PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, New Jersey 08038-0236

PSEG
Nuclear LLC

10 CFR 50.90

LR-N07-0099
LCR H05-01, Rev. 1
April 30, 2007

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Hope Creek Generating Station
Facility Operating License No. NPF-57
NRC Docket No. 50-354

Subject: Response to Request for Additional Information
Request for License Amendment - Extended Power Uprate

Reference: 1) Letter from George P. Barnes (PSEG Nuclear LLC) to USNRC, September 18, 2006
2) Letter from USNRC to William Levis, PSEG Nuclear LLC, April 20, 2007

In Reference 1, PSEG Nuclear LLC (PSEG) requested an amendment to Facility Operating License NPF-57 and the Technical Specifications (TS) for the Hope Creek Generating Station (HCGS) to increase the maximum authorized power level to 3840 megawatts thermal (MWt).

In Reference 2, the NRC requested additional information concerning PSEG's request. Attachments 1 and 3 to this letter restate the NRC questions and provide PSEG's responses. As noted in Reference 2, responses to questions 3.58 through 3.65, 3.8 and question 13.16 will be provided by May 10, 2007.

The response to question 14.41 will be submitted on or before May 10, 2007. The response is delayed to ensure it includes the most current and accurate information available using inputs from the revised PEPSE analysis. The need to update the PEPSE analysis of the plant heat balance at EPU conditions to reflect plant specific turbine information was identified during the Independent Design Verification of the EPU Design Change Package. Efforts to update the PEPSE model were completed in April 2007.

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PSEG has determined that the information contained in this letter and attachment does not alter the conclusions reached in the 10CFR50.92 no significant hazards analysis previously submitted.

There are no regulatory commitments contained within this letter.

Attachment 1 contains information proprietary to General Electric Company (GE). GE requests that the proprietary information in Attachment 1 be withheld from public disclosure in accordance with 10 CFR 9.17(a)(4) and 2.390(a)(4). An affidavit supporting this request is included with Attachment 1. Attachment 1 also contains information proprietary to Continuum Dynamics, Inc. (C.D.I.). C.D.I. requests that the proprietary information in Attachment 1 be withheld from public disclosure in accordance with 10 CFR 2.390(a)(4). An affidavit supporting this request is included with Attachment 1.

A non-proprietary version of PSEG's Attachment 1 responses is provided in Attachment 2.

Structural Integrity Associates report HC 31Q-301, "Hope Creek RPV Dome Dynamic Pressure Data Reduction," is provided in Attachment 4 in response to the NRC staff's request.

PSEG has updated Attachment 7 (Steam Dryer Evaluation) to the Reference 1 submittal. The updated Steam Dryer Evaluation is provided in Attachment 5 to this letter. Attachment 5 replaces, in its entirety, the previous version of the evaluation provided in Reference 1.

In response to NRC staff requests, updated C.D.I. Reports 06-16P, "Estimating High Frequency Flow Induced Vibration in the Main Steam Lines at Hope Creek Unit 1: A Subscale Four Line Investigation of Standpipe Behavior," and CDI Report No. 06-17, "Hydrodynamic Loads on Hope Creek Unit 1 Steam Dryer to 200 Hz," are provided in Attachments 6 and 7 to this letter. C.D.I. Report 06-16P contains information which C.D.I. considers to be proprietary. C.D.I. requests that the proprietary information be withheld from public disclosure in accordance with 10 CFR 2.390(a)(4). An affidavit supporting this request is provided in Attachment 6. PSEG will provide a non-proprietary version of the report suitable for public disclosure by May 10, 2007.

The Power Ascension Test Plan is provide in Attachment 8 in response to the NRC staff's request.

Should you have any questions regarding this submittal, please contact Mr. Paul Duke at 856-339-1466.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 4/30/07
(date)

Sincerely,

George P. Barnes

George P. Barnes
Site Vice President
Hope Creek Generating Station

Attachments (8)

1. Response to Request for Additional Information (proprietary)
2. Response to Request for Additional Information (non-proprietary)
3. Response to Request for Additional Information 14.46
4. SIA Report HC 31Q-301, "Hope Creek RPV Dome Dynamic Pressure Data Reduction"
5. LCR H05-01, Rev. 1, Attachment 7, Rev. 1
6. CDI Report 06-16P, Rev. 2
7. CDI Report 06-17, Rev. 3
8. Power Ascension Test Plan

cc: S. Collins, Regional Administrator – NRC Region I
J. Shea, Project Manager - USNRC
NRC Senior Resident Inspector - Hope Creek
K. Tosch, Manager IV, NJBNE

General Electric Company

AFFIDAVIT

I, George B. Stramback, state as follows:

(1) I am Manager, Regulatory Services, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GE's letter, GE-HCGS-EPU-669, Edward D. Schrull (GE) to Larry Curran (PSEG), *Transmittal - Response to Request for Additional Information (RAI) Regarding Amendment Application for Hope Creek Generating Station Extended Power Uprate* – RAIs 3.58, 3.59, 3.60, 3.63, 3.64, 7.11, 14.42, and 14.49, GE Proprietary Information, dated April 20, 2007. The proprietary information in Enclosure 1, which is entitled *GE Responses to NRC RAIs 3.58, 3.59, 3.60, 3.63, 3.64, 7.11, 14.42, and 14.49,* is delineated by a double underline inside double square brackets. Figures and large equation objects are identified with double square brackets before and after the object. In each case, the superscript notation{3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, <u>Critical Mass Energy Project v. Nuclear Regulatory Commission,</u> 975F2d871 (DC Cir. 1992), and <u>Public Citizen Health Research Group v. FDA,</u> 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, resulting in potential products to General Electric;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a., and (4)b, above.

(5) To address 10 CFR 2.390 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed information about the results of analytical models, methods and processes, including computer codes, which GE has developed, obtained NRC approval of, and applied to perform evaluations of loss-of-coolant accident events in the GE Boiling Water Reactor ("BWR"). The development and approval of the BWR loss-of-coolant accident analysis computer codes was achieved at a significant cost to GE, on the order of several million dollars.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 20th day of April 2007.

George B. Stramback

George B. Stramback
General Electric Company

Continuum Dynamics, Inc.

(609) 538-0444 (609) 538-0464 fax 34 Lexington Avenue Ewing, NJ 08618-2302

AFFIDAVIT

Re: Information Requested by "NRC Request for Additional Information Regarding the Request for Extended Power Uprate (TAC No. MD3002)" and transmitted to the NRC by PSEG Nuclear Letter LR-N07-0099

I, Barbara A. Agans, being duly sworn, depose and state as follows:

1. I hold the position of Director, Business Administration of Continuum Dynamics, Inc. (hereinafter referred to as C.D.I.), and I am authorized to make the request for withholding from Public Record the Information contained in the documents described in Paragraph 2. This Affidavit is submitted to the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 2.390(a)(4) based on the fact that the attached information consists of trade secret(s) of C.D.I. and that the NRC will receive the information from C.D.I. under privilege and in confidence.

2. The Information sought to be withheld, as transmitted to PSEG Nuclear LLC as attachment to C.D.I. Letter No. 07078 dated 27 April 2007 Information Requested by "NRC Request for Additional Information Regarding the Request for Extended Power Uprate (TAC No. MD3002)" and transmitted to the NRC by PSEG Nuclear Letter LR-N07-0099.

3. The Information summarizes:

   (a) a process or method, including supporting data and analysis, where prevention of its use by C.D.I.'s competitors without license from C.D.I. constitutes a competitive advantage over other companies;
   (b) Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;
   (c) Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

   The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs 3(a), 3(b) and 3(c) above.

4. The Information has been held in confidence by C.D.I., its owner. The Information has consistently been held in confidence by C.D.I. and no public disclosure has been made and it is not available to the public. All disclosures to

third parties, which have been limited, have been made pursuant to the terms and conditions contained in C.D.I.'s Nondisclosure Secrecy Agreement which must be fully executed prior to disclosure.

5. The Information is a type customarily held in confidence by C.D.I. and there is a rational basis therefore. The Information is a type, which C.D.I. considers trade secret and is held in confidence by C.D.I. because it constitutes a source of competitive advantage in the competition and performance of such work in the industry. Public disclosure of the Information is likely to cause substantial harm to C.D.I.'s competitive position and foreclose or reduce the availability of profit-making opportunities.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to be the best of my knowledge, information and belief.

Executed on this 27th day of April 2007.

Barbara A. Agans
Continuum Dynamics, Inc.

Subscribed and sworn before me this day: April 27 2007

Eileen P. Burmeister, Notary Public

EILEEN P. BURMEISTER
NOTARY PUBLIC OF NEW JERSEY
MY COMM. EXPIRES MAY 6, 2007

Hope Creek Generating Station
Facility Operating License NPF-57
Docket No. 50-354

Extended Power Uprate

Response to Request for Additional Information

In Reference 1, PSEG Nuclear LLC (PSEG) requested an amendment to Facility Operating License NPF-57 and the Technical Specifications (TS) for the Hope Creek Generating Station (HCGS) to increase the maximum authorized power level to 3840 megawatts thermal (MWt).

In Reference 2, the NRC requested additional information concerning PSEG's request. Each NRC question is restated below followed by PSEG's response.

14) Mechanical & Civil Engineering Branch (EMCB)

14.1 Question Superceded by new Steam Dryer Data

14.2 Please submit bias errors and uncertainties for:

(a) The steam dryer finite element model (FEM) as to how accurate are the stress/force transfer function amplitudes (note this does not question the damping assumed by PSEG, but is related to the accuracy of the modal masses computed by the model, which dictates the mean transfer function amplitude), and

(b) the lack of rigorous analyses at time/frequency shifts of +/-2.5%, +/-5%, and +/-7.5%.

Response

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14.3 [[

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Response
PSEG in CDI Report 06-17 section 3.2 it states that the HCGS and Susquehanna steam delivery systems are 'nearly identical', but in the same paragraph it clarifies the similarities and the differences. The differences are the location of the standpipes and that Susquehanna has dead-headed branch lines off the main steam lines whereas HCGS does not.

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These sources and energy storage structures do not exist in the HCGS plant. Refer to RAI 14.60 for further details.

14.4 Your assertion that the Hope Creek ACM accuracy is negatively (conservatively) biased does not appear to address significant ACM underpredictions of the Quad Cities Unit 2 (QC2) 156Hz dryer loading peak. Since the largest load in the Hope Creek interim EPU dryer analysis is a safety relief valve (SRV) singing peak (based on the scale model test (SMT)), provide an ACM bias error based on the tones observed in QC2 during the instrumented dryer ACM validation studies.

Response
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14.5 In the Hope Creek EPU submittal Attachment 7 (Steam Dryer Evaluation), you determined a net dryer loading uncertainty of 27.2%, this uncertainty is not applied to the interim EPU dryer stress estimates. Explain how the estimated 27.2% uncertainty is applied to the Hope Creek dryer stress assessment.

Response
As stated in page 12 of Attachment 7 to the EPU LCR, PSEG elected to report the stress ratios as calculated in the finite element analysis without adding the uncertainty factor. This avoids the necessity of changing the finite element analysis results if the uncertainty values are changed.

The discussion below applies to the alternating stress ratios which consist entirely of stresses from flow induced vibration whereas, the peak stress ratio has a significant component from dead weight which can be accurately calculated.

Considering uncertainty, the alternating stress ratio, would be the reported value in the Finite Element Report divided by (1 $\pm$ uncertainty). For example, at nominal frequency, the minimum alternating stress ratio from CDI 06-27 R2 table 7a is 1.96. With an overall uncertainty of $\pm$ 27.2%, this alternating stress ratio is between 2.70 and 1.54, (1.96 / (1 $\pm$.272)).

14.6 Confirm whether PSEG has planned for any dryer or reactor pressure vessel (RPV) dynamic measurements which would quantify the low frequency (less than 50 Hz) loads acting on the dryer. If so, please specify.

Response
No in-plant measurements are planned. As discussed in the response to RAI 14.3, HCGS does not have a geometry that is believed to contribute to significant low frequency loadings.

14.7 Please provide the computational fluid dynamics (CFD) analyses results for the Hope Creek steam dryer at current licensed thermal power (CLTP) and EPU conditions.

Response
The CFD calculation was not used in the steam dryer analysis. As stated in LCR Attachment 7, the CFD was only used to provide a qualitative assessment that no new flow phenomenon was being created by EPU.

In mid-2005 PSEG undertook an exploratory investigation with a vendor (not CDI) into the possibilities that Computational Fluid Dynamics (CFD) could be used to generate steam dryer loads. This effort was abandoned before the end of 2005. Towards late 2005, PSEG had discussions with its primary vendor, CDI, who is also knowledgeable on CFD calculations. CDI provided PSEG with the opinion that it would be difficult to validate a CFD analysis for this application. Furthermore, the CFD simulations PSEG obtained from an earlier vendor could not be considered acceptable for defining loads since they were generated by a vendor without the prerequisite quality assurances for nuclear safety work and without any benchmarking of the CFD program. Since late 2005, no further effort was expended on CFD calculations.

PSEG elected to define the in-plant loads by Acoustic Circuit Modeling and to predict EPU changes/loads by the CDI 1/8th scale model test. The ACM has become the tool for estimating steam dryer loads from plant data used by all other pending EPU submittals and has been subject to benchmarking at QC2. The CDI SMT has recently been benchmarked, at CLTP, against HCGS plant data (CDI Report 07-01P). This is in line with the approach endorsed by the BWR Owners Group in late 2006.

14.8 In the Hope Creek EPU submittal Attachment 20 (Continuum [Dynamics], Inc. (CDI) Report No. 05-28P), CDI argues that [[

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Response

The strength of the ACM is that it does not need to identify or model the source of an input signal, e.g., SRV acoustic resonance. The ACM models the steam dome area, the steam dryer, and the portion of the MSL through the strain gage locations. The ACM converts the pressure pulses measured at the strain gages to pressure pulses across multiple locations on the steam dryer. It does not need to model any of the sources that create the pressure pulsations at the strain gage. The SRV standpipes are located downstream of the region modeled and the effect of the standpipes are present in the pressures detected by the strain gages.

SRV standpipe modeling is critical for scale model tests (SMT) since the SMT is used to predict the input to the ACM. Considerable effort was expended in the SMT SRV standpipe modeling to maximize the accuracy. This included taking measurements on a SRV under refurbishment to supplement the vendor drawings.

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14.9 Figures A.1 through A.26, of the Hope Creek EPU submittal Attachment 20
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<u>Response</u>
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14.10 [[

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Response
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14.11 [[

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Response
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14.12 Question Superceded by new Steam Dryer Data (February 28, 2007 Supplement)

14.13 [[

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Response

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]] After rebenchmarking, the one-eighth SMT predicts the onset of SRV acoustic at or about CLTP. This is consistent with plant data, which does not detect SRV acoustic resonance at CLTP [[

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14.14 In reference to the geometrical similarity between the SMT and the Hope Creek plant, in attachment 22 to the Hope Creek EPU submittal, clarify why the measured resonance frequency of SRV standpipes differs substantially from the estimated value.

Response
The initial estimate was made of the diameter of the SRV using an unscaled vendor drawing. This geometry gave [[
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As part of the 1/8th scale model testing to predict the load, a more thorough review was made to maximize the details. This included taking measurements and photographs of a SRV under refurbishment to obtain more information on the diameter of the SRV. The result was a more complex shape for the chamber which was replicated in the 1/8th SMT. The shape is as shown in Figure A-1 of CDI report 06-16. [[

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14.15 Substantiate the use of the load increase factors cited in Page 30 [[(185% in PRMS and 156% in differential pressure) instead of using the maximum values given in Table 8.2 of attachment 22 to the Hope Creek EPU submittal.]]

Response
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]] Using

a SMT to provide a prediction of a load not present at CLTP reduces the uncertainty during the power ascension; however, it is not intended to replace the verification performed by the power ascension test plan (refer to the response to RAI 14.33).

14.16 In reference to attachment 22 of the Hope Creek EPU submittal, please discuss the effects of the Normalized Maximum Differential pressure on the dryer for the low and high frequency excitations separately. The objective is to produce two figures similar to Fig. 8.8, whereby one figure is for the low and the other for the high frequency excitations.

Response

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14.17 In reference to attachment 22 of the Hope Creek EPU submittal, [[

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Response

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14.18 In reference to attachment 22 of the Hope Creek EPU submittal, [[

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Response
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14.19 In reference to Attachment 22 of the Hope Creek EPU submittal, demonstrate that the safety relief valves will operate properly at EPU conditions. PSEG's response to this request should include the assessment of (a) the acoustic - pressure in the standpipes at EPU conditions, and (b) the effect of acoustic pressure at EPU on the structural integrity of the SRVs.

<u>Response</u>
HCGS reviewed the acoustic resonance concern and its potential impact on valve operability as a result of the failures at Quad Cities. Quad Cities had several relief valve designs including several Target Rock valves that were subject to very high acoustic resonance in the MSLs prior to the mitigation efforts taken in early 2006. The valves that failed were not the Target Rock valves. The failure on a non-Target Rock valve was due to excess wear on valve components that was directly attributable to the high vibration.

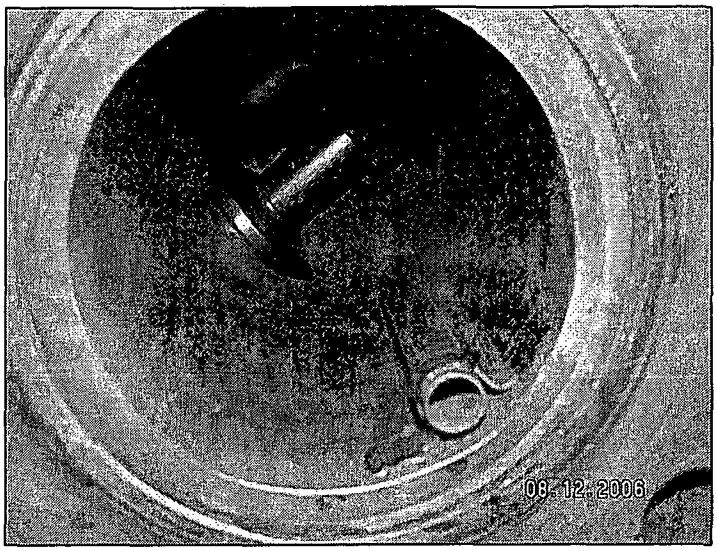
The photo is taken from the bottom of a Target Rock 7567F looking upward. The tube inside is the sensing line that leads to the seat of the valve's pilot operator. The other valve components exposed to the valve chamber are major components that are not considered susceptible to the pressure pulsations from acoustic resonance.

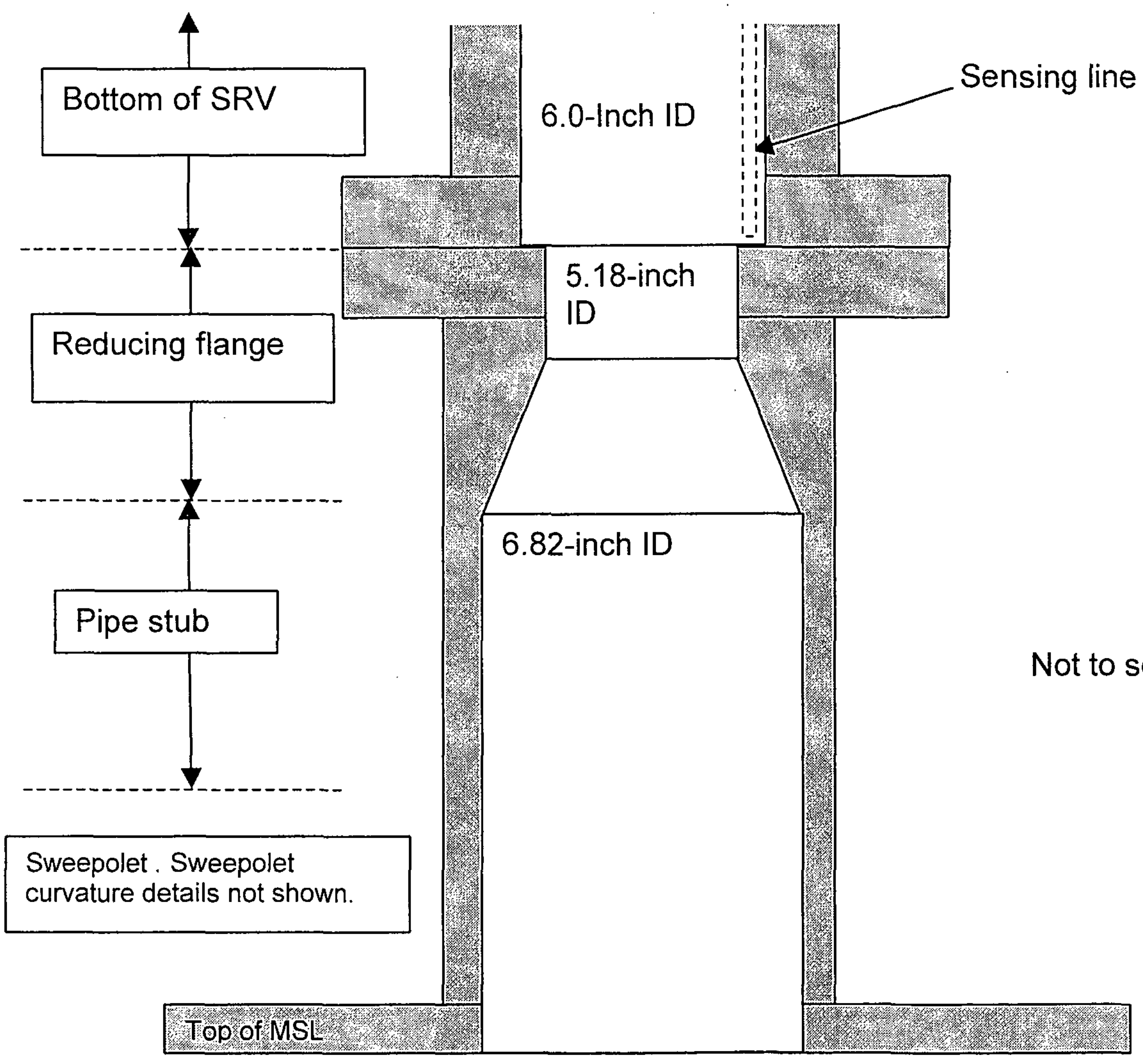
As illustrated in the sketch, the sensing line opening is just above the interface between the upper and lower halves of the flanges. The opening is approximately halfway up the overall chamber. The smaller ID of the lower flange half is intended to shield the sensing lines from flow induced phenomena when the valve disc is opened.

(a) [[

]] This is well below the margin maintained between the lowest setpoint and the operating pressure. The HCGS SRVs maintain a nominal margin of > 108 psid between operating pressure and setpoint. The 14 SRVs fall into three setpoint groupings – four at 1108 psig, five at 1120 psig, and five at 1130 psig. During power operation with a steam dome pressure of 1005 psig, pressure drops in the MSL result in the pressure at the SRV flange dropping below 1000 psig. [HNT1]

(b) As discussed in attachment 8, HCGS installed accelerometers on the two representative MSLs and took measurements in 2005 to quantify the vibration levels at CLTP and to demonstrate that there is sufficient margin for increases due to operation at 115% CLTP. Also, as discussed in attachment 8, HCGS will add accelerometers on four of the SRVs to specifically monitor the SRVs during the power ascension. The Power Ascension Test Plan (PATP) specifies power ascension test plateaus (every 5%) which allow verification that the measured values are acceptable. Should measured values exceed the criteria, the PATP requires a reduction in power for evaluation.


08-12-2006


Bottom of SRV
6.0-Inch ID
Sensing line
5.18-inch ID
Reducing flange
6.82-inch ID
Pipe stub
Not to scale.
Sweepolet . Sweepolet curvature details not shown.
Top of MSL

14.20 Question Superceded by new Steam Dryer Data (February 28, 2007 Supplement).

14.21 Question Superceded by new Steam Dryer Data (February 28, 2007 Supplement)

14.22 Question Superceded by new Steam Dryer Data (February 28, 2007 Supplement)

14.23 Question Superceded by new Steam Dryer Data (February 28, 2007 Supplement)

14.24 Question Superceded by new Steam Dryer Data (February 28, 2007 Supplement)

14.25 In the Hope Creek EPU submittal attachment 18 (CDI Report 06-17, Rev.2 "Hydrodynamic Loads on Hope Creek Unit 1 Steam Dryer to 200 Hz", September 2006), the results included in the report (e.g., Figures. 3.1 & 3.6) appear to contradict CDI's conclusion that the dryer load determined from SMT is conservative. PSEG is requested to address this apparent contradiction.

<u>Response</u>

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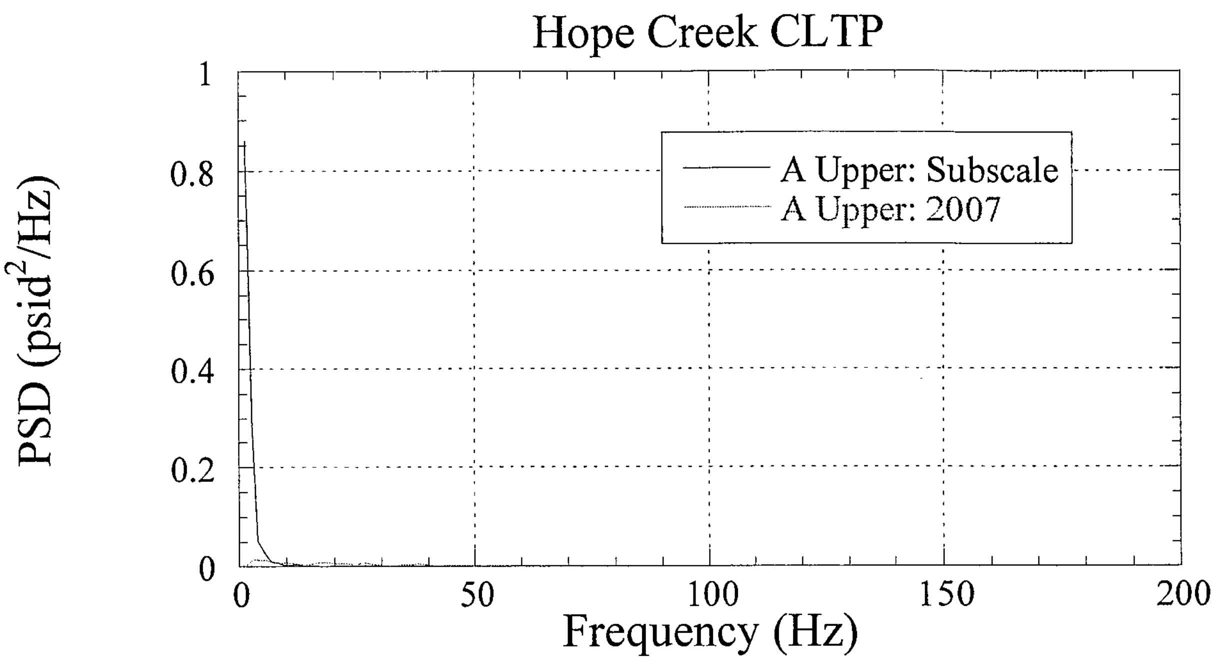

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14.26 In reference to the spectral peak near 135 Hz which appears at nodes 7 and 99 of Figure 4.6 in attachment 18 of the Hope Creek EPU submittal, please specify the source generating this 135 Hz peak. If it is the standpipe resonance frequency, then PSEG should explain why it is different from the frequency measured in SMT. PSEG should also explain why this frequency peak is not observed in the strain gage signals.

Response

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14.27 Since the field experience shows that strain gages do fail during operation, please explain whether PSEG has any plans to provide adequate redundancy so that sufficient amount of strain gage measurements can be made, despite failure of some strain gages, for reliable prediction of stresses in the steam dryer.

Response

PSEG obtained considerable input from Exelon and SIA in the selection and installation of strain gages. The failed strain gages were suspected of a common failure mode. In January 2007, PSEG performed a maintenance outage to restore, among other work, the 8 failed strain gages and confirmed that the failure was caused by a common mode failure. The splices between the strain gages and the containment cable were located by hot piping, causing the failure of the splices. The repairs were made and all channels provided readings on start-up.

Nevertheless, for prudence, PSEG is currently planning to install additional strain gages to provide redundancy and/or improve accuracy. The second set (of 32 strain gages) would be installed at 45° rotation from the existing strain gages.

14.28 In the Hope Creek EPU submittal attachment 19 (CDI Report No. 06-24, "Stress Analysis of the Hope Creek Unit 1 Steam Dryer for CLTP, Rev. 3," September 2006), the prediction of fluctuating pressure loads using a separate acoustic circuit analysis is discussed. The licensee asserts that the 80-Hz signal is not present in the MSL strain gage signals at CLTP but it is fictitiously introduced by ACM. The licensee is requested to explain whether ACM could have fictitiously modified the other peaks that are present in the predicted fluctuating loads. The licensee is also requested to explain the ACM mechanisms responsible for introducing the 80-Hz signal and [[

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Response
See responses to RAI 14.18 for an explanation [[

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14.29 In the Hope Creek EPU submittal Attachment 19, the licensee describes the model simplifications made in developing the finite element model of the Hope Creek steam dryer. The report also discusses modeling of certain specific components such as perforated plates and the vane bank model. Then the details of the finite element mesh and the types of elements are described. Please describe how the finite element model developed preserves the dynamic properties (mode shapes and natural frequencies) of the actual Hope Creek steam dryer.

Response
There are no HC1 steam dryer mode shapes or frequencies to compare against. The HC1 steam dryer has been exposed to high radiation levels for over 20 years of power operations. Due to ALARA considerations, the steam dryer must be kept submerged. Inspections are done with submergible, remote operated cameras. It would be dose prohibitive to perform hammer tests to measure the dynamic properties of the HC1 dryer. Although the steam dryers as delivered to the site were confirmed as identical, the Unit 1 dryer was modified on-site whereas the abandoned Unit 2 dryer was never modified. Thus the mode shape information can not be used since the modifications alter mode shapes and frequencies. While many of the modes will remain virtually unchanged between the dryers, it is not obvious which ones are altered by the modifications and which ones are not. The HC1 steam dryer finite element model was prepared using a standard industry program, ANSYS, which is believed to be the same as used by other utilities for their steam dryer modeling. Finite element models are routinely used in the industry and standard practices are followed in the formulation of the model (e.g., 1% damping, etc.). [[

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14.30 The alternating stresses at the welds calculated by the finite element analysis are multiplied by the weld factor to determine the actual fluctuating stresses at the welds. In Hope Creek, steam dryer plates of different thicknesses are welded together. However, the weld factor accounts for the stress concentration introduced by a weld between components of equal thickness. Explain why the stresses at the welds are not modified to include size effects, which account for the welding of the components having different thicknesses.

Response
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14.31 In the Hope Creek EPU submittal Attachment 21 (CDI Report No. 06-27, Rev. 0, "Stress Analysis of the Hope Creek Unit 1 Steam Dryer at CLTP and EPU Conditions Using 1/8th Scale Model Pressure Measurement Data, September 2006), it is questionable that a 50-step time history analysis can identify the frequency shift for the fluctuating loads that would impose the highest loads on the dryer under EPU conditions. For example, the lower Figure 6b page 11 (one without the 80 Hz signal) shows that for 0% frequency shift the maximum fluctuating load occurs at about 700 steps (1 second) into the time history analysis. The NRC staff requests the licensee to explain whether any frequency shift other than $\pm$ 10% would impose higher loads and generate higher stresses in the steam dryer under EPU conditions for a longer time duration (i.e., 2 or 3 seconds).

Response

In the revised analysis for EPU conditions, CDI Report 06-27 (Rev 2.) submitted to the NRC on February 28, 2007 by LR-N07-0034, a complete 2 second run was performed for every frequency shift. Table 7b identifies the limiting component and identifies the frequency where the limit is reached for that component. The most limiting component is again at the +10% frequency shift. Also, see response to RAI 14.2 for added information.

14.32 There is an assumed damping ratio of 1% with anchor points at 10 and 150 Hz for the transient pressure loading without any frequency shift described in section 3.5 of attachment 21 page 13. Explain whether the anchor points were changed when considering $\pm$ 10% frequency shift in the loading.

Response
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14.33 In Section 5, attachment 21 of the Hope Creek EPU submittal, the licensee reports that the minimum stress ratios, which correspond to alternating stresses, are less than 1.0 when $\pm$10% frequency shifts are considered. These stress ratios are calculated without accounting for ±27.2% uncertainty, which is reported in Attachment 7 of the Hope Creek EPU submittal. The licensee is requested to explain the effect of this uncertainty on the minimum stress ratios and identify the corresponding steam dryer components having stress ratio less than 1.0. Also, the licensee is requested to explain whether it plans to make any structural modifications to these components.

Response
CDI Report 06-27 R0 was first supplemented by Tech Evaluation 80090626 and was then superseded by Report 06-27 Rev 2. After preparing Tech Evaluation 80090626, PSEG undertook the margin recovery effort, documented in CDI Report 06-27 Revision 2, which was submitted to the NRC on February 28, 2007. Revision 2 shows that all stress ratios are well above 1.0. The response to RAI 14.5 addresses how the load magnitude uncertainty is considered. All alternating stress ratios at the nominal frequency are ≥ 1.96, which provides significant margin for uncertainty. All frequency variations (-10%, -7.5%, -5%, -2.5%, + 2.5%, +5%, +7.5% and +10%), with one exception are ≥ 1.62, which still provides significant margin for the load magnitude uncertainty.

The one exception is at the +10% frequency variation. The alternating stress ratio drops to 1.33 for the middle hood to end plate reinforcement strip.

When considering both the frequency uncertainty and the load magnitude uncertainty, the two can be combined by the square root of the sum of the squares (SRSS) since the uncertainties are independent of each other.

It is evident from CDI Report 06-27 R2, Figure 27 that the frequency shift for this node results in a substantial stress increase. At the plus10% frequency shift, the stress is 2.34 times the stress at nominal frequency, or 134% higher than at the nominal frequency. This equates to a frequency uncertainty of 134%. When the load uncertainty (27.2%) is combined by the SRSS with this frequency uncertainty, the combined uncertainty is only 2% larger than the frequency uncertainty. Thus, the stress ratio at this node for the 10% frequency shift remains above 1.30.

PSEG is not proposing or planning any steam dryer modifications. PSEG will perform a power ascension test plan which includes holding at specific power plateaus to verify that the actual, measured loads will not result in alternating stresses that exceed the fatigue allowable. The PATP is outlined in attachment 23 of the EPU LCR submittal.

14.34 Several dryer resonances are apparent in the stress power spectral densities (PSDs) shown in Figures 23-26, Attachment 21 of the Hope Creek EPU submittal. Please provide images and frequencies of the dryer resonances that respond significantly to the dryer loading.

Response
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14.35 The stresses based on Hope Creek in-plant MSL data show strong low frequency peaks (Figure 6.1 Attachment 19 of the Hope Creek EPU submittal), whereas the stresses based on SMT data are dominated by the SRV singing near 120 Hz (Figures 23-26 Attachment 21 of the Hope Creek EPU submittal). Please provide graphs which compare directly the dryer stress PSDs computed using in-plant Hope Creek data and SMT data at CLTP at the locations of maximum stress. These locations are given in Table 5.1, Attachment 19, and the nodes listed on page 78 of Attachment 21.

<u>Response</u>

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14.36 Question superceded by the new Steam Dryer Data (February 28, 2007 Supplement).

14.37 Attachment 8 (Flow Induced Vibration) of the Hope Creek EPU submittal, describes an assessment of flow induced vibration of systems and components in support of the EPU amendment request for Hope Creek. You indicate that some analyses remain underway for vibration susceptibility. Please provide the results or the progress of those analyses and discuss any resulting modifications or procedure changes.

Response
The following evaluations were completed following the transmittal of Attachment 8.

MS small bore piping connections: PSEG stated that small bore piping in the vicinity of the Turbine Stop Valve (TSV) and Turbine Control Valve (TCV) would receive further evaluation or alternatively be modified to improve vibration resistance. Twenty-four (24) MS small bore connections in the vicinity of the TSV and TCVs, consisting primarily of vents and drains, will be modified to improve vibration resistance by strengthening sockolet welds, as recommended in EPRI document TR 107455. This is being done during the EPU implementation outage, fall 2007.

EHC connections to TSV and TCV: PSEG performed a more detailed evaluation of the EHC connections, which based on industry data has been problematic at some plants even without power uprate. The evaluation concluded that with the exception of leakage from O-rings, there has been no tubing leakage/failures at HCGS. The root cause of O-rings leaks was a problem with identification of the proper O-ring as opposed to vibration.

In addition, the HCGS design initially or subsequent to commercial operation implemented all the GE suggested recommendations to reduce the overall vibration problems including but not limited to addition of accumulators, relocation of the EHC pumps off the skid, noise reduction (to eliminate internal pressure pulsations). Test Data on vibration tests done in 1989 as part of the conversion from full arc to partial arc high pressure turbine steam admission showed that the baseline, full arc vibration levels on EHC piping attached to the TSV and TCV were < 30% of allowable. With partial arc implementation, these levels were reduced to almost half of that value. PSEG has accordingly elected not to add flexible hoses on the tubing connections to the TCV and TSV.

All thermowells and sample probes evaluations have been completed. None require modification. See RAI 14.48.

No procedure changes are required.

14.38 Attachment 23 (Power Ascension Test Plan Overview) of the Hope Creek EPU submittal states that a detailed Power Ascension Test Plan will be provided to the NRC Staff before increasing power above CLTP. Please provide the draft or completed test plan along with the limit curves for power ascension, including the margin available from the fatigue stress limit if the curve is reached during power ascension.

Response
The power ascension Test Plan (PATP) is attached. The steam dryer limit curves are being developed. PSEG expects to provide the curves to the NRC on or before May 10, 2007.

14.39 In reference to Attachment 8 of the Hope Creek EPU submittal, provide (a) applicable types of accelerometers/instruments for each of Vibration Monitoring Groups, and (b) locations of instruments and technical basis for selection of the monitoring locations.

Response
PSEG monitoring consists of Vibration Monitoring Groups (VMG) 1 and VMG 3 as defined in ASME Operation and Maintenance (OM) Standards and Guides (S/G) Part 3, "Requirements for Preoperational and Initial Start-up Vibration Testing of Nuclear Power Plant Piping Systems".

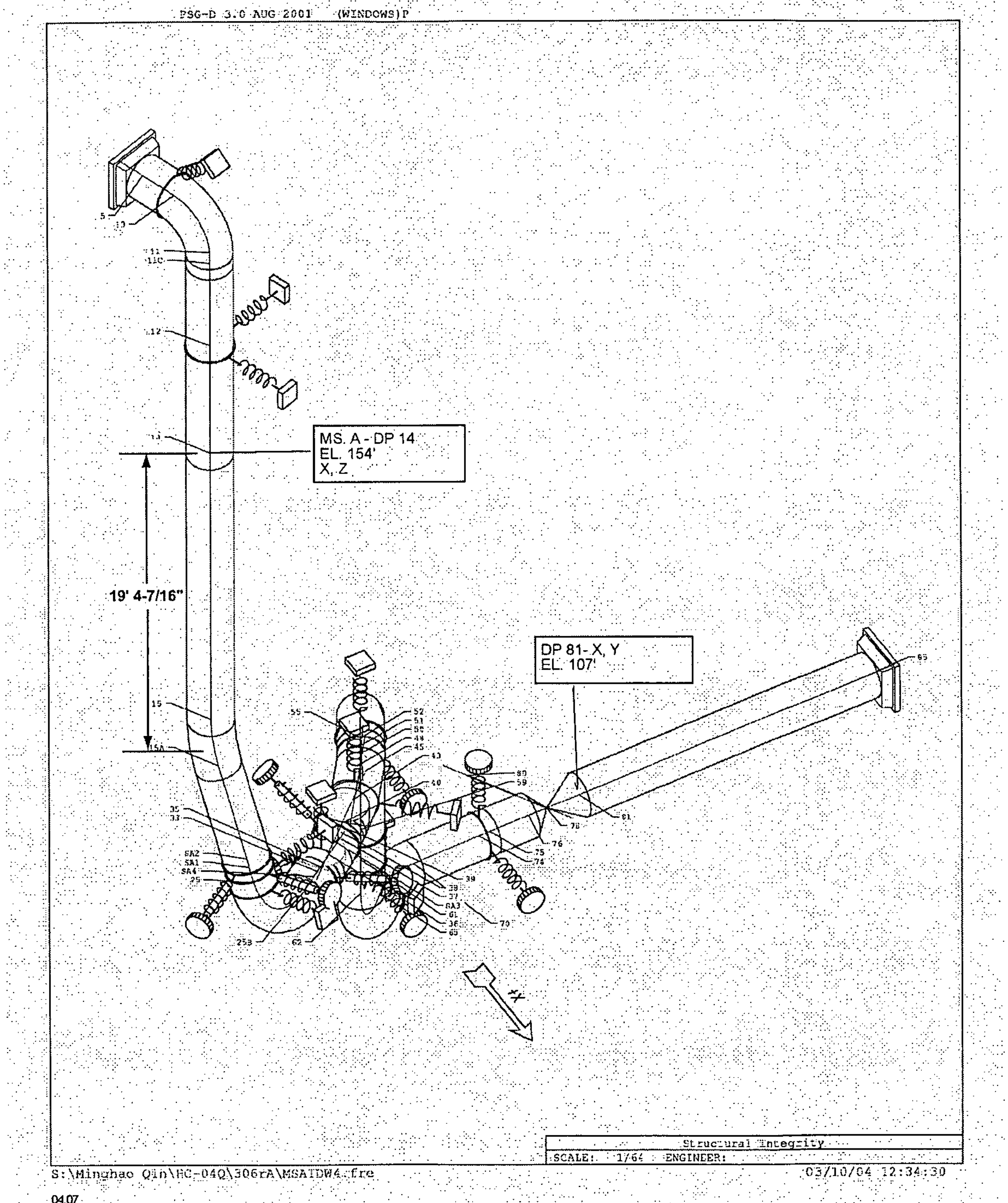
VMG 1:
The locations for the MS and FW accelerometers are provided in Table 2 of attachment 8 and are shown in "RAI 14.39 Figures 1 thru 7". The accelerometer selected is ENDEVCO Model 7703A-100.

As described in attachment 8, the instrumentation for VMG 1 consists of accelerometers. The accelerometer locations on this piping were selected based on detailed analyses of the piping, which identifies the resonance frequencies for the piping, correlates vibration levels to flow induced vibration (FIV) stress levels, and establishes the maximum allowed vibration (i.e., acceptance criteria). To determine the accelerometer locations, models of the piping were created, using PIPESTRESS which represents the dynamic characteristics of each monitored line. To provide the maximum number of natural frequencies with the minimum number of instruments, modal analyses of the piping systems were performed.

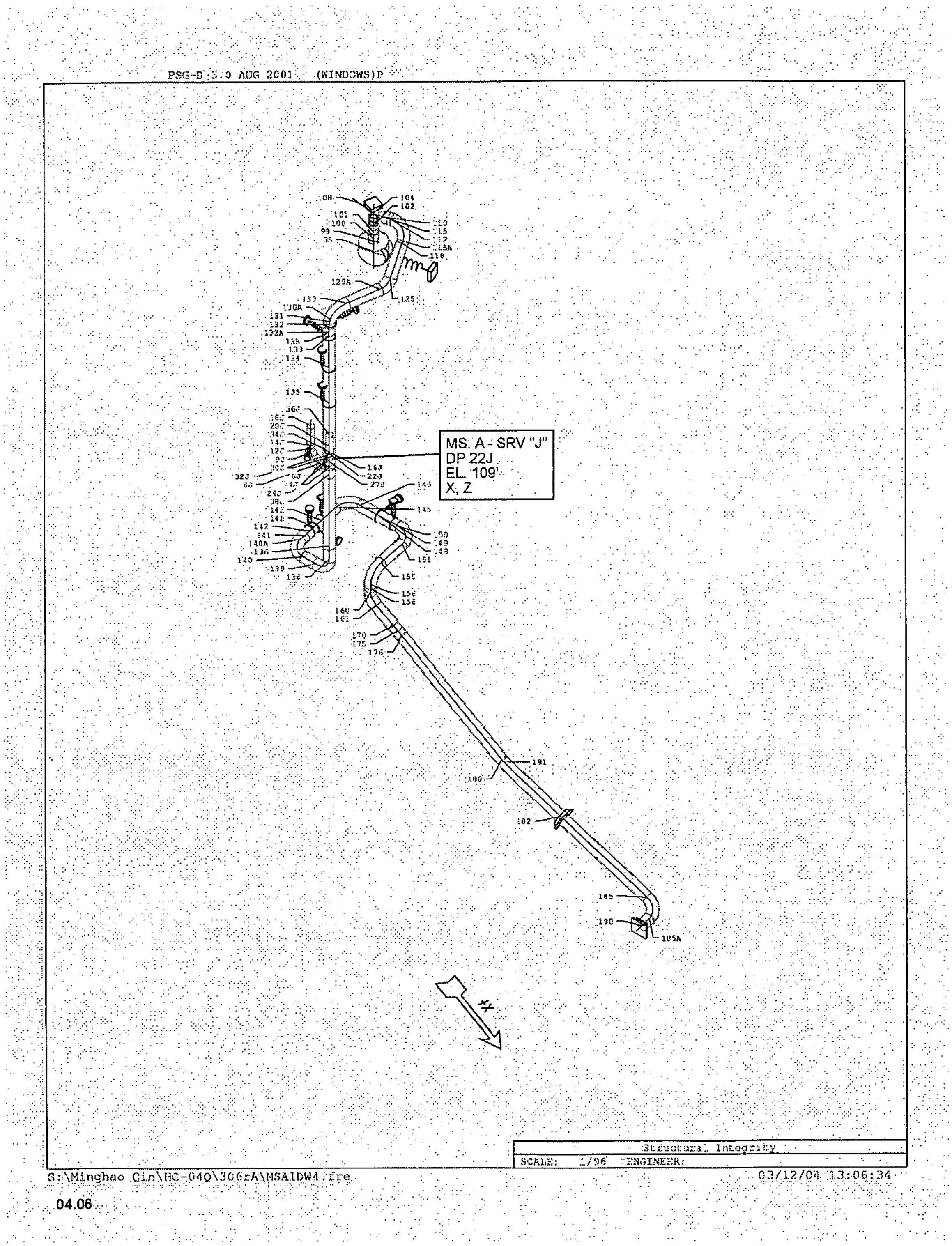
PSEG will add accelerometers on four (4) Safety Relief Valves (SRVs) (two SRVs on main steam lines "A" and 2 SRVs on MSL "B") to monitor acceptable vibration levels during power ascension.

VMG 3:
As part of the Power Ascension Test Plan (PATP), PSEG is selecting locations to be visually monitored. The selection considers ALARA/accessibility during power operation.

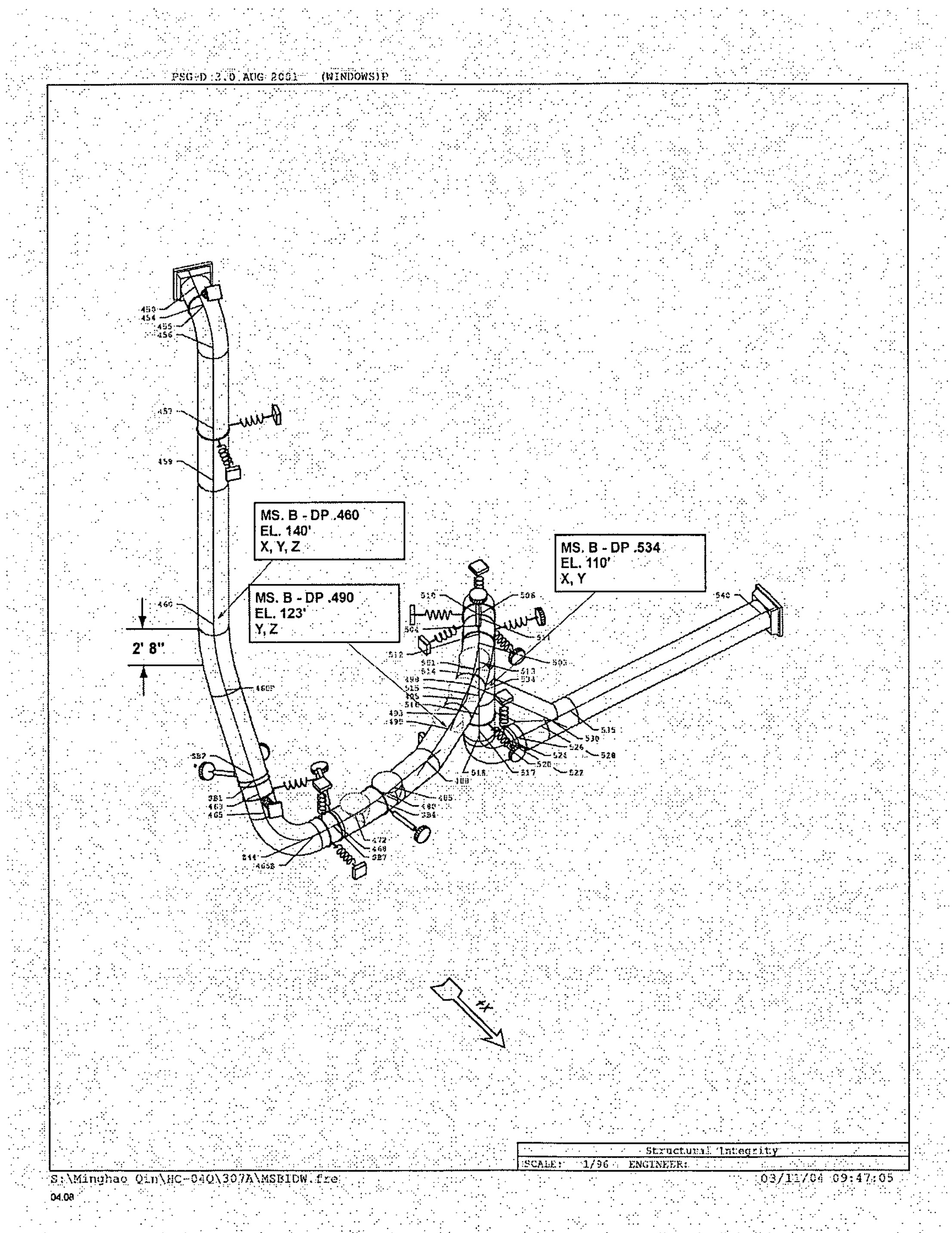
As stated in attachment 8, the condensate and reactor feed pumps will operate at an improved efficiency point and are not expected to increase in vibration. Thus, no additional instrumented monitoring is planned for these pumps as vibration monitoring already exists on the pumps. In addition, the condensate pump rooms are accessible during power operation. The walkdowns will include the condensate pump rooms.



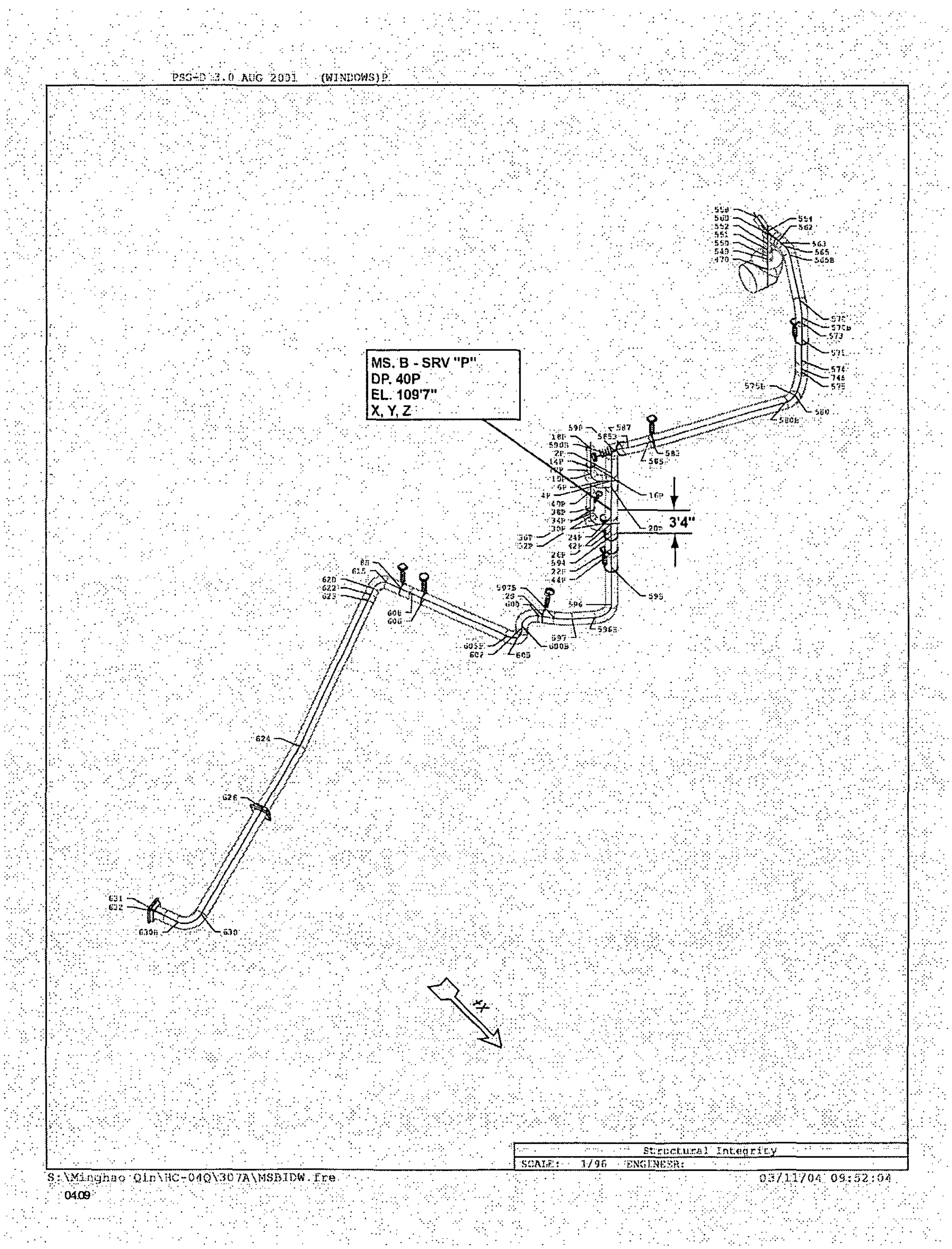
RAI 14.39 Figure 1. Main Steam Line A Accelerometer Locations – Drywell



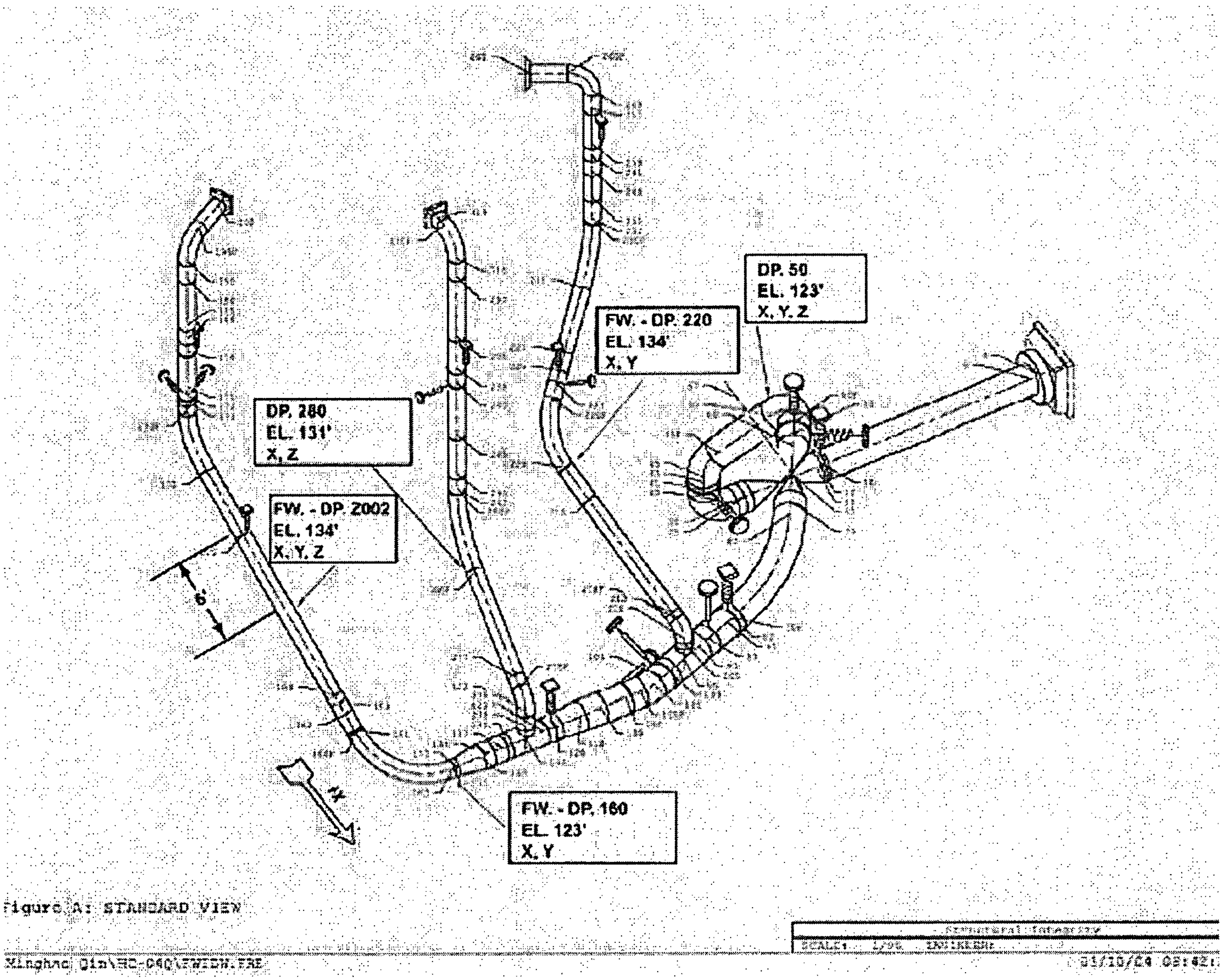
RAI 14.39 Figure 2. . Main Steam Line A SRVDL J Accelerometer Locations – Drywell



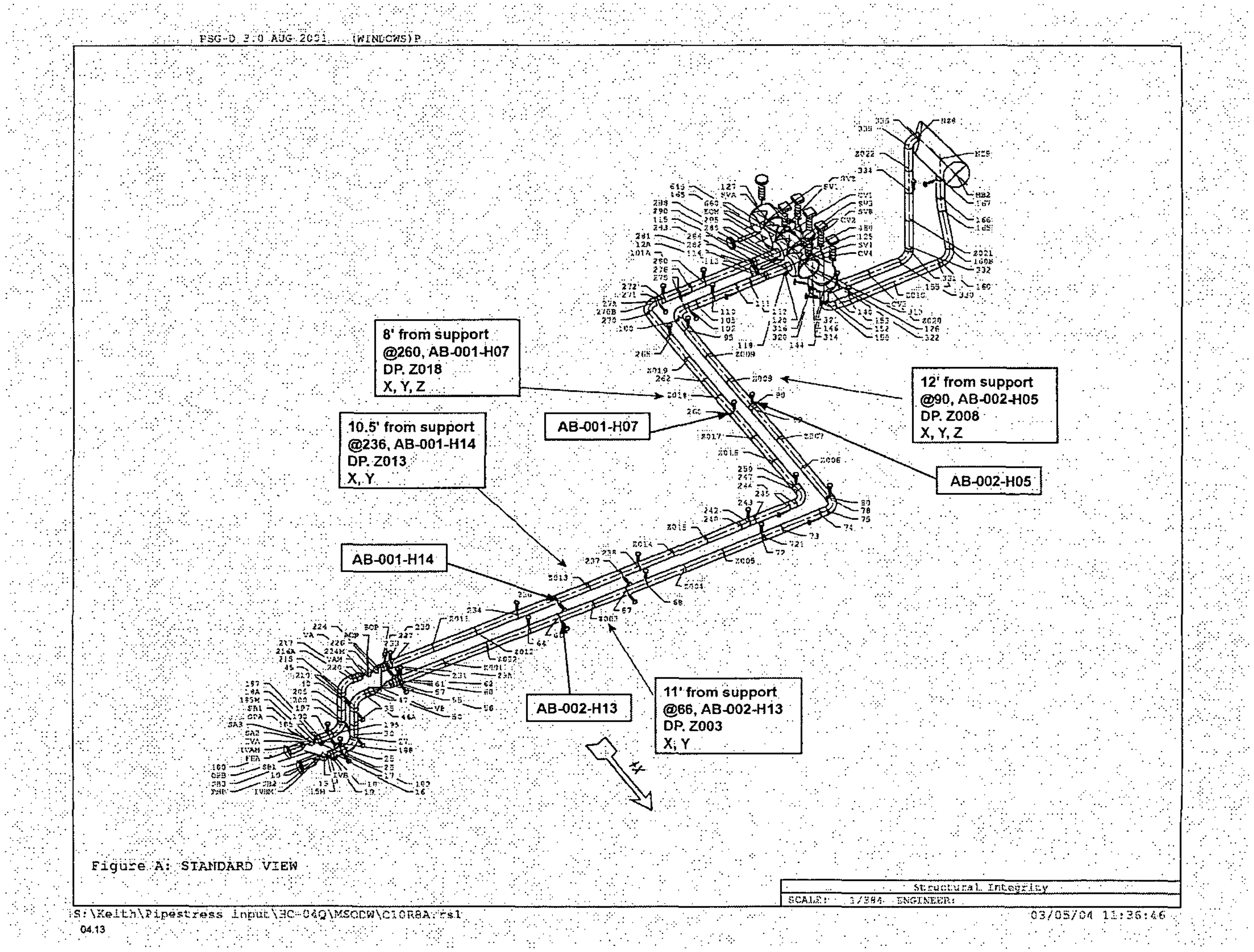
RAI 14.39 Figure 3. Main Steam Line B Accelerometer Locations – Drywell



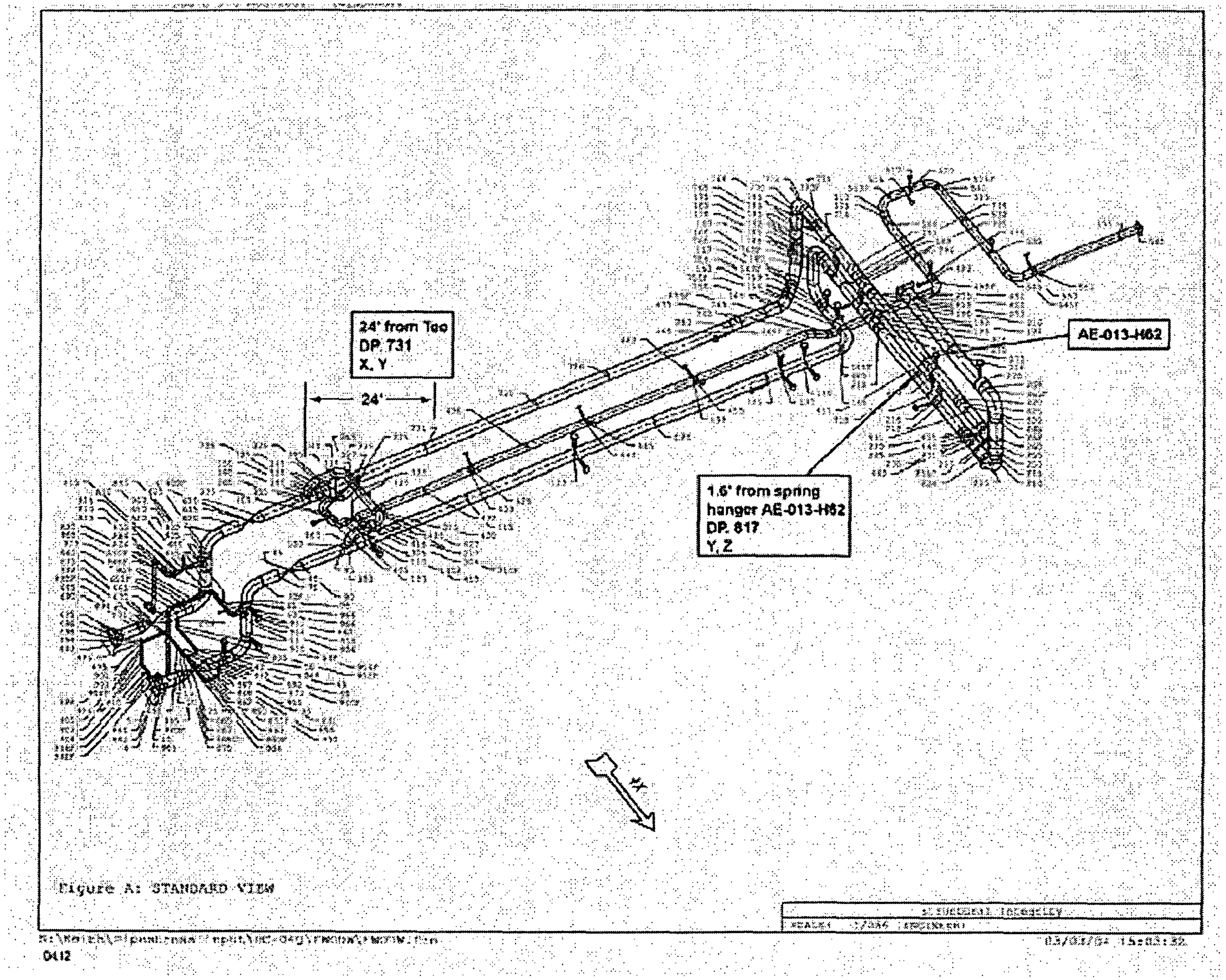
RAI 14.39 Figure 4. Main Steam Line B SRVDL P Accelerometer Locations – Drywell



RAI 14.39 Figure 5. Feedwater Piping Accelerometer Locations – Drywell



RAI 14.39 Figure 6. Main Steam Piping Accelerometer Locations – Turbine Building



RAI 14.39 Figure 7. Feedwater Piping Accelerometer Locations – Steam Tunnel

14.40 In Attachment 8 of the Hope Creek EPU submittal, it is indicated that the Hope Creek acceptance criteria for vibration level of the main steam, feedwater, and other piping systems are based on the guidance of ASME OM S/G Part 3 Code where it requires that the calculated stresses due to steady state vibration shall not exceed the allowable stress limit as specified by the Code. However, Tables 3 to 5 show that the acceptance criteria are based on the root-mean-square (RMS) of acceleration for each piping. The licensee is requested to demonstrate how the piping vibration level will be within the OM Code stress limit using the RMS acceleration value in place of the peak response spectrum used in the classical piping analysis.

Response

The acceptance criteria for the main steam, feedwater, and other piping systems were developed by performing a dynamic response spectrum piping analysis for each of the piping systems. The acceptance criteria for steady state operation were generated prior to collecting actual plant data so the frequency content of the piping systems was not known. The frequency content due to steady state vibration is typically broad band so the acceptance criteria was developed using an equivalent RMS input that would contain energy over the entire frequency range of interest. This differs from the "classical piping analysis" such as seismic analysis where the magnitude of the input amplified response spectra (ARS) varies with frequency. The calculated stresses used to develop the acceptance criteria are conservative since every frequency is assumed to have the same input magnitude. Comparison of the acceptance criteria to the measured acceleration RMS values is consistent with the broad band input used to develop the criteria. Details of the method used to develop the acceptance criteria are provided in the following paragraphs.

Broad band ARS of 1 g were inputted in each of the three orthogonal directions. The displacements, accelerations, and stresses due to the broad band ARS in each direction were calculated at each node of the piping system. The total response was obtained by combining the results from each of the three directions by the square root of the sum of the square (SRSS) method. This dynamic analysis provides the response of the piping system to a broad band ARS.

The steady state vibration is flow induced so the actual vibration loading is only applicable to the sections of piping normally containing flow. Since the flow is mostly parallel, the flow induced vibration provides excitation along the direction of the flow, not in all directions at each location. The stresses calculated due to the broad band ARS applied in all three orthogonal directions would result in a higher calculated stress than if only applied axially to each segment of pipe containing flow. This method yields lower allowable accelerations at each location than if only an axial load were applied to each non-stagnant section of pipe. This method produces conservative acceptance criteria.

The acceptance criteria for the measured accelerations were determined by multiplying the calculated acceleration at each sensor location in a unit load analysis by the ratio of the allowable steady state stress to the maximum calculated stress in the piping system. This ensures that the maximum steady state stress for each piping system does not exceed the ASME Operation and Maintenance (OM) Standards and Guides (S/G) Part 3.

14.41 [The response to question 14.41 will be submitted on or before 5/10/2007]

14.42 In the PUSAR Section 3.5.2, "Balance of plant piping," page 3-23, "Pipe Stresses" states that "No new postulated pipe break locations were identified." Provide a justification for this statement. Confirm whether and how the determination of line break locations is based on SRP Section 3.6.2, MEB 3-1 criteria.

<u>Response</u>
Pipe Break criteria were evaluated based on the requirements of Section 3.6.2 of the UFSAR, which is based on B.1.a and B.1.c of NRC Branch Technical Position MEB 3-1 (SRP 3.6.2). Where required, percentage temperature increases were applied to the existing stress levels for the applicable piping system at all node points due to CPPU conditions. The combinations of stresses were evaluated to meet the requirement of pipe break criteria. Based on these criteria, no new postulated pipe break locations were identified.

14.43 In the PUSAR Section 10.1.2, Liquid Line Breaks, states that "Only the mass and energy releases for HELBs in the Reactor Water Cleanup (RWCU) and FW systems may be affected by CPPU and were re-evaluated at CPPU conditions." Provide summaries of the evaluations for RWCU and FW line breaks.

<u>Response</u>
The RWCU and FW line break blowdown mass flow rate profiles at EPU conditions are determined by calculating the ratio of critical mass flux at CLTP and EPU conditions, then applying this ratio to the CLTP profile from the analysis of record. In the evaluation the Moody slip critical flow is used to determine blowdown mass flux values.

The RWCU and FW line break evaluations address operation at the following points on the Hope Creek EPU power flow map.

	Power/Flow Condition*
EPU Standard	102% EPU Thermal Power (EPUTP) / 100% Core Flow / Normal FW Temperature
EPU Standard w/FWTR	102% EPUTP / 100% Core Flow / Reduced FW Temperature
EPU ICF	102% EPUTP / 105% Core Flow / Normal FW Temperature
EPU ICF w/FWTR	102% EPUTP / 105% Core Flow / Reduced FW Temperature
EPU minimum pump speed (mps)	66.2% EPUTP / 39.2% Core Flow / Normal FW Temperature
EPU mps w/FWTR	66.2% EPUTP / 39.2% Core Flow / Reduced FW Temperature

* The evaluations do not specifically model the EPU / MELLLA condition (102% EPUTP, 99% Flow). The evaluations performed for the EPU Standard conditions 102% EPUTP / 100% Core Flow / Normal FW Temperature and 102% EPUTP / 100% Core Flow / Reduced FW Temperature) are representative of the normal feedwater temperature and reduced feedwater EPU / MELLLA conditions.

The results of the RWCU line break evaluation are summarized in the Tables 14.43-1 and 14.43-2.

Table 14.43-1

Power Flow Condition	CLTP to EPU Enthalpy Change (1) (Btu/lbm)
EPU Standard	-1.1
EPU Standard w/FWTR	-4.7
EPU ICF	0.0
EPU ICF w/FWTR	-3.6
EPU mps	-28.8
EPU mps w/FWTR	-32.6

(1) As compared to the current license basis value

Table 14.43-2

Power Flow Condition	RWCU Pump Discharge Mass Flux % increase (1)	RWCU HX Inlet Mass Flux % increase (1)	RWCU F/D Inlet Mass Flux % increase (1)	RWCU Pump Suction Mass Flux % increase (1)
EPU Standard	1.0%	0.6%	0.1%	0.6%
EPU Standard w/FWTR	4.4%	2.3%	0.6%	2.6%
EPU ICF	0.0%	0.0%	0.0%	0.0%
EPU ICF w/FWTR	3.4%	1.8%	0.4%	2.0%
EPU mps	26.4%	12.5%	3.3%	30.4%
EPU mps w/FWTR	29.5%	13.9%	3.7%	35.2%

(1) As compared to the current license basis value

Response for RWCU line break Environmental Conditions

The licensing basis RWCU line breaks outside containment were evaluated during original plant design using the COPDA computer code. Pressure and temperature profiles for the various postulated RWCU breaks were evaluated. The design basis analysis was based on a 17 node reactor building model.

A benchmarking analysis was performed using the COMPARE Mod 1 computer code using the same 17 node model as performed for the design basis model. The benchmarking analysis was performed to evaluate the pressure and temperature response for the ARTS/MELLLA revised mass and energy releases. The results of the benchmarking study demonstrated that the results using the COMPARE computer code closely follow the results using COPDA. Therefore the COMPARE models developed using the original design basis COPDA physical input parameters were used for both the ARTS/MELLLA mass and energy releases and the EPU mass and enthalpy changes described above.

In addition to the benchmarking cases six different RWCU rooms were evaluated. The cases are;

1. Break in Room 4403 – RWCU discharge downstream of check valve
2. Break in Room 4506 – downstream of Regen Hx Outlet
3. 6" RWCU break upstream of pump in Room 4402
4. 6" RWCU upstream of pump in Room 4505
5. RWCU break in Room 4621 F/D Inlet
6. RWCU break in Room 4503 – RWCU Valve and Pump Room

Each of these cases were evaluated at the different power flow conditions defined above:

The peak compartment pressure and temperature following the design basis breaks in the RWCU piping inside the Reactor Building were determined using the COMPARE computer code. The mass and energy releases were modified to incorporate changed RWCU initial conditions for the different flow conditions defined above. The COMPARE results were either the same or less than the design basis pressure and temperature results.

In all cases evaluated the COMPARE results at EPU flow conditions are enveloped by the licensing basis pressure and temperature results (See Table 14.43-3).

For the FW line break case, the energy release (mass flux * enthalpy) results at the power flow conditions identified above are compared to the energy releases from a MSLB in the MST at current licensed conditions. The comparison demonstrates that the FWLB energy releases at CPPU conditions are bounded by energy releases from a MSLB in the MST at current licensed conditions.

Table 14.43-3

Summary Results RWCU Line Breaks						
Case	**Break**	**Room #**	**Pressure (psig)**		**Temperature (°F)**	
			Licensing Basis	**EPU**	**Licensing Basis**	**EPU**
1	Pump dischg.	4403	1.7	1.7	217	217
1	Pump dischg.	4405	1.7	1.7	217	217
2	Regen Hx Outlet	4506	2.1	1.7	217	217
3	6" Pump suction	4402	1.7	1.7	218	206
3	6" Pump suction	4321	1.6	1.6	217	206
4	6" Pump suction	4505	1.8	1.8	218	214
5	F/D (3" line)	4620	6.4	3.8	231	224
5	F/D (3" line)	4621	6.4	3.8	231	224
6	F/D (4" line)	4502	1.9	1.9	218	218
6	F/D (4" line)	4503	1.9	1.9	218	218

14.44 In the PUSAR Section 3.5.1, "Reactor Coolant Pressure Boundary Piping," page 3-19 "Feedwater Evaluation," states that the "CPPU does not have an adverse effect on the FW piping design. A review of postulated pipe break criteria concluded that at three locations, cumulative fatigue usage exceeds postulated pipe break criteria limit. (question was revised following conference call)

a) If the CPPU does not have an adverse effect on the FW piping, why is it necessary to perform structural modifications to ensure ASME code compliance prior to the implementation of the CPPU? Please clarify.

Response

The initial conclusions in PUSAR are based on a conservative GE screening analysis. The GE screening analysis reported that three locations may have a cumulative usage factor (CUF) greater than 0.1 at CPPU conditions, exceeding HCGS pipe break design criteria. PSEG subsequently completed reanalysis of Feedwater (FW) piping is at CPPU conditions as described below in 14.44(b). The piping meets the ASME code requirements of HCGS (ASME B&PV Code, Div. 1, Section III, 1977 Edition through Summer 1979 Addenda) without any structural modification.

b) Provide the summary of the piping reanalysis results and the schedule that the structural modifications will be completed where required to ensure that ASME Code stresses and fatigue usage factors will not exceed the criteria limit, prior to implementation of CPPU. If structural modifications are required, confirm that the structural analysis model (piping and/or pipe support) reflects any required structural modifications.

Response

Two of the three locations referenced in PUSAR Section 3.5.1 are at FW Containment Penetration Nozzles. The flued head penetrations were originally qualified by detailed finite element analysis performed by Basic Technology, Inc. in 1986. The ASME piping code of record was used to calculate the CUF based on the original loading specification and compared with the analyzed value at CPPU conditions. This comparison shows that the analyzed value of CUF at CPPU conditions is less than the CUF calculated on the basis of original loads, thereby meeting the HCGS pipe break design criteria.

The third location corresponds to FW Loop A data point 45 in the HCGS FW piping model. The FW piping reanalysis shows CUF less than 0.1 for this location, thereby meeting the HCGS pipe break design criteria.

The following table lists the highest stress and cumulative usage factor vs. allowables. The piping meets all Hope Creek ASME criteria without any structural modification.

LINE AE-035

Data Points	Equation(9) Level A (KSI)	Equation(9) Level B (KSI)	Equation(9) Level C (KSI)	Equation(9) Level D (KSI)	EQ.12 (KSI	EQ.13 (KSI	Fatigue Usage Factor
All	21.028	19.138	19.194	28.656	22.857	47.306	.599
Allowables	29.59	35.51	44.38	59.18	59.18	59.18	1.0

LINE AE-036

Data Points	Equation(9) Level A (KSI)	Equation(9) Level B (KSI)	Equation(9) Level C (KSI)	Equation(9) Level D (KSI)	EQ.12 (KSI	EQ.13 (KSI	Fatigue Usage Factor
All	21.331	27.382	20.635	28.742	32.728	45.463	.573
Allowables	29.59	35.51	44.38	59.18	59.18	59.18	1.0

14.45 In the PUSAR Section 10.1.2, “Liquid Line Breaks,” page 10-3 “pipe whip and jet impingement,” it is indicated that the FW piping was evaluated for temperature increases associated with CPPU conditions but it did not result in pipe stress levels above the thresholds required for postulating HELBs, except at locations already evaluated for breaks. Provide a summary of this evaluation for the NRC staff’s review.

Response

UFSAR section 3.6.2.1.1 “Break Location in High Energy Fluid System Piping” states that high energy piping system line breaks and effects have been evaluated in accordance with sections B.1.a and B.1.c of BTP (Branch Technical Position) MEB (Mechanical Engineering Branch) SRP (Standard Review Plan) 3.6.2. For the Feedwater Piping Inside Containment SRP 3.6.2 is consistent with the piping stress requirements described in UFSAR 3.6.2.1.1.1.

The two feedwater piping trains inside containment are identified as AE035 and AE036. Pipe-break stress values at locations where the stress (EQ. 10) or cumulative fatigue usage factor (0.10) exceeds these criteria for the AE035 and AE036 are tabulated in the two tables below.

In all instances where Equation 10 exceeds 2.4 Sm, equations 12 and 13 are less than 2.4 Sm. At all locations where the cumulative usage factor exceeds 0.1, a pipe break has already been postulated. Therefore, based upon the reanalysis of the feedwater piping inside containment for EPU conditions, no new pipe break locations need to be postulated.

LINE AE-035

Node Point	Node Type	New Stress EQ. 10 (ksi)	New Stress EQ. 12 (ksi)	New Stress EQ. 13 (ksi)	Pipe Break Stress Limit 2.4 Sm (ksi)	New Cumulative Usage Factor	Pipe Break Cumulative Usage Factor Limit	Basis for Break Selection
15	TTJ	57.42	NR	NR	47.34	.1995	0.10	TE
25	TTJ	60.821	NR	NR	47.34	.2192	0.10	MIB
30	Bran.	54.939	NR	NR	47.34	.2416	0.10	*
60	TTJ	56.566	NR	NR	47.34	.1946	0.10	MIB
70	TTJ	56.502	NR	NR	47.34	.1938	0.10	MIB
95	TEE	75.819	13.188	42.467	47.34	.2551	0.10	MIB
108	LUG	23.039	NR	NR	47.34	.9253	0.10	MIB
130	TEE	65.425	18.392	34.920	47.34	.2141	0.10	MIB
140	TTJ	63.344	14.908	41.996	47.34	.0297	0.10	***
178	LUG	18.296	NR	NR	47.34	.3756	0.10	MIB
195	TTJ	50.366	22.857	16.258	47.34	.0427	0.10	***
196	TTJ	49.373	22.23	17.187	47.34	.0430	0.10	***
200	TTJ	62.214	8.443	30.831	47.34	.5988	0.10	TE
205	TTJ	66.23	13.986	42.702	47.34	.1006	0.10	**
225	LUG	19.007	NR	NR	47.34	.1673	0.10	MIB
250	LUG	14.941	NR	NR	47.34	.3593	0.10	MIB
260	TTJ	48.542	16.889	24.078	47.34	.0359	0.10	***
261	TTJ	49.624	17.98	23.389	47.34	.0357	0.10	***
265	TTJ	60.591	NR	NR	47.34	.5209	0.10	TE
270	TTJ	62.216	15.065	34.848	47.34	.0964	0.10	***
288	LUG	22.196	NR	NR	47.34	.3799	0.10	MIB
315	TTJ	62.615	6.329	31.520	47.34	.5348	0.10	TE
			NR	NR				

LINE AE-036

Node Point	Node Type	New Stress EQ. 10 (ksi)	New Stress EQ. 12 (ksi)	New Stress EQ. 13 (ksi)	Pipe Break Stress Limit 2.4 Sm (ksi)	New Cumulative Usage Factor	Pipe Break Cumulative Usage Factor Limit	Basis for Break Selection
15	TTJ	57.555	NR	NR	47.34	.2289	0.10	TE
25	TTJ	61.086	6.952	30.476	47.34	.2539	0.10	MIB
30	BC	55.224	NR	NR	47.34	.2754	0.10	*
60	TTJ	62.547	5.260	34.35	47.34	.2651	0.10	MIB
70	TTJ	56.313	NR	NR	47.34	.2202	0.10	MIB
90	TTJ	36.855	NR	NR	47.34	.1017	0.10	**
100	TTJ	37.557	NR	NR	47.34	.1033	0.10	**
95	TEE	88.219	17.263	47.654	47.34	.54	0.10	MIB
108	LUG	24.86	NR	NR	47.34	.9436	0.10	MIB
130	TEE	58.803	NR	NR	47.34	.2369	0.10	MIB
140	TTJ	57.639	14.625	35.396	47.34	.0332	0.10	***
178	LUG	17.39	NR	NR	47.34	.3744	0.10	MIB
180	BC	54.733	NR	NR	47.34	.3055	0.10	MIB
195	TTJ	58.29	25.949	20.837	47.34	.054	0.10	***
200	TTJ	61.754	6.954	30.773	47.34	.5725	0.10	TE
206	TTJ	67.48	14.606	43.867	47.34	.1021	0.10	**
210	TTJ	53.083	25.025	36.351	47.34	.0092	0.10	***
225	LUG	19.921	NR	NR	47.34	.1677	0.10	MIB
250	LUG	15.589	NR	NR	47.34	.3602	0.10	MIB
265	TTJ	60.392	NR	NR	47.34	.5219	0.10	TE
270	TTJ	57.987	12.888	32.245	47.34	.0861	0.10	***
275	TTJ	55.106	32.09	26.869	47.34	.0266	0.10	***
288	LUG	22.504	NR	NR	47.34	.3795	0.10	MIB
315	TTJ	61.228	5.328	30.762	47.34	.5313	0.10	TE

* This is next point to DP 25 where break is postulated.
** These points are on TEE where DP 95 break is postulated.
*** These points are below the stress and **Cumulative** Usage Factor criteria and therefore no break is postulated.

NOTES:

TTJ: Tapered Transition Joint
TE: Terminal End
MIB: Mandatory Intermediate Break
NR: Not Required

14.46 [See Attachment 3]

14.47 In the PUSAR Sections 3.2.2 through 3.2.2.3, "Reactor Vessel Structural Evaluation," states that "The effect of CPPU was evaluated to ensure that the reactor vessel components continue to comply with the existing structural requirements of the ASME B & PV Code. For the components under consideration, the 1968 code with addenda to and including winter 1969, which is the code of construction, is used as the governing code. However, if a component's design has been modified, the governing code for that component is the code used in the stress analysis of the modified component. The Hope Creek CPPU utilizes the original code of construction as the governing code for all components for CPPU conditions. New stresses are determined by scaling the "original" stresses based on the CPPU conditions (temperature and flow). The analyses were performed for the design, the normal and upset, and the emergency and faulted conditions. If there is an increase in annulus pressurization, jet reaction, pipe restraint or fuel lift loads, the changes are considered in the analysis of the components affected for normal, upset, emergency and faulted conditions."

a) Provide a summary of the analyses stated above which justify that loading changes due to CPPU in the analysis of the components affected at the normal, upset, emergency and faulted conditions do not affect the structural integrity of these components.

Response

As defined in the LTR for CPPU, the only components that require evaluation are: (a) those with a pre-existing (OLTP) CUF >0.5 and (b) those that experience an increase in flow, temperature, Reactor Internals Pressure Differences (RIPDs), and other mechanical loads due to CPPU. Therefore, the only components in the HCGS vessel that require evaluation for CPPU operating conditions are the main closure studs, shroud support, feedwater nozzle safe end, and core spray nozzle.

For the main closure studs and the core spray nozzle, there is a small (0.2%) change in temperature, but no change in pressure or flow. Hence, this small change in temperature has an insignificant effect on primary plus secondary stresses (P+Q) and fatigue Cumulative Usage Factor (CUF).

For the shroud support, there is no increase to the thermal stresses due to CPPU. The dynamic loads and recirculation LOCA loads do not change for CPPU conditions. The only changes are due to an RIPD increase of 11.1% across the shroud support. This causes an increase in the primary stresses (P) of the same percentage. As a result, (P+Q) increases approximately 3%. This is an insignificant increase; it is judged that the CUF remains unchanged.

With regard to the Feedwater Nozzle, the safe end is the limiting component. The only increases for this component are the temperature and flow rate, which have been assessed. System plus rapid cycling events are included in the

CPPU CUF, which is conservatively calculated. No leakage has been identified for this component. As such, the safe end is qualified for 23 years of operation.

Table 14.47-1 provides the Original Licensed Thermal Power (OLTP) CUF compared to the Constant Pressure Power Uprate (CPPU) results.

Similarly, (P+Q) values are presented in the Table 14.47-2.

b) Provide a list of components that have their design modified along with a description of the design modifications, governing code, and maximum stress summary versus allowable stress limits at critical locations.

Response
Table 14.47-3 provides a summary of the applicable Code, stresses, and allowable stresses for all components that have been modified since the original design.

In addition to the component evaluations for modifications summarized in Table 14.47-3, welded overlays on the core spray nozzle to safe end weld (N5B) and the reactor vessel recirculation inlet nozzle to safe end weld (N2K) were satisfactorily evaluated for EPU conditions as described in response to RAI 5.3 (PSEG letter LR-N07-0056 dated March 22, 2007).

c) Provide the procedural tensioning method of Main Closure Studs that includes loads due to CPPU conditions. Show that the tensioning stud load including tolerances is within code allowables when including the higher CPPU conditions.

Response
As provided above in response to RAI 14.47a, the effect of CPPU on main closure stud CUF and (P+Q) is not significant. Therefore, no change to the stud tensioning method or elongation tolerances is required.

Table 14.47-1

Component	OLTP CUF	CPPU CUF	Conclusion
Main Closure Studs	0.755	0.755	Component Acceptable
Core Spray Nozzle	0.796	0.796	Component Acceptable
Shroud Support	0.672	0.672	Component Acceptable
Feedwater Nozzle Safe End	0.950	0.999	Component Acceptable*

* This CUF is based upon 23 years of service. System plus rapid cycling events are included. The calculation for rapid cycling includes very

conservative assumptions regarding leakage. This component should be managed by inspection.

Table 14.47-2

Component	OLTP P+Q (ksi)	CPPU P+Q (ksi)	Code Allowable (ksi)	Conclusion
Main Closure Studs	108.9	109.11	110.4	Component Acceptable
Core Spray Nozzle (See Note 1)	13.76	13.79	43.11	Component Acceptable
Shroud Support (See Note 1)	22.03	24.41	69.9	Component Acceptable
Note 1: Thermal Bending has been removed as allowed by the ASME Code.				

Table 14.47-3

Component	Modification	Code	Modification Maximum Stress at OLTP (ksi)	Maximum Stress at CPPU (ksi)	Allowable Stress (ksi)
Recirculation Inlet Nozzle	Safe End and Thermal Sleeve Replacement	ASME Boiler & Pressure Vessel Code, 1974 Edition and Addenda up to Summer 1976	26.4	30.2	41.17
CRD Hydraulic System Return Nozzle	Nozzle Capped	ASME Boiler & Pressure Vessel Code, 1974 Edition and Addenda up to Winter 1975	39.48	39.56	80.1
Feedwater Nozzle Safe End	Safe End Replacement	ASME Boiler & Pressure Vessel Code, 1974 Edition and Addenda up to Summer 1976	18.6 (Thermal Bending Removed)	23.46 (Thermal Bending Removed)	53.1

14.48 Pipe in-line components such as thermowells and sample probes experience increased vibrations due to flow past or through that component. In the PUSAR Section 3.4.1, "FIV Influence on Piping," states that "The safety-related thermowells and sample probes in the MS and FW piping systems have been identified and are being evaluated for the increased main steam and feedwater flow conditions, respectively, as a result of CPPU. Any thermowell or sample probe that is found to be unacceptable will be modified as necessary. Evaluation of non-safety related thermowells and sample probes is described separately." Attachment 8 further discusses the effects of FIV on thermowells and sample probes. For FW and Condensate, attachment 8 of the Hope Creek EPU submittal states that "Based on a review of existing calculations, the frequency ratio (excitation frequency/natural frequency) at 115% CLTP remains well below the original design criteria of < 0.80. Quantify "well below" in the summary requested below. For FW and Condensate thermowells, Attachment 8 also states that the protrusion length "is 2.5-inches, and it is tapered from 1.5-inches to 1.0 inch. Due to their short protrusion, they are not considered susceptible." Provide basis and justification of this statement. Provide a quantitative summary of the evaluation that supports the acceptability of the thermowells and sample probes in the MS, FW and related piping systems. Identify nonconforming component(s) and provide description of their modification(s).

<u>Response</u>
None of the thermowells or sample probes require modification for the proposed power uprate (115% CLTP). With a constant pressure power uprate, the primary impact on in-line instrumentation is on systems which will see a significant increase in flow velocities.

All non-safety related FW and condensate sample probes are built from solid bars with a tapered OD from 1.5-inches to 1.0-inches (None are built from standard piping components). Lengths vary in order to obtain representative sampling points in the flow stream. The two most limiting sample probes had lengths of 11.6-inches and 12.9-inches. At 115% CLTP, the non-SR FW and condensate sample probes have a frequency ratio (excitation frequency/natural frequency) $\leq$ 0.19, less than one-fourth of the screening criteria of 0.80.

All non-safety related FW and condensate thermowells are likewise built from solid bars with a tapered OD from 1.5-inches to 1.0-inches but with shorter protrusion lengths than sample probes. For those thermowells in the larger bore piping, the protrusion length is 2.5-inches. Thus, they are considered even less susceptible to FIV since their frequency ratio (excitation frequency/natural frequency) at 115% CLTP is well below 0.19.

The Safety Related (SR) thermowells and sample probes in the MS and the single SR thermowell in the FW system were analyzed by GE. They are all tapered design, but of different OD's. Their frequency ratio at 115% CLTP is calculated as:

- SR FW thermowell: 0.21.
- SR MSL sample probes: 0.40.
- SR MSL thermowells (TE1004A-D): 0.435.
- SR MSL thermowell (TE040) had a frequency ratio of 1.00. It received a finite element modeling to confirm that the total vibration stresses were 52% of the allowable. The allowable used was 7690 psi.

14.49 In the PUSAR Section 3.4.2, "FIV Influence on Reactor Internal Components," states that "The increase in power may increase the level of reactor internals vibration. Analyses were performed to evaluate the effects of flow-induced vibration on the reactor internals at CPPU conditions. This evaluation used a reactor power of 3952 MWt and 105% of rated core flow. This assessment was based on vibration data obtained during startup testing of the prototype plant (Browns Ferry Unit 1). For components requiring an evaluation but not instrumented in the prototype plant, vibration data acquired during the startup testing from similar plants or acquired outside the RPV is used. The expected vibration levels for CPPU region were estimated by extrapolating the vibration data recorded in the prototype plant or similar plants and from GE Nuclear Energy BWR operating experience. These expected vibration levels were then compared with the established vibration acceptance limits. The following components were evaluated:

a) Shroud
b) Shroud head and moisture separator
c) Jet pumps
d) Feedwater sparger
e) Steam dryer
f) Jet pump sensing lines

The results of the vibration evaluation show that continuous operation at a reactor power of up to 3952 MWt and 105% of rated core flow will not result in any detrimental effects on the evaluated reactor internal components (except the steam dryer)." Provide a summary of the evaluation results for each of the above components except the steam dryer and the technical basis that supports the rational that reactor power of up to 3952 MWt and 105% of rated core flow will not result in any detrimental effects on the reactor internal components (based on the evaluated prototype plant).

<u>Response</u>
The acceptance criteria for the shroud, shroud head and separator, jet pumps and feedwater sparger is that the maximum stress anywhere in the component be less than the limiting stress as per GE criteria of 10,000 psi. This limiting

value ensures that no fatigue is accumulated by the component, and is lower than the ASME Curve C fatigue limit of 13,600 psi. Table 14.49-1 lists the maximum stress values for each component under both OLTP and 3952 MWt reactor power and 105% of rated flow conditions.

Stress values for all these components are thus under GE acceptance criteria of 10,000 psi. For the Jet Pump Sensing Lines (JPSL) the acceptance criteria is the prevention of JPSL resonance with the Vane Passing Frequency (VPF). This no-resonance condition is met both under OLTP and 3952 MWt reactor power and 105% of rated flow conditions.

The OLTP data is obtained from the startup measurements made at the prototype plant (Browns Ferry 1) at various power levels and core flows. These are documented in Browns Ferry 1 Vibration Measurements, GENE document 386HA219, December 1975. The 3952 MWt and 105% of rated core flow values are obtained by extrapolation of the measured data. Summary of the evaluations is as follows:

<u>Shroud</u>
For the shroud, the square of the increase in flow velocity due to power and core flow increase is used to calculate the increase in vibration. Maximum stresses during OLTP are very low and will remain well within acceptance criteria during EPU when the vibrations are increased to account for the flow increase. The vibrations amplitudes are calculated to increase by about 58% during EPU. The calculated maximum stress at 3952 MWt and 105% of rated core flow is less than [[ ]]

<u>Shroud Head and Separator</u>
For the shroud head and separators, the square of the increase in separator velocity due to power and core flow increase is used to calculate the increase in vibration. Due to the increase in power, the separator flow velocity increases. Using the flow velocity squared relationship, the vibration amplitudes are calculated to increase by about 58%, when operation at 3952 MWt and 105% of rated core flow is considered and result in a maximum stress of under [[ ]]

<u>Jet Pumps</u>
Test point H22 at ~ 70% rod line and 100 % core flow and test point H24 at ~100% rod line and 100% core flow from startup data on a prototype plant were selected and used to extrapolate to EPU at 105% core flow. This yielded a predicted maximum response of less than [[ ]]of the acceptance criteria at 3952 MWt and 105% of rated core flow conditions.

<u>Feedwater Sparger</u>

Feedwater spargers are a triple thermal sleeve design. The maximum stresses with the triple thermal sleeve design are less than [[ ]] the stresses during EPU are calculated by using the square of the increase in FW flow (57%) and are less than [[ ]]

Jet Pump Sensing Lines (JPSL)
For the JPSL's, finite element models were made and the natural frequencies of the lines under in-reactor conditions were found while the Hope Creek reactor was still under construction. The natural frequencies are dependent on the as-built line length. The as-built lengths of critical lines identified by analysis were measured while the Hope Creek reactor was still under construction. Impact tests on the critical lines were also performed. The analysis and test results indicated that the [[ ]] mode natural frequency of JPSL [[ ]] may be in resonance with the Vane Passing Frequency (VPF). Therefore, an additional support was added for JPSL [[ ]] while the Hope Creek reactor was still under construction. The rest of the lines had no problem with VPF resonance. The JPSL resonance is due to recirculation pump speed and not due to power uprate, per se.

Item	Component	OLTP Maximum Stress Value	3952 MWt and 105% of Rated Core Flow **Maximum Stress Value**
1	Shroud	[[	
2	Shroud head and separator		
3	Jet pumps		
4	Feedwater sparger		]]

Table 14.49-1

14. 50 Question Deleted following Conference Call

14.51. In the past, small bore pipe failures due to high cyclic fatigue attributed to vibration have led to forced outages and plant shutdowns.

a) Attachment 8 of the Hope Creek EPU Submittal, Section 4.2.3, "FW Component Susceptibility", states that "Small bore lines attached to the FW headers were reviewed by experienced piping design engineers during RF13 (spring 2006)." Provide a summary of the review and a *technical basis that justifies your conclusion that none of the FW small bore branch lines is susceptible to higher EPU vibration.*

b) Attachment 8 of the Hope Creek EPU Submittal, Section 4.1.3, "MS System Component Review," indicates that similar review effort as in the FW small bore lines was performed for the small bore MS lines. Provide a summary of this review that qualifies the small bore MS lines for the higher EPU vibration.

c) Attachment 8 of the Hope Creek EPU Submittal, Section 4.1.3 states that "MS small bore connections in the vicinity of the TSV and TCVs will receive further evaluations to justify as-is, or alternatively, they will be modified to improve vibration resistance. Modifications may include strengthening of the sockolet welds or improvements in the supports. This includes the Electro Hydraulic Control (EHC) unit connections." Provide a summary of the evaluation for these small bore piping systems at the higher CPPU conditions. Also provide a description of any required structural modifications, as applicable.

Response

The EPU project team reviewed the piping isometrics, which include the small bore attachments and routing, and performed physical walkdowns during a refueling outage to determine actual conditions. They also had the quantitative vibration data collected in 2005 at 100% CLTP on the MS and FW main headers. This vibration monitoring program and CLTP data is summarized in Attachment 8 of the EPU submittal including the conclusion that there is substantial margins to address EPU increases. RAI 14.39 provides the diagrams for monitored lines and instrument locations.

The two individuals performing the evaluations had a combined 40 years of experience on piping design/stress evaluations and 35 years of experience specific to HCGS. The walkdown guidelines included noting any concerns on the condition of:

- The piping and pipe supports
- Insulation on subject and adjacent pipes.
- Attached components and branch lines
- Structures and components adjacent and below
- Valves, operators (actuators) and attached wiring, piping and tubing

a) FW Small Bore Lines:

Inside Containment:

Each of the two 24-inch FW main headers has a check valve directly downstream of the containment penetration. A valve leakage test location is immediately downstream of each check valve. The containment penetration, an anchor, minimizes vibration at the check valve location.

Each of the two 24-inch headers splits into three 12-inch headers, which connect to the reactor vessel. Each of the six FW 12-inch headers has a cantilevered pressure instrument line. Although the highest FW vibration was recorded on these 12-inch headers, the maximum flow induced vibration (FIV) displacement was 1.6 mils (0.4 mils root mean square (RMS)) and the maximum vibration level was 0.108 g-RMS. These values reflect the limiting CLTP FIV case, recirculation pumps at maximum speed. Due to the low CLTP levels, adequate margin is available for EPU.

Reactor Building (Steam Tunnel)

As reported in Attachment 8 of the EPU submittal, the measured CLTP FIV levels on the 24-inch FW main headers in the steam tunnel are approximately 0.01 g-RMS, even lower than the FW values inside the containment.

The outboard FW check valves and their downstream FW valve leakage test connections are in close proximity to the containment penetration, an anchor which minimizes vibration at the check valve location.

The low vibration levels is judged not to pose any thereat to intermediate sized connections such as the 4-inch RWCU and 6-inch RCIC connections to the FW main headers.

Turbine Building:

As noted in Section 4.5 of Attachment 8, the reactor feed pumps (RFPs) at EPU will be operating closer to their optimal design point. Since the RFPs are not expected to be a source of increased vibration levels and since the FW vibration levels (measured in the steam tunnel) are low, it was judged that the small bore connections in the turbine building by the 6th point feedwater heater and RFPs the were not at risk.

b) MSL Small Bore

Inside Containment:

There are four 26-inch main steam line (MSL) headers inside containment. The small bore connections are discussed below.

Inboard MSL/Main Steam Isolation Valve (MSIV) Drains: Piping is in close proximity to containment penetration, an anchor, that minimizes vibration on the lines.

Main Steam Flow Elements: Piping is designed for seismic events which would require the design to dampen any motion. The small bore connection to the large bore is a buttweld, which is more vibration resistant than a socket weld that is typically used for a small bore connection.

MSIV –Seal Leakoff: Piping was cut and capped in RF13. In addition, piping is in close proximity to the containment wall anchor.

MSLs Outside Containment thru to the Main Steam Stop Valves:

The MSLs are designed to seismic I criteria up to the Main Steam Stop Valves (MSSV).

MSIV –Seal Leakoff: A significant amount of piping was cut and capped earlier. The piping is near the containment penetration, an anchor which minimizes vibration.

Main Steam Drain Pot Small-Bore Drains: One of the two small bore connections off of the 10-inch main steam drain pot was cut and capped. The second remains in service. The drain pot is near the containment penetration, an anchor which minimizes vibration.

Vent and Drain Piping Near Main Steam Stop Valves (MSSV): A double valve vent appears on each main steam line upstream of the MSSVs. This is a cantilevered mass. Downstream of each of the MSSVs is a 2-inch pipe that vents to the condenser through a 3-inch header pipe. This piping is analyzed for seismic loadings.

MSL connections downstream of the MSSVs are addressed in c) below.

c) The MS small bore connections downstream of the MSSVs, including the EHC connections, are addressed in the response to RAI 14.37.

14.52. Steam flow and feedwater flow will increase as a result of the CPPU implementation. Flow velocities affect pipe wall thinning due to flow accelerated corrosion (FAC). In the PUSAR Section 10.7 page 10-35 states that "Based on experience at CLTP operating conditions and previous FAC modeling results, it is anticipated that the CPPU operating conditions may result in the need for additional FAC monitoring points. The CHECWORKSTM FAC modeling techniques allow for the identification of additional monitoring points required for CPPU." Identify additional FAC inspection points that will result due to higher CPPU operating conditions.

Response

In December 2002, PSEG FAC Program performed a study using the CHECWORKS model software to evaluate the effect that a 20% OLTP uprate would have on the wear rates of the piping systems, and determine if the uprate would lead to significant pipe replacements. Increases in wear rates were found in portions of the condensate, feedwater, heater drain, and seal steam systems. The study revealed that the power uprate operating conditions would have a minimal impact on FAC wear rates. The average predicted wear rate would not cause an increased need for physical modifications or replacements. Based on the 2002 study results, seven additional inspections have been added to the RF14 inspection scope to serve as a baseline to monitor the effects of post-CPPU wear rates. Components have been selected on the 'A' and 'B' feedwater trains downstream of the high pressure feedwater heaters, the seal steam system, the drain line from the #5C to #4C feedwater heater, and the drain line from the #4C to the #3C feedwater heater.

CHECWORKS is normally updated for best estimate operating conditions after the start of an operating cycle. This was done after RF13 (April 2006) for the RF14 (October 2007) inspection scope. Since operating conditions will change due to the CPPU after RF14, the CHECWORKS model is in the process of being updated with the new operating conditions. This process is being done prior to the outage to provide confirmation of the 2002 study that showed a minimal impact on FAC wear rates. Any additional monitoring or inspection required by the FAC program will be implemented based on the results of the updated model.

14.53 Question Deleted following Conference Call (previously addressed)

14.54 Discuss in detail how the verification and validation of the ACM computer code was performed to satisfy the provisions of ASME NQA-1, "Quality Assurance Requirements for Nuclear Facility Applications," Subpart 2.7, "Quality Assurance Requirements for Computer Software for Nuclear Facility Applications," which has been accepted by the NRC in satisfying the requirements in 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel

Reprocessing Plants." Your discussion should include how the bench-marking of the ACM computer code was accomplished.

Response
ACM model development followed the procedures for analysis and calculation generation, and computer code generation, as found in the CDI Nuclear Quality Assurance Manual (Rev. 14). This manual requires compliance to applicable sections of ANSI N45.2, ANSI/ASME NQA-1, and reporting requirements of 10CFR Part 21. Model validation is detailed in CDI Report No. 05-28P.

Model benchmarking is detailed in the attached document entitled "Bounding Methodology to Predict Full Scale Steam Dryer Loads from In-Plant Measurements."

BOUNDING METHODOLOGY TO PREDICT FULL SCALE STEAM DRYER LOADS FROM IN-PLANT MEASUREMENTS

A Summary of Quad Cities Unit 2 Data Reduction and Model Validation

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14.55 Provide the validation documentation of 1/8th SMT, as well as the uncertainty and bias error associated with the use of SMT. The validation should include the benchmarking of the scale model by using the Quad cities 2 in-plant test data. This validation should consider the low and the high frequency loading separately (e.g. comparison of the total RMS amplitude without considering the frequency content is not recommended).

Response

The CDI 1/8th SMT for HCGS was benchmarked against the HCGS in-plant data at the same reactor power, CLTP. This is a better benchmark than a comparison with Quad Cities 2. Refer to the response to RAI 14.11 and CDI Report 07-01P. The data provided includes the PSD comparison between the HC SMT and the HC in-plant data for 0-200 Hz.

PSEG is not relying solely on the SMT. The FEA based on in-plant data at CLTP, 06-24 R3, demonstrates that the steam dryer has significant margin to accommodate an increase in any of the loads present at CLTP. The key purpose of the SMT was to provide as much information on SRV acoustic resonance that existing technology could provide since SRV acoustic resonance is not present at CLTP but is anticipated above CLTP. PSEG believes that the CDI 1/8th SMT is the best technology presently available for this purpose. PSEG selected this option after the CDI SMT was able to replicate the QC2 in-plant relief valve acoustic resonance, which allowed CDI to design and test a fix on the 1/8th SMT that successfully mitigated the QC2 relief valve acoustic resonance.

Note that when the margin recovery effort was undertaken, the SMT re-benchmarking assumed, conservatively, that SRV acoustic resonance commences immediately above CLTP. Using a SMT is a proactive step that PSEG undertook to reduce the power ascension unknowns. However, this does not substitute for verification during EPU power ascension. PSEG will perform the same key verification steps during the power ascension to ensure the steam dryer integrity as was done by earlier EPU power ascension that was done without the benefit of a SMT.

14.56 The licensee indicated in the public meeting that the Mach number used for the SMT data were re-evaluated and revised in Revision 2 of the CDI 06-27stress report. Discuss how you measure, calculate and validate the Mach number used in scale model testing for both 1/5th and 1/8th scales, including uncertainty. Please submit this report to the NRC for the staff review.

<u>Response</u>
Please refer to the response to RAI 14.13. The rebenchmarking effort is discussed in CDI Report 06-16P Revision 2, in Attachment 6 to this letter.

14.57 Discuss how you monitor loading on the steam dryer due to vibration at the re-circulation pump bypass frequency.

<u>Response</u>
PSEG understands that the question was intended to read "...at the pump vane passing frequency".

HCGS as part of the remedial actions on recirculation system vibration had GE provide an analysis of the effects of the vane passing frequency (VPF) on the reactor internals. GE concluded that the components in the upper zone of the reactor, such as the moisture separators and dryers, are primarily affected by the increased steam flow rather than recirculation pump drive flow.

14.58 Discuss how you monitor the low-frequency pressure loading.

Response
The HCGS MSL strain gages include frequency response in the low range. If there is low frequency content in the MSL, it will be detected. CDI Report 07-01P Figure 3.3 shows the PSD in-plant data for all strain gage locations.

Also, refer to RAI 14.60 on concerns as to the presence of high magnitude, low frequency loads at units, such as HCGS, without dead headed MS branch lines.

14.59 The data presented in the public meeting did not include the bias and uncertainty that are involved in the Strain Gage measurement, ACM analysis and Finite Element analysis. The licensee is requested to provide final stresses and fatigue margins in the steam dryer after all the structural modifications, uncertainties and bias errors are taken into account.

Response
No steam dryer modifications are planned. Refer to the response to 14.33 for the alternating stress ratio values considering the strain gage measurement and ACM uncertainty.

Refer to the response to RAI 14.2 for the uncertainty on the finite element analysis (FEA). The uncertainty in the FEA frequency is addressed by varying the frequency of the load by up to +/- 10% at 2.5% intervals. Other than frequency, the uncertainty in the FEA is small, and when combined by the square root of the sum of the square (SRSS) with the uncertainty in the strain gage and ACM, it is negligible. Note that the FEA assumed 1% Raleigh damping which is considered low. Damping values above 1% would reduce the alternating stresses.

14.60 The licensee indicated in the March 2, 2007, public meeting, that the conservatism factor was derived based on the pressure loads on the dryer resulting from the ACM analyses. The licensee is requested to discuss in detail how these conservative factors were determined. The information should include the effects of frequency content that are significant in the dynamic analysis and structural response. Also describe the accuracy of the ACM analysis for Hope Creek for low frequency pressure loading.

Response

The conservatism in the steam dryer pressure loads, discussed in the March 2, 2007 meeting, is shown in CDI Report 07-01P, submitted to the NRC on March 13, 2007. This report shows the conservatism of the 2006 in-plant data that was used as the input the CLTP FEM. Also, it includes the SMT benchmark against in-plant data at CLTP. Both comparisons include a PSD comparison up to 200 Hz.

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14.61 Based on the Public Meeting with Hope Creek on Friday, March 2, 200[7], the NRC staff requests that the licensee provide the following two documents for review.

a) Report on RPV dome dynamic pressure data recently collected by PSEG (Structural Integrity Report).

Response
SIA report "Hope Creek RPV Dome Dynamic Pressure Data Reduction", Report HC 31Q-301, is attached.

b) Stress report based on new in-plant strain gage data at CLTP with all gages working.

Response
HCGS did not rerun the CLTP Finite Element Analysis (FEA). At the March 2, 2007 meeting, PSEG stated that the CLTP FEA previously submitted (CDI Report 06-24 R3) was conservative since it used the 2006 loads, and CDI report 07-01, transmitted to the NRC on March 13, 2007 showed that there was significant conservatism in the 2006 loads. Since the CLTP FEA already showed significant margin in the alternating stress ratios, it was felt that there was no need to re-run the CLTP FEA.

14.62 In the conference call discussion on March 12, 2007, CDI indicated that the errors in flow rate were due to high friction in the piping in the subscale model. The licensee is requested to provide:

a) Validation of Mach number of SMT for CLTP and EPU condition. The validation should be performed for the 1/8th and 1/5th subscale models.
Response
Refer to RAI 14.13.

b) [[
]].

Response
[[
]]

c) Revision or additional information to clearly indicate all the changes required in the earlier submittal (i.e., Attachment 7 to the September 18, 2006, EPU amendment request, Attachment 1 to the October 10, 2006 supplement, CDI reports 06-16, 06-17, and 06-26) which result from the new measurement and Mach number revision.

Response
Attachment 7 has been updated and is attached.

Attachment 1 to the October 10, 2006 supplement was an estimate of the EPU alternating stress ratios if the excess load conservatism was removed. It was done with the information then available. Subsequent to transmitting it, PSEG undertook a margin recovery effort, which is documented in CDI Report 06-27 R2 transmitted to the NRC on February 28, 2007. This was a more rigorous analytical effort to remove excess conservatism. It included re-benchmarking the SMT and rerunning the interim EPU FEA to recalculate the stress ratios. Thus, CDI Report 06-27 R2 is considered a replacement for Attachment 1.

CDI Reports 06-16P and 06-17 have been updated to revision 2 and 3, respectively and are attached.

Technical Note 06-26 was submitted to the NRC in support of the algorithm developed to bound in-plant loads using data from only 2 MSLs. Subsequently, in early February 2007, in-plant data was taken after all strain gage channels were restored to service. CDI Report 07-01P, submitted to the NRC on March 13, 2007 demonstrates that the 2006 data was conservative. Thus, there is no longer a need to demonstrate that the algorithm was conservative.

14.63 With regard to the 80 Hz the licensee indicated that RPV level sensor measurements show no strong acoustic mode existing at or near 80 Hz. It is requested to submit a report that documents these measurement data to the NRC for review as it uses these data to justify filtering 80 Hz peaks from their ACM model of the Hope Creek plant.

Response
SIA report "Hope Creek RPV Dome Dynamic Pressure Data Reduction", Report HC-31Q-301, is attached.

14.64 In a March 12 conference call, the licensee indicated that the new measurements show that the dryer load estimated from the first (May 2006) measurements at CLTP is conservative, in comparison to that determined from the new measurements. The licensee is requested to provide the frequency spectra of the new vs. old loads at CLTP conditions.

Response
CDI Report 07-01P Figures 4.1 provides the dP comparisons across all low resolution nodes. Figure 4.3 provides the PSD comparison at the peak locations (outer hood) for 0 – 200 Hz. PSEG submitted CDI Report 07-01P to the NRC on March 13, 2007.

7) Balance-of-Plant Branch (SBPB) (additional questions)

7.9 PUSAR Section 10.1.2 states that the mass and energy releases for high energy line breaks (HELB) in the feed water (FW) system were evaluated for CPPU and that the energy release from the FW line break at CPPU conditions is bounded by the energy release from a main steam line break at current licensed conditions. However, the PUSAR does not address the increased mass release from an HELB in the feed water system and its effect upon internal flooding. The Updated Final Safety Analysis Report (UFSAR) does address the mass release and its effect upon internal flooding for CLTP in Section 3.6.2.1.1.1.

a) Explain the effects of increased feed water flow from a feed water break at CPPU upon internal flooding including the effects stated in Section 3.6.2.1.1.1 of the UFSAR.

Response

The FW line break addressed in UFSAR Section 3.6.2.1.1.1 is postulated to occur in the reactor building main steam tunnel. The tunnel is designed for the effects of steam pressure and flooding from a double-ended break of the largest branch line of the feed water system. The existing FW line break flood analysis has been reviewed to determine the impact due to CPPU conditions. The flooding analysis is based on a mass release that results in a complete flooding of this tunnel. The mass release required to completely flood the tunnel does not change as a result of CPPU; consequently the UFSAR statement of Section 3.6.2.1.1.1 does not change for CPPU.

7.10 Section 6.4.1.1.1 of the PUSAR states in reference to the Station Service Water System (SSWS), that the CPPU effect is bounded by the loss of coolant accident (LOCA) analysis. Section 6.4.1.1.2 considers only a Safety Auxiliary Cooling System (SACS) LOCA heat load calculation when determining the adequacy of SACS for CPPU. Table 9.2-4 of the UFSAR for current licensed thermal power (CLTP) shows loss of offsite power (LOOP) as a greater heat load on SACS than LOCA in 3 of the 4 scenarios listed. The one scenario where Table 9.2-4 shows LOCA as a greater heat load than LOOP is for the one loop long term scenario (greater that 30 minutes for LOOP and greater than 10 minutes for LOCA). Considering this information, please explain the following:

a) Explain in greater detail why the SACS is sufficient for recovery from a LOCA and from a LOOP for CPPU. To [facilitate] the staff's review, provide an updated Table 9.2-4 for CPPU.

Response
CPPU results in increased RHR heat loads during LOCA and LOOP design basis accident conditions due to increased suppression pool temperatures resulting from higher decay heat loads. For the design basis Case C LOCA at 102% of CPPU at 3840 MWt, the peak calculated post-LOCA suppression pool temperature is 212.3°F. For the design basis LOOP event, the peak suppression pool calculated temperature is 213.6°F.

It is assumed for the DBA LOCA (UFSAR Case C) that no offsite power is available coincident with a single failure of "A" EDG, resulting in a single RHR pump and heat exchanger available for suppression pool cooling. The same assumption is used in the LOOP scenario. In the LOCA, RHR is placed in service after 10 minutes. In the LOOP, RHR is placed in service after 15 minutes based on suppression pool temperature increasing above 120°F following manual SRV blowdown. The LOOP also assumes 100°F/hour cool-down rate, which exceeds the Hope Creek administrative cool-down limit of 90°F/hour.

The maximum calculated heat load removed at peak suppression pool temperature by a single RHR heat exchanger in the suppression pool cooling mode supplied with 100°F SACS cooling, K= 307 Btu/sec-°F, are calculated for the LOCA (212.3°F) and LOOP (213.6°F), as shown below:

$$\begin{aligned} \text{LOCA } Q_{RHR} &= 3600\ \alpha_{\mathbf{RHR}}\ (T_{RHR} - T_{sacs}) \\ &= 3600 \text{ sec/hr } (307 \text{ Btu/sec-°F}) (212.3\text{°F} - 100\text{°F}) \\ &= 124.1 \text{ MBtu/hr} \end{aligned}$$

$$\begin{aligned} \text{LOOP } Q_{RHR} &= 3600\ \alpha_{\mathbf{RHR}}\ (T_{RHR} - T_{sacs}) \\ &= 3600 \text{ sec/hr } (307 \text{ Btu/sec-°F}) (213.6\text{°F} - 100\text{°F}) \\ &= 125.6 \text{ MBtu/hr} \end{aligned}$$

The evaluation of SACS heat loads conservatively uses a bounding value for both LOOP and LOCAs and is based on an assumed bounding suppression pool temperature of 215°F, as shown below:

$$\begin{aligned} Q_{RHR} &= 3600\ \alpha_{\mathbf{RHR}}\ (T_{RHR} - T_{sacs}) \\ &= 3600 \text{ sec/hr } (307 \text{ Btu/sec-°F}) (215\text{°F} - 100\text{°F}) \\ &= 127.1 \text{ MBtu/hr} \end{aligned}$$

The127.1 Mbtu/hr is a conservative upper bound heat rejection rate for the RHR heat exchanger for both LOCA and LOOP conditions. The Hope Creek UHS analyses (calculation EG-0047) models the RHR heat load based on actual heat exchanger performance and does not assume a fixed heat load. Consequently, by observing the UHS technical specification temperature limits, the SACS HX outlet temperature will remain below its maximum post-accident value of 100°F.

A marked-up version of Table 9.2-4 is provided below.

TABLE 9.2-4

STACS FLOWRATES AND HEAT LOADS FOR VARIOUS MODES OF OPERATION

	Normal Operation				Normal Shutdown	
	~~One Loop~~		~~Two Loops (one testing)~~		~~Two Loops~~	
	gpm	$x10^6$ Btu/h	~~gpm~~	~~$x10^6$ Btu/h~~	gpm	$x10^6$ Btu/h
Motor-generator set coolers	1,800 (2)	~~11.2~~ 11.27	1,800 (2)	11.2	1,800 (2)	~~11.2~~ 11.27
Main turbine lube oil coolers	1,725 (1)	9.36	1,725 (1)	9.36	1,725 (1)	~~9.36~~ 0
EHC hydro fluid cooler	10 (1)	0.04	10 (1)	0.04	10 (1)	~~0.04~~ 0
General H_2 coolers	2,088 (4)	~~22.0~~ 21.95	2,088 (4)	22.0	2,088 (4)	~~22.0~~ 0
Generator stator coolers	1,866 ~~1,750~~ (2)	~~16.1~~ 17.16	1,750 (2)	16.1	1,866 ~~1,750~~ (2)	~~16.1~~ 0
Isophase bus coolers	100 ~~52~~ (1)	~~0.52~~ 0.68	52 (1)	0.5	100 ~~52~~ (1)	~~0.52~~ 0
Alterrex cooler	160 (1)	0.39	160 (1)	0.39	160 (1)	~~0.39~~ 0
RFPT lube oil coolers	489 (3)	1.2	489 (3)	1.2	489 (3)	1.2
Secondary cond pump coolers	30 (3)	0.13	30 (3)	0.13	30 (3)	0.13
Turbine bldg chillers	10,500 (3)	~~58.5~~ 58.59	10,500 (3)	58.5	10,500 (3)	~~58.5~~ 58.59
Process sampling	29 (1)	0.5	29 (1)	0.5	29 (1)	0.5
Station air compressor	270 (1)	2.24	270 (1)	2.24	270 (1)	2.24
Mezz pipe chase cooler	153 (1)	0.5	153 (1)	0.5	153 (1)	0.5
Condenser compartment coolers	671 ~~612~~ (4)	~~2.0~~ 2.205	612 (4)	2.0	671 ~~612~~ (4)	~~2.0~~ 2.205
STACS Demineralizers	55 (1)	-	55 (1)	-	55 (1)	-
Htg sys cond. coolers (11) (Turbine Bldg.)	140	1.7	140	1.7	140	1.7
TACS total	~~19,723~~ 19,946	~~124.68~~ 126.22	19,723	124.68	~~19,723~~ 19,946	~~124.68~~ 76.54

TABLE 9.2-4 (cont)

STACS FLOWRATES AND HEAT LOADS FOR VARIOUS MODES OF OPERATION

	~~LOP < 30 Minutes~~				LOP ≥ 30 Minutes			
	~~One Loop~~		~~Two Loops~~		One Loop		Two Loops	
	~~gpm~~	~~$x10^6$ Btu/h~~	~~gpm~~	~~$x10^6$ Btu/h~~	gpm	$x10^6$ Btu/h	gpm	$x10^6$ Btu/h
Motor-generator set coolers								
Main turbine lube oil coolers								
EHC hydro fluid cooler								
General H2 coolers								
Generator stator coolers								
Isophase bus coolers								
Alterrex cooler								
RFPT lube oil coolers	~~NOT~~		~~NOT~~		NOT		NOT	
Secondary cond pump coolers	~~OPERATING~~		~~OPERATING~~		OPERATING		OPERATING	
Turbine building chillers								
Process sampling								
Station air compressor								
Mezz pipe chase cooler								
Condenser compartment coolers								
STACS Demineralizers								
Htg sys cond. coolers (11)								
TACS total								

TABLE 9.2-4 (cont)

	LOCA < 10 Minutes				LOCA ≥ 10 Minutes			
	~~One Loop~~		~~Two Loops~~		One Loop		Two Loops	
	gpm	$x10^6$ Btu/h	~~gpm~~	~~$x10^6$ Btu/h~~	gpm	$x10^6$ Btu/h	gpm	$x10^6$ Btu/h
Motor-generator set coolers								
Main turbine lube oil coolers								
EHC hydro fluid cooler								
General H2 coolers								
Generator stator coolers								
Isophase bus coolers								
Alterrex cooler								
RFPT lube oil coolers	NOT		NOT		NOT		NOT	
Secondary cond pump coolers	OPERATING		OPERATING		OPERATING		OPERATING	
Turbine building chillers								
Process sampling								
Station air compressor								
Mezz pipe chase cooler								
Condenser compartment coolers								
STACS Demineralizers								
Htg sys cond. coolers[(11)]								
TACS total								

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TABLE 9-2-4 (cont)
STACS FLOW RATES AND HEAT LOADS FOR VARIOUS MODES OF OPERATION

	Normal Operating				Normal Shutdown	
	~~One Loop~~		~~Two Loops (one testing)~~		~~Two Loops~~	
	gpm	$x10^6$ Btu/h	~~gpm~~	~~$x10^6$ Btu/h~~	gpm	$x10^6$ Btu/h
SACs Demineralizers	26 (1)	0			26 (1)	0
1E equipment chillers (Note 20)	408 (1)	2.52	816 (2)	2.52 (8)	408 (1) ~~816 (2)~~	~~2.52 (8)~~ 2.52
RHR heat exchangers	-	-	8,650 (1)(7)	-	7,000 (1) ~~11,300 (2)~~	~~234.7~~ 260
RHR pump seal coolers	-	-	10 (2)(7)(15)	0.18 (7)	23 (1/1)(15) ~~46 (4)(15)~~	~~0.44~~ 0.22
RHR motor bearing coolers	-	-	12 (1)(7)	0.02 (7)	12 (2) ~~24 (4)~~	~~0.04~~ 0.02
Fuel pool HXs (Note 20)	2,000 (2)	~~16.1~~ 17.6	2,000 (2)	16.1	2,000 (2)	~~16.1 (12)~~ 17.6 (12)
Diesel generator coolers	-	-	1,600 (2)(7)	19.75 (7)	-	-
DG room coolers	-	-	760 (2)(7)	3.8 (7)	-	-
FRVS cooling coils	-	-	1,140 (3)(7)	-	-	-
RHR pump room coolers	-	-	78 (1)(7)	0.38 (7)	78 (1) ~~156 (2)~~	~~0.76~~ 0.40
RHR pump and HX room coolers	-	-	89 (1)(7)	0.38 (7)	89 (1) ~~178 (2)~~	~~0.76~~ 0.42
RCIC pump room coolers	-	-	13 (1)(7)	0.06 (7)	-	-
Core spray pump room cooler	-	-	136 (2)(7)	0.44 (7)	-	-
Control room chillers(Note 20)	1,588 (1)	7.53	3,176 (2)	7.53 (8)	1,588 (1)	7.53
Containment gas comp. (Note 20)	4 (1)	0.05	8 (2)(7)	0.05 (8)	4 (1)	0.05
HPCI pump room cooler	-	-	35 (1)(7)	0.18 (7)	-	-
Post LOCA sampling station	-	-	10 (1)(7)	0.11 (7)	-	-
SACS total	4,026 ~~4,000~~	~~26.20~~ 27.70	18,533	51.50	11,228 ~~23,700~~	~~263.34~~ 289.0
Grand total (STACS)	~~23,723 (2)~~ 23,972	~~150.88 (2)~~ 153.92	38,256 (4)	176.18 (4)	~~43,423 (4)~~ 31,174	~~388.02 (4)~~ 365.54

TABLE 9-2-4

	~~LOP < 30 Minutes~~ ~~One Loop~~		~~Two Loops~~		LOP $\geq$ 30 Minutes One Loop		Two Loops	
	gpm	$x10^6$ Btu/h	gpm	$x10^6$ Btu/h	gpm	$x10^6$ Btu/h	gpm	$x10^6$ Btu/h
SACs Demineralizers	26 (1)	0			26 (1)	0	52 (2)	0
1E equipment chillers	408 (1)	2.52	816 (2)	2.52 (8)	408 (1)	2.52	408 (1) ~~816~~ ~~(2)~~	~~2.52~~ ~~(8)~~ 2.52
RHR heat exchangers	8,650 (1)	26.00	17,300 (2)	52.00	8,650 (1)(17)	~~123.80~~ (17) 127.1	18,000 ~~17,300~~ (2)	~~234.70~~ 209.2
RHR pump seal coolers	20 (4)(15)	0.36	20 (4)(15)	0.36	20 ~~33~~ (4)(15)	~~0.62~~ 0.36	20 ~~46~~ (4)(15)	~~0.88~~ 0.36
RHR motor bearing coolers	24 (4)	0.04	24 (4)	0.04	24 (4)	0.04	24 (4)	0.04
Fuel pool heat exchangers	1,000 (1)	-	2,000 (2)	-	2000 (2) ~~1,000~~ ~~(1)~~	~~8.05~~ (12) 17.6	2,000 (2)	~~16.10~~ (12) 17.6
Diesel generator coolers	3,200 (4)(14)	39.50	3,200 (4)(14)	39.50	3,200 (4)(14)	39.50	3,200 (4)(14)	39.50
DG room coolers	1,520 (4)(16)	7.60	1,520 (4)(16)	7.60	1040 ~~1,520~~ (4)(16)	7.60	1040 ~~1,520~~ (4)(16)	7.60
FRVS cooling coils	-	-	-	-	-	-	-	-
RHR pump room coolers	156 (2)	0.76	156 (2)	0.76	156 (2)	~~0.76~~ 0.80	156 (2)	~~0.76~~ 0.80
RHR pump and hx room coolers	178 (2)	0.76	178 (2)	0.76	178 (2)	~~0.76~~ 0.84	178 (2)	~~0.76~~ 0.84
RCIC pump room cooler	13 (1)	0.06	13 (1)	0.06	13 (1)	~~0.06~~ 0.09	13 (1)	~~0.06~~ 0.09
Core spray pump room cooler	-	-	-	-	-	-	-	-
Control room chillers	1,588 (1)	7.53	3,176 (2)	7.53 (8)	1,588 (1)	7.53	1588 (1) ~~3,176~~ ~~(2)~~	7.53 ~~(8)~~
Containment gas compressor	4 (1)	-	4 (1)	-	4 (1)	0.05	4 (1)	0.05
HPCI pump room cooler	35 (1)	0.18	35 (1)	0.18	35 (1)	~~0.18~~ 0.23	35 (1)	~~0.18~~ 0.23
Post LOCA sampling station		-	-	-	-	-	-	-
SACS total	16,796	85.31	28,442	111.31	17,342 ~~16,809~~	~~191.47~~ 204.3	26,718 ~~28,468~~	~~310.68~~ 286.39
Grand total (STACS)	16,796 (2)	85.31	28,442 (4)	111.31 (4)	~~16,809~~ ~~(2)~~ 17,342	~~191.47~~ ~~(2)~~ 204.3	~~28,468~~ ~~(4)~~ 26,718	~~310.68~~ ~~(4)~~ 286.39

TABLE 9.2-4 (cont)

	LOCA < 10 Minutes (19)				LOCA ≥ 10 Minutes			
	~~One Loop~~		Two Loops		One Loop		Two Loops	
	gpm	$x10^6$ Btu/h	gpm	$x10^6$ Btu/h	gpm	$x10^6$ Btu/h	gpm	$x10^6$ Btu/h
SACs Demineralizers	52 (2)	0			52 (2)	0	52 (2)	0
1E equipment chillers	408 (1)	2.52	816 (2)	2.52 (8)	408 (1)	2.52	408 (1) ~~816 (2)~~	2.52 ~~(8)~~
RHR heat exchangers	-	-	-	-	8,650 (1)(17)	~~123.80~~ (17) 127.1	18,000 ~~17,300~~ (2)	209.20
RHR pump seal coolers	20 (4)(15)	0.36	20 (4)(15)	0.36	20 (4)(15)	0.36	20 (4)(15)	0.36
RHR motor bearing coolers	24 (4)	0.04	24 (4)	0.04	24 (4)	0.04	24 (4)	0.04
Fuel pool heat exchangers	2000 (2) ~~1,000 (1)~~	~~8.05~~ 17.6	2,000 (2)	16.10	2000 (2) ~~1,000 (1)~~	~~8.05~~ (12) 17.6	2,000 (2)	~~16.10~~ (12) 17.6
Diesel generator coolers	3,200 (4)(14)	39.50	3,200 (4)(14)	39.50	3,200 (4)(14)	39.50	3,200 (4)(14)	39.50
DG room coolers	1,520 (4)(16)	7.60	1,520 (4)(16)	7.60	1,520 (4)(16)	7.60	1,520 (4)(16)	7.60
FRVS cooling coils	1,400 (4)(18)	4.40	2,280 (6)	4.40 (10)	1,140 (3)(18)	4.39	1140 (3) ~~2,280 (6)~~	4.39 ~~(10)~~ (18)
RHR pump room coolers	156 (2)	~~0.76~~ 0.80	156 (2)	0.76	156 (2)	~~0.76~~ 0.80	156 (2)	~~0.76~~ 0.80
RHR pump and hx room coolers	178 (2)	~~0.76~~ 0.84	178 (2)	0.76	178 (2)	~~0.76~~ 0.84	178 (2)	0.76 0.84
RCIC pump room coolers	13 (1)	~~0.06~~ 0.09	13 (1)	0.06	13 (1)	~~0.06~~ 0.09	13 (1)	0.06 0.09
Core spray pump room cooler	72 (4) ~~136 (2)~~	~~0.44~~ 1.08	272 (4)	0.88	136 (2)	~~0.44~~ 0.54	272 (4)	~~0.88~~ 1.08
Control room chillers	1,588 (1)	~~7.52~~ 7.53	3,176 (2)	7.52 (8)	1,588 (1)	~~7.52~~ 7.53	1588 (1) ~~3,176 (2)~~	~~7.52 (8)~~ 7.53
Containment gas compressor	~~4.0 (1)~~	~~0.05~~	4 (1)	0.05	4.0 (1)	0.05	4 (1)	0.05
HPCI pump room cooler	35 (1)	~~0.18~~ 0.23	35 (1)	0.18	35 (1)	~~0.18~~ 0.23	35 (1)	~~0.18~~ 0.23
Post LOCA sampling station	-	-	-	-	10 (1)	0.11	10 (1)	0.11
SACS total	10,866 ~~9,682~~	~~72.24~~ 82.62	13,694	80.73	19,134 ~~18,082~~	~~196.14~~ 209.33	28,620 ~~31,004~~	~~290.03~~ 291.97
Grand total (STACS)	~~9,682 (2)~~ 10,866	~~72.24 (2)~~ 82.62	13,694 (4)	80.73 (4)	~~18,082 (2)~~ 19,134	~~196.14 (2)~~ 209.33	31,004 (4) 28,620	290.03 (4) 291.97

NOTES:

(1) through (6) Number of units in operation, 1 through 6 units, respectively.

~~(7) Intermittent load for testing.~~

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TABLE 9.2-4 (cont)

NOTES: (cont)

~~(8) Flow is to two units; heat load is for one unit.~~

(9) Operator action is required to restart SFPCCS.

~~(10) Flow is to three units in each loop; heat duty is for two units per loop~~.

(11) Operation of this system occurs only during the heating season and corresponds with reduced load on the Turbine Bldg Chillers. Full flow and heat load will not occur coincident with full flow and load on the chillers. For this reason, this equipment is not included in the TACS System totals.

(12) If SAC HX outlet temp. cannot be maintained less than its max design temp., flow to fuel pool HX will be isolated to reduce total system heat load.

(13) The tables do not include the effects of a loss of instrument air.

(14) The min. flow rate to each EDG cooler is approximately 700 gpm; however, nuisance alarms may sound in the Control Room during periods of high SACS temperatures.

(15) The required SACS flow for the RHR pump seal coolers is 18 gpm if the RHR pump is supporting shutdown cooling. If the RHR's pump's suction is from the suppression pool, the required SACS flow to the RHR pump seal cooler is only 5 gpm.

(16) Value for one room cooler per EDG. For certain single failure conditions, two room coolers per EDG are required at 260 gpm and 1.1 Mbtu/hr per cooler (220 gpm and 1.1 Mbtu/hr per cooler for SACS loop outage and 2 EDGs crosstied, see Section 9.4.6.2.7). Both room coolers are available for these particular single failure scenarios.

(17) RHRHX flow and heat load assumes suppression pool cooling only (limiting condition).

(18) Post LOCA, either three or four FRVS coils operating is acceptable. If four FRVS coils are assumed operating, for the short term LOCA (<10 minutes) the minimum required flow is 1400 gpm based on three at full capacity 380 gpm and one degraded at 260 gpm. With a minimum of three operating in the long term, the required flow is 1140 (380 gpm each). Also, four FRVS coils at an average flow of 340 gpm to eare also acceptable in either the long or short term.

(19) Post LOCA short-term (< 10 minutes), RHR heat load can be transferred to SACS during automatic LPCI injection.

(20) During elevated river water temperatures, assuming two SACS loop operation, these loads may be placed on the SACS loop not supplying the TACS loads.

(21) **Component flow and heat load information in the above table is bounding for any power level up to a rated thermal power (RTP) of 3840 MWt for all components except the Generator Stator and Hydrogen coolers which are evaluated at 3673 MWt.**

b) Why is the heat load on the residual heat removal (RHR) heat exchangers for long term recovery from a LOOP the same as for recovery from a LOCA for the One Loop case in Table 9.2-4?

Response
RHR heat loads change due to CPPU during design basis accident conditions (LOCA and LOOP) due to increased predicted suppression pool temperatures and improved modeling. CPPU containment response analyses show post-LOCA pool temperature increases to 212.3°F and post-LOOP to 213.6°F based on operation at a RTP of 102% of 3840 MWt. The RHR heat load during a LOCA increases from 121.7 to 124.1 MBtu/hr, and decreases during a LOOP from 132.5 to 125.6 MBtu/hr. The decrease during the LOOP is due to removal of excess conservatism in the original design calculations that did not credit containment heat sinks and a revised decay heat model based on ANS 5.1 methodology.

The heat load used to evaluate CPPU is conservatively set at 127.1 MBtu/hr for both DBA cases as described above in the response to 7.10.a, above[1].

c) Why are both SACS loops required for LOCA recovery as stated in the third to last paragraph in Section 9.2.2.2 of the UFSAR and does this affect the explanation requested above.

Response
The statement in question (3rd to last paragraph of 9.2.2.2) is accurate and remains valid for CPPU. In the short term (injection phase), cooling water from SACS is required for LPCI pump cooling and for Filter, Recirculation, and Ventilation System (FRVS) cooling. With two independently powered SACS pumps in each separate SACS header, no single active failure will defeat adequate cooling to these components. A passive failure is not postulated in the short term. In the long term, as stated in the next paragraph of 9.2.2.2, the SACS system provides its essential functions with a single active or passive failure.

d) Why is the LOCA the bounding analysis for the SACS heat load when Section 5.4.7.2.2 of the UFSAR states that in effect the shutdown cooling mode is the largest duty for the RHR heat exchangers?

Response
Shutdown cooling mode provides the largest duty for the RHR heat exchangers since the approach temperature is approximately 110°F higher than the approach temperature for suppression pool cooling. However, this is not considered the

1 In 1999 when the maximum post-accident SACS temperature was increased from 95°F to 100°F, a conservative CLTP value of 123.8 MBtu/hr was applied to both LOCA and LOOP events, based on the bounding assumption of peak suppression pool temperature at 212°F. This bounding CLTP value currently appears in Table 9.2-4 but will be replaced upon CPPU implementation with the new bounding value of 127.1 MBtu/hr.

bounding load for SACS analyses because (1) shutdown cooling is not used post-accident and (2) the plant cool-down rate is manually controlled by plant operators.

During a plant cool-down with peak UHS temperature, cool-down rates below 90°F/hour may be required (during the early part of the cool-down) to prevent exceeding the SACS maximum outlet temperature of 95°F. Hope Creek calculation BC-0052 (Plant Cool-Down using One RHR Heat Exchanger) evaluates this scenario. By observing the 95°F SACS outlet temperature limit for normal operation, BC-0052 shows that RCS temperature can be reduced below 200°F under CPPU conditions in 13.5 hours using only one RHR heat exchanger, thereby satisfying the 24-hour requirement. Prior to CPPU, the BC-0052 calculation result was 9.0 hours. Since a large margin remains to the 24 hour limit (10.5 hours of margin), the peak UHS temperature could be increased without exceeding shutdown cooling requirements.

Following a LOCA, cool-down rates are not operator controlled. Reactor decay heat is released to the containment which is subsequently removed by RHR heat exchangers in the suppression pool cooling mode. In this case, the Technical Specification limits on UHS temperature are selected to prevent exceeding the 100°F maximum post-accident SACS outlet temperature. The Technical Specification UHS limits incorporate accident assumptions that include failures that can result in only one available RHR heat exchanger. The UHS temperature limits govern shutdown cooling operation as well.

e) Does Technical Specification Limiting Condition for Operation (LCO) 3.7.1.3 for the ultimate heat sink require revision for CPPU. Explain.

<u>Response</u>
TS 3.7.1.3 was revised in 2006. This amendment request was based on Hope Creek UHS calculations that accommodate the additional heat from CPPU. The primary calculation EG-0047, Revision 4 (UHS Temperature Limitations) was submitted to the NRC as part of LCR H05-012 (Amendment 168). No further changes to this calculation are required for CPPU. TS 3.7.1.3 does not require revision for CPPU.

8) SG Tube Integrity & Chem. Eng Br (CSGB) (additional questions)

Protective Coating Systems (Paints) - Organic Materials

8.7 Based on the UFSAR, it is the NRC staff's understanding that, (1) Service Level I coatings were not procured and applied according to RG 1.54 because it was not yet issued at the time most plant NSSS equipment was ordered, (2) most NSSS equipment is coated with inorganic zinc qualified to ANSI N101.2, (3) the amount of unqualified coatings on NSSS equipment is less than about 26 lb (12 Kg), (4) the drywell and exposed metal in the drywell and torus are coated with phenolic epoxy qualified to ANSI N101.2, (5) the suppression chamber is coated with phenolic epoxy qualified to ANSI N101.2, and (6) the total amount of unqualified coatings for non-NSSS equipment is less than about 242 lb (110 Kg).

a) Please provide a discussion on the qualification requirements for original and repair coatings to confirm or correct the staff's understanding.

Response
The Staff understanding as stated above is correct. While most NSSS coatings are qualified to the standards and requirements of ANSI N101.2, the quality assurance requirements of RG 1.54 were not applied because it was not yet issued. Further confirmation of the Staff understanding can be found in responses to RAIs 8.9, 8.10 and 8.12.

As stated in UFSAR Section 6.1.2.1.1, GE specified that most Nuclear Steam Supply System (NSSS) equipment be coated with a prime coat of inorganic zinc. This coating was qualified under ANSI N101.2 for equipment exposed to DBA conditions inside the containment. New Service Level 1 coatings and repairs to existing Service Level 1 coatings are performed in accordance with PSEG standard NC.DE-TS.ZZ-6006(Q) based on ASTM D5144-00,"Standard Guide for Use of Protective Coating Standards in Nuclear Power Plants". The requirements of this standard are further described in the response to RAI 8.12.

8.8 In the PUSAR Section 4.2.6 provides an estimate for qualified containment coating debris of 85 lb (39 Kg) from "paint chips." The staff infers that this quantity corresponds to the highest value from NEDO-32686, Rev. 1 for combinations of inorganic zinc and epoxy (the predominant coating systems in the Hope Creek containment). Please confirm the staff's understanding or describe the methodology used for determining this value.

Response
Debris quantities in the suppression pool are based NEDO-32686 "Utility Resolution Guidance (URG) for ECCS Suction Strainer Blockage" guidance and tabulated in design specification H-1-VAR-MDS-0357(Q).

The staff's understanding as stated above is correct. In NEDO-32686, Volume III, on performance of containment coatings during a LOCA, three estimates of representative coating systems are provided. The estimates range from 47 lbs. to 85 lbs. In its strainer performance evaluation, Hope Creek has applied the largest (85 lb.) value.

8.9 Section 4.2.6 provides an estimate for unqualified containment coating debris of 270 lb (122 Kg) following a design-basis LOCA. Because this value is equivalent to the sum of the amounts stated in Section 6.1.2 of the UFSAR for unqualified coatings on NSSS and non-NSSS equipment, the staff infers that the analysis assumes all unqualified coatings in primary containment will become debris following a LOCA. Please confirm the staff's understanding, or discuss the methodology for determining the amount of debris from unqualified coatings.

Response
The staff understanding that all unqualified coatings become debris following a LOCA is correct. As stated in sections 6.1.2.1.1 and 6.1.2.2 of the UFSAR, the total amount of unqualified paint in the containment for the NSSS is estimated to be less than 12 kilograms. The total quantity of unqualified coatings in the containment for non-NSSS supplied components is estimated to be less than 110 kilograms. The total amount of unqualified coatings in containment is the sum of 12 + 110 = 122 kg (270 lb).

8.10 Please discuss the conditions (temperature, pressure, radiological dose) used to qualify Service Level I protective coatings in containment for current operating conditions and whether they remain bounding for DBA conditions following the extended power uprate. If the original qualification conditions were not bounding for any coatings, please discuss your plans to qualify those coatings.

Response
Per ANSI Standards N101.2, "Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities" Service Level 1 applies to coatings inside primary containment where coating failure may form solid debris products under DB LOCA conditions. As stated in the UFSAR section 6.1.2.1, original GE specifications for most Nuclear Steam Supply System (NSSS) equipment required that they be coated with a prime coat of inorganic zinc. The suppression chamber is coated with a phenolic epoxy (immersion) compound. The drywell and exposed structural metal inside the drywell are coated with modified phenolic epoxy. Generally, exposed metal surfaces of equipment located inside the drywell and torus are coated with a modified phenolic epoxy. All of these coatings have been qualified in accordance with ANSI N101.2.

As stated in ANSI Standards N101.2, "For general qualification, protective coatings shall be tested at conditions that simulate the DBA environment with regards to temperature, pressure, chemical solutions and radiation." As stated in N101.2, paragraph 4.4.2, *Irradiation Test*, DBA integrated radiation doses typically range between 1E8 rad to 2E9 rad. The total integrated dose for testing coatings at Hope Creek was 9.5E8 rad. The bounding integrated radiation level following a DBA LOCA after CPPU implementation increases inside the drywell from 7.24E7 rads (CLTP) to 8.4E7 rads (CPPU).

Coatings at Hope Creek were tested at 340°F and 62 psig. As tabulated in PUSAR Table 4-1, containment pressure increases from 48.6 psig to 50.6 psig and temperature increases from 291°F to 298°F following a DBA LOCA after implementation of CPPU (analyzed at 102% of 3952 MWt). Both of these parameters are below testing limits of 340°F and 62 psig.

As shown above, test conditions used for qualifying level 1 coatings remain bounding for plant conditions after implementation of CPPU.

8.11 Section 4.2.6 of the PUSAR states that CPPU conditions do not affect the methods for calculating the amount of debris generated, but it does not discuss the results of the calculations. Section 4.2.6 also states that the existing calculations for zones of influence remain valid because the pipe break locations do not change. These statements do not directly address the effects of the change to CPPU conditions, such as the size of the zone of influence (ZOI) at pipe break locations already postulated, or a comparison of the amount of coatings debris generated under current and CPPU conditions. Please discuss your evaluation of the effects of changing to CPPU conditions on the ZOI, the amount of coatings debris generated, and the operation of emergency cooling systems.

Response

Jet impingement loads have been evaluated for CPPU and determined to be bounded by existing calculations and analyses. Jet impingement thrust forces are determined by the equation F = K (P) (A), where K is the thrust factor, P is operating pressure, and A is the area of the break opening. The K factors used in the original analyses were conservative, bounding values that remain valid for CPPU. Similarly, break areas do not change. Therefore, pressures at break openings were evaluated. In all cases, pressures used in the original analyses were bounding and remained valid for CPPU. Hence, jet forces resulting from high energy pipe breaks are bounding for CPPU conditions.

Based on the methods and guidelines provided by the Utility Resolution Guidance for ECCS Suction Strainer Blockage (URG), dated November 5, 1996, CPPU does not impact the variables used in the determination of calculated debris volumes. As such, ECCS pump head losses due to debris accumulation on ECCS suction strainers located in the suppression pool are not affected by CPPU.

8.12 Please discuss your requirements for inspecting, removing, and replacing degraded containment coatings, and the effects of CPPU conditions on these activities.

Response

New Service Level 1 coatings and repairs to existing Service Level 1 coatings are performed in accordance with PSE&G technical standard NC.DE-TS.ZZ-6006(Q) based on ASTM D5144-00,"Standard Guide for Use of Protective

Coating Standards in Nuclear Power Plants". Additional guidance for application, maintenance and periodic assessment of safety related coatings is provided in procedure ER-AA-330-008. CPPU conditions do not change requirements of either the technical standard or procedure since level 1 coatings have been qualified for conditions that bound CPPU (see response to 8.10).

Technical standard NC.DE-TS.ZZ-6006(Q) establishes requirements for the selection, application (including surface preparation), touchup, repair, inspection, and testing of the Service Level I protective coatings within the primary containment. Allowable coatings for Service Level 1 use inside containment are tabulated in Attachment 2 of the technical standard. Inspection guidance is provided in Section 4.9.1 of ER-AA-330-008. This section relies on NUREG 1801 (Chapter XI), Protective Coating Inspection and Maintenance Programs, for inspection guidance.

8.13 Table 6.1-3 of the Hope Creek UFSAR lists organic materials other than paint in the primary containment, including Kerite and Hypalon electrical insulation. *Please describe the evaluations you performed, and discuss the results of those evaluations, to determine the effects of CPPU conditions on the generation of hydrogen and organic gases from paints and other organic materials in containment (e.g., cable insulation).*

Response

The total conductor insulation and cable jacket material, including Kerite and Hypalon conductor/jacket, was determined to support assumptions made in the post-LOCA control room and offsite dose calculation. The mass of acid forming Hypalon from cables inside of the containment was used as an input to the post-LOCA pH calculation to show that the pH of the suppression pool following a LOCA remains above 7 for 30 days. The Hypalon cable evaluation was performed prior to the EPU Project and is not affected by EPU since there is a negligible change to cable quantities inside containment. The pH calculation and the control room and offsite dose calculation were revised for the EPU (due to greater fission product quantities present at the beginning of the accident).

The requirement to determine hydrogen and oxygen concentrations and to start recombiners currently remains in the Hope Creek Severe Accident Guidelines (SAGs) as a potential beyond design-basis activity. However, the revised 10CFR50.44 (68FR54123 dated 9/16/03) does not define a design basis LOCA hydrogen release and eliminates the requirements for hydrogen control systems to mitigate such releases. Hope Creek License Amendment No. 160, issued on 8/9/05, eliminates the Technical Specification requirements for hydrogen recombiners and hydrogen/oxygen monitors.

Any additional gases that are produced would result in oxygen dilution and slow the approach to hydrogen flammability. The CPPU analysis did not include the generation of gases from paints and other organic materials in containment and this is conservative.

Flow-Accelerated Corrosion (FAC)

8.14 According to the PUSAR, page 10-34, your FAC inspection program is based on guidelines from the EPRI and American Society of Mechanical Engineers. Please describe in more detail your criteria for scoping and prioritizing components in your FAC program, including how your criteria compare to the guidance in EPRI NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program."

Response
The Hope Creek FAC program follows the guidelines described in station procedure ER-AA-430-1001 "Guidelines for Flow Accelerated Corrosion Activities" which emulates NSAC-202L-R2. Section 4.2.1 of the procedure describes inspection selection (scoping). The parts of the selection process are:

1) CHECWORKS Model: The Hope Creek FAC Program selects components based on the results of the model's output (i.e., wear rate and remaining life). Components are selected from both lines that have not been inspected and from lines that have inspected components.

2) Industry Experience: The Hope Creek FAC program selects inspection components based on operating experiences (OEs) from the industry that are applicable to Hope Creek. Periodically, OEs are reviewed for Hope Creek applicability. If the event is applicable, suitable components are selected to address the issue.

3) Station Experience: The Hope Creek FAC program selects inspection components based on station experiences. Periodically, the corrective action program is reviewed to discover if any situations had occurred that would be applicable to the program, i.e., valve leak-bys, steam leaks, abnormal valve usage (e.g., open when should be closed), etc. The thermal performance report is also reviewed periodically to identify any applicable leaking valves whose piping may need to be inspected. Inspection components are also selected based on requests from system engineers or from design changes.

4) Re-Inspections: The Hope Creek FAC program selects inspection components based on the next scheduled inspection (NSI) number. The component's NSI is based on the wear rate and the minimum allowable wall thickness. Components with an NSI that is equal to the next outage are inspected.

5) Susceptible Non-Modeled (SNM): The Hope Creek FAC program selects inspection components based on the susceptibility of the non-modeled piping. A large amount of FAC susceptible piping cannot be modeled because of a lack of operating parameter data. This includes almost all of the small-bore piping. This also includes feedwater heater shells. Lines that are deemed highly susceptible and could have detrimental consequences if failure occurred are slated for inspection.

6) Engineering Judgment: The Hope Creek FAC program also selects inspection components based on engineering judgment. Engineering judgment is used when selecting inspection locations through knowledge based on experience.

Priority is given to inspection locations which were inspected based on plant experience or on components that may require repair.

8.15 Please describe your most recent repair or replacement performed as a result of FAC. Include in your description the component replaced, the extent of degradation, actions to prevent recurrence, and how this experience was used to update the FAC program for existing and EPU conditions.

<u>Response</u>
<u>Description</u>: In December 2006, a 26-inch x 26-inch fabricated carbon steel tee on the #3A feedwater heater (FWH) extraction steam supply line developed a through-wall leak approximately 1.5 inches downstream of the upstream weld. The tee is immediately downstream of a 26-inch check valve and immediately upstream of a 26-inch gate valve and connects to the #3 feedwater heaters extraction steam supply equalizer line. The through-wall hole was approximately 3/8-inch x 1-inch. The repair consisted of a carbon steel ½-inch thick welded patch 4 inches wide extending 260 degrees around the upper main run of the tee.

<u>Extent of Condition:</u> Using a refined grid pattern (1-inch x 1-inch), wall thickness measurements of the tee showed degradation for the first two to three inches downstream of the check valve then an abrupt recovery to above nominal wall thickness. Wall thickness measurements were taken on the #3C FWH tee and the results showed that degradation was present in the same area as the 'A' tee but the 'C' tee was above the allowable minimum wall thickness and would remain so throughout the operating cycle. The 'A' and the 'C' tees were last inspected in 2000 (4.5 cycles) and 1999 (5.5 cycles) respectively. The 'B' tee had been inspected consecutively for 6 cycles. It was last inspected in 2004 and the wear trend indicated minimal degradation.

Recurrence Prevention: A permanent repair of the 'A' tee will be planned for RF14 (October 2007). PSEG also plans to address degradation to the 'C' tee and to inspect the 'B' tee during RF14.

This event will not cause any changes in the program. A reduced grid size was used to detect the extent of the degradation. A parallel component was inspected for extent of condition. The degraded tee was repaired and placed back in service. The tees will continue to be monitored.

8.16 Please discuss how components are inspected and evaluated with respect to the guidance in EPRI NSAC-202L-R2, in which suitability for continued service is based on current wall thickness, acceptable wall thickness, and predicted wall thickness at the time of the next inspection. Discuss how your acceptance criteria for minimum wall thickness are consistent with maintaining structural integrity.

Response

At Hope Creek, the components are inspected using the ultrasonic techniques (UT). Grid size and layout for the components are those recommended by NSAC-202L-R2. Grid size is reduced in areas of significant wear. Wall thickness data is received from the field and is downloaded into the "FAC Manager" evaluation software. "FAC Manager" is an evaluation tool produced by CSI Technologies, Inc., and is used at numerous nuclear plants. Various design parameters, including minimum allowable wall thickness as calculated by the mechanical design group, are loaded into the evaluation tool for each component. The data is reviewed and evaluated. The evaluation methods available through "FAC Manager" are those described in NSAC-202L-R2. The choice of the method is dependent on the type of component and its history. Results of the evaluation reveal if the component will remain above minimum allowable wall thickness throughout the next operating and what the predicted minimum wall thickness will be at the end of the operating cycle. Additionally, the evaluation shows the remaining service life of the component (based on the calculated minimum allowable wall thickness) and the next scheduled inspection (NSI) outage. The NSI is an outage prior to the time that the component reaches minimum allowable wall thickness. Piping is analyzed using minimum wall thickness according to the Hope Creek design methodology and acceptable only if it meets all the design requirements of Hope Creek.

8.17 The PUSAR states on page 10-35 that the temperature of selected portions is predicted to increase a maximum of 13°F. However, PUSAR Table 10-12 indicates the temperature of some components is predicted to increase by up to 19°F (e.g., condensate piping temperature changing from 154 - 365°F at the current power level to 153 - 384°F at higher power). Please clarify this apparent discrepancy between your statement about the maximum temperature change and the values shown in the table.

Response
The 13°F is the calculated FW temperature difference between the reactor heat balances for 120% OLTP and for CLTP.

For the purposes of evaluating flow assisted corrosion (FAC), the HCGS program inputs the temperature predicted for the specific line, rather than a single generic value. The values are based on the plant's heat balance which includes the balance of plant power block components (for example, the turbine, feedwater heaters (FWH), condenser, condensate system, extraction steam, FWH drain lines, moisture separator, and feedwater system). As can be seen in Table 10-12, the power uprate temperature impact varies with the line and system. The temperatures reported in PUSAR Table 10-12 were obtained from the turbine heat balance for 120% OLTP (GE Turbine, AA-02-086.v.3 dated 09/10/02) and the CLTP heat balance of record for HCGS, which is based on the PEPSE model (H-1-ZZ-MDC-1847).

8.18 Table 10-12 in the PUSAR describes changes in the variables that affect FAC rates. However, because the FAC rate is determined by the interactions of these variables, comparing the parameters may not indicate how they affect the FAC rate. Please discuss the effect of the CPPU conditions on the FAC rates as predicted by your CHECWORKS model, for example by providing the FAC rates for several (e.g., 5 to 10) components representing the highest predicted FAC rates before the uprate and the highest rates after the uprate (i.e., two potentially different sets of components). Include the calculated corrosion rates for comparison.

Response
In December 2002, a study was performed using the CHECWORKS model software to evaluate the effect that the then proposed 20% power uprate would have on the wear rates of the piping systems and if the uprate would lead to significant pipe replacements. The study concluded that the average predicted wear rates would not cause an increased need for replacements. Increases in wear rates were found in portions of the condensate, feedwater, heater drain, and seal steam systems.

The following tables contain high wear rate components that are representative of various systems. This method was used to eliminate the possibility of listing several high wear components on the same line and/or the component's exact location on a parallel train.

Before Uprate *

System	Line Name	Component ID	Description	Wear Rate /Year (mil)
Seal Steam	Steam Seal Evaporator Steam Supply	1-AF-004-S06-T2	Tee	27.4
Extraction Steam	Cross Under Steam to #5 Feedwater Heater Header	1-AC-012-S20-T1	Tee	20.3
Heater Drains	#6B Feedwater Heater to #5B Feedwater Heater	1-AF-076-S06-L2	Elbow	18.3
Extraction Steam	Cross Under Steam Header to #5B Feedwater Heater	1-AC-012-S22-T1	Tee	17.2
Heater Drains	#4A Feedwater Heater to #3A Feedwater Heater	1-AF-108-S01-L1	Elbow	14.9
Feedwater	Minimum Flow Line	1-AE-005-S03-T1	Tee	13.4
Cross Around	Header Tee to 'A' Moisture Separator	AC33-N-001	Nozzle	13.4
Moisture Separator Drains	'A' Moisture Separator to Header Tee	1-AC-031-S04-T1	Tee	11.9

* Based on RF13 inputs and Cycle 13 operating conditions.

After Uprate#

System	Line Name	Component ID	Description	Wear Rate /Year (mil)
Seal Steam	Steam Supply to Steam Seal Evaporator	1-AF-004-S05-P1	Pipe	25.9
Heater Drains	FWH 4B to FWH 3B	1-AF-109-S01-L1	Elbow	16.1
Condensate	Secondary Condensate Pump Discharge Header	1-AD-111-S01-N1	Nozzle	15.8
Condensate	3A Feedwater Heater to 4A Feedwater Heater	1-AD-031-S01-N1	Nozzle	15.1

System	Line Name	Component ID	Description	Wear Rate /Year (mil)
Heater Drains	3A Feedwater Heater to 2A Feedwater Heater	1-AF-141-S02-L2	Elbow	13.6
Heater Drains	5C Feedwater Heater to 4C Feedwater Heater	1-AF-095-S03-L1	Elbow	12.3
Condensate	2A Feedwater Heater to #2 Feedwater Heater Header	1-AD-062-S01-L1	Elbow	10.2

After uprate wear rates are based on the operating conditions of the 120% OLTP uprate and input data from refueling outage RF10 (Autumn 2002)

8.19 Please discuss your FAC program for small bore piping, including how it compares to the guidance in Appendix A of NSAC-202L-R2.

<u>Response</u>
The Hope Creek FAC Program is in the process of establishing a small-bore program as part of the Hope Creek Asset Management Initiative. NSAC-202L-R2 Appendix A will be used as guidance. A Susceptible Non-Modeled Analysis (SNM) of the FAC program's susceptible piping has been completed. Following the guidelines addressed in Appendix A of NSAC-202L-R2, the program's piping that could not be modeled by CHECWORKS was ranked based on consequence of failure and degree of susceptibility (based on assumed operating conditions). Small-bore piping is included in the SNM. The small-bore piping whose consequence of failure is more than minimal and whose susceptibility to FAC is high (based on assumed operating conditions) have been identified and will be included in the program's pro-active pipe replacement program. The small-bore piping whose susceptibility is less than high will be scheduled for inspections and monitored. Numerous small-bore lines have already been replaced with non-susceptible material. HPCI/ RCIC steam supply drain lines, Reactor Feed Pump Turbine Steam Chest drain lines, valve drain lines, and feedwater heater operating vent lines are an example of the small-bore piping that has been replaced with non-susceptible material.

8.20 Please discuss how your program addresses flow-related thinning other than FAC, such as erosion-corrosion due to high velocity fluids or suspended particles.

Response
The Hope Creek FAC Program inspects certain components for degradation caused by liquid droplet impingement (LDI). Indications that LDI may be present are valve leak-bys, or conditions (open valves, leaks) that cause the velocity of the two-phased mixture to increase dramatically. The FAC program also inspects for cavitation per system engineering requests.

References

1. PSEG letter LR-N06-0286, Request for License Amendment: Extended Power Uprate, September 18, 2006

2. NRC letter, Hope Creek Generating Station - Request for Additional Information Regarding Request for Extended Power Uprate (TAC NO. MD3002), April 20, 2007

Hope Creek Generating Station
Facility Operating License NPF-57
Docket No. 50-354

Extended Power Uprate

Response to Request for Additional Information

In Reference 1, PSEG Nuclear LLC (PSEG) requested an amendment to Facility Operating License NPF-57 and the Technical Specifications (TS) for the Hope Creek Generating Station (HCGS) to increase the maximum authorized power level to 3840 megawatts thermal (MWt).

In Reference 2, the NRC requested additional information concerning PSEG's request. NRC question 14.46 is restated below followed by PSEG's response.

14) Mechanical & Civil Engineering Branch (EMCB)

14.46 The increased main steam flow results in increased forces and moments from the Turbine Stop Valve (TSV) closure transient at CPPU conditions. The TSV load was used in the design of MS piping system. Provide a quantitative summary of the main steam and associated piping system evaluation (inside and outside containment), including pipe supports, that contains the increased loading associated with the TSV closure transient at CPPU conditions along with a comparison to the code allowable limits. Include data at critical locations (i.e. nozzles, penetrations, etc). For nonconforming piping and pipe supports, provide a summary of modifications required to ensure that piping and pipe supports are structurally adequate to perform their intended design function and the schedule for completion of these modification[s].

Response
Main steam piping supports and other critical piping components are evaluated for the Turbine Stop Valve Closure (TSVC) loads. The TSVC load diminishes rapidly for branch piping and is considered insignificant after the first support and/or elbow attached to MS piping. The attached pages from 14.46-3 to 14.46-101 provide the stress data at critical locations and allowable vs. calculated values for CPPU conditions.

All of the supports that are listed in pages 14.46-102 to 14.46-189 include the existing (CLTP) loads, extended power uprate loads ("CPPU" or "EPU"), and the ratio of extended power uprate loads to Design Load

The supports that were modified for the CPPU condition are listed in page 14.46-190. No other supports require modification due to CPPU Loads.

References

1. PSEG letter LR-N06-0286, Request for License Amendment: Extended Power Uprate, September 18, 2006

2. NRC letter, Hope Creek Generating Station - Request for Additional Information Regarding Request for Extended Power Uprate (TAC NO. MD3002), April 20, 2007

MS Line A

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122, Rev. 9 *Page No: 22, 34, 36, 253, 293, 325, 329, 333, 390

Calculation Title: Main Steam Line 'A ', MSRV Lines A, J & R

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	011	24,637	26,041	31,860	0.82
Emergency	011	22,480	22,480	39,825	0.56
Faulted	011	24,941	26,363	53,100	0.50
Equation : 10 **	045F	58,860	60,567	53,100	1.14
Equation : 12	045F	40,724	40,724	53,100	0.77
Equation : 13	045F	22,627	22,627	53,100	0.43
Equation : 14 (Fatigue) CUF	200	0.04	0.041	0.100	OK

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
** Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.

Project:	Hope Creek Extended Power Uprate		
Calculation No.:	C-0122, Rev. 9	*Page No:	22, 34, 36, 253, 293, 325, 329, 333, 390
Calculation Title:	Main Steam Line 'A ', MSRV Lines A, J & R		
Description:	Main Steam Piping - Line A***		

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	011	24,637	26,041	31,860	0.82
Emergency	011	22,480	22,480	39,825	0.56
Faulted	011	24,941	26,363	53,100	0.50
Equation : 10 **	064***	58,421	60,115	53,100	1.13
Equation : 12	064***	37,933	37,933	53,100	0.71
Equation : 13	064***	22,327	22,327	53,100	0.42
Equation : 14 (Fatigue) CUF	200	0.04	0.041	0.100	OK

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
** Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.
*** Elbow '064 to '063N

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122, Rev. 9 *Page No: 22, 34, 36, 253, 293, 325, 329, 333, 390

Calculation Title: Main Steam Line 'A ', MSRV Lines A, J & R

Description: Main Steam Piping - Line A***

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	011	24,637	26,041	31,860	0.82
Emergency	011	22,480	22,480	39,825	0.56
Faulted	011	24,941	26,363	54,600	0.48
Equation : 10 **	064***	56,809	58,456	53,100	1.10
Equation : 12	064***	36,516	36,516	53,100	0.69
Equation : 13	064***	22,293	22,293	53,100	0.42
Equation : 14 (Fatigue) CUF	200	0.04	0.041	0.100	OK

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
** Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.
*** Elbow '064 to '063N

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122, Rev. 9 *Page No: 22, 34, 36, 253, 293, 325, 329, 333, 390

Calculation Title: Main Steam Line 'A ', MSRV Lines A, J & R

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	011	24,637	26,041	31,860	0.82
Emergency	011	22,480	22,480	39,825	0.56
Faulted	011	24,941	26,363	53,100	0.50
Equation : 10 **	064***	56,803	58,450	53,100	1.10
Equation : 12	064***	36,516	36,516	53,100	0.69
Equation : 13	064***	22,293	22,293	53,100	0.42
Equation : 14 (Fatigue) CUF	200	0.04	0.041	0.100	OK

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
** Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.
*** Elbow 064 to 065F

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122, Rev. 9 *Page No: 22, 34, 36, 253, 293, 325, 329, 333, 390

Calculation Title: Main Steam Line 'A ', MSRV Lines A, J & R

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	011	24,637	26,041	31,860	0.82
Emergency	011	22,480	22,480	39,825	0.56
Faulted	011	24,941	26,363	53,100	0.50
Equation : 10	300***	51,479	52,972	54,600	0.97
Equation : 12	300***	22,833	22,833	54,600	0.42
Equation : 13	300***	28,603	28,603	54,600	0.52
Equation : 14 (Fatigue) CUF	200	0.04	0.041	0.100	OK

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9

*** Branch Connection Sweepolet

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122, Rev. 9 *Page No: 22, 34, 36, 253, 293, 325, 329, 333, 390

Calculation Title: Main Steam Line 'A ', MSRV Lines A, J & R

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	011	24,637	26,041	31,860	0.82
Emergency	011	22,480	23,761	39,825	0.60
Faulted	011	24,941	26,363	53,100	0.50
Equation : 10	021N***	47,988	49,380	53,100	0.93
Equation : 12	021N***	25,673	25,673	53,100	0.48
Equation : 13	021N***	22,694	22,694	53,100	0.43
Equation : 14 (Fatigue) CUF	200	0.04	0.041	0.100	OK

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9

*** Elbow 021N to 021F

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122, Rev. 9 **Page Nos.: 86, 87, 88

Calculation Title: Main Steam Line ' A '; MSRV Lines A, J & R

Description: Main Steam Piping-Line A MSIV (Inboard) Bonnet Flange Loads Evaluation*

Inboard MSIV	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable (Note 1)	Ratio= Maximum/ Allowable	Remark
Inboard	073	Level B	Axial F	2,155	2,786	2,155	2,786	29,270	0.0952	OK (Note 2)
			Moment	514,872	665,729	514,872	665,729	1,610,000	0.4135	OK (Note 2)
		Level C	Axial F	2,155	2,786	2,155	2,786	29,270	0.0952	OK (Note 2)
			Moment	514,872	665,729	514,872	665,729	1,610,000	0.4135	OK (Note 2)
		Level D	Axial F	2,155	2,786	2,566	2,786	29,270	0.0952	OK (Note 2)
			Moment	514,872	665,729	610,529	665,729	1,610,000	0.4135	OK (Note 2)

* Level A is not affected by TSV Loads.
Forces and Moments are In Lbs and in In-Lbs respectively.
**from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
Note 1: Allowable are taken from GE Document 213A8411 Rev.0
Note 2: The load increase due to TSV is greater than the existing enveloped loads. However, the increase is lower than the allowable.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 **Page Nos. 86, 89 through 92

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: Main Steam Line A - Inboard MSIV Inlet and Outlet Connection Loads Evaluation*

Inboard MSIV	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Ratio= Maximum/Allowable	Remark
Inlet Connection	069	Level B	Axial Stress	7,940	10,266	7,940	10,266	17,700	0.580	(Note 1)
			Tor. Stress	768	993	768	993	17,700	0.056	(Note 1)
			Bend. stress	4,977	6,435	4,977	6,435	17,700	0.364	(Note 1)
		Level C	Axial Stress	7,940	10,266	7,940	10,266	17,700	0.580	(Note 1)
			Tor. Stress	768	993	768	993	17,700	0.056	(Note 1)
			Bend. stress	4,977	6,435	4,977	6,435	17,700	0.364	(Note 1)
		Level D	Axial Stress	7,940	10,266	7,940	10,266	17,700	0.580	(Note 1)
			Tor. Stress	768	993	830	993	17,700	0.056	(Note 1)
			Bend. stress	4,977	6,435	4,977	6,435	17,700	0.364	(Note 1)
Outlet connection	077	Level B	Axial Stress	7,937	10,263	7,937	10,263	17,700	0.580	(Note 1)
			Tor. Stress	800	1,034	800	1,034	17,700	0.058	(Note 1)
			Bend. stress	3,557	4,599	3,557	4,599	17,700	0.260	(Note 1)
		Level C	Axial Stress	7,937	10,263	7,937	10,263	17,700	0.580	(Note 1)
			Tor. Stress	800	1,034	800	1,034	17,700	0.058	(Note 1)
			Bend. stress	3,557	4,599	3,557	4,599	17,700	0.260	(Note 1)
		Level D	Axial Stress	7,943	10,270	7,943	10,270	17,700	0.580	(Note 1)
			Tor. Stress	708	915	764	915	17,700	0.052	(Note 1)
			Bend. stress	3,627	4,690	3,794	4,690	17,700	0.265	(Note 1)

* Level A is not affected by TSV Loads.
Stresses are in psi

**from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9

Note 1: The load increase due to TSV is greater than the existing enveloped loads. However, the increase is lower than the allowable.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 *Page Nos. 47 through 50

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: Main Steam Piping - Line A MSIV Acceleration Loads Evaluation **

Node Pt.	Description	ASME Load Level	Loading Direction	Loading Combination with TSV*	EPU Loads	Existing Enveloped Load*	Maximum of EPU & Enveloped Loads	Qualified by Test	Remarks
071	Body	Level B	AH	0.388	0.502	0.388	0.502	(Note 1)	OK
			AV	0.171	0.221	0.235	0.235	(Note 1)	OK
		Level D	AH	0.417	0.539	0.545	0.545	(Note 1)	OK
			AV	0.271	0.350	0.616	0.616	(Note 1)	OK
075	Operator	Level B	AH	3.290	4.254	3.290	4.254	(Note 1)	OK
			AV	0.598	0.774	0.598	0.774	(Note 1)	OK
		Level D	AH	3.351	4.332	4.024	4.332	(Note 1)	OK
			AV	0.864	1.117	0.864	1.117	(Note 1)	OK
073	Bonnet Flange	Level B	AH	0.610	0.788	0.613	0.788	2.0 (Note 1)	OK
			AV	0.221	0.286	0.221	0.286	3.0 (Note 1)	OK
		Level D	AH	0.615	0.795	1.233	1.233	4.5 (Note 1)	OK
			AV	0.265	0.342	0.420	0.420	5.0 (Note 1)	OK

*from GE stress Report 23A6126 Rev. 1 dated 2/7/89 which is apart of Calculation C-0122 Rev.9
**Acceleration Loads are in G's
Note 1: NEDC 31020 - Hope Creek Environmental Qualification Report MSIV Actuator, Attachment 5 and Appendix H.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 *Page Nos. 44, 45 and 46

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: Main Steam-Line A RPV Nozzle Loads Evaluation

Component	Node Pt.	ASME Load Level (Note 1)	Loading (Note 2)	Loading Combination with TSV	EPU Loads (Note 3)	Allowable	Ratio= Maximum/ Allowable	Remark
RPV	001	Secondary (Level B)	HR	81,970	105,987	674,200	0.157	OK
		Secondary (Level B)	MR	3,513,508	4,542,966	14,384,000	0.316	OK
		Primary (Level D)	HR	47,989	62,050	374,520	0.166	OK
		Primary (Level D)	MR	2,047,157	2,646,974	7,417,000	0.357	OK

Forces and Moments are In Lbs and in In-Lbs respectively.

*from GE Stress Report 23A6126 Rev.1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9

Note 1 Levels A and C are not affected by the TSV loads

Note 2 For Secondary load level, HR and MR are the envelop of case 1 and case 3
HR and MR are calculated at the RPV / NOZZLE junction using given FX, FY, FZ, MX, MY, MZ load components.

Note 3 For the EPU loads , only the load combination with TSV load is assumed to be impacted.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 **Attachment 9, Page Nos. 19 and 20

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: Main Steam Piping - Line A Penetration Flued Head Evaluation*

Anchor Number	Node Pt.	ASME Load Level	**Loading Direction	**Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable (Note 1)	Ratio = Max/Allowable	Remark
ANC	83	OBE + TSVC	Axial (P)	50,391	65,156	50,391	65,156	79,000	0.825	OK
			Shear (V)	3,953	5,111	3,953	5,111	28,300	0.181	OK
			Moment (M)	574,563	742,910	574,563	742,910	2,212,000	0.336	OK
		Level D	Axial (P)	118,210	152,846	118,210	152,846	564,300	0.271	OK
			Shear (V)	19,079	24,669	19,079	24,669	338,600	0.073	OK
			Moment (M)	1,374,266	1,776,926	1,374,266	1,776,926	5,078,000	0.350	OK

* Level A and Level C are not affected by TSV Loads.
Forces (P), (V) and Moments (M) are in Lbs and in In-Lbs respectively.
Note 1: Penetration Flued Head Allowable are taken from Attachment 9, Pages 19 & 20 in Calc. No. C-0122 Rev. 9

MS Line A – SRV Lines

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 Page Nos.: 38, 476

Calculation Title : Main Steam Line ' A ', MSRV Lines A, J & R

Description: SRV Piping - Line A Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remarks
Equation : 8 Sustained Loads		381 .	8,119	8,119	22,500	0.361	Note 1
Equation : 9	Occasional	382**	7,005	7,404	27,000	0.274	
	Level C	344F	10,393	10,985	33,750	0.325	
	Level D	382	26,589	26,589	45,000	0.591	Note 1
Equation :10	Thermal + OBED	392	32,748	32,748	22,500	1.455	Note 2
Equation 11	Thermal + Sustained	392	37,040 (Note 2)	37,040	37,500	0.988	Note 1

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
**Maximum load for TSV load combination.
Note 1: Not affected by Power Uprate.
Note 2: Since Equation 10 is not satisfied, Equation 11 is used to satisfy the required criteria

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 Page Nos.: 38, 459

Calculation Title : Main Steam Line ' A ', MSRV Lines A, J& R

Description: SRV Piping - Line A Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Ratio: Power Uprate to Original
Equation : 8 Sustained Loads		381	8,119	8,119	22,500	0.361	Note 1
Equation : 9	Occasional	382**	7,005	7,404	27,000	0.274	
	Level C	344F	10,393	10,985	33,750	0.325	
	Level D	382	26,559	26,559	45,000	0.590	Note 1
Equation :10	Thermal + OBED	354	20,622	20,622	22,500	0.917	Note 1
Equation 11	Thermal + Sustained	354	25,341 (Note 2)	25,341	37,500	0.676	Note 1

* From Stress Report
**Maximum load for TSV load combination.
Note 1: Not affected by Power Uprate.

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 Page Nos.: 41, 531

Calculation Title : Main Steam Line ' A ', MSRV Lines A, J & R

Description: SRV Piping - Line J Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remarks
Equation : 8 Sustained Loads		183F	7,649	7,649	22,500	0.340	Note 1
Equation : 9	Occasional	152F	24,047	25,418	27,000	0.941	
	Level C	183F	9,118	9,638	33,750	0.286	
	Level D	152F	24,295	24,295	45,000	0.540	Note 1
Equation :10	Thermal + OBED	180	21,672	21,672	22,500	0.963	Note 1
Equation 11	Thermal + Sustained	180	26,167	26,167	37,500	0.698	Note 1

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
Note 1: Not affected by Power Uprate.

Project : Hope Creek Extended Power Uprate

Stress Report No. : 23A6126- Rev. 1 Page Nos.: 41, 504

Calculation Title : Main Steam Piping & Equipment Loads

Description: SRV Piping - Line J Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remarks
Equation : 8 Sustained Loads		183F	7,649	7,649	22,500	0.340	Note 1
Equation : 9	Occasional	152F	24,047	25,418	27,000	0.941	
	Level C	183F	9,118	9,638	33,750	0.286	
	Level D	152F	24,295	24,295	45,000	0.540	Note 1
Equation :10	Thermal + OBED	130N	20,253	20,253	22,500	0.900	Note 1
Equation 11	Thermal + Sustained	130N	25,316 (Note 2)	25,316	37,500	0.675	Note 1

* From Stress Report
Note 1: Not affected by Power Uprate.

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 Page Nos.: 42, 614

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: SRV Piping - Line R Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remarks
Equation : 8	Sustained Loads	291	8,127	8,127	22,500	0.361	Note 1
Equation : 9	Occasional	282N	23,517	24,857	27,000	0.921	
	Level C	248	10,975	11,601	33,750	0.344	
	Level D	282N	23,517	23,517	45,000	0.523	Note 1
Equation :10	Thermal + OBED	282N	28,118	28,118	22,500	1.250	Note 2
Equation 11	Thermal + Sustained	282N	33,187	33,187	37,500	0.885	Note 1

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9

Note 1: Not affected by Power Uprate.

Note 2: Since Equation 10 is not satisfied, Equation 11 is used to satisfy the required criteria

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 Page Nos :42, 604, 614

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: SRV Piping - Line R Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remarks
Equation : 8 Sustained Loads		291	8,127	8,127	22,500	0.361	Note 1
Equation : 9	Occasional	282N	23,517	24,857	27,000	0.921	
	Level C	248	10,975	11,601	33,750	0.344	
	Level D	282N	23,517	23,517	45,000	0.523	Note 1
Equation :10	Thermal + OBED	262	22,857	22,857	22,500	1.016	Note 2
Equation 11	Thermal + Sustained	262	27,615	27,615	37,500	0.736	Note 1

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9

Note 1: Not affected by Power Uprate.

Note 2: Since Equation 10 is not satisfied, Equation 11 is used to satisfy the required criteria

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 Page Nos.: 42, 603

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: SRV Piping - Line R Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remarks
Equation : 8 Sustained Loads		291	8,127	8,127	22,500	0.361	Note 1
Equation : 9	Occasional	282N	23,517	24,857	27,000	0.921	
	Level C	248	10,975	11,601	33,750	0.344	
	Level D	282N	23,517	23,517	45,000	0.523	Note 1
Equation :10	Thermal + OBED	260N	22,474	22,474	22,500	0.999	Note 1
Equation 11	Thermal + Sustained	260N	27,523	27,523	37,500	0.734	Note 1

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
Note 1: Not affected by Power Uprate.

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 Page Nos.: 42, 578

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: SRV Piping - Line R Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remarks
Equation : 8 Sustained Loads		291	8,127	8,127	22,500	0.361	Note 1
Equation : 9	Occasional	282N	23,517	24,857	27,000	0.921	
	Level C	248	10,975	11,601	33,750	0.344	
	Level D	282N	23,517	23,517	45,000	0.523	Note 1
Equation :10	Thermal + OBED	240N	13,050	13,050	22,500	0.580	Note 1
Equation 11	Thermal + Sustained	240N	19,181	19,181	37,500	0.511	Note 1

* from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
Note 1: Not affected by Power Uprate.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 *Page Nos. 60 through 73

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: SRV Lines A, J & R SRV Inlet & Outlet Flange Moments Loads Evaluation

SRV Line	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Ratio= Maximum/ Allowable	Remark
SRV A Inlet	306	Level B	MR	283,066	366,004	308,618	366,004	800,000	0.458	(Note 2)
		Level D	MR	294,495	380,782	316,614	380,782	925,000	0.412	(Note 2)
SRV A Outlet	310	Level B	MR	214,050	276,767	219,956	276,767	600,000	0.461	(Note 2)
		Level D	MR	220,697	285,361	226,526	285,361	600,000	0.476	(Note 2)
SRV J Inlet	106	Level B	MR	132,408	171,204	250,254	250,254	800,000	0.313	OK (Note 1)
		Level D	MR	136,742	176,807	250,967	250,967	925,000	0.271	OK (Note 1)
SRV J Outlet	110	Level B	MR	116,972	151,245	192,318	192,318	600,000	0.321	OK (Note 1)
		Level D	MR	119,692	154,762	192,742	192,742	600,000	0.321	OK (Note 1)
SRV R Inlet	206	Level B	MR	174,369	225,459	198,150	225,459	800,000	0.282	(Note 2)
		Level D	MR	174,369	225,459	198,150	225,459	925,000	0.244	(Note 2)
SRV R Outlet	210	Level B	MR	147,491	190,706	166,171	190,706	600,000	0.318	(Note 2)
		Level D	MR	147,491	190,706	166,171	190,706	600,000	0.318	(Note 2)

Forces and Moments are in Lbs and in In-Lbs respectively.
*from GE Stress Report 23A6126 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
Note 1: EPU Loads are less than the Existing Enveloped Loads and are within allowable.
Note 2: The load increase due to TSV is greater than the existing enveloped loads. However, the increase is lower than the allowable.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0122 Rev. 9 **Page Nos. 47 , 51, 52 and 53

Calculation Title: Main Steam Line ' A ', MSRV Lines A, J & R

Description: SRV Lines A, J & R Valve Acceleration Loads Evaluation *

Node Pt.	Description	ASME Load Level	Loading Direction	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Remarks
306	SRV LINE A	Level B	AH	0.340	0.440	2.182	2.182	8.00	OK (Note 1)
			AV	0.322	0.416	0.554	0.554	6.00	OK (Note 1)
		Level D	AH	0.398	0.514	2.192	2.192	8.00	OK (Note 1)
			AV	0.365	0.472	0.580	0.580	6.00	OK (Note 1)
106	SRV LINE J	Level B	AH	0.328	0.424	1.502	1.502	8.00	OK (Note 1)
			AV	0.163	0.211	0.547	0.547	6.00	OK (Note 1)
		Level D	AH	0.379	0.490	1.514	1.514	8.00	OK (Note 1)
			AV	0.193	0.250	0.550	0.550	6.00	OK (Note 1)
206	SRV LINE R	Level B	AH	0.350	0.453	1.616	1.616	8.00	OK (Note 1)
			AV	0.227	0.294	0.565	0.565	6.00	OK (Note 1)
		Level D	AH	0.403	0.521	1.629	1.629	8.00	OK (Note 1)
			AV	0.259	0.336	0.578	0.578	6.00	OK (Note 1)

* Level A and Level C are not affected by TSV Loads.
Acceleration Loads are in G's
**from GE Stress Report 23A6126 Rev.1 dated 2/7/89 which is a part of Calculation No. C-0122 Rev. 9
Note 1: EPU loads are less than Existing Enveloped Loads. Therefore, the structural integrity of the SRV valves are not affected.

MS Line B

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page No: 22, 35-37, 206, 363, 411

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Ext. Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: EPU to Allowable
Equation : 9 Normal/Upset	009	25,788	27,258	31,860	0.86
Emergency	009	25,464	25,464	39,825	0.64
Faulted	009	26,030	27,514	53,100	0.52
Equation : 10 **	066F	59,230	60,948	53,100	1.15
Equation : 12	066F	39,985	39,985	53,100	0.75
Equation : 13	066F	27,852	27,852	53,100	0.52
Equation : 14 (Fatigue) CUF	200	0.08	0.081	0.100	0.81

*from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev.7

**Since equation 10 is not satisfied , the piping is qualified by equations 12 and 13.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page No: 22, 35, 36-37, 206, 367, 411

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Ext. Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: EPU to Allowable
Equation : 9 Normal/Upset	009	25,788	27,258	31,860	0.86
Emergency	009	25,464	25,464	39,825	0.64
Faulted	009	26,030	27,514	53,100	0.52
Equation : 10 **	066F	58,074	59,758	53,100	1.13
Equation : 12	066F	39,482	39,482	53,100	0.74
Equation : 13	066F	26,343	26,343	53,100	0.50
Equation : 14 (Fatigue) CUF	200	0.08	0.081	0.100	0.81

*from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev.7

**Since equation 10 is not satisfied , the piping is qualified by equations 12 and 13.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page No: 22, 35, 36-37, 206, 323, 411

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Ext. Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: EPU to Allowable
Equation : 9 Normal/Upset	009	25,788	27,258	31,860	0.86
Emergency	009	25,464	25,464	39,825	0.64
Faulted	009	26,030	27,514	53,100	0.52
Equation : 10	049F	49,787	51,231	53,100	0.96
Equation : 12	049F	31,374	31,374	53,100	0.59
Equation : 13	049F	23,451	23,451	53,100	0.44
Equation : 14 (Fatigue) CUF	200	0.08	0.081	0.100	0.81

*from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev.7

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page No: 22, 35-37, 206, 359, 411

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Ext. Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: EPU to Allowable
Equation : 9 Normal/Upset	009	25,788	27,258	31,860	0.86
Emergency	009	25,464	25,464	39,825	0.64
Faulted	009	26,030	27,514	53,100	0.52
Equation : 10	065	49,537	50,974	53,100	0.96
Equation : 12	065	31,492	31,492	53,100	0.59
Equation : 13	065	25,590	25,590	53,100	0.48
Equation : 14 (Fatigue) CUF	200	0.08	0.081	0.100	0.81

*from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev.7

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page No: 22, 35-37, 411, 422

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Ext. Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: EPU to Allowable
Equation : 9 Normal/Upset	009	25,788	27,258	31,860	0.86
Emergency	009	25,464	25,464	39,825	0.64
Faulted.	009	26,030	27,514	53,100	0.52
Equation : 10 **	300***	55,557	57,168	54,600	1.05
Equation : 12	300	23,090	23,090	54,600	0.42
Equation : 13	300	30,445	30,445	54,600	0.56
Equation : 14 (Fatigue) CUF	200	0.08	0.081	0.100	0.81

*from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev.7

**Since equation 10 is not satisfied , the piping is qualified by equations 12 and 13.
***Branch Connection Sweepolet 300 to 39

- 14.46-32 -

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 **Page Nos: 92, 93 and 94

Calculation Title: Main Steam Line ' B ' , MSRV Lines B, F, K & P

Description: Main Steam Piping Line B - MSIV (Inboard) Bonnet Flange Loads Evaluation*

Inboard MSIV	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable (Note 1)	Ratio= Maximum/Allowable	Remark
Inboard	074	Level B	Axial F	2,030	2,625	2,030	2,625	29,270	0.0897	OK (Note 2)
			Moment	437,213	565,316	431,513	565,316	1,610,000	0.3511	OK (Note 2)
		Level C	Axial F	2,030	2,625	2,030	2,625	29,270	0.0897	OK (Note 2)
			Moment	437,213	565,316	437,213	565,316	1,610,000	0.3511	OK (Note 2)
		Level D	Axial F	2,222	2,873	2,344	2,873	29,270	0.0982	OK (Note 2)
			Moment	477,212	617,035	551,025	617,035	1,610,000	0.3833	OK (Note 2)

* Level A is not affected by TSV Loads.
** from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is part of Calculation No. C-0121 Rev.7

Forces and Moments are in Lbs and in In-Lbs respectively.

Note 1: Allowable are taken from GE Document 213A8411 Rev.0.
Note 2: The EPU loads are greater than the existing enveloped loads. However, the EPU loads are lower than the allowable.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 **Page Nos. 92, 95 through 98

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: Main Steam Piping-Line B Inboard MSIV Inlet and Outlet Connection Loads Evaluation *

Inboard MSIV	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Ratio= Maximum/Allowable	Remark
Inlet Connection	070	Level B	Axial Stress	7,987	10,327	7,987	10,327	17,700	0.583	(Note 1)
			Tor. Stress	613	793	613	793	17,700	0.045	(Note 1)
			Bend. stress	10,365	13,402	10,365	13,402	17,700	0.757	(Note 1)
		Level C	Axial Stress	7,987	10,327	7,987	10,327	17,700	0.583	(Note 1)
			Tor. Stress	613	793	613	793	17,700	0.045	(Note 1)
			Bend. stress	10,365	13,402	10,365	13,402	17,700	0.757	(Note 1)
		Level D	Axial Stress	7,992	10,334	7,992	10,334	17,700	0.584	(Note 1)
			Tor. Stress	669	865	740	865	17,700	0.049	(Note 1)
			Bend. stress	10,848	14,026	10,848	14,026	17,700	0.792	(Note 1)
Outlet connection	078	Level B	Axial Stress	8,204	10,608	8,204	10,608	17,700	0.599	(Note 1)
			Tor. Stress	407	526	407	526	17,700	0.030	(Note 1)
			Bend. stress	6,213	8,033	6,407	8,033	17,700	0.454	(Note 1)
		Level C	Axial Stress	8,204	10,608	8,204	10,608	17,700	0.599	(Note 1)
			Tor. Stress	407	526	407	526	17,700	0.030	(Note 1)
			Bend. stress	6,213	8,033	6,407	8,033	17,700	0.454	(Note 1)
		Level D	Axial Stress	8,210	10,816	8,210	10,616	17,700	0.600	(Note 1)
			Tor. Stress	456	590	456	590	17,700	0.033	(Note 1)
			Bend. stress	6,549	8,468	6,749	8,468	17,700	0.478	(Note 1)

* Level A is not affected by TSV Loads.
**from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation of C-0121 Rev. 7.
Stresses are in psi
Note 1: The EPU loads are greater than the existing enveloped loads. However, the EPU loads are lower than the allowable.

Project:	Hope Creek Extended Power Uprate	
Calculation No.:	C-0121, Rev. 7	*Page Nos.: 50 through 53
Calculation Title:	Main Steam Line ' B ' MSRV Lines B, F, K & P	
Description:	Main Steam Piping - Line B MSIV Acceleration Loads Evaluation **	

Node Pt.	Description	ASME Load Level	Loading Direction	Loading Combination with TSV *	EPU Loads	Existing Enveloped Load*	Maximum of EPU & Enveloped Loads	Qualified by Test	Remarks
072	Body	Level B	AH	0.436	0.564	0.436	0.564	(Note 1)	OK
			AV	0.429	0.555	0.551	0.555	(Note 1)	OK
		Level D	AH	0.491	0.635	0.856	0.856	(Note 1)	OK
			AV	0.532	0.687	0.659	0.687	(Note 1)	OK
076	Operator	Level B	AH	1.721	2.225	1.795	2.225	(Note 1)	OK
			AV	1.623	2.098	1.623	2.098	(Note 1)	OK
		Level D	AH	1.768	2.286	2.926	2.926	(Note 1)	OK
			AV	1.938	2.506	1.938	2.506	(Note 1)	OK
074	Bonnet Flange	Level B	AH	0.352	0.455	0.493	0.493	2.0 (Note 1)	OK
			AV	0.589	0.761	0.657	0.761	3.0 (Note 1)	OK
		Level D	AH	0.395	0.510	0.886	0.886	4.5 (Note 1)	OK
			AV	0.716	0.926	0.774	0.926	5.0 (Note 1)	OK

*from GE Stress Report 23A6127 Rev.1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev.7
**Acceleration Loads are in G's
Note 1: NEDC 31020 - Hope Creek Environmental Qualification Report MSIV Actuator

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page Nos. 47, 48 and 49

Calculation Title: Main Steam System Line ' B ', MSRV Lines B, F, K & P

Description: Main Steam Piping - Line B RPV Nozzle Loads

Component	Node Pt.	ASME Load Level (Note 1)	Loading (Note 2)	Loading Combination with TSV	EPU Loads (Note 3)	Allowable	Ratio= Maximum/ Allowable	Remark
RPV	001	Secondary (Level B)	HR	74,999	96,974	674,200	0.144	OK
		Secondary (Level B)	MR	2,934,963	3,794,907	14,384,000	0.264	OK
		Primary (Level D)	HR	49,482	63,980	374,520	0.171	OK
		Primary (Level D)	MR	1,955,944	2,529,036	7,417,000	0.341	OK

*from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev.7
Forces and Moments are in Lbs and in In-Lbs respectively.

Note 1 Levels A and C are not affected by the TSV loads
Note 2 For Secondary load level, HR and MR are the envelope of case 1 and case 3
HR and MR are calculated at the RPV / NOZZLE junction using given FX, FY, FZ, MX, MY, MZ load components.
Note 3 For the EPU loads , only the load combination with TSV load is assumed to be impacted.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121 Rev. 7 **Attachment 9, Page Nos. 20 and 21

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: Main Steam Piping - Line B Penetration Flued Head Evaluation*

Anchor Number	Node Pt.	ASME Load Level	**Loading Direction	**Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable (Note 1)	Ratio = Max/Allowable	Remark
ANC	84	OBE + TSVC	Axial (P)	51,165	66,156	51,165	66,156	79,000	0.837	OK
			Shear (V)	3,968	5,131	5,381	5,381	28,300	0.190	OK
			Moment (M)	644,316	833,101	644,316	833,101	2,212,000	0.377	OK
		Level D	Axial (P)	109,442	141,509	109,442	141,509	564,300	0.251	OK
			Shear (V)	29,706	38,410	31,550	38,410	338,600	0.113	OK
			Moment (M)	3,280,370	4,241,518	3,347,297	4,241,518	5,078,000	0.835	OK

* Level A and Level C are not affected by TSV Loads.
Forces (P), (V) and Moments (M) are in Lbs and in In-Lbs respectively.
Note 1: Penetration Flued Head Allowable are taken from Attachment 9, Pages 20 & 21 in Calc. No. C-0121 Rev. 7

MS Line B – SRV Lines

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page Nos.: 23, 39 & 536

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: SRV Line B - Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress* (Psi)	Ext. Power Uprate Stress (Psi)	Code Allowable Stress (Psi)	Ratio: EPU to Allowable	Remark
Equation : 8 Sustained Loads		326	6,635	6,635	22,500	0.295	Note 1
Equation : 9	Occasional	340	15,022	15,878	27,000	0.588	
	Level C	310F	11,823	12,497	33,750	0.370	
	Level D	340	15,022	15,022	45,000	0.334	Note 1
Equation :10	Thermal + OBED	355F	13,773	13,773	22,500	0.612	Note 1
Equation 11	Thermal + Sustained	355F	19,463	19,463	37,500	0.519	Note 1

* from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev. 7

Note 1: Not affected by Power Uprate.

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page Nos.: 23, 41, 567 & 581

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: SRV Line F - Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress* (Psi)	Ext. Power Uprate Stress (Psi)	Code Allowable Stress (Psi)	Ratio: EPU to Allowable	Remark
Equation : 8 Sustained Loads		457	7,648	7,648	22,500	0.340	Note 1
Equation : 9	Occasional	431	15,303	16,175	27,000	0.599	
	Level C	431	15,303	16,175	33,750	0.479	
	Level D	431	25,897	25,897	45,000	0.575	Note 1
Equation :10	Thermal + OBED	420N	9,848	9,848	22,500	0.438	Note 1
Equation 11	Thermal + Sustained	420N	15,287	15,287	37,500	0.408	Note 1

* from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev. 7

Note 1: Not affected by Power Uprate.

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page Nos.: 23, 43, & 665

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: SRV Line K - Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress* (Psi)	Ext. Power Uprate Stress (Psi)	Code Allowable Stress (Psi)	Ratio: EPU to Allowable	Remark
Equation : 8 Sustained Loads		287	7,648	7,648	22,500	0.340	Note 1
Equation : 9	Occasional	220F	19,590	20,707	27,000	0.767	
	Level C	257	10,509	11,108	33,750	0.329	
	Level D	220F	19,590	19,590	45,000	0.435	Note 1
Equation :10	Thermal + OBED	275N	12,172	12,172	22,500	0.541	Note 1
Equation 11	Thermal + Sustained	275N	17,695	17,695	37,500	0.472	Note 1

* from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev. 7

Note 1: Not affected by Power Uprate.

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page Nos.: 23, 45, & 703

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: SRV Line P - Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress* (Psi)	Ext. Power Uprate Stress (Psi)	Code Allowable Stress (Psi)	Ratio: EPU to Allowable	Remark
Equation : 8 Sustained Loads		193	7,648	7,648	22,500	0.340	Note 1
Equation : 9	Occasional	140	18,243	19,283	27,000	0.714	
	Level C	140	12,641	13,362	33,750	0.396	
	Level D	140	18,243	18,243	45,000	0.405	Note 1
Equation :10	Thermal + OBED	125N	11,306	11,306	22,500	0.502	Note 1
Equation 11	Thermal + Sustained	125N	16,275	16,275	37,500	0.434	Note 1

* from GE Stress Report 23A6127 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev. 7

Note 1: Not affected by Power Uprate.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 *Page Nos. 58, 60 through 75

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K & P

Description: SRV Inlet & Outlet Flange Moments Loads Evaluation

SRV Line	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Ratio= Maximum/ Allowable	Remark
SRV P Inlet	103	Level B	MR	143,215	185,177	271,662	271,662	800,000	0.340	OK (Note 1)
		Level D	MR	146,025	188,810	272,990	272,990	925,000	0.295	OK (Note 1)
SRV P Outlet	105	Level B	MR	151,858	196,352	209,389	209,389	600,000	0.349	OK (Note 1)
		Level D	MR	153,856	198,936	210,262	210,262	600,000	0.350	OK (Note 1)
SRV K Inlet	203	Level B	MR	134,241	173,574	335,586	335,586	800,000	0.419	OK (Note 1)
		Level D	MR	135,237	174,861	335,872	335,872	925,000	0.363	OK (Note 1)
SRV K Outlet	205	Level B	MR	137,663	177,998	233,726	233,726	600,000	0.390	OK (Note 1)
		Level D	MR	136,832	176,924	234,059	234,059	600,000	0.390	OK (Note 1)
SRV B Inlet	303	Level B	MR	449,499	581,202	475,150	581,202	800,000	0.727	(Note 2)
		Level D	MR	449,499	581,202	475,150	581,202	925,000	0.628	(Note 2)
SRV B Outlet	305	Level B	MR	350,599	453,325	360,761	453,325	600,000	0.756	(Note 2)
		Level D	MR	350,599	453,325	360,862	453,325	600,000	0.756	(Note 2)
SRV F Inlet	403	Level B	MR	107,288	138,723	169,383	169,383	800,000	0.212	OK (Note 1)
		Level D	MR	113,765	147,098	171,891	171,891	925,000	0.186	OK (Note 1)
SRV F Outlet	405	Level B	MR	94,276	121,899	137,345	137,345	600,000	0.229	OK (Note 1)
		Level D	MR	99,097	128,132	139,595	139,595	600,000	0.233	OK (Note 1)

*from GE Stress Report 23A6127 Rev.1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev.7
Forces and Moments are in Lbs and in In-Lbs respectively.
Note 1: EPU Loads are less than the Existing Enveloped Loads and are within allowable.
Note 2: The EPU loads are greater than the existing enveloped loads. However, the EPU loads are lower than the allowable.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0121, Rev. 7 **Page Nos. 50, 54 through 57

Calculation Title: Main Steam Line ' B ', MSRV Lines B, F, K, & P

Description: Main Steam Piping - Line B SRV Valve Acceleration Loads Evaluation *

Node Pt.	Description	ASME Load Level	Loading Direction	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Remarks
103	SRV LINE P	Level B	AH	0.294	0.380	1.854	1.854	8.00	OK (Note 1)
			AV	0.374	0.484	1.234	1.234	6.00	OK (Note 1)
		Level D	AH	0.350	0.452	1.863	1.863	8.00	OK (Note 1)
			AV	0.431	0.557	1.252	1.252	6.00	OK (Note 1)
203	SRV LINE K	Level B	AH	0.336	0.434	1.547	1.547	8.00	OK (Note 1)
			AV	0.396	0.512	1.508	1.508	6.00	OK (Note 1)
		Level D	AH	0.400	0.518	1.562	1.562	8.00	OK (Note 1)
			AV	0.459	0.593	1.526	1.526	6.00	OK (Note 1)
303	SRV LINE B	Level B	AH	0.426	0.551	2.189	2.189	8.00	OK (Note 1)
			AV	0.332	0.429	2.218	2.218	6.00	OK (Note 1)
		Level D	AH	0.514	0.665	2.207	2.207	8.00	OK (Note 1)
			AV	0.395	0.511	2.228	2.228	6.00	OK (Note 1)
403	SRV LINE F	Level B	AH	0.449	0.581	1.703	1.703	8.00	OK (Note 1)
			AV	0.236	0.305	1.416	1.416	6.00	OK (Note 1)
		Level D	AH	0.544	0.704	1.731	1.731	8.00	OK (Note 1)
			AV	0.280	0.362	1.424	1.424	6.00	OK (Note 1)

* Level A and Level C are not affected by TSV Loads.
**from GE Stress Report 23A6127 Rev.1 dated 2/7/89 which is a part of Calculation No. C-0121 Rev. 7
Acceleration Loads are in G's
Note 1: EPU loads are less than Existing Enveloped Loads. Therefore, the structural integrity of the SRV valves are not affected.

MS Line C

- 14.46-45 -

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page No: 38, 40 & 217

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	008	24,554	25,954	31,860	0.81
Emergency	008	23,343	23,343	39,825	0.59
Faulted	008	25,132	26,565	53,100	0.50
Equation : 10 **	042F***	55,862	57,482	53,100	1.08
Equation : 12	042F***	35,644	35,644	53,100	0.67
Equation : 13	042F***	27,097	27,097	53,100	0.51
Equation : 14 (Fatigue) CUF	100	0.05	0.051	0.100	OK

* from GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
** Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.
***thick elbow assumption.

- 14.46-46 -

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page No: 38, 40 & 217

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	008	24,554	25,954	31,860	0.81
Emergency	008	23,343	23,343	39,825	0.59
Faulted	008	25,132	26,565	53,100	0.50
Equation : 10 **	052F	53,792	55,352	53,100	1.04
Equation : 12	052F	34,555	34,555	53,100	0.65
Equation : 13	052F	27,097	27,097	53,100	0.51
Equation : 14 (Fatigue) CUF	100	0.05	0.051	0.100	OK

* from GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
** Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.

Project:	Hope Creek Extended Power Uprate
Calculation No.:	C-0138, Rev. 9 *Page No: 38, 40 & 217
Calculation Title:	Main Steam Line ' C ', MSRV Lines C, E, G & L
Description:	Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	008	24,554	25,954	31,860	0.81
Emergency	008	23,343	23,343	39,825	0.59
Faulted	008	25,132	26,565	53,100	0.50
Equation : 10	042F***	50,139	51,593	53,100	0.97
Equation : 12	042F***	26,536	26,536	53,100	0.50
Equation : 13	042F***	27,453	27,453	53,100	0.52
Equation : 14 (Fatigue) CUF	100	0.05	0.051	0.100	OK

* from GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
*** thin elbow assumption.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 **Page Nos.: 105, 106 and 107

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: Main Steam Piping-Line C MSIV (Inboard) Bonnet Flange Loads Evaluation*

Inboard MSIV	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable (Note 1)	Ratio= Maximum/ Allowable	Remark
Inboard	056	Level B	Axial F	2,134	2,759	2,237	2,759	29,270	0.0943	(Note 2)
			Moment	462,299	597,753	462,299	597,753	1,618,000	0.3694	(Note 2)
		Level C	Axial F	2,134	2,759	2,237	2,759	29,270	0.0943	(Note 2)
			Moment	462,299	597,753	462,299	597,753	1,618,000	0.3694	(Note 2)
		Level D	Axial F	2,281	2,949	2,433	2,949	29,270	0.1008	(Note 2)
			Moment	525,121	678,981	586,106	678,981	1,618,000	0.4196	(Note 2)

* Level A is not affected by TSV Loads.
Forces and Moments are in Lbs and in In-Lbs respectively.
**from GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
Note 1: Allowable are taken from GE Document 213A8411 Rev. 0
Note 2: The EPU loads are greater than the existing enveloped loads. However, the EPU loads are lower than the allowable.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 **Page Nos.105, 108 through 111

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: Main Steam Piping-Line C Inboard MSIV Inlet and Outlet Connection Loads Evaluation *

Inboard MSIV	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Ratio= Maximum/ Allowable	Remark
Inlet Connection	054	Level B	Axial Stress	7,790	10,072	7,790	10,072	17,700	0.5691	(Note 1)
			Tor. Stress	566	732	566	732	17,700	0.0413	(Note 1)
			Bend. stress	9,436	12,201	9,436	12,201	17,700	0.6893	(Note 1)
		Level C	Axial Stress	7,790	10,072	7,790	10,072	17,700	0.5691	(Note 1)
			Tor. Stress	566	732	566	732	17,700	0.0413	(Note 1)
			Bend. stress	9,436	12,201	9,436	12,201	17,700	0.6893	(Note 1)
		Level D	Axial Stress	7,823	10,115	7,824	10,115	17,700	0.5715	(Note 1)
			Tor. Stress	613	793	661	793	17,700	0.0448	(Note 1)
			Bend. stress	9,821	12,699	9,821	12,699	17,700	0.7174	(Note 1)
Outlet connection	058	Level B	Axial Stress	8,293	10,723	8,293	10,723	17,700	0.6058	(Note 1)
			Tor. Stress	386	499	386	499	17,700	0.0282	(Note 1)
			Bend. stress	6,864	8,875	7,079	8,875	17,700	0.5014	(Note 1)
		Level C	Axial Stress	8,293	10,723	8,293	10,723	17,700	0.6058	(Note 1)
			Tor. Stress	386	499	386	499	17,700	0.0282	(Note 1)
			Bend. stress	6,864	8,875	7,079	8,875	17,700	0.5014	(Note 1)
		Level D	Axial Stress	8,298	10,729	8,298	10,729	17,700	0.6062	(Note 1)
			Tor. Stress	409	529	409	529	17,700	0.0299	(Note 1)
			Bend. stress	7,184	9,289	7,438	9,289	17,700	0.5248	(Note 1)

* Level A is not affected by TSV Loads.
Stresses are in psi
**from GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev.9
Note 1: The EPU loads are greater than the existing enveloped loads. However, the EPU loads are lower than the allowable.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page Nos. 55 through 58

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: Main Steam Piping - Line C MSIV Acceleration Loads Evaluation**

Node Pt.	Description	ASME Load Level	Loading Direction	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Qualified by Test	Remarks
055	Body	Level B	AH	0.459	0.593	0.459	0.593	(Note 1)	OK
			AV	0.508	0.656	0.670	0.670	(Note 1)	OK
		Level D	AH	0.511	0.661	1.135	1.135	(Note 1)	OK
			AV	0.581	0.751	0.738	0.751	(Note 1)	OK
057	Operator	Level B	AH	1.758	2.273	1.798	2.273	(Note 1)	OK
			AV	1.800	2.327	1.800	2.327	(Note 1)	OK
		Level D	AH	2.073	2.680	3.010	3.010	(Note 1)	OK
			AV	2.110	2.728	2.110	2.728	(Note 1)	OK
056	Bonnet Flange	Level B	AH	0.364	0.470	0.364	0.470	2.0 (Note 1)	OK
			AV	0.675	0.872	0.771	0.872	3.0 (Note 1)	OK
		Level D	AH	0.407	0.527	0.955	0.955	4.5 (Note 1)	OK
			AV	0.772	0.998	0.857	0.998	5.0 (Note 1)	OK

*from GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
**Acceleration Loads are in G's
Note 1: NEDC 31020 - Hope Creek Environmental Qualification Report MSIV Actuator.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page Nos. 52, 53 and 54

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: Main Steam Piping - Line C RPV Nozzle Loads Evaluation

Component	Node Pt.	ASME Load Level (Note 1)	Loading (Note 2)	Loading Combination with TSV	EPU Loads (Note 3)	Allowable	Ratio= Maximum/ Allowable	Remark
RPV	001	Secondary (Level B)	HR	79,982	103,417	674,200	0.153	OK
		Secondary (Level B)	MR	3,869,725	5,003,554	14,384,000	0.348	OK
		Primary (Level D)	HR	48,788	63,083	374,520	0.168	OK
		Primary (Level D)	MR	2,315,204	2,993,559	7,417,000	0.404	OK

Forces and Moments are in Lbs and in In-Lbs respectively.
*from GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of calculation No. C-0138 Rev.9

Note 1 Levels A and C are not affected by the TSV loads

Note 2: For Secondary load level, HR and MR are the envelope of case 1 and case 3
HR and MR are calculated at the RPV / NOZZLE junction using given FX, FY, FZ, MX, MY, MZ load components.

Note 3: For the EPU loads, only the load combination with TSV load is assumed to be impacted.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0138 Rev. 9 **Attachment 9, Page Nos. 28 and 29

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: Main Steam Piping - Line C Penetration Flued Head Evaluation*

Anchor Number	Node Pt.	ASME Load Level	**Loading Direction	**Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable (Note 1)	Ratio = Max/Allowable	Remark
ANC	62	OBE + TSVC	Axial (P)	55,446	71,692	55,446	71,692	79,000	0.907	OK
			Shear (V)	5,267	6,810	6,256	6,810	28,300	0.241	OK
			Moment (M)	739,722	956,461	739,722	956,461	2,212,000	0.432	OK
		Level D	Axial (P)	55,101	71,246	55,101	71,246	564,300	0.126	OK
			Shear (V)	5,547	7,172	8,620	8,620	338,600	0.025	OK
			Moment (M)	1,216,796	1,573,317	1,216,796	1,573,317	5,078,000	0.310	OK

* Level A and Level C are not affected by TSV Loads.
Forces (P), (V) and Moments (M) are in Lbs and in In-Lbs respectively.
Note 1: Penetration Flued Head Allowable are taken from Attachment 9, Pages 28 & 29 in Calc. No. C-0138 Rev. 9

MS Line C – SRV Lines

- 14.46-54 -

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page Nos.: 42 & 583

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: SRV Piping - Line C Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remark
Equation : 8 Sustained Loads		311F	7,974	7,974	22,500	0.354	Note 1
Equation : 9	Occasional	348F	19,772	20,899	27,000	0.774	
	Level C	335F	17,878	18,897	33,750	0.560	
	Level D	361N	20,971	20,971	45,000	0.466	Note 1
Equation :10	Thermal + OBED	361F**	13,439	13,439	22,500	0.597	Note 1
Equation 11	Thermal + Sustained	361F	18,906	18,906	37,500	0.504	Note 2

* From GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
Note 1: Not affected by Power Uprate.
Note 2: Equation 10 satisfies the required criteria. Equation 11 is not required.
** Stresses at all other node points of SRV Line C is less than this value

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page Nos.: 44 & 599

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: SRV Piping - Line E Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remark
Equation : 8 Sustained Loads		133N	10,626	10,626	22,500	0.472	Note 1
Equation : 9	Occasional	110F	24,589	25,991	27,000	0.963	
	Level C	117N	19,130	20,220	33,750	0.599	
	Level D	110F	25,204	25,204	45,000	0.560	Note 1
Equation :10	Thermal + OBED	107N	15,221	15,221	22,500	0.676	Note 1
Equation 11	Thermal + Sustained	107N	20,668	20,668	37,500	0.551	Note 2

* From GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
Note 1: Not affected by Power Uprate.
Note 2: Since Equation 10 is satisfied, Equation 11 is not required.

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page Nos.: 46 & 735

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: SRV Piping - Line G Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remark
Equation : 8 Sustained Loads		424N	8,138	8,138	22,500	0.362	Note 1
Equation : 9	Occasional	406	24,102	25,476	27,000	0.944	
	Level C	406	21,176	22,383	33,750	0.663	
	Level D	406	24,102	24,102	45,000	0.536	Note 1
Equation :10	Thermal + OBED	466F	16,298	16,298	22,500	0.724	Note 1
Equation 11	Thermal + Sustained	466F	21,140	21,140	37,500	0.564	Note 2

* From GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
Note 1: Not affected by Power Uprate.
Note 2: Since Equation 10 is satisfied, Equation 11 is not required.

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page Nos.: 48 & 762

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: SRV Piping - Line L Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remark
Equation : 8	Sustained Loads	236F	7,845	7,845	22,500	0.349	Note 1
Equation : 9	Occasional	218N	21,240	22,451	27,000	0.832	
	Level C	213F	20,137	21,285	33,750	0.631	
	Level D	218N	23,066	23,066	45,000	0.513	Note 1
Equation :10	Thermal + OBED	218N	15,613	15,613	22,500	0.694	Note 1
Equation 11	Thermal + Sustained	218N	20,850	20,850	37,500	0.556	Note 2

* From GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
Note 1: Not affected by Power Uprate.
Note 2: Since Equation 10 is satisfied, Equation 11 is not required.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page Nos. 71, 89 through 104

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: SRV Inlet & Outlet Flange Moments Loads Evaluation

SRV Line	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Ratio= Maximum/ Allowable	Remark
SRV E Inlet	103	Level B	MR	253,041	327,182	385,513	385,513	800,000	0.482	OK (Note 1)
		Level D	MR	257,845	333,394	387,024	387,024	925,000	0.418	OK (Note 1)
SRV E outlet	105	Level B	MR	247,310	319,772	325,626	325,626	600,000	0.543	OK (Note 1)
		Level D	MR	250,337	323,686	327,426	327,426	600,000	0.546	OK (Note 1)
SRV L Inlet	203	Level B	MR	242,938	314,119	275,105	314,119	800,000	0.393	(Note 2)
		Level D	MR	242,938	314,119	275,105	314,119	925,000	0.340	(Note 2)
SRV L Outlet	205	Level B	MR	221,024	285,784	235,318	285,784	600,000	0.476	(Note 2)
		Level D	MR	221,024	285,784	235,318	285,784	600,000	0.476	(Note 2)
SRV C Inlet	303	Level B	MR	205,206	265,331	265,617	265,617	800,000	0.332	OK (Note 1)
		Level D	MR	205,206	265,331	265,617	265,617	925,000	0.287	OK (Note 1)
SRV C outlet	305	Level B	MR	197,291	255,097	240,115	255,097	600,000	0.425	(Note 2)
		Level D	MR	197,291	255,097	240,115	255,097	600,000	0.425	(Note 2)
SRV G Inlet	403	Level B	MR	168,364	217,695	231,486	231,486	800,000	0.289	OK (Note 1)
		Level D	MR	168,364	217,695	231,486	231,486	925,000	0.250	OK (Note 1)
SRV B outlet	405	Level B	MR	177,420	229,404	206,545	229,404	600,000	0.382	(Note 2)
		Level D	MR	177,420	229,404	206,545	229,404	600,000	0.382	(Note 2)

*from GE Stress Report 23A6128 Rev.1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev.9

Forces and Moments are in Lbs and in In-Lbs respectively.

Note 1: EPU Loads are less than the Existing Enveloped Loads and are within allowable.

Note 2: The EPU loads are greater than the existing enveloped loads. However, the EPU loads are lower than the allowable.

Project:	Hope Creek Extended Power Uprate
Calculation No.:	C-0138, Rev. 9 **Page Nos. 55, 59 through 62
Calculation Title:	Main Steam Line ' C ', MSRV Lines C, E, G & L
Description:	SRV Valve Acceleration Loads Evaluation *

Node Pt.	Description	ASME Load Level	Loading Direction	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Remarks
103	SRV LINE E	Level B	AH	1.311	1.695	1.984	1.984	8.00	OK (Note 1)
			AV	0.540	0.699	1.105	1.105	6.00	OK (Note 1)
		Level D	AH	1.311	1.695	1.984	1.984	8.00	OK (Note 1)
			AV	0.540	0.699	1.105	1.105	6.00	OK (Note 1)
203	SRV LINE L	Level B	AH	1.300	1.681	2.306	2.306	8.00	OK (Note 1)
			AV	0.515	0.666	1.214	1.214	6.00	OK (Note 1)
		Level D	AH	1.300	1.681	2.306	2.306	8.00	OK (Note 1)
			AV	0.515	0.666	1.214	1.214	6.00	OK (Note 1)
303	SRV LINE C	Level B	AH	1.213	1.568	2.051	2.051	8.00	OK (Note 1)
			AV	0.386	0.499	1.484	1.484	6.00	OK (Note 1)
		Level D	AH	1.213	1.568	2.051	2.051	8.00	OK (Note 1)
			AV	0.404	0.523	1.489	1.489	6.00	OK (Note 1)
403	SRV LINE G	Level B	AH	0.912	1.179	2.008	2.008	8.00	OK (Note 1)
			AV	0.247	0.320	1.110	1.110	6.00	OK (Note 1)
		Level D	AH	0.912	1.179	2.008	2.008	8.00	OK (Note 1)
			AV	0.288	0.372	1.119	1.119	6.00	OK (Note 1)

* Level A and Level C are not affected by TSV Loads.
Acceleration Loads are in G's
**from GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9
Note 1: EPU loads are less than Existing Enveloped Loads and allowable. Therefore, the structural integrity of the SRVs is not affected.

MS Line C – HPCI Line

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0138, Rev. 9 *Page No: 50 & 819

Calculation Title: Main Steam Line ' C ', MSRV Lines C, E, G & L

Description: HPCI Piping at Main Steam Line C
Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable
Equation : 9 Normal/Upset	504F	19,066	20,153	31,860	0.63
Emergency	529F	8,553	8,553	39,825	0.21
Faulted	502	21045	22,245	53,100	0.42
Equation : 10 **	502	47,378	48,752	53,100	0.92
Equation : 12	502	15,898	15,898	53,100	0.30
Equation : 13	502	20,174	20,174	53,100	0.38
Equation : 14 (Fatigue) CUF	529N	0.02	0.020	0.100	OK

* from GE Stress Report 23A6128 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0138 Rev. 9

** Equation 10 is satisfied. Equations 12 and 13 are not required.

MS Line D

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page No: 22, 33 through 36, 283, and 398

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable	Remark
Equation : 9 Normal/Upset	009	21,023	22,221	31,860	0.697	OK
Emergency	009	20,014	20,014	39,825	0.503	OK
Faulted	009	21,562	22,791	53,100	0.429	OK
Equation : 10	039F	70,347	72,387	53,100	1.363	Note 1
Equation : 12	039F	51,854	51,854	53,100	0.977	Note 2
Equation : 13	039F	22,756	22,756	53,100	0.429	Note 2
Equation : 14 (Fatigue) CUF	300	0.096	0.097	0.100	0.974	OK

*from GE Stress Report 23A6129 Rev.1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8
Note 1: Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.
Note 2: Pipe Breaks have been postulated at NP-39 per Calc. No. SC-44 Rev.1 Attachment: A1 Sheet 1 of 2

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page No: 22, 33 through 36, 334 and 398

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable	Remark
Equation : 9 Normal/Upset	009	21,023	22,221	31,860	0.697	OK
Emergency	009	20,014	20,014	39,825	0.503	OK
Faulted	009	21,562	22,791	53,100	0.429	OK
Equation : 10	051F	54,840	56,430	53,100	1.063	Note 1
Equation : 12	051F	35,973	35,973	53,100	0.677	
Equation : 13	051F	22,351	22,351	53,100	0.421	
Equation : 14 (Fatigue) CUF	300	0.096	0.097	0.100	0.974	OK

*from GE Stress Report 23A6129 Rev.1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8

Note 1: Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page No: 22, 33 through 36, 328 and 398

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable	Remark
Equation : 9 Normal/Upset	009	21,023	22,221	31,860	0.697	OK
Emergency	009	20,014	20,014	39,825	0.503	OK
Faulted	009	21,562	22,791	53,100	0.429	OK
Equation : 10	050	44,068	45,346	53,100	0.854	OK
Equation : 12	050	25,012	25,012	53,100	0.471	
Equation : 13	050	25,888	25,888	53,100	0.488	
Equation : 14 (Fatigue) CUF	300	0.096	0.097	0.100	0.974	OK

*from GE Stress Report 23A6129 rev. 1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page No: 22, 33 through 36, 247 and 398

Calculation Title: Main Steam Line ' D ', MSRV Lines M; D & H

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable	Remark
Equation : 9 Normal/Upset	009	21,023	22,221	31,860	0.697	OK
Emergency	009	20,014	20,014	39,825	0.503	OK
Faulted	009	21,562	22,791	53,100	0.429	OK
Equation : 10	021N	47,227	48,597	53,100	0.915	OK
Equation : 12	021N	26,305	26,305	53,100	0.495	
Equation : 13	021N	22,170	22,170	53,100	0.418	
Equation : 14 (Fatigue) CUF	300	0.096	0.097	0.100	0.974	OK

*from GE Stress Report 23A6129 rev. 1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page No: 22, 33 through 36, 383 and 398

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable	Remark
Equation : 9 Normal/Upset	009	21,023	22,221	31,860	0.697	OK
Emergency	009	20,014	20,014	39,825	0.503	OK
Faulted	009	21,562	22,791	53,100	0.429	OK
Equation : 10	200	47,739	49,123	54,600	0.900	OK
Equation : 12	200	20,951	20,951	54,600	0.384	
Equation : 13	200	27,995	27,995	54,600	0.513	
Equation : 14 (Fatigue) CUF	300	0.096	0.097	0.100	0.974	OK

*from GE Stress Report 23A6129 rev. 1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page No: 22, 33 through 36, 396 and 398

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Maximum Stress Intensities

CRITERIA PER ASME SECTION III NB-3600	Node Number	Original Maximum Stress* (PSI)	Power Uprate Stress (PSI)	Code Allowable Stress (PSI)	Ratio: Power Uprate to Allowable	Remark
Equation : 9 Normal/Upset	009	21,023	22,221	31,860	0.697	OK
Emergency	009	20,014	20,014	39,825	0.503	OK
Faulted	009	21,562	22,791	53,100	0.429	OK
Equation : 10	300	64,131	65,991	54,600	1.209	Note 1
Equation : 12	300	28,701	28,701	54,600	0.526	
Equation : 13	300	26,990	26,990	54,600	0.494	
Equation : 14 (Fatigue) CUF	300	0.096	0.097	0.100	0.974	OK

*from GE Stress Report 23A6129 rev. 1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8

Note 1: Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 **Pages 85, 86 and 87

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Main Steam Piping - Line D MSIV (Inboard) Bonnet Flange Loads Evaluation*

Inboard MSIV	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Ratio = Maximum / Allowable	Remark
Inboard	059	Level B	Axial F	2,209	2,856	2,209	2,856	29,000	0.0985	OK (Note 1)
			Moment	246,125	318,240	246,125	318,240	1,610,000	0.1977	OK (Note 1)
		Level C	Axial F	2,209	2,856	2,209	2,856	29,000	0.0985	OK (Note 1)
			Moment	246,125	318,240	246,125	318,240	1,610,000	0.1977	OK (Note 1)
		Level D	Axial F	2,377	3,073	3,040	3,073	29,000	0.1060	OK (Note 1)
			Moment	291,610	377,052	325,731	377,052	1,610,000	0.2342	OK (Note 1)

* Level A is not affected by TSV Loads.
Forces and Moments are in Lbs and in In-Lbs respectively.
**from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8
Note 1: The EPU load is greater than the existing enveloped loads. However, the EPU load is lower than the allowable.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 **Pages 85, 88 through 91

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Main Steam Piping - Line D Inboard MSIV Inlet and Outlet Connection Loads Evaluation*

Inboard MSIV	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Ratio = Maximum / Allowable	Remark
Inlet Connection	055	Level B	Axial Stress	7,853	10,154	7,853	10,154	17,700	0.5737	(Note 1)
			Tor. Stress	661	855	661	855	17,700	0.0483	(Note 1)
			Bend. stress	6,345	8,204	6,345	8,204	17,700	0.4635	(Note 1)
		Level C	Axial Stress	7,853	10,154	7,853	10,154	17,700	0.5737	(Note 1)
			Tor. Stress	661	855	661	855	17,700	0.0483	(Note 1)
			Bend. stress	6,345	8,204	6,345	8,204	17,700	0.4635	(Note 1)
		Level D	Axial Stress	7,884	10,194	7,884	10,194	17,700	0.5759	(Note 1)
			Tor. Stress	697	901	718	901	17,700	0.0509	(Note 1)
			Bend. stress	6,743	8,719	6,743	8,719	17,700	0.4926	(Note 1)
Outlet Connection	063	Level B	Axial Stress	7,953	10,283	7,953	10,283	17,700	0.5810	(Note 1)
			Tor. Stress	661	855	661	855	17,700	0.0483	(Note 1)
			Bend. stress	4,597	5,944	4,597	5,944	17,700	0.3358	(Note 1)
		Level C	Axial Stress	7,953	10,283	7,953	10,283	17,700	0.5810	(Note 1)
			Tor. Stress	661	855	661	855	17,700	0.0483	(Note 1)
			Bend. stress	4,597	5,944	4,597	5,944	17,700	0.3358	(Note 1)
		Level D	Axial Stress	7,968	10,303	7,968	10,303	17,700	0.5821	(Note 1)
			Tor. Stress	695	899	730	899	17,700	0.0508	(Note 1)
			Bend. stress	4,871	6,298	4,871	6,298	17,700	0.3558	(Note 1)

* Level A is not affected by TSV Loads.
Stresses are in psi
**from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8
Note 1: The EPU loads are greater than the existing enveloped loads. However, the EPU loads are lower than the allowable.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page Nos.: 46 through 49

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Main Steam Piping - Line D MSIV Acceleration Loads Evaluation**

Node Pt.	Description	ASME Load Level	Loading Direction	Loading Combination with TSV*	EPU Loads	Existing Enveloped Load*	Maximum of EPU & Enveloped Loads	Qualified by Test	Remarks
057	Body	Level B	AH	0.419	0.542	0.419	0.542	(Note 1)	OK
			AV	0.191	0.247	0.249	0.249	(Note 1)	OK
		Level D	AH	0.452	0.584	0.567	0.584	(Note 1)	OK
			AV	0.265	0.343	0.580	0.580	(Note 1)	OK
061	Operator	Level B	AH	1.050	1.357	1.050	1.357	(Note 1)	OK
			AV	0.577	0.746	0.577	0.746	(Note 1)	OK
		Level D	AH	1.211	1.566	1.587	1.587	(Note 1)	OK
			AV	0.824	1.066	0.862	1.066	(Note 1)	OK
059	Bonnet Flange	Level B	AH	0.404	0.523	0.494	0.523	2.0 (Note 1)	OK
			AV	0.224	0.290	0.248	0.290	3.0 (Note 1)	OK
		Level D	AH	0.483	0.625	0.955	0.955	4.5 (Note 1)	OK
			AV	0.248	0.320	0.326	0.326	5.0 (Note 1)	OK

*from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No.: C-0139 Rev. 8
**Acceleration Loads are in G's
Note 1: NEDC 31020 - Hope Creek Environmental Qualification Report MSIV Actuator.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page Nos. 43, 44 and 45

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Main Steam Line D RPV Nozzle Loads Evaluation

Component	Node Pt.	ASME Load Level (Note 1)	Loading (Note 2)	Loading Combination with TSV	EPU Loads (Note 3)	Allowable	Ratio = EPU Loads/ Allowable	Remark
RPV	001	Secondary (Level B)	HR	85,012	109,921	674,200	0.163	OK
		Secondary (Level B)	MR	3,433,638	4,439,694	14,384,000	0.309	OK
		Primary (Level D)	HR	44,237	57,198	374,520	0.153	OK
		Primary (Level D)	MR	1,899,131	2,455,576	7,417,000	0.331	OK

Forces and Moments are in Lbs and in In-Lbs respectively.
*from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No.: C-0139 Rev. 8

Note 1: Levels A and C are not affected by the TSV loads.
Note 2: For Secondary load level, HR and MR are the envelope of case 1 and case 3
HR and MR are calculated at the RPV / NOZZLE junction using given FX, FY, FZ, MX, MY, MZ load components at safe end.
Note 3: For the EPU loads, only the load combination with TSV load is assumed to be impacted.

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 **Attachment 9, Page Nos. 24 and 25

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Main Steam Piping - Line D Penetration Flued Head Evaluation*

Anchor Number	Node Pt.	ASME Load Level	**Loading Direction	**Loading Combination with TSV (Note 1)	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable (Note 1)	Ratio = Max/Allowable	Remark
ANC	67	OBE + TSVC	Axial (P)	53,112	68,674	53,112	68,674	79,000	0.869	OK
			Shear (V)	3,762	4,864	3,762	4,864	28,300	0.172	OK
			Moment (M)	266,105	344,074	266,105	344,074	2,212,000	0.156	OK
		Level D	Axial (P)	55,077	71,215	55,077	71,215	564,300	0.126	OK
			Shear (V)	12,647	16,353	12,647	16,353	338,600	0.048	OK
			Moment (M)	770,208	995,879	770,208	995,879	5,078,000	0.196	OK

* Level A and Level C are not affected by TSV Loads.
Forces (P), (V) and Moments (M) are in Lbs and in In-Lbs respectively.
Note 1: Penetration Flued Head Loads and Allowable are taken from Attachment 9, Pages 24 & 25 in Calc. No. C-0139 Rev. 8

MS Line D – SRV Lines

Project :	Hope Creek Extended Power Uprate	
Calculation No.:	C-0139 Rev. 8	*Page Nos.:23, 37 & 472
Calculation Title:	Main Steam Line ' D ', MSRV Lines M, D & H	
Description:	SRV Piping - Line D	Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remark
Equation : 8 Sustained Loads		282	7,727	7,727	22,500	0.343	Note 1
Equation : 9	Occasional	236F	20,909	22,101	27,000	0.819	
	Level C	236F	15,894	16,800	33,750	0.498	
	Level D	236F	20,309	20,309	45,000	0.451	Note 1
Equation :10	Thermal + OBED	262N**	20,685	20,685	22,500	0.919	Note 1
Equation 11	Thermal + Sustained	262N	25,495	25,495	37,500	0.680	Note 1

* from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No.: C-0139 Rev. 8
Note 1: Not affected by Power Uprate.
** Stresses at all other node points of SRV Line D are less than this value

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page Nos.:23, 37 & 472

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: SRV Piping - Line D Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600		Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remark
Equation : 8 Sustained Loads		282	7,727	7,727	22,500	0.343	Note 1
Equation : 9	Occasional	236F	20,909	22,101	27,000	0.819	
	Level C	236F	15,894	16,800	33,750	0.498	
	Level D	236F	20,309	20,309	45,000	0.451	Note 1
Equation :10	Thermal + OBED	262N**	20,685	20,685	22,500	0.919	Note 1
Equation 11	Thermal + Sustained	262N	25,495	25,495	37,500	0.680	Note 1

* from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No.: C-0139 Rev. 8
Note 1: Not affected by Power Uprate.
** Stresses at all other node points of SRV Line D are less than this value

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page Nos.:23, 37 & 472

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: SRV Piping - Line H Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600	Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remark
Equation : 8 Sustained Loads	376	7,799	7,799	22,500	0.347	Note 1
Equation : 9 Occasional	336	15,471	16,353	27,000	0.606	
Level C	334	11,670	12,335	33,750	0.365	
Level D	336	15,471	15,471	45,000	0.344	Note 1
Equation :10 Thermal + OBED	358F**	17,588	17,588	22,500	0.782	Note 1
Equation 11 Thermal + Sustained	358F	23,504	23,504	37,500	0.627	Note 1

* from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No.: C-0139 Rev. 8
Note 1: Not affected by Power Uprate.
** Stresses at all other node points of SRV Line H are less than this value

Project : Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page Nos.:23, 37 & 472

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: SRV Piping - Line M Maximum Stress Intensities

CRITERIA PER ASME CODE SECTION III ND-3600	Node Number	Original Maximum Stress*	Power Uprate Stress	Code Allowable Stress	Ratio: Power Uprate to Original	Remark
Equation : 8 Sustained Loads	174	7,648	7,648	22,500	0.340	Note 1
Equation : 9 Occasional	134N	18,358	19,404	27,000	0.719	
Level C	174	8,802	9,304	33,750	0.276	
Level D	134N	18,358	18,358	45,000	0.408	Note 1
Equation :10 Thermal + OBED	156F**	17,743	17,743	22,500	0.789	Note 1
Equation 11 Thermal + Sustained	156F	22,257	22,257	37,500	0.594	Note 1

* from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No.: C-0139 Rev. 8
Note 1: Not affected by Power Uprate.
** Stresses at all other node points of SRV Line M are less than this value

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 *Page Nos. 60 through 72

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: SRV Inlet & Outlet Flange Moments Loads Evaluation

SRV Line	Node Pt.	ASME Load Level	Loading	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Ratio= Maximum / Allowable	Remark
SRV D Inlet	206	Level B	MR	305,453	394,951	377,749	394,951	800,000	0.494	(Note 2)
		Level D	MR	305,453	394,951	377,749	394,951	925,000	0.427	(Note 2)
SRV D Outlet	210	Level B	MR	239,033	309,070	289,652	309,070	600,000	0.515	(Note 2)
		Level D	MR	239,033	309,070	289,652	309,070	600,000	0.515	(Note 2)
SRV H Inlet	306	Level B	MR	356,845	461,401	474,055	474,055	800,000	0.593	OK (Note 1)
		Level D	MR	357,945	462,823	474,038	474,038	925,000	0.512	OK (Note 1)
SRV H Outlet	310	Level B	MR	304,158	393,276	320,333	393,276	600,000	0.655	(Note 2)
		Level D	MR	304,158	393,276	321,366	393,276	600,000	0.655	(Note 2)
SRV M Inlet	106	Level B	MR	140,402	181,540	243,358	243,358	800,000	0.304	OK (Note 1)
		Level D	MR	136,633	176,666	242,037	242,037	925,000	0.262	OK (Note 1)
SRV M Outlet	110	Level B	MR	123,316	159,448	183,583	183,583	600,000	0.306	OK (Note 1)
		Level D	MR	123,316	159,448	183,583	183,583	600,000	0.306	OK (Note 1)

*from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8
Forces and Moments are in Lbs and in In-Lbs respectively.
Note 1: EPU Loads are less than the Existing Enveloped Loads and are within allowable.
Note 2: The EPU loads are greater than the existing enveloped loads. However, the EPU loads are lower than the allowable.

- 14.46-80 -

Project: Hope Creek Extended Power Uprate

Calculation No.: C-0139 Rev. 8 **Page Nos. 46, 50 through 52

Calculation Title: Main Steam Line ' D ', MSRV Lines M, D & H

Description: Main Steam Piping - Line D SRV Valve Acceleration Loads Evaluation *

Node Pt.	Description	ASME Load Level	Loading Direction	Loading Combination with TSV	EPU Loads	Existing Enveloped Load	Maximum of EPU & Enveloped Loads	Allowable	Remarks
206	SRV LINE D	Level B	AH	0.390	0.505	2.199	2.199	8.00	OK (Note 1)
			AV	0.199	0.257	0.529	0.529	6.00	OK (Note 1)
		Level D	AH	0.468	0.605	2.214	2.214	8.00	OK (Note 1)
			AV	0.257	0.333	0.763	0.763	6.00	OK (Note 1)
306	SRV LINE H	Level B	AH	0.412	0.533	2.901	2.901	8.00	OK (Note 1)
			AV	0.263	0.340	0.528	0.528	6.00	OK (Note 1)
		Level D	AH	0.515	0.666	2.917	2.917	8.00	OK (Note 1)
			AV	0.327	0.422	0.705	0.705	6.00	OK (Note 1)
106	SRV LINE M	Level B	AH	0.412	0.532	1.779	1.779	8.00	OK (Note 1)
			AV	0.180	0.232	0.464	0.464	6.00	OK (Note 1)
		Level D	AH	0.511	0.661	1.805	1.805	8.00	OK (Note 1)
			AV	0.232	0.300	0.815	0.815	6.00	OK (Note 1)

* Level A and Level C are not affected by TSV Loads.
Acceleration Loads are in G's
**from GE Stress Report 23A6129 Rev. 1 dated 2/7/89 which is a part of Calculation No. C-0139 Rev. 8
Note 1: EPU loads are less than Existing Enveloped Loads. Therefore, the structural integrity of the SRV valves are not affected.

RCIC Line

Project: Hope Creek Extended Power Uprate

Calculation Nos.: 1. SR-1300, Rev.1 dated 10/12/93 — *Pages 11, 14, and 18
2. SR-1303, Rev.1 dated 9/7/94 — *Attachment 2 Pages 2, 221, and 222

Calculation Titles: 1. ASME Section III Class 1 Analysis of The Reactor Core Isolation Cooling System
2. RCIC Line from MS Line A to P11

RCIC Line No.: 1-FC-003-DBA-4"

Description: RCIC Piping - Highest Stress Summary

		Data Point	*Calculated Stress (Psi)	EPU Stress (Psi)	*Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9 :	Design	455	16,949	16,949	26,410	0.642	
	N/U	455	16,648	17,597	31,690	0.555	
	Emergency	455	17,383	17,383	39,610	0.439	
	Faulted	472	21,313	22,528	52,812	0.427	Note 1
Eq. 10**		472	58,302	59,993	52,812	1.136	
Eq. 12		472	1,409	1,409	52,812	0.027	
Eq. 13		472	28,976	28,976	52,812	0.549	
Usage Factor		472	0.0166	0.0168	0.1000	0.168	

**Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.
Note 1: Enveloped Faulted Values of 28497 Psi in SR-1300, Page 11 was not used due to lack of data point information.

Project: Hope Creek Extended Power Uprate

Calculation Nos.: 1. SR-1300, Rev.1 dated 10/12/93 *Pages 11, 14, and 18
2. SR-1303, Rev.1 dated 9/7/94 *Attachment 2 Pages 2, 221, and 222

Calculation Titles: 1. ASME Section III Class 1 Analysis of The Reactor Core Isolation Cooling System
2. RCIC Line from MS Line A to P11

RCIC Line No. : 1-FC-003-DBA-4"

Description: RCIC Piping - Highest Stress Summary

		Data Point	*Calculated Stress (Psi)	EPU Stress (Psi)	*Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9 :	Design	455	16,949	16,949	26,410	0.642	
	N/U	455	16,648	17,597	31,690	0.555	
	Emergency	455	17,383	17,383	39,610	0.439	
	Faulted	472	21,313	22,528	52,812	0.427	Note 1
Eq.10**		405	53,666	55,222	52,812	1.046	
Eq.12		405	3,603	3,603	52,812	0.068	
Eq. 13		405	19,342	19,342	52,812	0.366	
Usage Factor		405	0.0075	0.0076	0.1000	0.076	

**Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.
Note 1: Enveloped Faulted Values of 28497 Psi in SR-1300, Page 11 was not used due to lack of data point information.

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Project: Hope Creek Extended Power Uprate

Calculation Nos.:
1. SR-1300, Rev.1 dated 10/12/93 *Pages 11, 14, and 18
2. SR-1303, Rev.1 dated 9/7/94 *Attachment 2 Pages 2, 221, and 222

Calculation Titles:
1. ASME Section III Class 1 Analysis of The Reactor Core Isolation Cooling System
2. RCIC Line from MS Line A to P11

RCIC Line No. : 1-FC-003-DBA-4"

Description: RCIC Piping - Highest Stress Summary

		Data Point	*Calculated Stress (Psi)	EPU Stress (Psi)	*Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9 :	Design	455	16,949	16,949	26,410	0.642	
	N/U	455	16,648	17,597	31,690	0.555	
	Emergency	455	17,383	17,383	39,610	0.439	
	Faulted	472	21,313	22,528	52,812	0.427	Note 1
Eq.10		455	49,756	51,199	52,812	0.969	
Eq.12							Note 2
Eq. 13							Note 2
Usage Factor		405	0.0075	0.0076	0.1000	0.076	

Note 1: Enveloped Faulted Values of 28497 Psi in SR-1300, Page 11 was not used due to lack of data point information.
Note 2: Equations 12 & 13 are not required since Equation 10 is satisfied.

MS Drain Line

Project: Hope Creek Extended Power Uprate

Calculation No.: SR-1100, Rev 1 dated 9/21/94 *Pages 12, 16 and 37

Calculation Title: ASME Section III Class 1 Analysis of The Main Steam Isolation Valve (Inboard) Drain System

Line No. IDs: AB-050-DBA-3"

Description: Main Steam Drain Line Class 1 - Maximum Stress Intensity Summary

		Data Point	*Calculated Stress (Psi)	EPU Stress (Psi)	*Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9 :	Design	47	8,918	8,918	26,550	0.336	
	N/U	47	8,568	9,056	31,860	0.284	
	Emergency	47	9,209	9,209	39,820	0.231	
	Faulted	47	21,230	22,440	53,100	0.423	
Eq.10		145	44,557	45,849	53,100	0.863	
Eq.12	***						
Eq. 13	***						
Usage Factor		130	0.0205	0.0208	0.100	0.208	

***Not required since Equation (10) requirement is met.

- 14.46-87 -

Project: Hope Creek Extended Power Uprate

Calculation No.: SR-1100, Rev 1 dated 9/21/94 *Pages 13, 16 and 37

Calculation Title: ASME Section III Class 1 Analysis of The Main Steam Isolation Valve (Inboard) Drain System

Line No. IDs: AB-050-DBA-2"

Description: Main Steam Drain Line Class 1 - Maximum Stress Intensity Summary

		Data Point	*Calculated Stress (Psi)	EPU Stress (Psi)	*Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9 :	Design	417	7,317	7,317	26,550	0.276	
	N/U	417	7,005	7,404	31,860	0.232	
	Emergency	417	7,577	7,577	39,820	0.190	
	Faulted	417	12,063	12,751	53,100	0.240	
Eq.10		255	37,988	39,090	53,100	0.736	
Eq.12	***						
Eq. 13	***						
Usage Factor		262	0.0165	0.017	0.100	0.17	

***Not required since Equation (10) requirement is met.

Project: Hope Creek Extended Power Uprate

Calculation No.: Calculation No. C-136, Rev 8 *Section 3.2, Sheet Nos. 85 and 98

Calculation Title: Main Steam Drain Inside Drywell

Support ID: AB-050-H20 Type: RAD (Node No. 290)

Support Calc. No.: 1-P-AB-050-C19, Rev.2 Sheet No. 5

Drawing No.: FSK-P-1-AB-603, Rev.6

Description: From F22A - Main Steam Drain Line Support (Inside Drywell)

Load Case	Load Direction	*SRP Load (Lbs)	EPU Load (Lbs)	**Qualified Load (Lbs)	Ratio = EPU/ Qualified	Remarks
MAXNOR	FA	0	0	1,050	0.000	OK
MINNOR	FA	-397	-513	1,050	-0.489	OK
MAXUPS	FA	0	0	1,050	0.000	OK
MINUPS	FA	-442	-572	1,050	-0.544	OK
MAXFLT	FA	35	45	1,397	0.032	OK
MINFLT	FA	-533	-689	1,397	-0.493	OK

**Qualified Load are taken from PSE&G's Comment No. 45 dated 7/9/03 on Draft Task Report T0308, Rev. 0. (See Attachment # 9 of Ref. 4.)

RPV Head Vent Line

Project: Hope Creek Extended Power Uprate

Calculation Nos.:
1. SR-10855-2100, Rev.1 dated 3/2/93 — *Pages 13, 16, 17, 51 and 52
2. SR-2101, Rev.2 dated 8/30/95 — *Attachment 2 Pages 2 and 5.

Calculation Titles:
1. ASME Section III Class 1 Analysis of The Head Vent System
2. The Head Vent System

Head Vent Line Nos. : BB-192-DBA - 2" and AB-051-DBA - 2"

Description: Head Vent Piping - Highest Stress Summary

		Data Point	*Calculated Stress (Psi)	EPU Stress (Psi)	*Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9 :	Design	665	20,071	20,071	26,550	0.756	
	N/U	665	19,761	20,887	31,860	0.656	
	Emergency	665	20,331	20,331	39,820	0.511	
	Faulted	665	42,805	45,245	53,100	0.852	
Eq.10**		585	57,112	58,768	53,100	1.107	
Eq.12		585	7,957	7,957	53,100	0.150	
Eq. 13		585	13,524	13,524	53,100	0.255	
Usage Factor		585	0.0413	0.0419	0.1000	0.419	

**Since equation 10 is not satisfied, the piping is qualified by equations 12 and 13.

BALANCE

OF

PLANT

PIPING

Project:	Hope Creek Extended Power Uprate
Calculation No.:	SR-2400, Revision 1
Calculation Title:	Main Steam System
Component IDs:	Nodes 179 & 180
Description:	ASME Class 1 Piping – Butt Weld / TTJ @ Valve End

CLTP Design Pressure	No change	CLTP Operating Temperature	No Change
EPU Design Pressure	No change	EPU Operating Temperature	No Change

ASME CLASS 1		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	*Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9	Design						No change
	N/U	179	7,600	8,033	31,860	0.252	
	Emergency	179	8,724	9,221	39,820	0.232	
	Faulted						No change
Eq.10		180	23,593	24,277	53,100	0.457	
Eq.12							
Eq.13							
Usage Factor		180	0.0020	0.0030	1	0.0030	

Project: Hope Creek Extended Power Uprate

Calculation No.: SR-2400, Revision 1

Calculation Title: Main Steam System

Component IDs: Nodes 9 & 10

Description: ASME Class 1 Piping – Butt Weld / TTJ @ Valve End

CLTP Design Pressure No change CLTP Operating Temperature No Change
EPU Design Pressure No change EPU Operating Temperature No Change

ASME CLASS 1		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	*Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9	Design						No change
	N/U	9	7,620	8,054	31,860	0.253	
	Emergency	9	8,702	9,198	39,820	0.231	
	Faulted						No change
Eq.10		10	24,999	25,724	53,100	0.484	
Eq.12							
Eq.13							
Usage Factor		10	0.0024	0.0036	1	0.0036	

Project: Hope Creek Extended Power Uprate

Calculation No.: SR-2400, Revision 1

Calculation Title: Main Steam System

Component IDs: Nodes 529 & 530

Description: ASME Class 1 Piping – Butt Weld / TTJ @ Valve End

CLTP Design Pressure No change CLTP Operating Temperature No Change
EPU Design Pressure No change EPU Operating Temperature No Change

ASME CLASS 1		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	*Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9	Design						No change
	N/U	529	7,951	8,404	31,860	0.264	
	Emergency	529	9,186	9,710	39,820	0.244	
	Faulted						No change
Eq.10		530	25,166	25,896	53,100	0.488	
Eq.12							
Eq.13							
Usage Factor		530	0.0024	0.0036	1	0.0036	

A-4

Project:	Hope Creek Extended Power Uprate
Calculation No.:	SR-2400, Revision 1
Calculation Title:	Main Steam System
Component IDs:	Node 350
Description:	ASME Class 1 Piping – TTJ @ Valve End

CLTP Design Pressure	No change	CLTP Operating Temperature	No Change
EPU Design Pressure	No change	EPU Operating Temperature	No Change

ASME CLASS 1		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 9	Design						No change
	N/U	350	8,574	9,063	31,860	0.284	
	Emergency	350	10,004	10,574	39,820	0.266	
	Faulted						No change
Eq.10		350	27,194	27,983	53,100	0.527	
	Break			27,983	42,480	0.659	No break zone criteria satisfied
Eq.12							
Eq.13							
Usage Factor		350	0.0034	0.0051	1	0.0051	
	break	[illegible]	[illegible]	0.0051	0.1000		No break zone criteria satisfied

Project: Hope Creek Extended Power Uprate

Calculation No.: Pipe Stress Analysis C-0010, Revision 8

Calculation Title: Main Steam System

Component IDs: Node 565B

Description: ASME Class 2&3 Piping, B31.1 Piping

CLTP Design Pressure	No change	CLTP Operating Temperature	No Change
EPU Design Pressure	No change	EPU Operating Temperature	No Change

ASME CLASS 2&3 Q PIPING		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 8	Sustained						No change
Eq. 9	N/U	565B	15722	16619	21000	0.792	
	Emergency	565B	16445	17383	31500	0.552	
	Faulted						No change
Eq.10							No change
Eq.11							Not required

Project: Hope Creek Extended Power Uprate

Calculation No.: Pipe Stress Analysis C-0010, Revision 8

Calculation Title: Main Steam System

Component IDs: Node 590/E25

Description: ASME Class 2&3 Piping, B31.1 Piping

CLTP Design Pressure No change CLTP Operating Temperature No Change
EPU Design Pressure No change EPU Operating Temperature No Change

ASME CLASS 2&3 QS PIPING		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 8	Sustained						No change
Eq. 9	N/U	590	14975	15829	21000	0.754	
	Emergency						N/A – Not evaluated
	Faulted						No change
Eq.10							No change
Eq.11							Not required

A-8

Project: Hope Creek Extended Power Uprate

Calculation No.: *Pipe Stress Analysis C-0010, Revision 8*

Calculation Title: Main Steam System

Component IDs: Node 660/NZ29

Description: ASME Class 2&3 Piping, B31.1 Piping

CLTP Design Pressure No change CLTP Operating Temperature No Change
EPU Design Pressure No change EPU Operating Temperature No Change

B31.1 PIPING		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 11	Sustained						No change
Eq. 12	N/U	660	5972	6313	15240	0.415	
	Emergency						N/A – Not evaluated
	Faulted						No change
Eq.13/14							N/A

Project:	Hope Creek Extended Power Uprate
Calculation No.:	Pipe Stress Analysis C-0019, Revision 7
Calculation Title:	Main Steam System
Component IDs:	Node 660/NZ29
Description:	ASME Class 2&3 Piping, B31.1 Piping

CLTP Design Pressure	No change	CLTP Operating Temperature	No Change
EPU Design Pressure	No change	EPU Operating Temperature	No Change

B31.1 PIPING		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 11	Sustained						No change
Eq. 12	N/U	660	5665	5988	18000	0.333	
	Emergency						N/A – Not evaluated
	Faulted						N/A
Eq.13/14							N/A

A-10

Project	Hope Creek Extended Power Uprate
Calculation No.:	Pipe Stress Analysis C-1922, Revision 6
Calculation Title:	Main Steam System
Component IDs:	Node 85
Description:	ASME Class 2&3 Piping, B31.1 Piping

CLTP Design Pressure	No change	CLTP Operating Temperature	No Change
EPU Design Pressure	No change	EPU Operating Temperature	No Change

ASME CLASS 2&3 Q PIPING		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 8	Sustained						No change
Eq. 9	N/U	85	5385	5692	18000	0.317	
	Emergency						N/A – Not evaluated
	Faulted						No change
Eq.10							No change
Eq.11							No change

Project:	Hope Creek Extended Power Uprate
Calculation No.:	Pipe Stress Analysis C-1922, Revision 6
Calculation Title:	Main Steam System
Component IDs:	Node 180
Description:	ASME Class 2&3 Piping, B31.1 Piping

CLTP Design Pressure	No change	CLTP Operating Temperature	No Change
EPU Design Pressure	No change	EPU Operating Temperature	No Change

B31.1 PIPING		Data Point	Calculated Stress (Psi)	EPU Stress (Psi)	Allowable Stress (Psi)	Ratio EPU/ Allowable	Remarks
Eq. 11	Sustained						No change
Eq. 12	N/U	180	4657	4923	18000	0.273	
	Emergency						N/A – Not evaluated
	Faulted						No change
Eq.13/14							N/A

MAIN STEAM LINE "A" Calc. no. C-0122 Rev. 10									
SUPPORT HANGER NO.	SUPPORT CALC. NO.	SUPT CALC REV.	DATA PT	LOAD DIR	SER VICE LEVEL	EPU Load (lbs)	design Load (lbs)	Ratio = EPU/des	REMARKS
1-P-AB-030-H12 (RH12X, RH12Z)	1-P-AB-030-C004	3	47	X	B	87848	761630	0.115	
					D	673258	761630	0.884	Includes pipe break load
				Z	B	33248	80000	0.416	
					D	88187	570000	0.155	Includes pipe break load
1-P-AB-030-H13 (RH13X)	1-P-AB-030-C009	3	57	X	B	51285	191350	0.268	
					D	248232	322690	0.769	Includes pipe break load
1-P-AB-030-H14 (RH14Y, RH14X)	1-P-AB-030-C010	3	67	Y	B	82089	388380	0.211	
					D	266519	388380	0.686	Includes pipe break load
				X	B	81816	319570	0.256	
					D	321816	393620	0.818	Includes pipe break load
1-P-AB-030-H03	1-P-AB-030-C006	6	19	Lat	B	12567	44000	0.286	
					D	12567	44000	0.286	
1-P-AB-030-H02	1-P-AB-030-C002	6	17	Lat	B	17136	35000	0.490	
					D	17874	35000	0.511	
1-P-AB-030-H05	1-P-AB-030-C003	6	29	Lat	B	15922	44900	0.355	Snubber Allow
					D	18368	58000	0.317	
1-P-AB-030-H04	1-P-AB-030-C001	8	23	Lat	B	5976	44900	0.133	Snubber Allow
					D	5976	70000	0.085	
1-P-AB-053-H16	1-P-AB-053-C015	7	316	Lat	B	1172	36670	0.032	
					C	2281	36670	0.062	
1-P-AB-061-H11	1-P-AB-061-C013	5	124	Lat	B	5028	24693	0.204	
					C	5326	24693	0.216	
1-P-AB-066-H11	1-P-AB-066-C005	7	226	Lat	B	13549	31400	0.431	
					C	15286	34100	0.448	

MAIN STEAM LINE "B" Calc. no. C-0121 Rev. 8									
SUPPORT HANGER NO.	SUPPORT CALC. NO.	SUPT CALC REV.	DATA PT	LOAD DIR	SER VICE LEVEL	EPU Load (lbs)	design Load (lbs)	Ratio = EPU/des	REMARKS
1-P-AB-031-H02	1-P-AB-031-C004	6	19	Lat	B	14701	44900	0.327	Snubber Allow
					D	18421	70000	0.263	
1-P-AB-031-H03	1-P-AB-031-C003	4	21	Lat	B	16698	44900	0.372	Snubber Allow
					D	20045	70000	0.286	
1-P-AB-031-H04	1-P-AB-031-C005	7	29	Lat	B	11201	40000	0.280	
					D	13816	40000	0.345	Includes pipe break load
1-P-AB-031-H05	1-P-AB-031-C002	5	33	Lat	B	7213	44900	0.161	Snubber Allow
					D	10193	70000	0.146	
1-P-AB-031-H07	1-P-AB-031-C001	5	45	Lat	B	24634	44900	0.549	Snubber Allow
					D	27453	50000	0.549	
1-P-AB-031-H13	1-P-AB-031-C011	2	51	Lat	B	62966	175330	0.359	
					D	792534	831300	0.953	Includes pipe break load
1-P-AB-031-H12	1-P-AB-031-C006	2	53	Lat	B	91769	400000	0.229	
					D	607315	660000	0.920	Includes pipe break load
1-P-AB-031-H14	1-P-AB-031-C012	2	61	Lat	B	19861	250000	0.079	
					D	271748	275000	0.988	Includes pipe break load
1-P-AB-054-H13	1-P-AB-054-C013	7	316	Lat	B	1137	15000	0.076	Snubber Allow
					C	3778	15650	0.241	
1-P-AB-058-H12	1-P-AB-058-C012	7	418	Lat	B	347	15000	0.023	Snubber Allow
					C	765	15460	0.049	
1-P-AB-062-H17	1-P-AB-062-C016	5	248	Lat	B	9516	24200	0.393	
					C	11369	24200	0.470	
1-P-AB-065-H15	1-P-AB-065-C017	5	132	Lat	B	2746	40473	0.068	Snubber Allow
					C	4154	44530	0.093	

MAIN STEAM LINE "C" C-0138 Rev. 10									
SUPPORT HANGER NO.	SUPPORT CALC. NO.	SUPT CALC REV.	DATA PT	LOAD DIR	SER VICE LEVEL	EPU Load (lbs)	design Load (lbs)	Ratio = EPU/des	REMARKS
1-P-AB-032-H02	1-P-AB-032-C001	5	14	Lat	B	34759	44900	0.774	snubber capacity = design load
					D	34759	44900	0.774	Support is acceptable
1-P-AB-032-H03	1-P-AB-032-C002	5	17	Lat	B	22613	25000	0.905	
					D	22613	25000	0.905	Support is acceptable
1-P-AB-032-H04	1-P-AB-032-C003	5	22	Lat	B	12868	25688	0.501	
					D	15409	25688	0.600	Support is acceptable
1-P-AB-032-H07	1-P-AB-032-C008	6	37	Fvert	B	26864	44900	0.598	
					D	28692	44900	0.639	Support is acceptable
1-P-AB-055-H18	1-P-AB-055-C022	6	319	Fvert	B	606	15589	0.039	
					C	2368	15589	0.152	Support is acceptable
1-P-AB-057-H11	1-P-AB-057-C008	6	119	Lat	B	4075	15000	0.272	
					C	4985	15000	0.332	Support is acceptable
1-P-AB-059-H05	1-P-AB-059-C003	5	421	Lat	B	1499	15296	0.098	
					C	2656	15296	0.174	Support is acceptable
1-P-AB-063-H08	1-P-AB-063-C008	5	215	Fvert	B	809	38000	0.021	
					C	2705	38000	0.071	Support is acceptable
1-P-AB-032-H12	1-P-AB-032-C006	2	45	Lat	B	91769	400000	0.229	similar to 1-P-AB-031-H12, calc. C-0121

MAIN STEAM LINE "C" C-0138 Rev. 10 (Cont.)									
		SUPT			SER	EPU	design		REMARKS
SUPPORT	SUPPORT	CALC	DATA	LOAD	VICE	Load	Load	Ratio =	
HANGER NO.	CALC. NO.	REV.	PT	DIR	LEVEL	(lbs)	(lbs)	EPU/des	
(PR52)					D	607315	660000	0.920	Includes pipe break loads. support is acceptable
1-P-AB-032-H13	1-P-AB-032-C010	2	44	Lat	B	62966	175330	0.359	similar to 1-P-AB-031-H13, calc. C-0121
					D	792534	831300	0.953	Includes pipe break loads. support is acceptable
1-P-AB-032-H14	1-P-AB-032-C011	2	49	Lat	B	27288	175190	0.156	
(PR57)					D	190487	250000	0.762	Includes pipe break load, support is acceptable
1-P-FD-001-H01	1-P-FD-001-C001	5	532	Lat	B	6936	8000	0.867	
(RH01)					D	6936	8000	0.867	Support is acceptable
1-P-FD-001-H05	1-P-FD-001-C005	5	531	Lat	B	1968	35484	0.055	
(SH05)					D	2596	35484	0.073	Support is acceptable
1-P-FD-001-H06	1-P-FD-001-C006	4	523	Lat	B	6355	82800	0.077	
(RH06)					D	6355	82800	0.077	Support is acceptable
1-P-FD-001-H07	1-P-FD-001-C007	5	527	Lat	B	3428	93947	0.036	
(RH07)					D	3428	93947	0.036	Support is acceptable

MAIN STEAM LINE "D" C-0139 Rev. 9									
SUPPORT HANGER NO.	SUPPORT CALC. NO.	SUPT CALC REV.	DATA PT	LOAD DIR	SER VICE LEVEL	EPU Load (lbs)	design Load (lbs)	Ratio = EPU/des	REMARKS
1-P-AB-033-H02	1-P-AB-033-C001	6	17	Lat	B	10745	44900	0.239	snubber capacity = design load
					D	12573	44900	0.280	Support is acceptable
1-P-AB-033-H03	1-P-AB-033-C006	8	19	Lat	B	13951	44900	0.311	snubber capacity = design load
					D	13951	44900	0.311	Support is acceptable
1-P-AB-033-H05	1-P-AB-033-C003	7	27	Lat	B	10534	14362	0.733	
					D	11560	14362	0.805	Support is acceptable
1-P-AB-033-H04	1-P-AB-033-C008	6	29	Lat	B	3249	8314	0.391	
					D	3557	8314	0.428	Support is acceptable
1-P-AB-033-H12	1-P-AB-033-C002	3	40	X	B	28004	60000	0.467	Support is acceptable
					D	60009	60000	1.000	Includes pipe break load
			41	Lat	B	88406	570000	0.155	
					D	525488	570000	0.922	Includes pipe break load
1-P-AB-033-H13	1-P-AB-033-C011	3	46	X	B	73629	200000	0.368	Support is acceptable
					D	282116	322690	0.874	Includes pipe break load
1-P-AB-056-H19	1-P-AB-056-C018	7	222	Fvert	B	269	10819	0.025	
					C	1840	10819	0.170	Support is acceptable
1-P-AB-064-H10	1-P-AB-064-C007	6	126	Flat	B	1688	24455	0.069	
					C	1897	24455	0.078	Support is acceptable
1-P-AB-060-H06	1-P-AB-060-C008	6	330	Flat	B	4713	26499	0.178	
					C	8123	26499	0.307	Support is acceptable

RCIC LINE from MS Line "A" to P11 Calc. no. C-0123									
SUPPORT HANGER NO.	SUPPORT CALC. NO.	SUPT CALC REV.	DATA PT	LOAD DIR	SER VICE LEVEL	EPU Load (lbs)	design Load (lbs)	Ratio = EPU/des	REMARKS
1-P-FC-003-H08	1-P-FC-003-C006	7	416	Lat	N/U	1271	1339	0.949	
					FLTD	1891	2120	0.892	

MAIN STEAM Drain Inside the Drywell Calc. no. C-0136									
SUPPORT HANGER NO.	SUPPORT CALC. NO.	SUPT CALC REV.	DATA PT	LOAD DIR	SER VICE LEVEL	EPU Load (lbs)	design Load (lbs)	Ratio = EPU/des	REMARKS
1-P-AB-050-H020	1-P-AB-050-C019	3	290	Y	N/U	548	1050	0.522	
					FLTD	660	1050	0.629	
1-P-AB-050-H030	1-P-AB-050-C028	1	231	Y	N/U	204	235	0.868	
					FLTD	269	294	0.916	
1-P-AB-050-H029	1-P-AB-050-C020	2	352		N/U	307	650	0.472	
					FLTD	416	650	0.640	
1-P-AB-050-H021	1-P-AB-050-C027	1	410	Y	N/U	269	1150	0.234	
					FLTD	385	1150	0.335	

RPV VENT LINE Calc. no. C-1842									
SUPPORT HANGER NO.	SUPPORT CALC. NO.	SUPT CALC REV.	DATA PT	LOAD DIR	SER VICE LEVEL	EPU Load (lbs)	design Load (lbs)	Ratio = EPU/des	REMARKS
1-P-BB-192-H009	1-P-BB-192-C008	4	290	Lat	N/U	836	1090	0.767	
					FLTD	1090	1363	0.800	

Calc. No. C-0010							
Support Mk No.	NP	Direction	Existing Load	CPPU Load "A"	Design Load "B"	Ratio= A/B	Remarks*
1-P-AB-001-H017	230	Y-Snub	9392	12072	33505	0.360	
1-P-AB-001-H002	278	Z-Snub	24095	33002	47908	0.689	
1-P-AB-001-H003	27A	X-Snub	56695	77619	79000	0.98	
1-P-AB-001-H004	272	Y-Stop	17564	18223	23289	0.782	
1-P-AB-001-H008	250	Y-Stop	22206	23535	27558	0.854	
1-P-AB-001-H018	230	X-Stop	7604	9818	31280	0.314	
1-P-AB-001-H001	280	Y-Stop	9859	10162	32648	0.311	
1-P-AB-001-H005	265	Y-Stop	14657	15404	25107	0.614	
1-P-AB-001-H007	260	Y-Stop	19550	20665	28901	0.715	
1-P-AB-001-H011	242	Y-Stop	73599	77043	73599	1.047	Max. stress ratio = 1.05(0.28/0.5) = 0.59 < 1.0 OK
1-P-AB-001-H012	238	Y-Stop	37022	38607	38238	1.01	Max stress ratio = 1.01(0.233/0.375) = 0.628 < 1.0 ok
1-P-AB-001-H015	234	Y-Stop	21860	23293	28158	0.827	
1-P-AB-002-H001	111	Z-Snub	25662	35155	59640	0.589	
1-P-AB-002-H008	74	Y-Snub	57109	76821	106672	0.720	
1-P-AB-002-H003	102	X-Snub	58427	80031	58427	1.370	Max. stress ratio = 1.37(1/2.257) = 0.61< 1.0 OK

* Note: If the Stress Ratio was greater than one, the existing calculations were reviewed in detail. A load comparison was performed for the CPPU load versus the design load. The critical margin was identified, conservatism removed, and a new Stress Ratio was calculated as documented in the Remarks Column.

Calc. No. C-0010							
Support Mk No.	NP	Direction	Existing Load	CPPU Load "A"	Design Load "B"	Ratio= A/B	Remarks*
1-P-AB-002-H002	110	Y-Stop	14402	14742	39024	0.378	
1-P-AB-002-H004	95	Y-Stop	16224	17110	26797	0.639	
1-P-AB-002-H005	90	Y-Stop	17685	18380	31605	0.582	
1-P-AB-002-H007	80	Y-Stop	21075	22027	22335	0.986	
1-P-AB-002-H009	72	Y-Stop	36749	38026	36749	1.03	Max. stress ratio = 1.03(0.309/0.375) = 0.85 < 1.0 OK
1-P-AB-002-H011	68	Y-Stop	33803	35387	33804	1.05	Max. stress ratio = 1.05(0.406/0.5) = 0.85 < 1.0 OK
1-P-AB-002-H012	67	X-Stop	30997	35340	30997	1.14	Max. (N/U) stress ratio = 16374/20365 = 0.80 < 1.0 OK
1-P-AB-002-H014	64	Y-Stop	20708	21848	20708	1.06	Max. (N/U) stress ratio = 1.06(0.353/0.5) = 0.75 < 1.0 OK
1-P-AB-002-H016	60	Y-Snub	8989	11561	12000	0.963	
1-P-AB-002-H017	60	X-Stop	9645	10791	15660	0.689	
1-P-AB-003-H017	62A	X-Snub	53493	73203	53493	1.368	Max. stress ratio = (1.343/1.356) = 0.99 < 1.0 OK
1-P-AB-003-H004	622	Y-Stop	11849	12260	11849	1.035	Max. stress ratio = (12260/11849)(1/1.827) = 0.57 < 1.0 OK
1-P-AB-003-H002	632	Y-Stop	15933	16454	37323	0.441	
1-P-AB-003-H001	S33	Z-Snub	19965	27331	19965	1.369	Max. stress ratio = (27331/19965)(1/1.835) = 0.75 < 1.0 OK
1-P-AB-003-H006	615	Y-Stop	13102	13651	13102	1.042	Max. stress ratio = (13651/13102)(0.278/0.375) = 0.77 < 1.0 OK
1-P-AB-003-H007	610	Y-Stop	12322	13121	22611	0.580	
1-P-AB-003-H008	605	Y-Stop	24883	26410	51605	0.512	

Calc. No. C-0010

Support Mk No.	NP	Direction	Existing Load	CPPU Load "A"	Design Load "B"	Ratio= A/B	Remarks*
1-P-AB-003-H010	588	Y-Stop	29640	31537	42883	0.735	
1-P-AB-003-H011	587	X-Stop	30431	36711	37000	0.99	
1-P-AB-003-H012	586	X-Stop	13096	15529	29804	0.521	
1-P-AB-003-H013	584	Y-Stop	18085	19670	18085	1.088	Max. stress ratio = (19670/18085)(0.34/0.5) = 0.74 < 1.0 OK
1-P-AB-003-H015	580	Y-Snub	12030	16033	24524	0.654	
1-P-AB-003-H016	580	X-Stop	12617	13931	12841	1.085	Max. Upset ratio = (13931/12841)(1765/23900) = 0.08 < 1.0 OK
1-P-AB-004-H002	452	Y-Stop	13940	14478	27710	0.522	
1-P-AB-004-H001	453	Z-Snub	30355	41565	44000	0.94	
1-P-AB-004-H008	417	Z-Snub	66809	90963	91000	1.00	
1-P-AB-004-H011	407	X-Stop	33071	39504	39600	1.00	
1-P-AB-004-H016	400	X-Stop	7803	9230	34720	0.266	
1-P-AB-004-H010	408	Y-Stop	38216	39468	45172	0.874	
1-P-AB-004-H015	400	Y-Snub	11424	14971	11424	1.310	Max. stress ratio = (14971/11424)(1/1.357) = 0.97 < 1.0 OK
1-P-AB-004-H005	435	Y-Stop	16093	16675	16093	1.036	Max. stress ratio = (16675/16093)(0.26/0.375) = 0.72 < 1.0 OK
1-P-AB-004-H006	430	Y-Stop	13187	13775	13187	1.045	Max. stress ratio = (13775/13187)(0.24/0.375) = 0.67 < 1.0 OK
1-P-AB-004-H007	420	Y-Stop	14972	15544	14973	1.038	Max. stress ratio = (15544/14973)(0.274/0.375) = 0.76 < 1.0 OK
1-P-AB-004-H009	412	Y-Stop	34171	35322	34171	1.034	Max. stress ratio = (35322/34171)(0.266/0.375) = 0.73 < 1.0 OK

Calc. No. C-0010							
Support Mk No.	NP	Direction	Existing Load	CPPU Load "A"	Design Load "B"	Ratio= A/B	Remarks*
1-P-AB-004-H012	406	X-Stop	15322	17905	15322	1.169	Max. stress ratio (N/U) = (1.17)(1/2.165) = 0.54 < 1.0 OK
1-P-AB-004-H013	404	Y-Stop	21052	22374	29650	0.755	
1-P-AB-005-H005	741	X-Snub	12117	16599	12117	1.370	Max. stress ratio (N/U) = (1.37)(1/1.776) = 0.77 < 1.0 OK
1-P-AB-005-H001	720	Y-Stop	3659	3987	3658	1.090	Max. stress ratio = (3987/3658)(0.14/0.3125) = 0.49 < 1.0 OK
1-P-AB-005-H003	736	Y-Stop	7217	7479	8767	0.853	
1-P-AB-005-H006	743	Y-Stop	3454	3688	3453	1.068	Max stress ratio = 1.068(0.153/0.25) = 0.65 < 1.0 OK
1-P-AB-005-H007	835	Y-Stop	2396	2508	4471	0.561	
1-P-AB-005-H009	757	ANC		15107	14673	1.030	
				27280	26950	1.012	
				62264	60337	1.032	
				61044	60849	1.003	EPU Margin factor = 1.107/1.04 = 1.06 > 1.0 ok
				69039	66334	1.041	
				144239	143504	1.005	
1-P-AB-006-H001	910	Y-Stop	2973	3180	2973	1.070	
1-P-AB-006-H014	775	Y-Stop	0	8734	9011	0.969	
1-P-AB-006-H036	774	X-Stop	0	32115	32491	0.988	
1-P-AB-006-H008	860	Y-Stop	2857	3010	2875	1.047	Max. stress ratio = (3010/2857)(1/2.1) = 0.50 < 1.0 OK
1-P-AB-006-H010	810	Y-Stop	19636	20356	21149	0.963	
1-P-AB-006-H011	800	Y-Stop	7649	7753	9482	0.818	
1-P-AB-006-	950	Y-Stop	13594	13961	14003	0.997	

Calc. No. C-0010							
Support Mk No.	NP	Direction	Existing Load	CPPU Load "A"	Design Load "B"	Ratio= A/B	Remarks*
H002							
1-P-AB-006-H013	790	Y-Stop	6555	6817	10049	0.678	
1-P-AB-138-H005	E38	Y-Stop	29114	29939	29115	1.028	Max. stress ratio = (29939/29115)(1/1.188) = 0.87 < 1.0 OK
1-P-AB-138-H003	E15	Y-Stop	23709	25024	23708	1.056	Max. stress ratio = (25024/23708)(1/1.522) = 0.69 < 1.0 OK
1-P-AB-138-H006	E45	Y-Stop	50981	52719	63400	0.832	
1-P-AB-138-H001	E7	X-Snub	30886	42217	42300	1.00	
1-P-AB-138-H007	E55	Y-Stop	52220	54231	66900	0.811	
1-P-AC-006-H001	666	Snub-LAT	6780	9277	42913	0.216	
1-P-AC-006-H002	664	Snub-LAT	9179	12570	37811	0.332	
1-P-AC-006-H003	675	Y-Snub	1848	2529	43188	0.059	
1-P-AC-006-H004	690	X-Snub	1369	1876	1369	1.370	Max. stress ratio = (1876/1369)(0.165/0.375) = 0.60 < 1.0 OK
1-P-AC-007-H001	486	Snub-LAT	7260	9935	42913	0.232	
1-P-AC-007-H002	484	Snub-LAT	7249	9926	37811	0.263	
1-P-AC-007-H003	495	Y-Snub	1450	1984	30510	0.065	
1-P-AC-007-H005	512	Z-Snub	28339	28654	28339	1.011	Max stress ratio = 1.01(1/2.319) = 0.44 < 1.0 OK
1-P-AC-008-H001	316	Snub-LAT	7584	10380	42913	0.242	
1-P-AC-008-H002	314	Snub-LAT	44144	8695	37811	0.230	
1-P-AC-008-	322	Y-Snub	1496	2048	15953	0.128	

Calc. No. C-0010							
Support Mk No.	NP	Direction	Existing Load	CPPU Load "A"	Design Load "B"	Ratio= A/B	Remarks*
H003							
1-P-AC-009-H001	146	Snub-LAT	7662	10487	42913	0.244	
1-P-AC-009-H002	144	Snub-LAT	7158	9798	38169	0.257	
1-P-AC-009-H003	153	Y-Snub	1306	1788	37616	0.048	
1-P-AC-009-H005	167	Z-Snub	195615	195957	195615	1.002	Max stress ratio = 1.002(1/1.003) = 0.999 < 1.0 ok
1-P-AD-001-H003	A90	ANC	664	703			
			7045	7094			
			2886	3006			This support was designed for Plastic Load
			12360	13105			
			438	559			
			6504	6720			
1-P-CA-001-H007	940	ANC	2727	2769			
			2289	2606			
			7178	7528			This support was designed for Plastic Load
			14274	14934			
			5396	5461			
			5882	6071			
1-P-CA-001-H004	930	Y-Stop	854	954	2321	0.411	
1-P-CA-001-H005	931	X-Stop	3509	3721	3510	1.060	Max stress ratio = (3721/3510)(1/1.13) = 0.94 < 1.0 OK
1-P-CV-000-H001	127	X-Snub	34483	47220	158857	0.297	
1-P-CV-000-H002	SVA	Z-Snub	21117	28909	63400	0.456	
1-P-CV-000-H003 (MST-3)	SVB	Z-Snub	18459	25288	63400	0.399	

Calc. No. C-0010							
Support Mk No.	NP	Direction	Existing Load	CPPU Load "A"	Design Load "B"	Ratio= A/B	Remarks*
1-P-FW-001-H016	990	ANC	2112	2304	3882	0.594	
			13064	13436	17650	0.761	
			2738	2891	5301	0.545	
			7282	7539	10472	0.720	
			18242	19236	28514	0.675	
			5498	5655	7432	0.761	
1-P-FW-001-H001	985	Y-Stop	16364	16876	16364	1.031	Max stress ratio = 1.03(0.303/0.3125) = 0.998 < 1.0 OK
1-P-AB-001-H009	244	Z-Snub	103441	140549	148000	0.95	
1-P-AB-001-H013	237	X-Stop	32986	37718	42000	0.90	
1-P-AB-001-H014	236	X-Stop	16790	18561	19500	0.95	
1-P-AB-002-H013	66	X-Stop	15096	16282	16300	1.00	
1-P-AB-003-H009	600	Z-Snub	71675	98019	98100	1.00	
1-P-AB-004-H004	442	X-Snub	54913	75007	82500	0.91	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-008-H02

Support Calc. No.: 1-P-AB-008-C11

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	514	551	1,700	0.324	
MINUPS	FZ	514	551	1,700	0.324	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-008-H03

Support Calc. No.: 1-P-AB-008-C3

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable"
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	900	1,233	1,700	0.725	
MINUPS	FY	900	1,233	1,700	0.725	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-008-H05

Support Calc. No.: 1-P-AB-008-C5

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	3,040	3,077	3,077	1.000	
	FZ	493	530	1,700	0.312	
MINUPS	FY	3,040	3,077	3,077	1.000	
	FZ	493	530	1,700	0.312	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-008-H06

Support Calc. No.: 1-P-AB-008-C6

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	869	906	1,700	0.533	
MINUPS	FY	869	906	1,700	0.533	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-008-H07

Support Calc. No.: 1-P-AB-008-C7

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ CLTP	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,024	1,061	1,700	0.624	
	FZ	649	731	1,700	0.430	
MINUPS	FY	1,024	1,061	1,700	0.624	
	FZ	649	731	1,700	0.430	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-008-H08 (NP 52)

Support Calc. No.: 1-P-AB-008-C2

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						"Acceptable"
MAXNOR						
MINNOR						
MAXUPS	FX	3,380	4,490	22,730	0.198	
MINUPS	FX	3,380	4,490	22,730	0.198	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-008-H09

Support Calc. No.: 1-P-AB-008-C8

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,340	1,377	1,700	0.810	
MINUPS	FY	1,340	1,377	1,700	0.810	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-008-H10

Support Calc. No.: 1-P-AB-008-C9

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,346	1,383	1,700	0.814	
MINUPS	FY	1,346	1,383	1,700	0.814	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-009-H02

Support Calc. No.: 1-P-AB-009-C6

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	503	540	1,700	0.318	
MINUPS	FZ	503	540	1,700	0.318	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-009-H03

Support Calc. No.: 1-P-AB-009-C3

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	900	1,233	1,700	0.725	
MINUPS	FY	900	1,233	1,700	0.725	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-009-H05

Support Calc. No.: 1-P-AB-009-C8

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	3,060	3,097	3,100	0.999	
	FZ	532	569	1,700	0.335	
MINUPS	FY	3,060	3,097	3,100	0.999	
	FZ	532	569	1,700	0.335	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-009-H06

Support Calc. No.: 1-P-AB-009-C4

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	816	853	1,700	0.502	
MINUPS	FY	816	853	1,700	0.502	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-009-H07

Support Calc. No.: 1-P-AB-007-C9

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,122	1,159	1,700	0.682	
	FZ	951	1,025	1,700	0.603	
MINUPS	FY	1,122	1,159	1,700	0.682	
	FZ	951	1,025	1,700	0.603	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-009-H08 (NP 152)

Support Calc. No.: 1-P-AB-009-C2 Rev. 3

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remark s
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	3,134	4,170	22,712	0.184	
MINUPS	FX	3,134	4,170	22,712	0.184	

Project: Hope Creek Extended Power Uprate
Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-009-H09

Support Calc. No.: 1-P-AB-009-C10

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,111	1,148	1,700	0.675	
MINUPS	FY	1,111	1,148	1,700	0.675	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-009-H10

Support Calc. No.: 1-P-AB-009-C11

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,008	1,045	1,500	0.697	Strut assembly weak link
						allowable = 1500#.
MINUPS	FY	1,008	1,045	1,500	0.697	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-010-H02

Support Calc. No.: 1-P-AB-010-C6

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	494	531	1,700	0.312	
MINUPS	FZ	494	531	1,700	0.312	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev. 7

Calculation Title: Main Steam Bypass

Support ID: AB-010-H03

Support Calc. No.: 1-P-AB-010-C3

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	900	1,233	1,700	0.725	
MINUPS	FY	900	1,233	1,700	0.725	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-010-H05

Support Calc. No.: 1-P-AB-010-C8

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						Acceptable "
MAXNOR						
MINNOR						
MAXUPS	FY	3,010	3,047	3,047	1.000	
	FZ	570	607	1,700	0.357	
MINUPS	FY	3,010	3,047	3,047	1.000	
	FZ	570	607	1,700	0.357	

Project: Hope Creek Extended Power Uprate

Analysis No. : Pipe Stress Calculation C-0019, Rev.7

Calculation Title: Main Steam Bypass

Support ID: AB-010-H06

Support Calc. No.: 1-P-AB-010-C9

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						
MINNOR						
MAXUPS	FY	873	910	1,700	0.535	
MINUPS	FY	873	910	1,700	0.535	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev.7**

Calculation Title: Main Steam Bypass
Support ID: AB-010-H07

Support Calc. No.: 1-P-AB-010-C10

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remark s
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	702	739	1,700	0.435	
	FZ	1,032	1,069	1,700	0.629	
MINUPS	FY	702	739	1,700	0.435	
	FZ	1,032	1,069	1,700	0.629	
						common with
						support AB-008-H07.

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-010-H08 (NP 252)

Support Calc. No.: 1-P-AB-010-C4 Rev. 3

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	2,969	3,968	22,674	0.175	
MINUPS	FX	2,969	3,968	22,674	0.175	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Outside Bypass

Support ID: AB-010-H09

Support Calc. No.: 1-P-AB-010-C11

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,926	1,963	1,926	1.019	See below
MINUPS	FY	1,926	1,963	1,926	1.019	See below

Existing Minimum Margin Factor = 2.27
New Minimum Margin Factor = 2.27/1.019 = 2.23 > 1.0 OK

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-010-H10

Support Calc. No.: 1-P-AB-010-C2

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,210	1,247	1,523	0.819	
MINUPS	FY	1,210	1,247	1,523	0.819	

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-011-H02
Support Calc. No.:	1-P-AB-011-C3
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	236	273	1,700	0.161	
MINUPS	FZ	236	273	1,700	0.161	

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-011-H03
Support Calc. No.:	1-P-AB-011-C4
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	900	1,233	1,700	0.725	
MINUPS	FY	900	1,233	1,700	0.725	

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-011-H05
Support Calc. No.:	1-P-AB-010-C6
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	2,399	2,436	2,436	1.000	
	FZ	708	745	1,700	0.438	
MINUPS	FY	2,399	2,436	2,436	1.000	
	FZ	708	745	1,700	0.438	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev.7**

Calculation Title: Main Steam Bypass

Support ID: AB-011-H06 (NP 342)

Support Calc. No.: 1-P-AB-011-C7 (Rev. 4)

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks " Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	2,500	3,203	22,880	0.140	
MINUPS	FX	2,500	3,203	22,880	0.140	
						Similar support AB-010-H08 lug
						weld margin factor 1.358 & pipe
						clamp allowable = 30,000#.

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-011-H07
Support Calc. No.:	1-P-AB-011-C8
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,089	1,126	1,700	0.662	
MINUPS	FY	1,089	1,126	1,700	0.662	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-011-H08

Support Calc. No.: 1-P-AB-011-C9

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,077	1,144	1,700	0.673	
MINUPS	FY	1,077	1,144	1,700	0.673	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-012-H02

Support Calc. No.: 1-P-AB-012-C3

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	327	364	1,700	0.214	
MINUPS	FZ	327	364	1,700	0.214	

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-012-H03
Support Calc. No.:	1-P-AB-012-C4
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	900	1,233	1,700	0.725	
MINUPS	FY	900	1,233	1,700	0.725	

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-012-H05
Support Calc. No.:	1-P-AB-012-C6
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	2,247	2,284	2,284	1.000	
	FZ	937	974	1,700	0.573	
MINUPS	FY	2,247	2,284	2,284	1.000	
	FZ	937	974	1,700	0.573	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-012-H06 (NP 442)

Support Calc. No.: 1-P-AB-012-C7 Rev. 3

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	2,461	3,126	4,000	0.782	
MINUPS	FX	2,461	3,126	4,000	0.782	
						Common w/ support AB-010-H08

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-012-H07

Support Calc. No.: 1-P-AB-012-C8

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	956	993	1,700	0.584	
MINUPS	FY	956	993	1,700	0.584	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-012-H08

Support Calc. No.: 1-P-AB-012-C8

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	808	845	1,700	0.497	
MINUPS	FY	808	845	1,700	0.497	

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-013-H02
Support Calc. No.:	1-P-AB-013-C3
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	413	450	1,700	0.265	
MINUPS	FZ	413	450	1,700	0.265	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-013-H03

Support Calc. No.: 1-P-AB-013-C4

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	900	1,233	1,700	0.725	
MINUPS	FZ	900	1,233	1,700	0.725	

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-013-H05
Support Calc. No.:	1-P-AB-013-C6
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	2,217	2,254	2,254	1.000	See calc 1-P-SB-008-C005 Rev. 2
	FZ	1,242	1,279	1,700	0.752	
MINUPS	FY	2,217	2,254	2,254	1.000	
	FZ	1,242	1,279	1,700	0.752	

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-013-H06 (NP 542)
Support Calc. No.:	1-P-AB-013-C7 Rev. 3
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	2,467	3,096	4,000	0.774	pipe clamp allowable = 4,000 #
MINUPS	FX	2,467	3,096	4,000	0.774	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev.7**

Calculation Title: Main Steam Bypass

Support ID: AB-013-H07

Support Calc. No.: 1-P-AB-013-C8

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,710	1,747	1,710	1.022	See below
MINUPS	FY	1,710	1,747	1,710	1.022	

Minimum Margin Factor for EPU = 1.63 > 1.022 ok

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-013-H08

Support Calc. No.: 1-P-AB-013-C8

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FA	2,317	2,354	2,755	0.854	
MINUPS	FA	2,317	2,354	2,755	0.854	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-014-H02

Support Calc. No.: 1-P-AB-014-C4

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	1,121	1,158	1,700	0.681	
MINUPS	FZ	1,121	1,158	1,700	0.681	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-014-H03

Support Calc. No.: 1-P-AB-014-C5

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	900	1,233	1,700	0.725	
MINUPS	FY	900	1,233	1,700	0.725	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-014-H04

Support Calc. No.: 1-P-AB-014-C6

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	3,254	3,698	24,000	0.154	
MINUPS	FX	3,254	3,698	24,000	0.154	
						Common with supports
						AB-015-H04 and AB-016-H04.

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-014-H06

Support Calc. No.: 1-P-AB-014-C8

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,808	1,882	1,767	1.065	See below
						Strut Allowable = 11630
MINUPS	FY	1,808	1,882	1,767	1.065	MF = 11630/1882 = 6.18 > 1.0 OK

Existing Minimum Margin Factor = 6.94
New Minimum Margin Factor = 6.94/1.065 = 6.49

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-015-H02

Support Calc. No.: 1-P-AB-015-C4

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	1,685	1,722	1,700	1.026	See below
MINUPS	FZ	1,685	1,722	1,700	1.026	

Existing Minimum Margin Factor = 8.79
New Minimum Margin Factor = 8.79/ 1.026 = 8.70

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-015-H03

Support Calc. No.: 1-P-AB-015-C5

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	1,000	1,370	1,700	0.806	
MINUPS	FY	1,000	1,370	1,700	0.806	

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev.7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-015-H04
Support Calc. No.:	1-P-AB-015-C6
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	3,179	3,549	24,100	0.147	
MINUPS	FX	3,179	3,549	23,100	0.147	
						No material furnished with this
						support, plus common support
						AB-014-H04

Project:	Hope Creek Extended Power Uprate
Analysis No. :	**Pipe Stress Calculation C-0019, Rev. 7**
Calculation Title:	Main Steam Bypass
Support ID:	AB-015-H05
Support Calc. No.:	1-P-AB-015-C7
Description:	8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	2,216	2,327	2,895	0.804	
MINUPS	FY	2,216	2,327	2,895	0.804	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-016-H02

Support Calc. No.: 1-P-AB-016-C4

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	100	137	1,700	0.081	
MINUPS	FZ	100	137	1,700	0.081	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-016-H03

Support Calc. No.: 1-P-AB-016-C5

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	900	1,233	1,700	0.725	
MINUPS	FY	900	1,233	1,700	0.725	

Project: Hope Creek Extended Power Uprate

Analysis No. : **Pipe Stress Calculation C-0019, Rev. 7**

Calculation Title: Main Steam Bypass

Support ID: AB-016-H04

Support Calc. No.: 1-P-AB-016-C6

Description: 8" Main Steam Bypass

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	2,056	2,356	23,400	0.101	
MINUPS	FX	2,056	2,356	23,400	0.101	
						No material furnished ; common
						with support AB-014-H04.

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H16 (NP 139)

Support Calc. No.: 1-P-AB-006-C8 Rev. 3

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	633	761	904	0.842	
MINUPS	FZ	606	745	775	0.961	

Project: Hope Creek Extended Power Uprate

Calculation No.: Pipe Stress Calculation C-1922, Rev.6

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H17 NP 137

Support Calc. No.: 1-P-AB-006-C32 Rev. 1

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	862	1,063	1,500	0.709	
MINUPS	FZ	862	1,063	1,500	0.709	

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H18 NP 132)

Support Calc. No.: 1-P-AB-006-C26 Rev. 2

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	443	549	1,500	0.366	
MINUPS	FY	443	549	1,500	0.366	

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H19 (NP 120)

Support Calc. No.: 1-P-AB-006-C29 Rev. 1

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	354	437	588	0.743	
MINUPS	FY	354	437	588	0.743	

Project: Hope Creek Extended Power Uprate

Calculation No.: Pipe Stress Calculation C-1922, Rev.6

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H20 (NP 112)

Support Calc. No.: 1-P-AB-006-C028 Rev. 2

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	1,065	1,323	1,250	1.058	
MINUPS	FZ	1,065	1,323	1,250	1.058	

From calc. Minimum Margin Factor = 1.507
New Minimum Margin Factor = 1.507/1.058 = 1.42 > 1.0 OK

Project: Hope Creek Extended Power Uprate

Calculation No.: Pipe Stress Calculation C-1922, Rev.6

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H21 (NP 109)

Support Calc. No.: 1-P-AB-006-C9 Rev. 3

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	225*	89	225	0.396	
MINUPS	FX	225*	89	225	0.396	

* Minimum design load. This is still greater than the EPU load.

Project: Hope Creek Extended Power Uprate
Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H23 (NP 75B)

Support Calc. No.: 1-P-AB-006-C30 Rev. 2

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	461	524	706	0.742	
MINUPS	FY	461	524	706	0.742	

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H24 (NP 75A)

Support Calc. No.: 1-P-AB-006-C33 Rev. 3

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	Hori.Skew	225*	124	260	0.477	
MINUPS	Hori.Skew	225*	124	260	0.477	

* Minimum design load. This is still greater than the EPU load.

Project:	Hope Creek Extended Power Uprate
Calculation No.:	**Pipe Stress Calculation C-1922, Rev.6**
Calculation Title:	Main Steam Outside Containment
Support ID:	AB-006-H25 (NP 75)
Support Calc. No.:	1-P-AB-006-C31 Rev. 2
Description:	Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	Hori.Skew	225*	125	260	0.481	
MINUPS	Hori.Skew	225*	125	260	0.481	

* Minimum design load. This is still greater than the EPU loads.

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H26 (NP 65A)

Support Calc. No.: 1-P-AB-006-C16 Rev. 3

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	225*	160	259	0.618	
MINUPS	FX	225*	160	259	0.618	

* Minimum design load. This is still greater than the EPU loads.

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H28 (NP 58)

Support Calc. No.: 1-P-AB-006-C16 Rev. 3

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	225*	98	259	0.378	
MINUPS	FZ	225*	98	259	0.378	

* Minimum Design load. This is still greater than the EPU load.

Project:	Hope Creek Extended Power Uprate
Calculation No.:	**Pipe Stress Calculation C-1922, Rev.6**
Calculation Title:	Main Steam Outside Containment
Support ID:	AB-006-H29 (NP 48)
Support Calc. No.:	1-P-AB-006-C35 Rev. 2
Description:	Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FX	661	843	820	1.028	See below
MINUPS	FZ	270	336	400	0.840	

Existing Minimum Margin Factor = 1.244
New Minimum Margin Factor = 1.244/1.028 = 1.21 > 1.0 OK

Project:	Hope Creek Extended Power Uprate
Calculation No.:	**Pipe Stress Calculation C-1922, Rev.6**
Calculation Title:	Main Steam Outside Containment
Support ID:	AB-006-H31 (NP 38)
Support Calc. No.:	1-P-AB-006-C27 Rev. 3)
Description:	Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	225*	94	259	0.363	
MINUPS	FZ	225*	94	259	0.363	

* Minimum design load. This is still greater than the EPU load.

Project:	Hope Creek Extended Power Uprate
Calculation No.:	**Pipe Stress Calculation C-1922, Rev.6**
Calculation Title:	Main Steam Outside Containment
Support ID:	AB-006-H32 (NP 16)
Support Calc. No.:	1-P-AB-006-C34 Rev. 2
Description:	Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	225*	255	413	0.617	
MINUPS	FZ	225*	255	413	0.617	

* Minimum design load.

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-006-H33 (NP 15)

Support Calc. No.: 1-P-AB-006-C13 Rev. 2

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	567	696	718	0.969	
MINUPS	FY	567	696	718	0.969	

Project:	Hope Creek Extended Power Uprate
Calculation No.:	**Pipe Stress Calculation C-1922, Rev.6**
Calculation Title:	Main Steam Outside Containment
Support ID:	AB-006-H35 (NP 47)
Support Calc. No.:	1-P-AB-006-C6 Rev. 3
Description:	Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	Hori.Skew	225*	212	260	0.815	
MINUPS	Hori.Skew	225*	212	260	0.815	

* Minimum design load. This is still greater than the EPU load.

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-127-H03 (NP 95C)

Support Calc. No.: 1-P-AB-127-C5 Rev. 1

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FZ	479	590	551	1.071	See below
MINUPS	FZ	479	590	551	1.071	

Existing Minimum Margin Factor = 31.25
New Minimum Margin Factor = 31.25/1.071 = 29.18 > 1.0 OK

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-127-H04 (NP 95B)

Support Calc. No.: 1-P-AB-127-C6 Rev. 2

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	FY	225*	175	259	0.676	
MINUPS	FY	225*	175	259	0.676	

* Minimum design load. This is still greater than the EPU loads.

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-127-H05 (NP 100)

Support Calc. No.: 1-P-AB-127-C3 Rev. 2

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks UNITS: lbs and Ft-lbs.
UPSET	FX	761*	981	*		" Acceptable "
Min/Max	FY	259*	313	*		
	FZ	127*	152	*		
	MX	242* ft.#	279	*		
	MY	360* ft.#	426	*		
	MZ	1210* ft.#	1,457	*		

Note : * Symbolizes actual loads per latest analysis, but not used for design.
This support is evaluated for plastic forces = 10108 # and plastic moments = 6802 ft-lbs.

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-128-H05 (NP 180)

Support Calc. No.: 1-P-AB-128-C2 Rev. 2)

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remark s
UPSET	FX	479*	585	*		" Acceptable"
Min/Max	FY	130*	161	*		
	FZ	363*	449	*		
	MX	56* ft.#	67	*		
	MY	1336* ft.#	1,657	*		
	MZ	186* ft.#	228	*		

Note : * Symbolizes actual loads per latest analysis, but not used for design.
This support is evaluated for plastic forces = 10108 # and plastic moments = 6802 ft-lbs.

Project:	Hope Creek Extended Power Uprate
Calculation No.:	**Pipe Stress Calculation C-1922, Rev.6**
Calculation Title:	Main Steam Outside Containment
Support ID:	AB-128-H07 (NP 160)
Support Calc. No.:	1-P-AB-128-C4 Rev. 1
Description:	Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	Vert. Skew	447	549	488	1.125	See below
MINUPS	Vert. Skew	447	549	488	1.125	

Existing Minimum Margin Factor = 49.3
New Minimum Margin Factor = 49.3/1.125 = 43.8 > 1.0 OK

Project: Hope Creek Extended Power Uprate

Calculation No.: **Pipe Stress Calculation C-1922, Rev.6**

Calculation Title: Main Steam Outside Containment

Support ID: AB-128-H08 (NP 161)

Support Calc. No.: 1-P-AB-128-C5 Rev. 2

Description: Supply to Air Ejector and Steam Seal Evaporator

Load Case	Load Direction	CLTP Load (Lbs)	EPU Load (Lbs)	Design Load (Lbs)	Ratio EPU/ Design	Remarks
						" Acceptable "
MAXNOR						N/A
MINNOR						N/A
MAXUPS	Vert. Skew	487	599	534	1.122	See below
MINUPS	Vert. Skew	487	599	534	1.122	

Existing Minimum Margin Factor = 1.6
New Minimum Margin Factor = 1.6/1.122 = 1.43 > 1.0 OK

The following supports were modified as shown in remarks column:

Support Mk No.	Remarks
1-P-AB-001-H009	Upgrade weld size
1-P-AB-001-H013	New Strut, Clamp & Rear Bracket, Upgrade weld
1-P-AB-001-H014	New Strut, Clamp & Rear Bracket, Upgrade weld
1-P-AB-002-H013	Add stiffener plates & new welds
1-P-AB-003-H009	Upgrade weld
1-P-AB-004-H004	Upgrade weld and add additional weld