This letter forwards proprietary information in accordance with 10 CFR 2.390. The balance of this letter may be considered non-proprietary upon removal of Attachments 8 - 13.

Sam Belcher
Vice President-Nine Mile Point

P.O. Box 63
Lycoming, New York 13093
315.349.5200
315.349.1321 Fax

CENG
a joint venture of Constellation Energy · eDF

NINE MILE POINT
NUCLEAR STATION

June 30, 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) – Steam Dryer and Probabilistic Risk Assessment

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) Letter from T. A. Lynch (NMPNS) to Document Control Desk (NRC), dated May 7, 2010, Response to Request for Additional Information Regarding Nine Mile Point Nuclear Station, Unit No. 2 – Re: Steam Dryer Review of the License Amendment Request for Extended Power Uprate Operation (TAC No. ME1476)

(d) E-mail from R. Guzman (NRC) to T. H. Darling (NMPNS), dated June 8, 2010, Follow-up RAI Question – Nine Mile Point Unit 2 EPU – Probabilistic Risk Assessment Review

A001
NRR

This letter forwards proprietary information in accordance with 10 CFR 2.390. The balance of this letter may be considered non-proprietary upon removal of Attachments 8 - 13.

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) and e-mail dated June 8, 2010, the NRC staff requested additional information regarding the steam dryer and probabilistic risk assessment (PRA).

The NMPNS letter dated May 7, 2010 (Reference c) provided responses to the March 10, 2010 (Reference b) requests for additional information (RAIs), with the exception of NMP2-EMCB-SD-RAIs - 6, 7, 8, 9, 11, 12, 20, 21 and 24. The letter stated that responses to the nine remaining RAIs would be submitted by June 30, 2010. The responses to the nine RAIs are provided in Attachment 1 (non-proprietary) and Attachment 8 (proprietary). Information supporting these RAI responses is provided in Attachments 4, 5, and 6 (non-proprietary) and Attachments 9 through 13 (proprietary). In addition, the reply to the RAI provided in the e-mail dated June 8, 2010 (Reference d) is also provided in Attachments 1 and 8.

This letter is submitted with the proprietary version of CDI Report No. 10-11, "Stress Assessment of Nine Mile Point Unit 2 Steam Dryer Using the Acoustic Circuit Model Rev. 4.1," (Attachment 9). The non-proprietary version of CDI Report No. 10-11 will be submitted by July 9, 2010. In addition, there is only a proprietary version of CDI Report No. 10-06, "Development and Qualification of Instrumentation to Determine Unsteady Pressures in Piping" (Attachment 12) included, since development of a non-proprietary version was determined not feasible.

Attachments 8 - 13 are considered to contain proprietary information exempt from disclosure pursuant to 10 CFR 2.390. Therefore, on behalf of Continuum Dynamics Incorporated (CDI), NMPNS hereby makes application to withhold these attachments from public disclosure in accordance with 10 CFR 2.390(b)(1). An affidavit from CDI detailing the reason for the request to withhold the proprietary information is provided in Attachment 7.

Attachment 2 provides supplemental information that discusses the findings of an interior inspection of accessible portions of the steam dryer that was conducted in April 2010.

Attachment 3 lists new regulatory commitments identified in this submittal.

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 30 day of June, 2010.

WITNESS my Hand and Notarial Seal:

Notary Public

My Commission Expires:

2/28/14
Date

JOHN C JOSH
NOTARY PUBLIC, STATE OF NEW YORK
NO. 01JO4837303
QUALIFIED IN OSWEGO COUNTY
COMMISSION EXPIRES 2/28/14

SB/STD

Attachments:

1. Response to Request for Additional Information Regarding License Amendment Request for Extended Power Uprate Operation (NON-PROPRIETARY)

2. Supplemental Information – Findings of Interior Inspection of Steam Dryer

3. List of Regulatory Commitments

4. CDI Report No. 10-09NP, "ACM Rev. 4.1: Methodology to Predict Full Scale Steam Dryer Loads from In-Plant Measurements," Rev. 1 (NON-PROPRIETARY)

5. CDI Report No. 10-10NP, "Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level on Nine Mile Point Unit 2 Steam Dryer to 250 Hz Using ACM Rev. 4.1," Rev. 1 (NON-PROPRIETARY)

6. SIA 1000632.301, Revision 0, "May 2010 Nine Mile Point Unit 2 Main Steam Line Strain Gage Data Reduction" (NON-PROPRIETARY)

7. Affidavit Justifying Withholding Proprietary Information From Continuum Dynamics Incorporated (CDI)

8. Response to Request for Additional Information Regarding License Amendment Request for Extended Power Uprate Operation (PROPRIETARY)

9. CDI Report No. 10-09P, "ACM Rev. 4.1: Methodology to Predict Full Scale Steam Dryer Loads from In-Plant Measurements," Rev. 1 (PROPRIETARY)

10. CDI Report No. 10-10P, "Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level on Nine Mile Point Unit 2 Steam Dryer to 250 Hz Using ACM Rev. 4.1," Rev. 1 (PROPRIETARY)

11. CDI Report No. 10-11P, "Stress Assessment of Nine Mile Point Unit 2 Steam Dryer Using the Acoustic Circuit Model Rev. 4.1," Rev. 0 (PROPRIETARY)

12. CDI Report 10-06P, "Development and Qualification of Instrumentation to Determine Unsteady Pressures in Piping," (PROPRIETARY)

13. SIA 1000632.301, Revision 0, "May 2010 Nine Mile Point Unit 2 Main Steam Line Strain Gage Data Reduction" (PROPRIETARY)

cc: NRC Regional Administrator, Region I
NRC Resident Inspector
NRC Project Manager
A. L. Peterson, NYSERDA (w/o Attachments 8 - 13)

ATTACHMENT 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST FOR EXTENDED POWER UPRATE OPERATION (NON-PROPRIETARY)

Certain information, considered proprietary by Continuum Dynamics Incorporated, has been deleted from this Attachment. The deletions are identified by double square brackets.

Nine Mile Point Nuclear Station, LLC
June 30, 2010

ATTACHMENT 1
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST FOR EXTENDED POWER UPRATE OPERATION (NON-PROPRIETARY)

By letter dated May 27, 2009, as supplemented on August 28, 2009, December 23, 2009 February 19, 2010, April 16, 2010, May 7, 2010, and June 3, 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). By letter dated March 10, 2010 and e-mail dated June 8, 2010, the NRC staff requested additional information in the steam dryer and probabilistic risk assessment (PRA) assessment areas.

The NMPNS letter dated May 7, 2010 provided the responses to the March 10, 2010 requests for additional information (RAIs), with the exception of NMP2-EMCB-SD-RAI - 6, 7, 8, 9, 11, 12, 20, 21 and 24. The responses to those RAIs and the RAI provided in the e-mail dated June 8, 2010 are provided in this Attachment. The NRC request is repeated (in italics), followed by the NMPNS response.

NMP2-EMCB-SD-RAI-6

This pertains to the [[ ]] signals from the current licensed thermal power (CLTP) signals, [[ ]] the hydrodynamic and acoustic loads on the steam dryer. In a recent conference call with NMPNS on October 30, 2009, regarding the use of Revision 4 of the Continuum Dynamics Incorporated (CDI) Acoustic Circuit Model (ACM), with respect to the extended power uprate (EPU) application, the NRC staff was informed that during the benchmarking of the ACM parameters, by means of the Quad Cities Unit 2 (QC2) data, the [[ ]] from the main steam line (MSL) strain gage signals used to estimate the steam dryer loads. Therefore, it is [[ ]] from the NMP2 strain gage data prior to computing dryer loads using Rev. 4 of the ACM.

The licensee is requested to provide revised dryer stress analysis results for EPU conditions based on dryer loads [[ ]]. In addition, the licensee is requested to ensure that the minimum alternating stress ratio (SR-a) is not less than 2.0 for any dryer component for the projected EPU conditions.

NMNPS Response

This NRC RAI asks a question regarding the NMP2 EPU application of Revision 4 of the CDI ACM. In response to this and other RAIs, the NMP2 steam dryer stress analysis was revised using Revision 4.1 of the CDI ACM (Attachments 4 and 9). The revised loads analysis (Attachments 5 and 10) follows the approach discussed with the NRC at the March 18, 2010, meeting regarding the NMP2 EPU License Amendment Request. The revised analysis:

1. Utilizes main steam line strain gage data collected during a power ascension on May 2 through May 7, 2010 at CLTP conditions;
2. Involves a re-benchmark of the Quad Cities Unit 2 data; and
3. Applies the same filtering techniques used on the Quad Cities data to the NMP2 data. Because the Quad Cities data did not have [[ ]] to filter, those signals are not subtracted in the NMP2 ACM Rev.4.1 loads report (Attachments 5 and 10).

The stress analysis of the NMP2 steam dryer in accordance with CDI ACM Rev. 4.1 (Attachment 11) determined that several locations in the steam dryer have alternating stress ratios below the EPU criterion of 2.0. Because of changes in dominant frequency peaks and the generally more conservative loads model (limited filtering, no noise subtraction, etc.), additional reinforcements are necessary. The reinforcements consist of: (i) a localized reinforcement of the lifting rod support braces and their attachment welds to the steam dryer side plate; (ii) addition of a reinforcement plate over the outboard section of the middle hood located between the closure plate and existing middle hood reinforcement strip, and; (iii) addition of a total of four 20 lb masses on the inner hoods to reduce high stresses on the inner hood/hood support welds. These three modifications are in addition to the previously planned reinforcement of the closure plates and its attachment welds. With these modifications in place, the limiting alternating stress ratio on the steam dryer increases to greater than 2.76 for all locations identified as warranting modification.

In addition, stress analysis identifies a group of locations (group 4) that have an SR-a = 2.65 when an endurance limit of 13.6 ksi is utilized. Without modifications, this would limit the steam flow to 117.5%

original licensed thermal power (OLTP) conditions. While modification concepts are presented and feasible, complete stress evaluations for the modifications are not considered warranted, because a factor of two margin was demonstrated when the group 4 locations were analyzed utilizing the endurance limit (16.5 ksi) based on curve B of Fig I-9.2.2 in Appendix I of Section III of the ASME Boiler and Pressure Vessel code. For this endurance limit, no additional modifications are required to meet the required factor of 2 margin to the endurance limit for 120% EPU.

In addition, this is supported by the supplemental measurements acquired by the [[ ]] installed on MSL-D described in CDI Report 10-06P (Attachment 12) and discussed in Structural Integrity Associates, Inc. (SIA) calculation 1000632.301 (Attachments 6 and 13). This data set indicates that noise in the frequency intervals, when scaled based on the velocity squared rule, is biasing the stress ratio high. Because noise is the governing component of the load, the load is not expected to increase with velocity squared scaling. Thus, a large margin above the factor of two will exist at 120% EPU.

Power ascension testing will demonstrate substantial margin without modification of the group 4 locations.

NMP2-EMCB-SD-RAI-7

The licensee is requested to provide a detailed description (i.e., a step-by-step procedure) of how the QC2 MSL strain gage signals at CLTP were modified (both during and after data acquisition) before they were applied to the ACM Rev. 4 Code (whose results were used for benchmarking) to estimate acoustic loads on the instrumented QC2 dryer. Please also provide a step-by-step comparison of this benchmarking procedure with the procedures used in revising the MSL strain gage signals at CLTP for NMP2.

Additionally, the licensee is requested to provide the following information about any exclusion frequencies:

a) Provide the amplitudes of the QC2 MSL strain gage signals for the exclusion frequencies (60, 120 and 180 Hz) at CLTP conditions before these frequencies were removed or filtered. Discuss which of these frequencies were treated as exclusion frequencies in modifying the QC2 signals.

b) Provide the information on the QC2 recirculating pump frequency, and provide the amplitudes of the MSL strain gage signals at this frequency. Explain whether this frequency was treated as an exclusion frequency in modifying QC2 signals.

c) Explain whether any exclusion frequency filtering was also applied to the instrumented QC2 dryer pressure signals.

d) Provide a comparison of frequencies that were treated as exclusion frequencies in the ACM Rev. 4 benchmarking and NMP2 stress analysis. Please also provide an explanation of the differences.

NMNPS Response

The NMP2 steam dryer stress analysis was revised using Revision 4.1 of CDI ACM (Attachments 4 and 9).

a. Attachments 4 and 9 provide the procedure requested in this RAI, and describes the benchmarking performed to the QC2 data as requested in this RAI.

b. Attachments 4 and 9 provide the procedure requested in this RAI, and describes the benchmarking performed to the QC2 data as requested in this RAI.

c. Attachments 4 and 9 provide the procedure requested in this RAI, and describes the benchmarking performed to the QC2 data as requested in this RAI. CDI did not perform removal of any exclusion frequencies from the pressure data received from Exelon. However, the data appears to have been screened for 60 Hz and other multiples prior to CDI receiving the data. This could not be confirmed.

d. The revised NMP2 steam dryer loads analysis based on Revision 4.1 of CDI ACM (Attachments 5 and 10) follows the approach discussed with the NRC at the March 18, 2010, meeting regarding the NMP2 EPU License Amendment Request. It provides a comparison of the frequencies that were treated as exclusion frequencies in the ACM Rev. 4.1 benchmarking and the NMP2 stress analysis.

NMP2-EMCB-SD-RAI-8

This RAI pertains to the [[ ]] signals from the MSL strain gage signals at CLTP, [[ ]] the hydrodynamic and acoustic loads on the steam dryer. In a recent conference call with NMPNS on 4 February 2010, on using Revision 4 of the Continuum Dynamics Incorporated (CDI) Acoustic Circuit Model (ACM), regarding their Extended Power Uprate (EPU) application, the NRC staff was informed that during the benchmarking of the ACM parameters, by means of the Quad Cities Unit 2 (QC2) data, [[ ]] the data used to estimate the steam dryer loads. Therefore, it is [[ ]] to the NMP2 strain gage data prior to computing dryer loads using Rev. 4 of the ACM.

The licensee is requested to provide revised dryer stress analysis results for EPU conditions based on dryer loads [[ ]]. In addition, the licensee is requested to ensure that the minimum alternating stress ratio (SR-a) is not less than 2.0 for any dryer component for the projected EPU conditions.

NMNPS Response

This NRC RAI asks a question regarding the NMP2 EPU application of Revision 4 of the CDI ACM. In response to this and other RAIs, the NMP2 steam dryer stress analysis was revised using Revision 4.1 of the CDI ACM (Attachments 4 and 9). The revised loads analysis (Attachments 5 and 10) follows the approach discussed with the NRC at the March 18, 2010, meeting regarding the NMP2 EPU License Amendment Request. The revised analysis:

1. Utilizes main steam line strain gage data collected during a power ascension on May 2 through May 7, 2010 at CLTP conditions;
2. Involves a re-benchmark of the Quad Cities Unit 2 data; and
3. Applies the same filtering techniques used on the Quad Cities data to the NMP2 data. [[ ]] is applied identically to the Quad Cities data and the Nine Mile Point data. The [[ ]] was presented at the NRC meeting on March 18, 2010, and involves separate factors at the upper and lower strain gage locations, based on [[ ]].

The response to NMP2-EMCB-SD-RAI-6 provides a discussion of the results of the revised CDI Stress Report (Attachment 11) regarding the minimum alternating stress ratio.

NMP2-EMCB-SD-RAI-9

Contrary to the staff's understanding of the methodology employed in ACM Rev. 4 benchmarking, based on the QC2 data, various boiling-water reactor plants are using an approach that would result in [[

]]

NMNPS Response

This NRC RAI asks a question regarding the NMP2 EPU application of Revision 4 of the CDI ACM. In response to this and other RAIs, the NMP2 steam dryer stress analysis was revised using Revision 4.1 of the CDI ACM (Attachments 4 and 9). The revised loads analysis (Attachments 5 and 10) follows the approach discussed with the NRC at the March 18, 2010, meeting regarding the NMP2 EPU License Amendment Request. The revised analysis:

1. Utilizes main steam line strain gage data collected during a power ascension on May 2 through May 7, 2010 at CLTP conditions;
2. Involves a re-benchmark of the Quad Cities Unit 2 data; and
3. Applies the same filtering techniques used on the Quad Cities data to the NMP2 data.

The response to NMP2-EMCB-SD-RAI-7 summarizes the data reduction approach established in Revision 4.1 of the CDI ACM. The response to NMP2-EMCB-SD-RAI-6 provides the impact on projected EPU stresses.

NMP2-EMCB-SD-RAI-11

Large peaks in the steam dryer loading at frequencies [[ ]] were reported in Rev. 1 of CDI Report 08-08P, "Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level on Nine Mile Point Unit 2 Steam Dryer to 250 Hz" (see Figure 4.6). Those peaks have disappeared in revisions 2 and 3 of the CDI Report 08-08P. Explain the cause of these peaks in Rev. 1 of the report, and the reason(s) why they no longer exist in Rev. 3 of the report.

NMPNS Response

This RAI asked a question regarding a data set that is no longer being utilized. During the April 2010 refueling outage, the failed main steam strain gage channels were repaired. On May 2 through May 7, 2010, main steam line strain gage data was collected during a power ascension to CLTP conditions (Attachments 6 and 13). This data set serves as the input to a Revision 4.1 of the CDI ACM (Attachments 4 and 9). This new methodology is discussed in the responses to NMP2-EMCB-SD-RAI-6 and NMP2-EMCB-SD-RAI-8.

The peaks in the data removed from the 2008 data set were not evident in the new 2010 data set. No filtering was performed in this frequency range from the 2010 data.

NMP2-EMCB-SD-RAI-12

In Table 3.2 of CDI Report No. 08-08P, Rev. 3: "Acoustic and Low Frequency Hydrodynamic Loads at CLTP Power Level on Nine Mile Point Unit 2 Steam Dryer to 250 Hz", dated December 2009, several frequency peaks are attributed to pipe vibrations and are therefore filtered from the strain gage signals before calculating the dryer dynamic loading. Therefore the applicant is requested to:

a. *[[ ]]*

b. *[[ ]]*

c. *[[ ]]*

d. *[[ ]]*

e. *[[ ]]*

f. *[[ ]]*

NMPNS Response

This RAI asks questions regarding a data set that is no longer being utilized. During the April 2010 refueling outage, the failed main steam strain gage channels were repaired. On May 2 through May 7, 2010, main steam line strain gage data was collected during a power ascension at CLTP conditions (Attachments 6 and 13). This data set serves as the input to Revision 4.1 of the CDI ACM (Attachments 4 and 9).

a. Revision 4.1 of the CDI ACM data analysis (Attachments 4 and 9) does not exclude main steam line frequency peaks associated with main steam line piping vibration. This new methodology is discussed in the responses to NMP2-EMCB-SD-RAI-6 and NMP2-EMCB-SD-RAI-8.

b. Main steam line pipe vibrations are not filtered in the new analysis, so no single strain gage signals from the MSL strain gage pairs were utilized for the purpose of rejection of pipe vibrations.

c. Main steam line pipe vibration peaks are not filtered in the new analysis.

d. Main steam line pipe vibration peaks are not filtered in the new analysis.

e. Main steam line pipe vibration peaks are not filtered in the new analysis.

f. No amplitude reductions associated with main steam line pipe vibration were fed into Revision 4.1 of the CDI ACM code.

NMP2-EMCB-SD-RAI-20

Appendix A of the CDI report 09-26P, "Stress Assessment of Nine Mile Point Unit 2 Steam Dryer at CLTP and EPU Conditions", discusses submodeling and the closure plate modification, which includes the addition of stiffening ribs on the plate, so that the alternate stress ratio will be greater than 2.0. The staff requests details on how the modified closure plate is incorporated in the finite element model of the steam dryer. The licensee has incorporated the increased fundamental frequency (256 Hz) of the modified plate by increasing the thickness of the original unmodified plate. The fundamental mode shape of the modified closure plate would be different than that of the unmodified plate, and is not accounted for in the finite element model that is used to calculate the stresses in the steam dryer. As discussed in Appendix A (p. 95), the shape of the fundamental mode would determine the locations of the significant stresses. Therefore, the licensee is requested to include both the fundamental frequency and mode shape of the modified closure plate in the finite element model, perform the stress analysis using this model, and then provide the resulting stresses.

NMPNS Response

The procedure for incorporating the thickened closure plate solution is as follows: First, the closure plate is considered by itself in order to *design* the necessary reinforcements. For this purpose, the closure plate support and forcing conditions do not need to be exactly the same as in the full model since *evaluation* of the design is subsequently carried out on the complete steam dryer.

Once the design of the closure plate is finalized, a finite element model of the complete steam dryer with the thicker closure plates is constructed. This is accomplished by using the ANSYS model (referred to as Model 1) developed for the dryer with the original unmodified closure plates, selecting the closure plates and assigning new thicknesses to these components. The revised model of the complete steam dryer with the thicker closure plates incorporated is referred to as Model 2. [[

]]

[[

]]

For completeness, the fundamental frequency and mode shape of the thickened closure plate, when connected to the complete NMP2 steam dryer, are calculated using Model 2 (entire steam dryer with the fully integrated thicker closure plate). The fundamental frequency is 263.6 Hz, which is close to the 256 Hz frequency of the isolated closure plate. The accompanying mode shape is given in Figure 20-1 and is clearly seen to involve participation of connected members such as part of the hood. As already indicated, this coupled mode is included in the harmonic analysis used to generate the results in Attachment 15 of the NMPNS letter to NRC dated December 23, 2009.

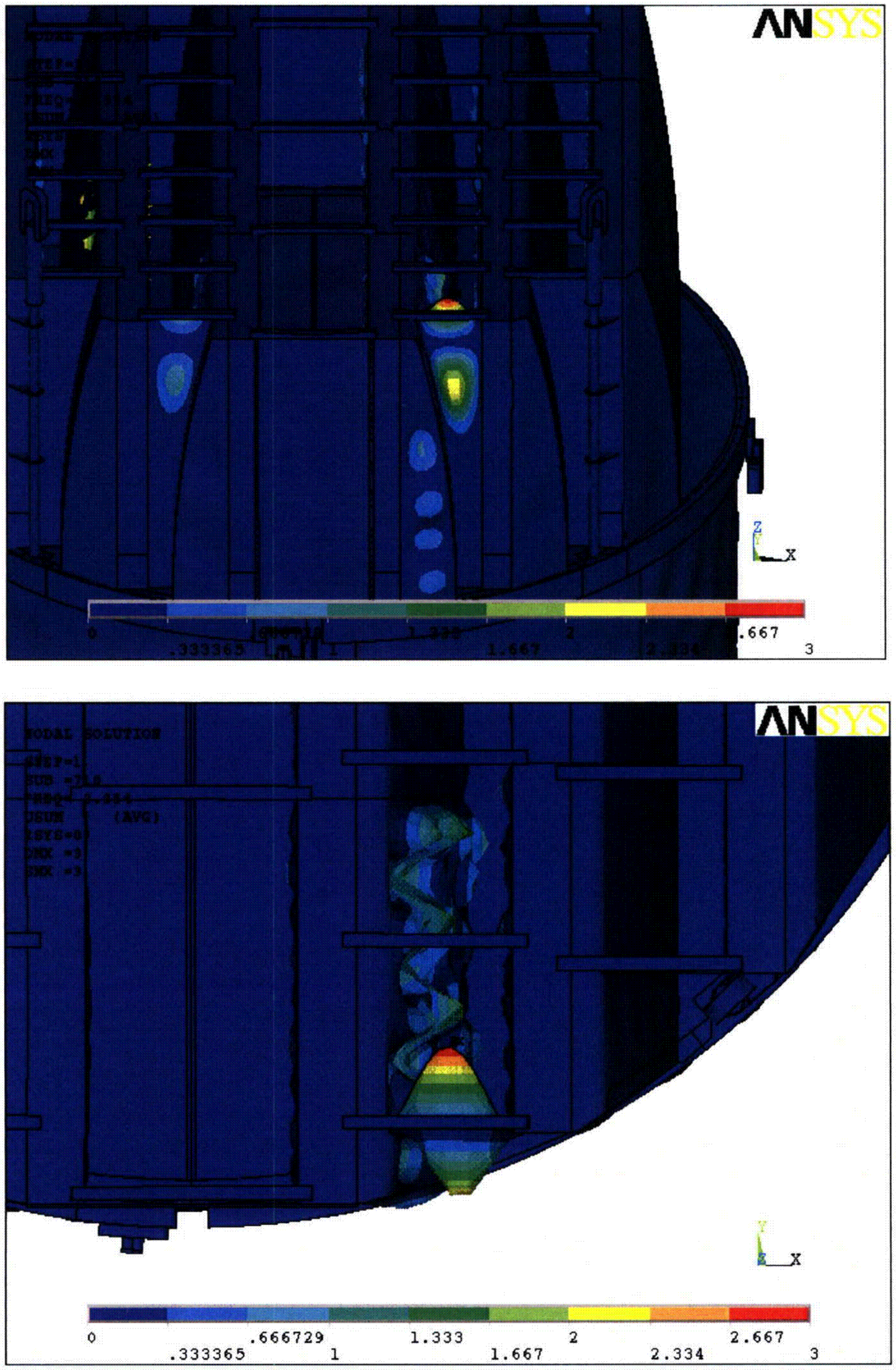

Figure 20-1. Eigenmode at 263.6 Hz, corresponding to the fundamental mode of the closure plate generated with Model 2. The top view shows participation of the inner hood.

NMP2-EMCB-SD-RAI-21

For submodeling analysis of the modified closure plate, the applicant cuts the global model by an intersection box (typically a 6" cube) and obtains the resulting intersection lines as discussed in Appendix A of the CDI Report 09-26P. The licensee is requested to confirm whether the intersection lines are located at an adequate distance away from the weld, so that the mesh refinement at the weld produces local changes to stress and strain, while stresses and displacement on the intersection lines remain unchanged.

NMPNS Response

The sub-modeling procedure is designed to produce more accurate estimates of the stress field in the vicinity of the weld location of interest. As one moves away from this location, the stress field in the sub-model deviates from that in the global model because:

(i) The forces and moments applied to each intersected edge of the sub-model perimeter are averaged along the edge. This averaging ensures that the integrated forces and moments acting on the edge are preserved, while promoting good numerical behavior and limiting the number of parameters in the least squares minimization procedure. Clearly however, if the stress field along an edge has a strong localized variation (e.g., because it is near another structural discontinuity), then this behavior will not be fully reflected in the integrated forces and moment distribution. But this is not a deficiency of the approach since, again, the goal is to maximize the accuracy of the reconstruction at the weld location of interest, rather than along the intersection lines.

(ii) Matching between the stress components in the global model and sub-model is carried out near the weld location rather than near the sub-model perimeter. This is intentional since the goal is to accurately reconstruct the stress field near the high stress location rather than away from this location.

The location of the sub-model intersection lines is a compromise between two competing requirements. Placing the intersection lines farther away minimizes the impact of edge discretization errors (e.g., such as the errors introduced by integrating forces and moments along an intersection edge) upon the stress field about the location of interest. In the most extreme case, the boundaries would be sufficiently far away to encompass the entire dryer and there would be no boundary errors. However, locating the sub-model intersection lines too far away will compromise the validity of the body force distribution used to account for inertial effects and acoustic loads.

A linearly varying body force is introduced to represent dynamic loads and acoustic pressures acting on the sub-model. Six parameters are needed to define this linear distribution and these parameters are determined by zeroing the reaction forces acting at the sub-model support nodes (the same approach underlies the ANSYS "inertial relief" option used to eliminate free-body restraint forces). Adopting a linearly varying distribution is accurate when the extent of the sub-model is small compared to the wavelengths associated with acoustic loads or structural mode shapes. When the boundaries are placed further away, the linear approximation deteriorates. The linear distribution can be interpreted as the first two terms in a Taylor series expansion of the full dynamic and acoustic loads acting on the sub-model.

For a sufficiently small sub-model the nonlinear terms are negligible. However, as the model size increases the second and higher order terms in the Taylor series also increase and eventually dominate.

Summarizing, an accurate reproduction of the acoustic and inertial forces warrants a small sub-model with intersection lines near the evaluation point of interest. Conversely, to minimize discretization errors at the edge a model with distant boundaries is preferred. The 6" sub-model dimension strikes a trade-off between these two requirements.

The effects of mesh refinement in the sub-model are examined by means of the following example for one of the reinforced closure plate/hood attachment welds (node 95172) described in Appendix A of Attachment 15 of the NMPNS letter to NRC dated December 23, 2009. Since the baseline solid element mesh used in the original evaluation is already extremely fine (reported sub-model are usually solved in the finest grid possible with the available computational memory), the mesh is coarsened to approximately twice the grid spacing and the stress results compared. The total number of nodes in the coarse grid is 166,931 and total number of nodes in the finer grid is 828,504. Figure 21-1 shows the grids in the vicinity of the high stress location.

Identical loadings are applied to the sub-model. The expectation is that while stresses at re-entrant corners will change, the linearized stresses used to generate the stress reduction factors will be converged. In Table 21-1 linearized stress results for the fine grid are reproduced from Table 13 in Appendix A of Attachment 15 of the NMPNS letter to NRC dated December 23, 2009, and compared to the corresponding values for the coarse grid. The stress distributions along the paths C-C1 (the path with the highest linearized stress) are compared in Figure 21-2 revealing how the stress singularities change with grid refinement, but linearized stresses are converged. For the limiting path C-C1 the linearized stresses obtained with the coarse and fine mesh models differ by less than 0.5%. For all remaining lower stress paths the stress differences are less than 8%.

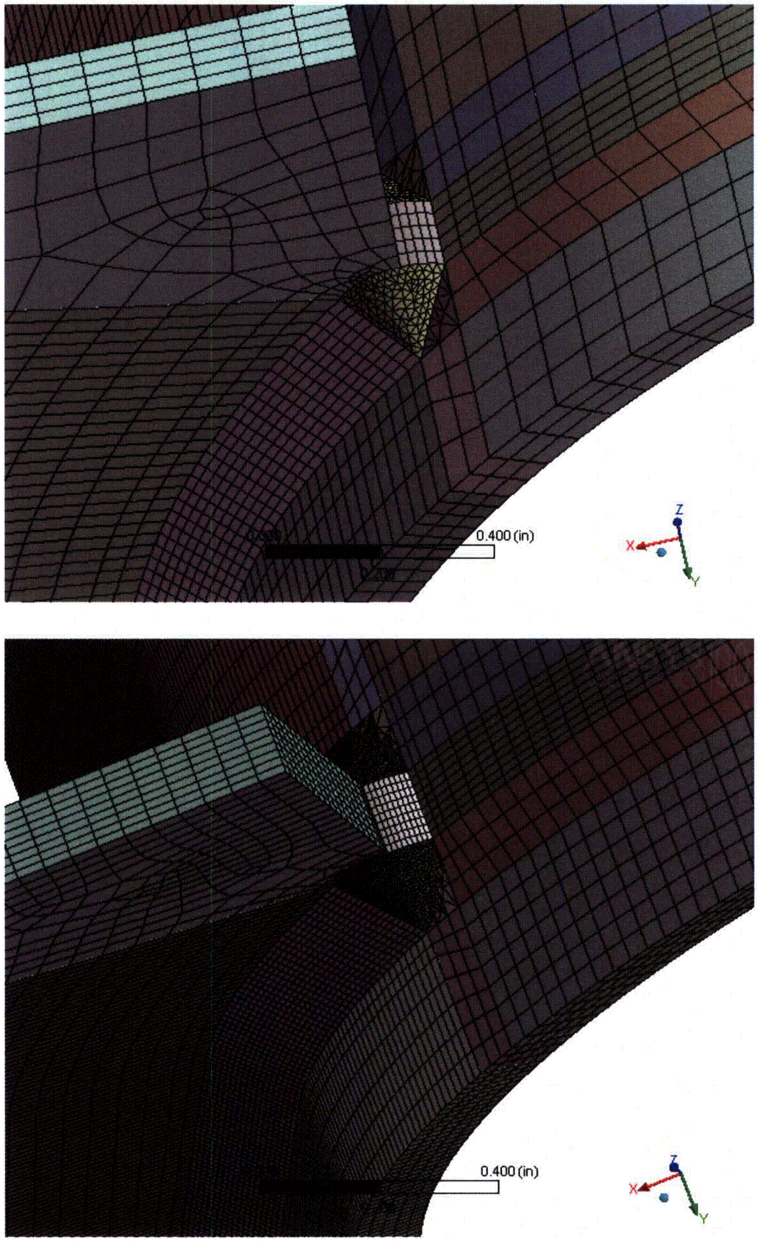

Figure 21-1. Coarse grid (top) and fine grid (bottom) in solid sub-model.

Path	Membrane + bending stress intensity, psi		Difference, %
	Coarse model	Fine model (reported)	
AB	1888	1910	1.2
AC	2364	2437	3.1
AD	1710	1696	-0.8
AE	2373	2421	2.0
AF	618	639	3.4
A1-B1	1858	2002	7.8
A1-C1	2707	2689	-0.7
A1-D1	1843	1837	-0.3
A1-E1	2652	2696	1.7
A1-F1	1501	1598	6.5
C-C1	2750	2762	0.4

Table 21-1. Linearized stresses in the fine and coarse models. Three paths with largest stresses are highlighted.

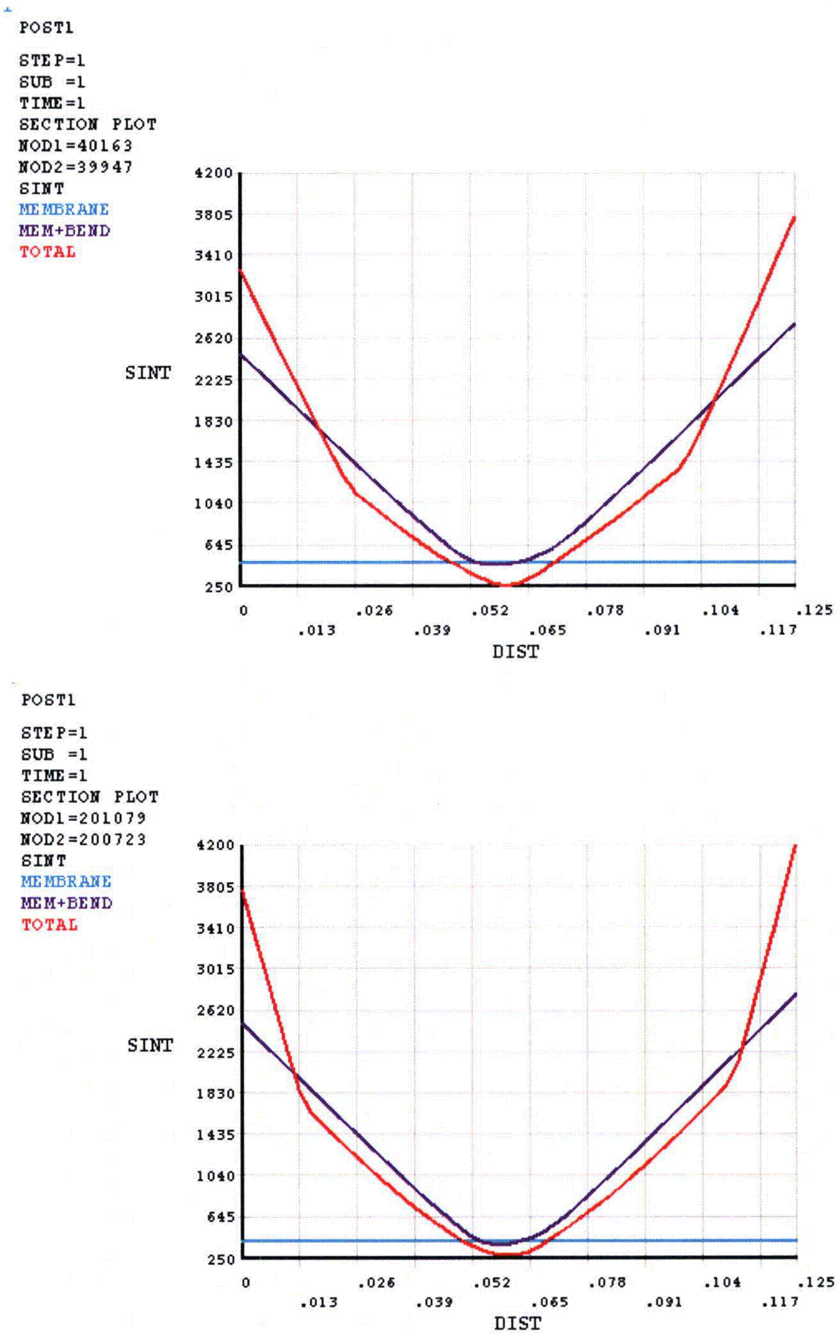

Figure 21-2. Stress intensity distribution along the path C-C1 in coarse model (top) and fine model (bottom). Red – total stress, violet – membrane + bending stress, blue – membrane stress.

NMP2-EMCB-SD-RAI-24

The licensee is requested to explain the cause(s) of the fatigue cracks in the drain channel to skirt vertical welds. If these cracks are associated with the steam dryer acoustic loading, it is requested that the licensee explain why the estimated steam dryer alternating stresses are significantly less than 13,600 psi. If these cracks are not associated with the steam dryer acoustic loading, the licensee is requested to explain how the mechanism(s) responsible will be accounted for EPU conditions.

NMPNS RESPONSE

The two visual indications associated with the DC-V3-320 degree drain channel weld and the single indication associated with the DC-V7-140 were re-inspected in April 2010, using enhanced visual (EVT-1) methods. In addition, the indications were depth sized using phased array ultrasonic testing (UT). The visual inspection confirmed no change in length of indications.

The indications are short (approximately 1 to 1-½ inch in length), extremely tight (no crack opening evident) with no evidence of growth over 3 inspections spanning 6 years of operation. The UT confirmed the indications were not through-wall, with the DC-V3-320-H depth indication at 0.161" and the DC-V3-320-E depth indication at 0.152". In the case of DC-V7-140, no through wall depth could be measured.

The conclusion is that these indications show none of the characteristics of fatigue cracks related to flow induced vibration (FIV) based on the indication characteristics, the multiple visual inspections without measurable change and the UT which confirms the indications are shallow in the ¼ inch thick steam dryer skirt. This is a fillet weld to the dryer skirt and the indication is perpendicular with no associated stress riser. The skirt has multiple complex bending modes, and if the bending modes in the skirt are governing the weld, the drain channel and the skirt would continue to crack in both directions. Once initiated by a fatigue mechanism, the crack would not stop given the broad flex modes evident in the skirt from the Finite Element Analysis (FEA). The fact that the indication is shallow and localized and the fact that it is stable over several inspections all are features that are consistent with a localized cold work region related to fabrication as the most likely cause.

The indication inspection results and characterization that the indication is not related to FIV fatigue is consistent with the flaw assessment previously submitted in the NMP2 EPU License Amendment Request. The analysis demonstrates that the indication remains stable and does not propagate as a result of EPU operating conditions.

1. The existing steam dryer flaw evaluation reports the maximum range of CLTP FIV stresses at the initiation site to be less than 215 pounds per square inch (psi) and the resulting $\Delta K_I = \sim 0.7$ ksi-in$^{0.5}$ [Table 4-1 of Attachment 13.5 of NMPNS Letter to the NRC dated May 27, 2009].

2. If FIV was the cause of the CLTP fatigue cracking at this location then:

   a. The range of FIV stresses at CLTP must be greater than 13,600 psi as the Staff identified in the RAI.

b. If this were true, then using the same linear elastic fracture mechanics (LEFM) model used in Attachment 13.5 of NMPNS letter to the NRC dated May 27, 2009, the ΔK_I at this location would then be on the order of 40 ksi-in$^{0.5}$.

c. Considering the broadband nature of the steam dryer FIV loading, which generally contains frequency content in the 0-250 Hz frequency band, the number of cycles accumulated in a two year operating cycle can be estimated as:

$$n = 125\frac{cycles}{\sec}\cdot 365\frac{day}{yr}\cdot 24\frac{hr}{day}\cdot 3600\frac{\sec}{hr}\cdot 2\ yr = 7.9E9\ cycles$$

d. Given the above number of cycles and ΔK_I , a crack would have initiated within one operating cycle and the fatigue crack growth predicted to occur within one operating cycle would be substantial (on the order of tens to hundreds of inches).

3. The NMP2 steam dryer has operated at CLTP conditions for multiple cycles, with multiple inspection results that show no crack growth. Given these conditions, FIV loading cannot be the causal mechanism for crack initiation.

The EVT inspection identified a similar ½" long linear indication in the DC-V3-320 degree drain channel area. The visual indication shows the same extremely tight configuration as the other two indications. The UT of this location shows a depth of approximately 0.05". This indication is considered to be caused by the same mechanism as the other indications in the DC-V3-320 degree drain channel.

The existing steam dryer flaws will be re-examined during the refueling outage implementing EPU and the first refueling outage after implementation of EPU. This conservative approach is expected to confirm the analytical results through use of field observation. The conservative methods used in the analysis, coupled with the load monitoring to be performed during power ascension and the re-inspection provide a multifaceted, comprehensive, and sufficient approach to demonstrate that the existing flaws in the NMP2 steam dryer are not going to pose a loose parts concern that would negatively impact safe plant operation.

NRC RAI 1 – Probabilistic Risk Assessment – e-mail dated June 08, 2010

Section 2.13.1.3.2 of the submittal provides a brief explanation of the impact of EPU on fire ignition frequency for the NMP2 PRA. It states that frequency of fires is not dependent on reactor power or operation, however; it further states that there is a potential risk increase due to decrease in human reliability. The greatest increase in risk from EPU implementation derives from less time operators have to perform necessary actions. The EPU may not have an impact on Fire Ignition Frequency or Fire Mitigation; however, it may have an impact on operator actions after a fire has been identified and/or mitigated due to less available time.

Please provide additional information explaining the potential decreases in time related to operator actions for fire scenarios. Describe the potential risk increases due to decreases in human reliability for fire scenarios resulting from the proposed EPU implementation.

NMPNS Response

No significant changes to the control room are being made that would impact the Probabilistic Risk Assessment (PRA) Human Reliability Analysis (HRA).

The human reliability performance shaping factor that is principally influenced by EPU is the time available to detect, diagnose and perform required actions. The higher power level and resulting decay heat levels post trip reduce the time available for some operator actions in the PRA. Modular Accident Analysis Program (MAAP) thermal hydraulic calculations were performed to estimate the changes in timing for these operator actions. These timings were used as input to the HRA.

In the EPU submittal, human reliability was evaluated for response to fires inside the control room, and also in the case of abandonment of the control room. These actions are associated with Reactor Pressure Vessel (RPV) blow down when high pressure injection systems are unavailable.

As a result of EPU, these actions now have a response margin of less than 35 minutes prior to core damage verses less than 40 minutes pre-EPU. However, the operators are procedurally required and are routinely trained to take action to depressurize within 10 minutes. The following table is an excerpt from Table 2.13-7 of the Power Uprate Safety Analysis Report (PUSAR) provided in the NMP2 EPU License Amendment Request dated May 27, 2009. It provides the changes in human error probability (HEP) related to the decrease in response margin for these actions.

Basic Event	Description	Pre-EPU		Post-EPU	
		Time	HEP	Time	HEP
HRAZHRBOPSRICS02	Recover From Fire in Control Room	40 Min	2.0E-3	35 Min	2.3E-3
HRAZHRBOPSRICF03	Recover From Fire in Control Room at Remote Shutdown Panel	40 Min	1.2E-2	35 Min	4.4E-2

Note that the time available for these operator actions is based on time required to preclude core damage. In the PRA analysis the condition used to establish the onset of fuel damage is 1800°F for 10 minutes (hottest node).

The most impacted action is operator recovery from fire in the control room using the Remote Shutdown Panel. From a design basis perspective, N2-SOP-78, "Control Room Evacuation," requires operator action within 9 minutes of an event to maintain water level above top of active fuel (TAF). For the control room evacuation procedures, there is no change in the action time and no new required actions. The CLTP action time to initiate a blow down from the remote shutdown panel is within 10 minutes (Updated Safety Analysis Report (USAR) Section 9B.8.2.4). Operators have demonstrated that the actions for the control room evacuation can be performed within this time frame. The design basis analysis was revised for EPU and takes credit for a peak fuel clad temperature of < 1500°F, instead of requiring RPV water level to remain above TAF. With this change in acceptance criteria, the maximum operator action time to initiate depressurization from the remote shutdown panel is 13.4 minutes. The containment temperature analysis was performed with a nominal operator action time of 10 minutes. Although the post-EPU conditions lead to a RPV water level reaching TAF in a shorter time frame, the impact on fuel temperature is small and does not approach the 1500°F design basis limit. This is within the PRA success criteria, is not a significant impact, and is evaluated in the PRA supporting the EPU submittal.

The impact of changes to these actions along with all the other operator actions that were affected by decreased response margins (listed in Table 2.13-7 of the Power Uprate Safety Analysis Report provided in the NMP2 EPU License Amendment Request dated May 27, 2009) resulted in an increase in a Core Damage Frequency (CDF) of 7.3E-7 and an increase in the Large Early Release Frequency (LERF) of 1.2E-8.

ATTACHMENT 2

SUPPLEMENTAL INFORMATION – FINDINGS OF INTERIOR INSPECTION OF STEAM DRYER

Nine Mile Point Nuclear Station, LLC
June 30, 2010

ATTACHMENT 2
SUPPLEMENTAL INFORMATION – FINDINGS OF INTERIOR INSPECTION OF STEAM DRYER

In April 2010, additional inspections of the Nine Mile Point Unit 2 (NMP2) steam dryer were performed that included an interior inspection of accessible portions of the dryer with a focus on locations identified by operating experience noted in BWRVIP-139-A, "Steam Dryer Inspection and Flaw Evaluation Guidelines," and locations noted in the NMP2 steam dryer Finite Element Analysis (FEA) as potential high risk locations as a result of fabrication geometry. The hood support locations where inspections were performed are discussed in BWRVIP-139-A, Addendum D (BWRVIP responses to NRC Request for Additional Information (RAI)). As noted in Addendum D, cracking has been observed on the interior and at the base of some steam dryer hoods (Reference RAI 139-11 and Figure RAI 11-1).

The hood to base plate weld inspection was performed in Refueling Outage 12 for NMP2. The inspection confirmed the FEA configuration. The interior inspection did not identify any cracking at locations associated with the seal plates near the earthquake blocks (these locations were also noted in BWRVIP-139). The inspection did identify indications associated with the hood support attachment welds on the hood side of the support.

The indications in the hood support attachment welds are in a supplemental fillet weld at the bottom of the support. The indications in the middle and inner hood are approximately 1/2 inch in length and have characteristics indicative of fabrication induced stress relief cracking. It is evident from review of the inspection video that the bottom of the support plate was field fit and that the attachment fillet welds were closure welds. The hood support weld to the outer bank is a different configuration than the middle and inner hood and includes an additional backing plate. The indication in the outer hood support attachment is approximately 1-1/2 inches in length and restricted to the bottom two inches of the support to backing plate weld where a fillet weld was added which wraps around the bottom two inches. The attachment weld connecting the support to the hood extends to full height of the support (89 inches), however the crack is restricted to the bottom two inches where the support and backing plate fillet weld exist on the hood side of the support. The crack orientation and the crack behavior with 20+ years of service is consistent with the most likely cause related to fabrication induced peak stress. The conclusion based on the Invessel Visual Inspection (IVVI), the stress analysis, and the Current Licensed Thermal Power (CLTP) flaw assessment is that the indications are not caused by flow induced vibration (FIV) related fatigue. This assessment is consistent with the BWRVIP response to RAI 139-11. The BWRVIP assessment concluded "indications are associated with local stress concentration points, but appear to grow only a limited length. The distribution of the crack locations and relatively consistent length of these cracks suggest that they are stable (not growing) and might have resulted from relieving residual fabrication stresses or stresses from initial thermal expansion of the steam dryer."

The flaw assessment, performed consistent with BWRVIP-139-A guidance, demonstrated that these flaws will not propagate by fatigue and are acceptable for continued service at the current power level without repair. The evaluation of the flaws for the EPU condition applying the Revision 4.1 of the Continuum Dynamics Incorporated Acoustic Circuit Model stress analysis results discussed in NMP2-EMCB-SD-RAI-6 and NMP2-EMCB-SD-RAI-8 is not complete. By July 30, 2010, Nine Mile Point Nuclear Station (NMPNS) will submit its evaluation and conclusions regarding the recently identified indications in the hood support attachment.

ATTACHMENT 3

LIST OF REGULATORY COMMITMENTS

The following table identifies actions committed to in this document by Nine Mile Point Nuclear Station, LLC. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

Direct questions regarding these commitments to T. F. Syrell, Licensing Director, at (315) 349-5219.

REGULATORY COMMITMENT	DUE DATE
The existing steam dryer flaws will be re-examined during the refueling outage implementing EPU and the first refueling outage after implementation of EPU.	During the refueling outage implementing EPU and the first refueling outage after implementation of EPU.
The non-proprietary version of CDI Report No. 10-11 will be submitted by July 9, 2010.	July 9, 2010
By July 30, 2010, NMP2 will submit its evaluation and conclusions regarding the recently identified indications in the steam dryer hood support attachment.	July 30, 2010