	27
MSS	2-MSS-026-43-	42-Z	5	7.65	90	9
MSS	2-MSS-750-	126-X	4	6.12	35	17
MSS	2-MSS-750-	126-Y	6	9.18	39	24
MSS	2-MSS-750-	126-Z	4	6.12	36	17
MSS	2-MSS-026-45-	40-X	2	3.06	29	11
MSS	2-MSS-026-45-	40-Y	5	7.65	16	48
MSS	2-MSS-026-45-	40-Z	2	3.06	24	13
MSS	2-MSS-026-45-	75-X	2	3.06	30	10
MSS	2-MSS-026-45-	75-Y	4	6.12	25	24
MSS	2-MSS-026-45-	75-Z	4	6.12	27	23
MSS	2-MSS-026-45-	124-X	9	13.78	43	32
MSS	2-MSS-026-45-	124-Y	4	6.12	28	22
MSS	2-MSS-026-45-	124-Z	7	10.72	13	82
FWS	2-FWS-012-54-	85-X	5	7.65	25	31
FWS	2-FWS-012-54-	85-Y	4	6.12	20	31
FWS	2-FWS-012-54-	85-Z	4	6.12	25	24
FWS	2-FWS-024-60-	190-X	4	6.12	23	27
FWS	2-FWS-024-60-	190-Y	4	6.12	16	38
FWS	2-FWS-024-60-	190-Z	4	6.12	15	41

[1] Some of the monitoring locations have been moved for EPU based on configuration changes (e.g., snubber reduction) since initial plant startup and improved analysis techniques available for establishing the EPU monitoring locations and acceptance criteria.

Table 3-2 (Revised)
OLTP Results and EPU Projections for Turbine Building Monitoring Locations

System	Piping Segment	Monitoring Location-Direction	OLTP Measured Vibration (mils pk-pk)	EPU Projected Vibration (mils pk-pk)	EPU Acceptance Criteria (mils pk-pk)	Projected % of EPU Acceptance Criteria[1]
MSS	2-MSS-028-6-4	209-X	4	6.12	53	12
MSS	2-MSS-028-6-4	209-Y	9	13.78	284	5
MSS	2-MSS-028-6-4	209-Z	5	7.65	39	20
MSS	2-MSS-028-6-4	7082-X	5	7.65	114	7
MSS	2-MSS-028-6-4	7082-Y	5	7.65	54	14
MSS	2-MSS-028-6-4	7082-Z	11	16.84	51	33
MSS	2-MSS-028-8-4	521-X	2	3.06	276	1
MSS	2-MSS-028-8-4	521-Y	2	3.06	67	5
MSS	2-MSS-028-8-4	521-Z	4	6.12	35	17
MSS	2-MSS-018-34-	135-X	5	7.65	74	10
MSS	2-MSS-018-34-	135-Y	4	6.12	56	11
MSS	2-MSS-018-34-	135-Z	7	10.72	100	11
CNM	2-CNM-036-	60-X	13	19.90	64	31
CNM	2-CNM-036-	60-Y	4	6.12	127	5
CNM	2-CNM-036-	60-Z	4	6.12	169	4
CNM	2-CNM-020-41-	220-X	4	6.12	134	5
CNM	2-CNM-020-41-	220-Y	5	7.65	99	8
CNM	2-CNM-020-41-	220-Z	4	6.12	41	15
CNM	2-CNM-030-22-	241-X	4	6.12	46	13
CNM	2-CNM-030-22-	241-Y	2	3.06	NA	NA
CNM	2-CNM-030-22-	241-Z	2	3.06	23	13

[1] Some of the monitoring locations have been moved for EPU based on configuration changes (e.g., snubber reduction) since initial plant startup and improved analysis techniques available for establishing the EPU monitoring locations and acceptance criteria.

EMCB-14

a) *For the MS and FW piping, state the design-basis codes and years for the safety-related piping and pipe supports, inside and outside containment.*

b) *Verify that all structural evaluations of all SSCs, required for EPU, were performed in accordance with the design-basis codes of record for piping and pipe supports. If a different Code or Code edition other than the design-basis code of record was used for any of the SSCs, provide a justification.*

NMPNS Response EMCB-14

a) The design basis code of record for safety-related piping is ASME Section III, 1974 Edition. The design basis code of record for the non-safety-related piping is ANSI B31.1 1973, including Addenda through C.

b) All structural evaluations of all SSCs required for EPU were performed in accordance with the design basis code of record for piping and pipe supports with the following exceptions:

   The CLTP analysis applied a stress index different than the one described in the code of record in two instances where higher than allowable stresses occurred. The revised stress index that was used was taken from the 1989 ASME code year resulted in the EPU stresses being lower than the allowable. This is allowed by the ASME code and this CLTP application was retained for the EPU evaluation. The design basis code of record for the non-safety-related piping is ANSI B31.1 1973, including Addenda through C. No other versions of the Code were used.

   The fatigue usage calculation used for the thermal stratification location discussed in RAI EMCB-31 is conducted in accordance with ASME Section III, 2001 Edition with 2003 Addenda, Paragraph NB-3222.4(e). The Section III code of record for NMP2 is the 1974 Edition with no Addenda. Analysis to the newer Code is acceptable because NB-3222.4(e) is essentially unchanged between the two Editions.

EMCB-15

Provide a list of systems (inside and outside containment), for which temperature, pressure, flow and mechanical loads have been increased due to EPU. Please also provide the associated OLTP and EPU values.

NMPNS Response EMCB-15

EPU Affected Systems Inside Containment and Associated Values

System	OLTP Max Flow (Mlb/hr)	102% EPU Max Flow (Mlb/hr)	OLTP Max. Op. Temp (°F)	102% EPU Max Op. Temp (°F)	OLTP Max Op. Pres (psia)	102% EPU Max Op. Pres (psia)
Main Steam	14.300	18.066	547	544	1020	1050
Feedwater	14.600	18.034	420	443	1111.7	1150
Recirc. Suction	32.5	34.28	528	535.8	1064.7	1050.6
Recirc. Discharge	32.5	34.28	528	536.8	1317.7	1321.7
SRV Drain Lines	NA	NA	NA	NA	NA	NA
Reactor Pressure Vessel Head Vent Line	NA	NA	NA	NA	NA	NA
Main Steam Drain Line	NA	NA	NA	NA	NA	NA
RCIC	NA	NA	NA	NA	NA	NA

Note:
1. NA indicates no increase from OLTP to EPU or increase does not affect design basis analysis.

EPU Affected Systems Outside Containment and Associated Values

System	OLTP Max Flow (Mlb/hr)	100% EPU Max Flow (Mlb/hr)	OLTP Max. Op. Temp (°F)	100% EPU Max Op. Temp (°F)	OLTP Max Op. Pres (psia)	100% EPU Max Op. Pres (psia)
Main Steam	14.300	17.653	NA	NA	1020	1035
Extraction Steam	NA	NA	431	452	346	429
Feedwater	14.600	17.621	420	441	1430	1640
Condensate/Condensate Demin	NA	NA	361	378	NA	NA
Reactor Water Cleanup	NA	NA	NA	NA	1130	1132
Moisture Separator and Reheater Vents and Drains	NA	NA	541	542	969	976
High Pressure/Low Pressure Heater Drains	NA	NA	377	393	324	404
Feedwater Pump Recirculation and Balance Drum Leakoff	2.649	4.580	364	381	1430	1640
Auxiliary Steam	NA	NA	418	420	98	121
Turbine Plant Miscellaneous Drains	NA	NA	369	387	172	212
Circulating Water System	NA	NA	122	126	NA	NA
Turbine Generator Gland Seal and Exhaust Steam	NA	NA	103	104	NA	NA
Radwaste Auxiliary Steam	NA	NA	103	104	NA	NA
Control Rod Drive Hydraulics	NA	NA	139	141	NA	NA
Feedwater Pump Seals and Leakoff	NA	NA	133	139	NA	NA
Condenser Air Removal	NA	NA	132	138	NA	NA
Off Gas	NA	NA	710	773	NA	NA
Auxiliary Condensate	NA	NA	326	336	98	121
Feedwater Heater Relief Vents and Drains	NA	NA	NA	NA	415	465
Condensate Makeup and Drawoff	NA	NA	133	139	NA	NA
Hot Reheat	NA	NA	NA	NA	120	120

Notes:
1. NA indicates no increase from OLTP to EPU or increase does not affect design basis analysis.
2. CCS system is not listed since EPU changes to this system do not affect design basis analysis.

EMCB-16

Scaling factors from the percentage increases due to pressure temperature and flow for Code equations are shown in PUSAR Table 2.2-2. It is indicated in Tables 2.2-3 and 2.2-4, that these scaling factors are used to derive EPU stresses and fatigue CUFs (where applicable) from OLTP analyses values. Verify that these factors are the results of scaling OLTP to EPU values and not CLTP to EPU values, as this is not clear from the PUSAR presentation. Also, show how these scaling factors were derived.

NMPNS Response EMCB-16

The scaling factors are a percent increase over CLTP stresses and fatigue CUFs.

The scaling factors were derived from the CLTP to EPU values. The scaling factors were derived based on section 4.8 of Licensing Topical Report NEDC-32523P-A.

EMCB-17

PUSAR Tables 2.2-5c through 2.2-5g, for the balance of plant (BOP) piping, contain percent increases for pipe stresses and pipe support loads varying from 5 to 15 percent increases, due to EPU increased loads. These are not indications that piping and pipe supports meet Code equation allowable values without providing maximum resulted values compared to Code allowable values. Provide a brief summary that shows the EPU maximum Code equation stresses for the affected systems meet the Code or FSAR-listed allowable values.

NMPNS Response EMCB-17

The following table provides the maximum ANSI B31.1 Code stress ratios (i.e., Code stress value/Code stress allowable) resulting from the percentage increases listed in Tables 2.2-5c through 2.2-5g. If the ratio is less than 1.00, the Code stress allowable is met for the subject equation.

ANSI B31.1 Code Stress Equations

System	Eq. 11 Max Ratio	Eq. 12 Max Ratio	Eq. 13 Max Ratio	Eq. 14 Max Ratio
Extraction Steam (ESS)	0.47	0.39	1.32[1]	0.85
FW Heater Drains & Vents (HDH, HDL and SVH)	0.45	0.38	1.21[1]	0.83
Condensate (CNM)	NA[2]	NA[2]	0.84	0.89
Moisture Separator Reheater Vents and Drains (DSR and DSM)	0.67	0.72	1.00[1]	0.86
Auxiliary Condensate (CNA)	0.13	0.11	0.86	0.55

Notes:
1. Per ANSI B31.1 Code, Equation 13 stress may exceed allowable value if Equation 14 is satisfied.
2. Condensate system Equation 11 and 12 stresses are not affected by EPU.

EMCB-18

Verify whether the increased flow rate due to CPPU affects the structural analysis (pipe stress and support loads) of only the MS and FW piping.

NMPNS Response EMCB-18

The increase in flow rate due to CPPU only affects the structural analysis of the Main Steam and Feedwater piping. The structural analyses of all other systems inside and outside of containment are not affected by flow rate.

EMCB-19

The PUSAR states that "the MS piping pressures and temperatures are not affected by EPU." Please confirm that the increase in stresses and fatigue CUF values shown on Tables 2.2-3 and 2.2-5a are due only to EPU higher turbine stop valve closure (TSVC) transient loads.

NMPNS Response EMCB-19

Only the change in TSVC loads has an effect on MS pipe stresses. The increase in stresses and fatigue CUF values shown on Tables 2.2-3 and 2.2-5a are due only to EPU higher turbine stop valve closure (TSVC) transient loads. Main steam pressure and temperature change negligibly and therefore pipe stresses are not impacted by these parameters.

EMCB-20

a) *Describe the program and the method used to develop the loads due to the TSVC transient and how these loads were used to determine the pipe stresses.*

b) *Show the load combinations for pipe stresses and pipe support loads that include the TSVC loading.*

NMPNS Response EMCB-20

a) A complete transient analysis using TSV closure times was developed using RELAP5. The EPU analytical model was benchmarked against the OLTP values to ensure consistency of results. The EPU results were based on full EPU main steam flow and stop valve closure times. The maximum piping load was conservatively used to develop the factor.

b) The load combinations for Class 1 pipe stress and pipe support loads that include the TSVC loading are the occasional loads (for Normal, Upset, Emergency, and Faulted conditions) in ASME BPV III Code Equations 9, 10, 11, 13 and 14 (See USAR Table 3.9A-2 Part I). The load combinations for Class 2 and 3 pipe stress and pipe support loads that include the TSVC loading are the occasional loads (for Normal, Upset, Emergency, and Faulted conditions) in ASME BPV III Code Equation 9 (See USAR Table 3.9A-2 Part II). The load combinations for B31.1 Code Class pipe stress and pipe support loads that include the TSVC loading are the occasional loads (for Normal, Upset, Emergency, and Faulted conditions) in ANSI B31.1 Code Equation 12 (See USAR Table 3.9A-2 Part III).

For safety related piping, the factor developed in a) above was conservatively applied to the entire load. In cases where code allowables were exceeded due to conservatism, the factor was then only applied to the transient portion of the load.

The load combination for non-safety related pipe stress that includes the TSVC loads is taken from ANSI B31.1 Equation 12:

$$\frac{PD_0}{4t_n}+\frac{0.75iM_A}{Z}+\frac{0.75iM_B}{Z}\leq kS_h$$

Where

P = Internal design pressure, psig
D_0 = Outside diameter of pipe, in
t_n = Nominal wall thickness of component, in
M_A = Resultant moment loading on cross section due to weight and other sustained loads, in-lbs
M_B = Resultant moment loading on cross section due to occasional loads, in-lbs
Z = Section modulus, in^3
i = Stress Intensification Factor with 0.75i never being less than 1.0
S_h = Basic material allowable stress at maximum temperature from allowable stress tables, psi
k = 1.2 for occasional loads acting less than 1.0% of operating period

For EPU TSVC loads, the component of the equation containing M_B was increased by the TSVC load increase factor. This methodology is conservative since it assumes that the moment M_B is based entirely on the TSVC occasional event.

The following describes how the pipe support loads were analyzed and re-combined to get the EPU total load.

Load Case No.	Combination
2-Normal	DL +/- SRSS(OBEI, OCCU)
3-Upset	DL + THER +/- SRSS(OBET, OCCU)
4-Emergency	DL +/- SRSS(OBEI, OCCE)
5-Faulted	DL +/- SRSS(OCCF, SSEI)

1. OBEI, OBEA, SSEI, FtMax, SRVmax, Chug, SRV Single, and AP are taken from previous analyses.
2. Transient factor (Tables 2.2-2a and 2.2-2b of the PUSAR) is applied to the Ftmax load to get EPU Fluid Transient Load.
3. OBET is calculated as the sum of OBEI and OBEA.

4. OCCU is calculated as SRSS of SRVmax, EPU Fluid Transient, and Recoil (outside containment only).
5. OCCE is calculated as MAX(SRSS(Chug, OCCU), SRSS(CO, SRV Single (inside containment), SRVmax (outside containment), EPU Fluid Transient, Recoil force (outside containment only))).
6. OCCF is calculated as MAX(OCCE, SRSS(AP (inside containment only), EPU Fluid Transient)).
7. The load cases are then defined as:

DL=	Deadweight Load (as applicable)	SRVMAX=	Maximum value of symmetric/asymmetric/single SRV actuation events
THER=	Thermal Load (as applicable)	FT-MAX=	Maximum of 6 Fluid Transient events (including TSVC)
OBEI=	Operational Basis Earthquake Load	RECOIL=	Recoil force (outside containment only)
SSEI=	Safe Shutdown Earthquake Load	OBEA=	OBE Anchor Movements
CHUG=	Chugging Event	BASIC CO=	Condensation Oscillation
AP=	Annulus Pressurization Load	SRV Single=	Single SRV actuation (inside containment only)

EMCB-21

The PUSAR states that the condensate support "2CNM-PSR085A4" needs to be modified for EPU. Attachment 6 of the EPU LAR contains the modifications required for the EPU and states that for MS, FW, and BOP supports will be revised, as necessary. Are there any other pipe supports or piping that need to be modified as a result of EPU in addition to 2CNM-PSR085A4?

NMPNS Response EMCB-21

2CNM-PSR085A4 is the only support requiring modification due to the temperature, pressure and flow rate changes resulting from EPU.

EMCB-22

Page 2-38 of the PUSAR, in reference to the FW pipe supports states that the "the existing analyses bound the EPU conditions." Do the existing analyses for the FW system contain temperature and/or flow loadings that are higher than the EPU parameters? If not, then this statement is not correct and would need to be revised.

NMPNS Response EMCB-22

The EPU analyses were done for temperatures and pressures higher than OLTP. However, total OLTP loads calculated are higher than EPU and are bounding. Subsequent to the OLTP analyses, pipe stress was reduced due to the snubber reduction program. Therefore, it is possible for EPU loads to be bounded by the OLTP loads.

EMCB-23

Provide a brief description and the schedule of completion of any FW piping and pipe support modifications that may be required due to the FW system rerating at EPU conditions.

NMPNS Response EMCB-23

There are no FW piping or pipe support modifications required due to the FW system rerating at EPU conditions.

EMCB-24

Page 2-41 of the PUSAR states that, "For those [BOP] systems that do not require a detailed analysis, pipe routing and flexibility were determined to remain acceptable." Please explain the process of the evaluation that determined these systems acceptable at EPU conditions and state whether any of these systems are safety-related (SR).

NMPNS Response EMCB-24

The systems not requiring detailed analysis are non-safety related. The statement on page 2-41 of the PUSAR refers to small bore lines and/or cold lines (less 150°F) that do not contain detailed analyses. These lines were designed and routed in accordance with NMPNS engineering design standards. These standards were reviewed and it was determined that they remain bounding for EPU conditions.

EMCB-25

Page 2-43 of the PUSAR contains a paragraph which justifies WCS Class 1 piping at EPU conditions. Has an evaluation been conducted for the non-Class 1 SR WCS piping and what were the results/conclusion of the evaluation? If such an evaluation has not been performed for the WCS, provide your justification for not having evaluated the remainder of the WCS for EPU.

NMPNS Response EMCB-25

The Class 1 portion of the WCS system is analyzed to operating pressure range in accordance with ASME Section III Code Subsection NB. The non-Class 1 portion of this piping is analyzed to design pressure in accordance with ASME Section III Code Subsection NC. Since WCS EPU operating pressure does not exceed the current design pressure, only the Class 1 portion of this system requires analysis update.

EMCB-26

In many places of the PUSAR (Class 1 pipe stress), Tables 2.2-3 through 2.2-4, where the Code allowable for primary plus secondary stress intensity (Sn) of 3Sm (EQ 10) has not been met, the PUSAR indicates that the alternate criteria of the simplified elastic-plastic analysis (EQ 12, 13 and 14) have been employed. In these places though, the nodes for EQ 10 and the nodes for EQs 12, 13, and 14 are not the same. In addition, it is not clear whether the fatigue penalty for not meeting EQ 10 has been taken. Provide a technical justification or show that the criteria of the alternate Code equations have been met for those nodes that did not meet EQ 10.

NMPNS Response EMCB-26

In these evaluations, the highest reported CLTP equation stress was increased to account for EPU using the factors given in PUSAR Table 2.2-2 (these factors account for the fatigue penalty). PUSAR Tables 2.2-3 through 2.2-4 list the highest stresses for each equation and their associated node. Therefore, if higher bounding EQ 12, 13, and 14 stresses are acceptable at other nodes, the EQ 12, 13, and 14 stresses at the node for which EQ 10 stress exceeded the allowable will be acceptable as they are less than those reported. In accordance with ASME Section III, 1974 Edition, if the Equation 10 stress exceeded its allowable, Equations 12, 13 and 14 were used to show the stress was acceptable.

EMCB-27

For MS and FW Class 1 piping, are there currently any pipe stress analyses that utilize a later Code than the original code of record, American Society for Mechanical Engineers Boiler Pressure and Vessel Code (ASME Code) 1974 Edition.

NMPNS Response EMCB-27

As allowed by the ASME code of record, a stress index different than the one described in the code of record was used in two instances where higher than allowable stresses occurred in the CLTP evaluation. The revised stress index that was used was taken from the 1989 ASME Code year. The EPU stresses were evaluated in these two instances using the CLTP application of the 1989 ASME code year code stress index. All others use the ASME Code 1974 Edition. Also see RAI EMCB-14 response.

The fatigue usage calculation used for the thermal stratification location discussed in RAI EMCB-31 is conducted in accordance with ASME Section III, 2001 Edition with 2003 Addenda, Paragraph NB-3222.4(e). The Section III Code of Record for NMP2 is the 1974 Edition with no Addenda. Analysis to the newer Code is acceptable because NB-3222.4(e) is essentially unchanged between the two editions.

EMCB-28

Table 2.2-6 of the PUSAR shows that the Sn for the FW nozzle carbon steel safe end increased for EPU by approximately 24%. Provide a technical justification to explain why the EPU CUF decreased significantly (by approximately 32%). Provide a similar justification for the stainless steel safe end which also shows that the Sn increased for EPU, while the fatigue CUF decreased.

NMPNS Response EMCB-28

In PUSAR Table 2.2-6, "CUFs and S_{p+g} Values of Limiting Components," FW nozzle stress intensity values (S_n) are calculated using the standard GEH licensed EPU methodology. Initially, the same standard EPU scaling methodology used to calculate S_n values was applied in the calculation of EPU CUF values. The CUF calculation could not be qualified using standard methodology. Finite element analysis used at the FW nozzle carbon steel and stainless steel locations reduced the most critical fatigue transient scaling factors to as little as 1.0 and at most 1.15. Reductions in thermal cycle counts employed in the EPU CUF calculation caused the reduction in the CUF value from CLTP to EPU.

The CLTP evaluation for the carbon steel and stainless steel locations employed numbers of thermal cycles determined to be very conservative and not required for EPU. The cycles considered in the CLTP evaluation were from the "New Loads" analysis which was a bounding multi-plant evaluation. The EPU evaluation incorporates plant-specific NMP2 design basis cycles.

The EPU evaluation cycles are also consistent with the design basis cycles used in NMP2 cycle counting evaluations. The CUF decreased because the additional conservative cycles present in the CLTP evaluation were not required and therefore, not utilized for EPU.

EMCB-29

In Table 2.2-6, three locations where Sn exceeded the Code allowable limit of 3Sm, the simplified elastic-plastic analysis was performed. It is stated that "P+Q stresses are acceptable per the CLTP elastic-plastic analysis, which is valid at EPU conditions." The NRC staff notes that these locations show an increase in Sn values of approximately 10%, 24%, and 32%. To justify the above PUSAR statement, please provide a summary of the evaluations which shows that the special rules for exceeding 3Sm, as provided by (a) through (f) of Subparagraph NB3228.3 (ASME Sect III, 1974), have been met for the EPU Sn value.

NMPNS Response EMCB-29

Subparagraph NB-3228.3 of ASME Section III items (a) through (f) are satisfied as follows:

(a) Primary-plus-secondary membrane plus bending stress intensity, excluding thermal bending stresses, are less than $3S_m$ as shown in Table 2.2-6.
(b) S_a was multiplied by a re-calculated K_e factor as noted in both the Feedwater Nozzle and Steam Outlet Nozzle CUF calculations.

(c) The rest of the fatigue evaluation is the same as required in NB-3222.4, and the procedure of NB-3227.6 was not used.
(d) The maximum allowable range of thermal stress is calculated according to the requirements of NB-3222.5 and considering membrane stresses due to the maximum pressure of the bounding transient combination. Thermal ratcheting requirements are shown to be met by comparing Table 2.2-6 S_n values, which conservatively include stresses due to mechanical loads, to the calculated maximum allowable range of thermal stress.
(e) The minimum NB-3228.3 material table temperature is 700°F, the vessel operating temperature is 552°F and the vessel design temperature is 575°F. Temperatures never exceed 700°F; therefore requirement (e) is satisfied.
(f) No change from CLTP to EPU in minimum specified yield strength or minimum specified ultimate strength, qualification of S_y / S_u = 0.80 remains unchanged from CLTP to EPU.

EMCB-30

In Table 2.2-6, it is indicated that the shown fatigue CUFs for the FW nozzle are for a 40-year plant life. This table also shows the fatigue CUF for the steam outlet nozzle. Please indicate whether the steam outlet nozzle CUFs are for the 40-plant year life or the 60-year renewed plant life.

NMPNS Response EMCB-30

The Steam Outlet Nozzle CUF values reported in the PUSAR are for the 60-year license. See below:

Table ECMB-30-1

Item	Limiting Component	OLTP Value CUF 40 Years	CLTP Value CUF 40 Years	EPU Value CUF 40 Years	EPU Value CUF 60 Years[1]	ASME Code Allowable = 1.0/ Allowable Met?
1	Steam Outlet Nozzle • Carbon Steel Safe End • Nozzle to Shell Junction	• 0.025 • 0.540	• 0.025 • 0.540	• 0.063 • 0.579	• 0.094 • 0.868	• Yes • Yes

[1] 40 Year CUF value was scaled by 1.5 to account for 60 year license.

ATTACHMENT

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST FOR EXTENDED POWER UPRATE OPERATION

EMCB-31

a) In the current design basis of the plant, are there any piping analyses that contain stratification and is there any CLTP stratification monitoring currently in place? Please list these stratification locations.

b) Explain how these stratification locations have been evaluated and accepted for the EPU conditions and provide a summary of their evaluation results.

NMPNS Response EMCB-31

a) The feedwater system piping is the only piping inside and outside containment included in the thermal stratification analysis. The Feedwater and Reactor Water Clean-up systems have stratification monitoring.

b) In general, thermal stratification moments were calculated based on the temperature gradient, delta T, across the pipe profile. These moments are applied to the horizontal segments in the FW system. For most piping segments inside and outside containment, the moments applied in the original analysis were conservative and bound the EPU moments. In all other cases, scaling factors were derived based on the change in delta T. The scaling factors were applied to pipe stresses and support loads generated by the thermal stratification analysis. All design basis checks were found to remain within Code limits.

   MOV21B located on feedwater loop B (Line 2-FWS-024-28-4 for Class 4 and Line 2-FWS-024-51-1 for Class 1) is a location subject to thermal stratification monitoring which required supplemental finite element modeling and revised thermal cycle definition to address the EPU scaling factor. This location is a break exclusion zone where fatigue usage is required to be maintained less than 0.1. A solid, half section finite element model (FEM) including a portion of feedwater piping on the inlet and outlet side of the valve was used. The valve model comprises of the flow path, the body, and the bonnet (solid element type). The area of interest is the inlet-to-valve weld region. Static, transient, and stratification loading are applied to the FEM and stresses extracted from the area of interest for input to the fatigue analysis.

   The updated OLTP fatigue usage results are scaled by 1.035 to account for 4.3% stretch power uprate (PU) and the 1.15 is applied to account for Extended Power Uprate (EPU). This EPU scaling factor is only applied to half of the usage, since EPU is applicable to approximately half of the 40-year life. The cumulative usage factor (CUF) is shown in the far right column.

   The maximum 40-year CUF calculated for the feedwater valve MOV21B is 0.0664 and is located at the inside surface of Path 1, see Figure EMCB-31-1. This value meets the ASME Code allowable value of ≤0.1 for break exclusion areas. Therefore, the feedwater valve is acceptable for 40 years of operation, including 20 years of EPU operation. For the 60-year license period,the calculated CUF value exceeds 0.1. Fatigue monitoring of the feedwater MOV21B location using the FatiguePro fatigue monitoring software is anticipated to be adequate to maintain the margin below 0.1 for 60-year license period. If fatigue-monitoring trending predicts that fatigue usage cannot be maintained below 0.1, then corrective actions such as re-analysis, enhanced inspection, or repair/replacement will be implemented. Similar requirements will be implemented for the feedwater nozzles, see PUSAR Table 2.2-6, CUFs and Sp+q Values of Limiting Components, Note 5.

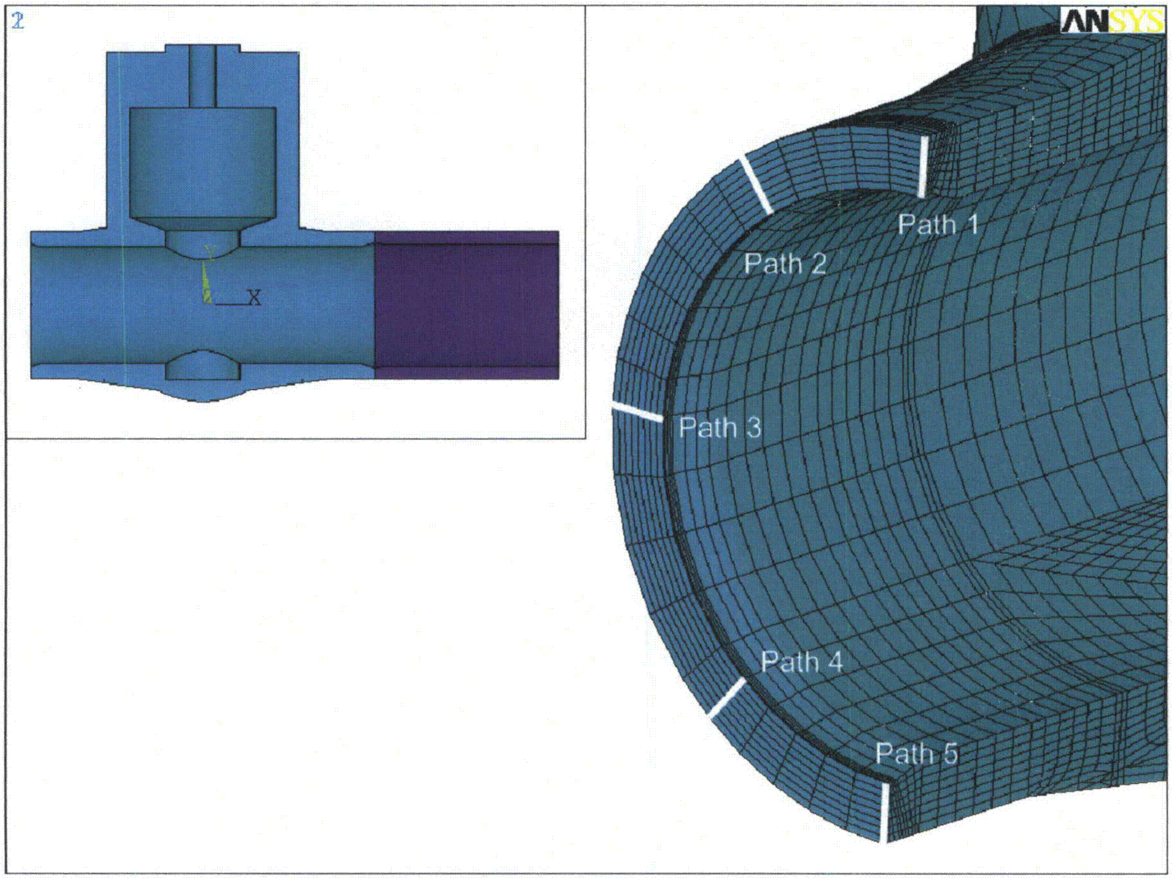
FW System MOV21B Fatigue Usage Results

Path$_1$	**Top Load Set$_2$**	**Sn (psi)**	**Ke$_3$**	**Salt (psi)$_3$**	**Fatigue Usage (Design Basis)**	**Fatigue Usage (Design Basis + PU)**	**Fatigue Usage (Design Basis + PU + EPU)**
1 (0°)	21 & 22	972	1	117,903	0.0597	0.0618	0.0664
2 (45°)	21 & 22	956	1	83,563	0.0308	0.0319	0.0343
3 (90°)	4 & 5	32,037	1	37,844	0.0252	0.0261	0.0281
4 (135°)	4 & 22	14,565	1	72,177	0.0287	0.0297	0.0319
5 (180°)	21 & 22	944	1	99,678	0.0531	0.0550	0.0591

1. Measured from top dead center
2. Load set 4 Event 9B – Feed Water Heater Loss Partial Heater By-Pass
   Load set 5 Event (8,10,11)A – Turbine Trip with By-Pass
   Load set 21 Stratification – Case 1A
   Load set 22 Seismic Inertia OBEI (2%) + Stratification – Case 1A
3. The symbols used in this calculation are from the ASME Code Section III, 1974 Edition with no Addenda and 2001 Edition with 2003 Addenda. They are defined as follows:
   Ke = Strain concentration factor used in Simplified Elastic-Plastic Analysis (NB-3228.5 [1]).
   Salt = Calculated alternating stress intensity, ksi (NB-3216.2).

Note:
The fatigue usage calculation is conducted in accordance with ASME Section III, 2001 Edition with 2003 Addenda, Paragraph NB-3222.4(e). The Section III code of record for NMP2 is the 1974 Edition with no Addenda. Analysis to the newer Code is acceptable because NB-3222.4(e) is essentially unchanged between the two editions.

Figure EMCB-31-1. Extraction Paths for Linearized Stress Results



EMCB-32

GE Hitachi Nuclear Energy (GEH) issued Safety Communication SC 09-01 to address an error in their methodology that developed Annulus Pressurization (AP) loads and lists NMP2 as one of the affected plants. SC 09-01 states that "the AP loads used as input for design adequacy evaluations of NSSS safety related components for "New Loads" plants might have resulted in non-conservative evaluations." SC 09-01 contains the following corrective action:

> *"Plants on the affected plant list should review their design and licensing basis in light of the issue presented above and consider reevaluating the AP loads to ensure that they are consistent with the plant's design-basis."*

It is also noted in PUSAR Section 2.6.2, Subcompartment Analyses, pp 2-233 that, "during the review of the impact of EPU conditions on the AP load, several non-conservative assumptions were discovered related to the original design-basis..." and that "the result of the combined changes of the non-

conservative assumptions and EPU is an increase in the AP load structural forces and accelerations in the range of 0% to 45% for most of the components and structures evaluated, with the increases for a few components in the range of 63% to 133%."

a) *Please confirm whether these two issues on AP loads are the same and whether the SC 09-01 recommended corrective action has been completed. Also, please verify whether EPU evaluations for reactor pressure vessel (RPV) nozzles, RPV supports and internals have considered these increased AP loads.*

b) *Page 2-40 of the PUSAR provides a discussion for the evaluation of AP loads on the RPV attached piping, piping supported on the bio shield wall (including the feedwater system, main steam system, high pressure and low pressure core spray systems, ICS head spray piping, reactor coolant system, residual heat removal system, standby liquid control system, and WCS), wetwell piping and piping outside containment but connecting to drywell penetrations. It also indicates that the effect of the increased AP loads on these SSCs is bounded by "other hydrodynamic loads." List these "other hydrodynamic loads" and whether, according to the NMP2 design basis, the AP loads combine with any of these hydrodynamic loads. Also, explain how it was determined that the AP loads are bounded by these "other hydrodynamic loads." In addition, discuss whether the new AP loads, (calculated and then applied to the structural analysis SSC models in the drywell) were affected by the AP loads, including the RPV and internals?*

NMPNS Response EMCB-32

a) The NMP2 LAR statement "several non-conservative assumptions" refers to the generic AP loads issues identified in SC09-01, as well as errors in the original NMP2 design basis calculations for some break locations that were identified during the EPU evaluations. The EPU evaluations have considered the increased AP loads resulting from SC09-01 in the evaluation of the AP loads. The EPU evaluations also corrected the errors in the original design basis calculations. SC09-01 raises additional questions regarding the original licensing basis AP load methodology that go beyond the evaluation performed by NMP2 related to the EPU LAR. The following provides a description of the NMP2 evaluation and how the evaluation has considered the SC09-01 issue.

The NMPNS assessment of the errors in the original licensing basis Mass and Energy (M&E) release was an evaluation using the methodology previously applied by GE to evaluate the impact on AP loads for the power uprate performed in 1994. This 4.3% uprate is known as the stretch uprate and represents the current licensed thermal power (CLTP) condition. The stretch uprate involved a power increase of 4.3% and an increase in reactor operating dome pressure from 1020 to 1035 psig. The GE method applied for the stretch uprate used a ratio of the M&E change to define a scaling factor applied to the calculated stress on components. This assumes the load change does not result in a change in frequency; the change in component loads is linear and the components are in the elastic range.

GEH informed NMPNS of the ongoing SC09-01 potentially reportable condition investigation and that this method for evaluating the impact of changes to the original AP load definition was potentially non-conservative. The GEH observation was that this method assumes a linear response to M&E release increase and that this assumption cannot be verified as a conservative assumption when applied to dynamic loads used as the forcing functions in a dynamic structural analysis. The reasons are discussed in the SC09-01. Fundamentally, the issue is that the M&E release change could result in a non linear change in component structural response because of the possibility that a component is near a resonant mode. In addition, the change in load has the potential to shift the frequency content of the pressure time history acting on the reactor vessel and internal components and attachments, which then in turn may introduce the potential to excite a different resonant mode on components or attachments. This combination has the potential to result in a non linear increase in component loading as compared to the change in the M&E release.

The safety communication notes that the potential exists for break locations with lower M&E release, off-rated power conditions or reduced FW temperature, to create higher component stresses as compared to the largest line break M&E release break location. The associated pressure time history and associated dynamic response may create a higher amplitude component loading at a given frequency than the largest M&E break location. The NMP2 original design basis included an AP loading matrix of dynamic loading as a function of frequency which was used to assess the reactor vessel and internal components and was used to define a bounding ARS for analysis of the vessel attached piping and primary containment structure. The AP loading matrix included the individual dynamic response calculations for all the high energy lines penetrating the biological shield wall; therefore, the break location aspect of SC09-01 is not applicable to NMP2.

In addition to the SC 09-01 issues described above that are applicable to NMP2, the LAR statement also refers to a NMP2 condition report that identified a non conservative assumption related to the calculated M&E releases used in the original design basis analyses for the recirculation discharge line break, feedwater line break, and LPCI line break locations. The EPU evaluations corrected these errors in the original design basis calculations.

The assessment of the impact on the AP load M&E release for EPU considered the locations where the M&E release was increased due to both EPU and the corrections in the original design basis calculations. The break locations evaluated were the recirculation discharge line, the FW line, and the LPCI line break locations noted in the LAR. Separate CLTP and EPU evaluations were made using the corrected design basis calculations in order to determine the impact due to EPU. Updated dynamic responses were generated for these locations and used to define revised composite ARS spectra for rated EPU operating conditions. Therefore, NMPNS considers the EPU assessment consistent with the recommendations of SC09-01.

The aspect of SC09-01 that NMPNS considers a current licensing basis issue is the potential for off-rated operating conditions to create a more limiting event as compared to the rated operating condition. NMPNS considers the licensing basis to be the rated operating condition. The BWROG has formed a committee to investigate the GEH SC09-01 safety communication. The BWROG committee approved work scope for 2010 is to investigate the SC09-01 methodology issue and determine the licensing basis required actions for each member. At this time NMPNS has assessed the M&E release at off-rated conditions as not limiting based on realistic M&E release versus the conservative NEDO-24548 methods applied for the rated operating condition. Based on the rated M&E releases limiting for all break locations, NMPNS has determined that no immediate actions are warranted and the BWROG effort adequately addresses the open SC09-01 issue for NMP2.

b) NMP2 is a Mark II containment design and as such, the suppression pool related dynamic loads associated with a reactor vessel blowdown create hydrodynamic loads on the reactor vessel and the associated vessel attachments. The containment design is coupled because of the over-under design. These hydrodynamic loads are the chugging loads, the pool swell loads, SRV discharge loads, etc. These loads are combined in the faulted load combination with the AP load and seismic load using the square root of the sum of the squares (SRSS) method. NMP2 USAR Tables 3.8-5 and 3.8-6 document the typical faulted loads combined with AP using SRSS. The EPU evaluation for the containment hydrodynamic loads is documented in Section 2.6.1.2 of the LAR. That evaluation concluded that the design basis LOCA hydrodynamic loads were not affected by EPU. For some components in the drywell, the AP load contribution into the SRSS was small compared to the hydrodynamic loads and, therefore, the assessment that the AP loads were bounded was based on review of the actual loads.

   As discussed in part a) above, the new AP load was used to define new dynamic loads for the RPV and internals and new ARS for attached piping. The new AP dynamic loads were combined with the containment hydrodynamic loads and used to reanalyze the RPV and internals. T he new composite ARS spectra were used in revised attached piping analysis to assess the impact on pipe stress, nozzle loading pipe supports, and containment penetrations.

EMCB-33

Explain how the effect of the increase in AP loads on the total component stresses are reduced when the AP loads are combined with the SSE seismic loads by the square root of the sum of the squares in the faulted load combination, as stated on page 2-234 of the PUSAR, and verify whether the worst-case scenario has been considered.

NMPNS Response EMCB-33

The AP loads are combined with the safe shutdown earthquake (SSE) seismic loads in the faulted load combination using the square root of the sum of the squares (SRSS). The SSE loads in the load combination are not affected by EPU. Because the SSE loads tend to be the dominant term in the load combination, the SRSS process diminishes the AP loads contribution to the total component stresses.

The assessment of the impact on the AP load M&E release for EPU considered the locations where the M&E release was increased due to both EPU and the observed original design basis issue discussed in SC09-01. The break locations evaluated were the recirculation discharge line, the FW line, and the LPCI line break locations noted in the LAR. Separate CLTP and EPU evaluations were made using the corrected design basis calculations in order to determine the impact due to EPU. The highest observed increase in component forces and accelerations resulting from EPU was 8%, with most showing only a slight increase or decrease. Based on the results of these evaluations, it was concluded that the impact due to EPU was minor. Updated dynamic responses were generated for these locations and used to define revised composite ARS spectra for rated EPU operating conditions. Therefore, NMPNS considers the EPU assessment consistent with the recommendations of SC09-01.

The evaluation of the components and structures impacted by the increased load were screened based on the locations with the minimum structural margin. The screening also included an assessment of the relative impact of the AP load on the margin. The evaluation considered the worst case (i.e., component/structure with the minimum structural margin and the component/structure where AP load has the largest contribution to the maximum stress).

EMCB-34

Provide a justification which shows that the EPU effects have been addressed for safety-related equipment with non-metallic components such as resilient seats in valves and hydraulic snubbers, non-metallic flex joint bellows, etc.

NMPNS Response EMCB-34

EPU effects have been addressed for safety-related equipment with non-metallic components within the Electrical (EQ) and Mechanical Equipment Qualification (MEQ) Programs described in USAR Section 3.11. These Programs were audited as part of the NMP2 operating license issuance process and specifically addressed in Section 3.11 of the Safety Evaluation Report issued as Supplement 4 to NUREG-1047. The effects of EPU on the equipment contained in the Electrical Equipment Qualification Program maintained in accordance with 10 CFR 50.49 are discussed in Section 2.3.1 of the PUSAR.

The MEQ Program includes safety-related mechanical equipment located in areas of the plant where the environmental conditions change as a result of design basis events, including high energy line breaks, moderate energy line cracks and Loss of Coolant Accidents. The MEQ Program provides a documented analysis of the non-metallic materials used in safety-related mechanical equipment to demonstrate that the environmental effects due to plant operation and postulated accidents would not degrade these materials in such a way as to prevent this equipment from performing its required safety function. The scope of the MEQ Program includes non-metallic gaskets, seals, seats, discs, o-rings, couplings, packing, etc. used in the construction of safety-related pumps, heat exchangers, unit coolers, fans, filters, strainers, dampers, pipe supports, hydraulic snubbers, mechanical penetrations, control rod drive mechanisms, and globe, gate, check, plug, butterfly, ball and relief valves. Program qualification documentation and materials analyses are maintained in the NMP2 MEQ Report.

The MEQ Program qualification documentation was reviewed based on changes to normal and accident radiological conditions and to the long term portion of the inside primary containment accident temperature profile, as these are the only environmental conditions impacted with operation at EPU conditions. The evaluation concluded that the EPU inside primary containment accident temperature profile and normal and accident radiation dose changes have little or no impact on the temperature and radiation tolerance of the mechanical equipment materials. The MEQ program excludes the effects of beta airborne radiation due to the encapsulation and shielding provided by the equipment to non-metallic parts and materials. The review concluded that there is no change in qualification status for MEQ Program components and this equipment has sufficient life to operate past the first outage following EPU implementation.

EMCB-35

Section 2.2.5 of the PUSAR, entitled, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," does not contain an evaluation for the electrical equipment. Please provide such an evaluation.

NMPNS Response EMCB-35

Category 1 electrical equipment is qualified for seismic loads and dynamic loads, as applicable. Dynamic loads are evaluated in PUSAR section 2.6.1.2 and are not affected by EPU. Primary input motions due to Safe Shutdown Earthquake are not affected by EPU. Therefore, Category 1 electrical equipment seismic and dynamic qualification is not impacted by EPU.

Containment & Ventilation

RAI-F-1A

Provide the peak containment pressures and peak containment temperatures resulting from EPU with a main steam line break in containment upstream of the main steam line flow restrictor.

NMPNS Response RAI-F-1A

Based on teleconference with the NRC reviewer on March 3 clarifying the RAI, the following response is provided.

NEDC-32424P-A, section 5.3, states the applicable plant Safety Analysis Report (SAR) analyses are evaluated as part of the uprate review process. Results of the evaluation will also be included explicitly or by reference in the Licensing Report to be submitted as part of the plant-specific uprate application. Subsequently, they will be part of an SAR update. Where necessary, analyses of all limiting accidents and transients are performed at the uprated conditions to show continued compliance with applicable regulatory requirements. The analyses will be performed using NRC approved codes. The assumptions and scope of the analysis will be consistent with the plant's current licensing bases. Appendix G describes the Methods and Assumptions for Containment Evaluation. The main steam line break in containment was not a limiting break prior to EPU.

Critical flow (choked) during the MSLB develops at the break as discussed in Section 6.2.1.1.3 of the NMP2 USAR and shown in Figures 6.2-13 and 6.2-14. Therefore, containment temperature and pressure response for the MSL break continues to be bounded at EPU conditions and no MSLB analysis was required.

RAI-F-12

Table 2.6-3 of NEDC-33351 provides RHR heat exchanger performance values used in the EPU analyses. These values (K-value of 265 BTU/sec-°F for EPU DBLOCA) are higher than the actual heat exchanger performance with service water at 82°F (K-factor of 239 BTU/sec-°F as discussed in NMP2 USAR, Section 6.2).

1 *Provide a justification for using a heat exchanger performance value for the analyses that is greater the actual performance value.*

2. *Provide a justification why the RHR heat exchanger total fouling resistance used for the EPU analysis (0.001344 hr-ft²-°F/BTU/HX for DBLOCA) is less than discussed in the NMP2 USAR (0.001 hr-°F-ft²/BTU for tube side fouling and 0.0005 hr-°F-ft²/BTU for shell side fouling).*

3. *Discuss the program NMP2 uses to assure the RHR heat exchangers perform at a level to assure the minimum performance values used in the EPU analyses are maintained. Include the margin NMP2 uses to account for instrumentation accuracy, low heat exchanger loads, and service water temperatures lower than the EPU analyses basis.*

NMPNS Response RAI-F-12

1. The USAR discussion describes the original design specified RHR performance which was defined based on an assumed decreased performance as compared to the RHR heat exchanger capability. The actual performance of the RHR heat exchanger based on clean design is equivalent to a K=384. The actual tested RHR K value is measured at a K of ~363. The large margin (~37%) between the EPU safety analysis assumed performance and the actual measured performance and periodic testing (4 year interval) and inspection/cleaning provide assurance that required performance will be met.

2. The original component specification fouling tolerances have been demonstrated to be overly conservative for the RHR heat exchanger when compared to actual performance monitoring of the RHR heat exchanger. The original heat exchanger specification fouling assumptions were based on a Tubular Exchanger Manufacturers Association (TEMA) assumed nominal great lakes water heat exchanger with continuous service conditions. The RHR heat exchanger operational conditions represent occasional service during shutdown cooling, occasional service for spent fuel pool cooling during refuel outages, and during periods of suppression pool cooling. Review of the 2004 and 2007 RHR heat exchanger test data concluded that actual heat exchanger fouling is ~13% of the EPU DBA-LOCA requirement, i.e., total allowed fouling is 0.001433).

   Note: The NMP2 LAR documents the RHR heat exchanger total fouling resistance used for the EPU analysis as 0.001433 hr-ft²-°F/BTU/HX for DBLOCA, the RAI appears to have a transposition error.

3. The NMP2 RHR heat exchanger performance monitoring program has a 4 year frequency. In addition, there is a periodic heat exchanger inspection and cleaning program. These programs assure that the minimum performance values used in the EPU analyses are maintained.

The overall test uncertainty consists of instrument accuracy and analytical uncertainty in projecting test data to limiting condition. The acceptance criterion for overall test uncertainty has been specified as 25% of the available thermal performance margin in accordance with EPRI TR-107397, "Service Water Heat Exchanger Testing Guidelines". Typically, the analysis uncertainty dominates. Review of 2004 and 2007 RHR heat exchanger test data concluded that the test measurement uncertainty ranges from approximately 1 to 4%, whereas the analysis uncertainty is approximately 6% of the projected heat duty at the limiting condition. The individual uncertainties are combined using SRSS.