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

PSEG
Nuclear LLC

10 CFR 50.90

LR-N07-0102
LCR H05-01, Rev. 1
May 10, 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
3) Letter from George P. Barnes (PSEG Nuclear LLC) to USNRC, April 30, 2007
4) Letter from George P. Barnes (PSEG Nuclear LLC) to USNRC, March 30, 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. In Reference 3, PSEG provided responses except for questions 3.58 through 3.65, 3.8, 13.16 and 14.41. Attachment 1 to this letter provides PSEG's responses to these remaining questions.

In a telephone conference on April 17, 2007, the NRC staff requested a clarification of PSEG's response to question 11.3 in Reference 4. PSEG's revised response to question 11.3 is also included in Attachment 1.

A001

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). Affidavits supporting this request are included with Attachment 1. A non-proprietary version of PSEG's Attachment 1 responses is provided in Attachment 2.

Attachment 6 to Reference 3 included a report containing proprietary information. A non-proprietary version of the report, suitable for public disclosure, is provided in Attachment 4 to this letter.

The steam dryer limit curves for power ascension will be provided in a separate transmittal.

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 5/10/07
(date)

Sincerely,

George P. Barnes

George P. Barnes
Site Vice President
Hope Creek Generating Station

Attachments (4)
1. Response to Request for Additional Information (proprietary)
2. Response to Request for Additional Information (non-proprietary)
3. Reactor Assembly Drawing - Question 3.58
4. C.D.I. Report No. 06-16NP, Rev. 2

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

PROPRIETARY INFORMATION NOTICE

This enclosure contains proprietary information of the General Electric Company (GE) and is furnished in confidence solely for the purpose(s) stated in the transmittal letter. No other use, direct or indirect, of the document or the information it contains is authorized. Furnishing this enclosure does not convey any license, express or implied, to use any patented invention or, except as specified above, any proprietary information of GE disclosed herein or any right to publish or make copies of the enclosure without prior written permission of GE. The header of each page in this enclosure carries the notation "GE Proprietary Information."

The GE proprietary information is identified by [[dotted underline inside double square brackets{3}]]. The superscript notation{3} refer to Paragraph (3) of the affidavit provided, which provides the basis for the proprietary determination.

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 to GE letter GE-HCGS-EPU-671, Revision 1, E. Schrull (GE) to L. Curran (PSEG), *Transmittal - Response to Request for Additional Information (RAI) Regarding Amendment Application for Hope Creek Generating Station Extended Power Uprate - RAI 3.8,* dated May 7, 2007. The proprietary information in the Enclosure 1, which is entitled *GE Response to NRC RAI 3.8*, is delineated by a [[dotted underline inside double square brackets.{3}]] Figures and large equation objects are identified with double square brackets before and after the object. In each case, the sidebars and 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, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 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 data and conclusions regarding GE Methods, pertaining to NEDC-33137P, *Applicability of GE Methods to Expanded Operating Domains,* which supports evaluations of the safety-significant changes necessary to demonstrate the regulatory acceptability for the expanded power/flow operating domains, including Extended Power Uprates, Constant Pressure Power Uprates, and the MELLLA+ domain, for a GE BWR, utilizing analytical models and methods, including computer codes, which GE has developed, obtained NRC approval of, and applied to perform evaluations of transient and accident events in the GE Boiling Water Reactor ("BWR"). The development and approval of these system,

component, and thermal hydraulic models and 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 7th day of May 2007.

George B. Stramback

George B. Stramback
General Electric Company

General Electric Company

AFFIDAVIT

I, **George B. Stramback,** state as follows:

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(2) The information sought to be withheld is contained in Enclosure 1 of GE's letter, GE-HCGS-EPU-669, Revision 1, 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 3.59, 3.60, 3.61, 3.64, 3.65, 7.11, 14.42, and 14.49*, GE Proprietary Information, dated May 7, 2007. The proprietary information in Enclosure 1, which is entitled *GE Responses to NRC RAIs 3.59, 3.60, 3.61, 3.64, 3.65, 7.11, 14.42, and 14.49*, is delineated by a [[dotted underline inside double square brackets.{3}]] 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, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

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

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(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.

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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 7th day of May 2007.

George B. Stramback
General Electric Company

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)

14.41 In the Hope Creek Power Uprate Safety analysis Report (PUSAR), Attachment 4 of the Hope Creek EPU submittal, Section 3.5.2, "Balance of plant piping", page 3-23, "Pipe Stresses" states that "Operation at the constant pressure power uprate (CPPU) conditions increases stresses on piping and piping system components due to slightly higher operating temperatures and flow rates internal to the pipes. For all systems, the maximum stress levels and fatigue analysis results were reviewed based on specific increases in temperature, pressure, and flow rate (see Tables 3-9 and 3-10). These piping systems have been evaluated and found to meet the appropriate code criteria for the CPPU conditions, based on the design margins between actual stresses and code limits in the original design. All piping is [also] below the code allowables of the [current] plant code of record, American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV Code), Div. 1, Section III, 1977 Edition through Summer 1979 Addenda for Class 1 piping and ASME B&PV Code -Section III, Division I, 1974 Edition, through winter 1974 Addenda for Class 2 and 3 piping." Page 3-22 contains a list of 20 Balance-Of-Plant (BOP) piping systems and states that "The effects of the CPPU conditions have been evaluated for these piping systems."

a) Provide a quantitative summary of the evaluation for each of the BOP piping systems listed on page 3-22. The evaluation should include maximum calculated stresses and fatigue usage factors for both the original and the EPU conditions, and the code allowables. Include data at critical locations (i.e. nozzles, penetrations, etc). If the data were estimated, show method of estimation.

Response

Effects of Flow Increase

Changes in flow rate due to CPPU only affect the Main Steam (MS) system piping and Class 1 Feedwater (AE) System piping stress analysis. The results of the MS piping reanalysis are presented in response to RAI 14.46. Class 1 feedwater piping reanalysis is described in response to 14.44 and 14.45.

Effects of Temperature and Pressure Increase

The following BOP piping systems have increases in temperature and pressure based on the current PEPSE CPPU heat balance:

(1) AC - Main Turbine including Main Steam Turbine Bypass piping
(2) AD - Condensate
(3) AE, FW - Feedwater, Reactor Feed Pump Turbine Steam
(4) AF - Extraction Steam Vents and Drain
(5) AK - Condensate Demineralizer

The effect of pressure changes is minimal in evaluation of stresses according to the piping code. There are sufficient design margins in both the pipe wall thickness and pipe stresses for every calculation.

The following is a summary of the affects of temperature on the systems listed above:

1. Main Turbine including Main Steam Turbine Bypass piping (AC)

   The majority of the Main Turbine including MS Turbine Bypass piping was supplied and qualified by GE (Drawing No. 713E561) and enveloped the EPU effect. The non-GE supplied piping sees a temperature increase of 4%. Review of existing calculations has shown that this small temperature increase has minimal affect on the piping or supports. Review demonstrated that the evaluated maximum piping and supports stresses meet appropriate code criteria for the CPPU conditions.

2. Condensate (AD)

   The Condensate System (AD) experiences a maximum of 14°F temperature increase for a small portion of the system due to CPPU conditions. Ratioing the maximum thermal stresses from the analyses of record for the new CPPU temperatures demonstrates a minimum design margin of 60% between actual stresses and the code limits in the original design. Based on a detailed review, the condensate piping maximum stress meets appropriate code criteria for the CPPU conditions. Detailed reviews of the pipe supports show that there is sufficient design margin such that all the supports meet the design requirement of the Codes of Records and have sufficient margins to operate at CPPU conditions.

3. Feedwater (AE) and Reactor Feed Pump Turbine Steam (FW)

   The Class 1 Feedwater reanalysis described in response to 14.44 and 14.45 considers the effect of the increased temperatures. The remaining AE and FW piping experiences a maximum increase of temperature of 3.4% due to CPPU conditions. A review of the AE and FW maximum pipe stress and support calculations shows there is sufficient design margins such that both the pipe and pipe supports meet all design requirement for the small CPPU temperature increases and have sufficient margins to operate at CPPU conditions.

4. Extraction Steam Vents and Drain (AF)

   A pre-existing condition for the #3 feedwater heater emergency drain line created a higher temperature differential than is seen on the rest of the system. This condition affected three stress calculations. Ratioing the maximum thermal stress of these three stress analyses of record for the new CPPU temperature demonstrates a minimum design margin of 56% between the CPPU stress and the original Code of Record allowable. The rest of the system shows a maximum of 5.6% temperature increase due to CPPU conditions. Detailed review demonstrates that the evaluated maximum piping and supports stresses meet appropriate code criteria for the CPPU conditions.

5. Condensate Demineralizer (AK)

   The Condensate Demineralizer System was originally designed using hand analysis and span charts. The system consists of a flexible piping layout supported by springs and rods. The AK System experiences a 6°F temperature increase due to CPPU loads. Review of the original design criteria shows that this small temperature increase will have negligible affect on the piping and supports.

b) Provide a summary of the evaluation for pipe supports for each of the evaluated BOP systems.

   Response
   See response for (a).

c) Provide similar information as in Item (A) above for inside containment piping systems discussed in PUSAR Section 3.5.1, "Reactor Coolant Pressure Boundary Piping."

Response
The flow increase in Main Steam and Feedwater Piping discussed in Part (a) of this response. The feedwater piping experiences a 3.4% temperature increase. The pipe stress analysis for the Feedwater System has been updated to reflect the new CPPU conditions and demonstrates that there are sufficient margins to operate at CPPU conditions. The pipe support calculations have been similarly updated and shown to meet all code requirements for the CPPU conditions.

d) Provide similar information as in Item (B) above for inside containment piping systems discussed in PUSAR Section 3.5.1, "Reactor Coolant Pressure Boundary Piping."

Response
See response for (c).

e) Identify newly added pipe supports and/or existing supports, if any, which required modifications for the EPU operation at Hope Creek.

Response
The following existing supports were modified for EPU. No new support was required for the EPU condition. The modified supports are listed below and for detail information see Response for 14.46.

Support Mk No.
1-P-AB-001-H009
1-P-AB-001-H013
1-P-AB-001-H014
1-P-AB-002-H013
1-P-AB-003-H009
1-P-AB-004-H004

3) BWR Systems Branch (SBWB) (question delayed for LTR draft SER)

Applicability of GE Interim Methods LTR (NEDC-33173P) on HCGS EPU

3.8. The NRC staff requests the licensee to provide the following additional information in regards to applicability of the GE Licensing Topical Report (LTR) (NEDC-33173P) (referenced in your submittal) for the Hope Creek EPU core design for Cycle 15:

a) Section [8] of the NRC staff draft safety evaluation report (SER) (Accession No. ML070390406) for NEDC-33173P provides the plant-specific application process and the required information when referencing the generic LTR. Please provide that information for HCGS Cycle 15 EPU operation, as required by the draft SER.

Response
Licensing Topical Report NEDC-33173P, "Applicability of GE Methods to Expanded Operating Domains", February 2006, was submitted by GE to the NRC on February 10, 2006. NEDC-33173P was prepared to address NRC questions regarding the applicability of GE's analytical methods to expanded operating domains, including EPU.

NEDC-33173P is incorporated by reference in PSEG's EPU application for HCGS. Section 3.0 of NEDC-33173P addresses the MELLLA+ operating domain and does not apply to the HCGS EPU.

Section 8 of the draft SE to NEDC-33173P covers the specific information that is required to be provided in plant-specific applications. The information required by this section, other than Section 8.6, is addressed in specific Limitations and Conditions, which is addressed in the response to Part b.

Section 8.6 requires that NEDC-33173P be referenced either directly by the plant's Technical Specifications or indirectly by incorporating NEDC-33173P in GESTAR II and referencing GESTAR II in the plant's Technical Specifications. GESTAR II is currently referenced in HCGS Technical Specification 6.9.1.9. GE has indicated to PSEG that a GESTAR administrative change request to incorporate NEDC-33173P in GESTAR II will be submitted.

b) Section [9] of the draft SER lists certain restrictions and limitations for plant specific EPU applications. The NRC staff requests the licensee to fully address each of these restriction and limitation, and provide justification as to why it is acceptable for HCGS to operate at EPU condition in light of the draft SER restrictions and limitations. If the licensee believes that any information which may already have been submitted to the NRC can be used to justify a response to part (a) & (b), as applicable to Cycle 15 (1st EPU Cycle), then the staff requests the licensee to clearly identify the specific information in the submittal, including the relevant pages of attachments and supplements to the submittal.

Response

The draft SE concludes that the NRC staff finds that the application of GENE methods to EPU is acceptable with the additional margins included in the methods and the changes in the calculation methodology delineated in the associated limitations. The implementation of each of the Limitations and Conditions stated in the draft SE for NEDC-33173P is addressed in Table 3.8-1. It should be noted that some of the Limitations and Conditions are specific to operation in the MELLLA+ domain. HCGS is not currently licensed for operation in this domain and the EPU submittal does not include MELLLA+. Therefore, those specific Limitations and Conditions do not apply to the HCGS EPU submittal, as indicated.

Table 3.8-1

1. TGBLA/PANAC Version (Section 3.1.5.2)
The neutronic methods used to simulate the reactor core response and that feed into the downstream safety analyses supporting operation at EPU/MELLLA+ will apply TGBLA06/PANAC11 or other NRC-approved neutronic method.

HC Implementation
TGBLA06/PANAC11 is being utilized by HCGS for the current CLTP conditions and was used to support the Hope Creek EPU licensing application. Therefore, HCGS is in compliance with this Condition.

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2. 3D Monicore (Section 3.1.5.2)
For EPU/MELLLA+ applications, relying on TGBLA04/PANAC10 methods, the bundle RMS difference uncertainty will be established from plant-specific core-tracking data, based on TGBLA04/PANAC10. The use of plant-specific trendline based on the neutronic method employed will capture the actual bundle power uncertainty of the core monitoring system.

HC Implementation
TGBLA06/PANAC11 is being utilized by HCGS for the current CLTP conditions and was used to support the HCGS EPU licensing application. Therefore, this Limitation is not applicable to the HCGS EPU licensing application.

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3. Power-to-Flow Ratio (Section 3.1.5.2)
Plant-specific EPU and expanded operating domain applications will confirm that the power-to-flow ratio will not exceed 50 MWt/Mlbm/hr at any statepoint in the allowed operating domain. For plants that exceed the power-to-flow value of 50 MWt/Mlbm/hr, the application will provide power distribution assessment to establish that neutronic methods axial and nodal power distribution uncertainties have not increased.

HC Implementation
Evaluations of the HCGS EPU conditions have confirmed that the core thermal power to total core flow ratio does not exceed 50 MWt/Mlbm/hr at any statepoint in the new operating domain. Therefore, HCGS is in compliance with this Condition.

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4. SLMCPR 1 (Section 3.2.2.2)
For EPU operation, a 0.02 value shall be added to the cycle-specific SLMCPR value. This adder is applicable to SLO, which is derived from the dual loop SLMCPR value.

HC Implementation
HCGS will comply with this Condition and incorporate the additional margin for EPU operating cycles.

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5. SLMCPR 2 (Section 3.2.2.2)
For operation at MELLLA+, including operation at the EPU power levels at the achievable core flow statepoint, a 0.03 will be added to the cycle-specific SLMCPR value. Due to instability concerns, SLO is not allowed for operation at MELLLA+

HC Implementation
As discussed previously, HCGS is not implementing MELLLA+. Therefore, this Condition is not applicable to the HCGS EPU license application.

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6. R-factor (Section 3.2.3)
The plant specific R-factor calculation at a lattice level will be consistent with the axial void conditions for given lattice. The plant-specific EPU application will confirm that the R-factor calculation is consistent with the predicted axial void conditions.

HC Implementation
HCGS will comply with this Condition and utilize R-factor calculations consistent with the predicted axial void conditions for HCGS cycle 15.

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7. ECCS-LOCA 1 (Section 3.2.5.1.1)
For applications requesting implementation of EPU or MELLLA+, the small and large break ECCS-LOCA analysis will include top-peaked and mid-peaked power shape in establishing the MAPLHGR and determining the PCT. This limitation is applicable for both the licensing bases PCT and the upper bound PCT.

HC Implementation
As noted in the response to RAI 3.47, [[

]] However, PSEG will comply with this Condition and perform EPU ECCS-LOCA analyses for the limiting GE14 fuel utilizing top peaked power shapes.

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8. ECCS-LOCA 2 (Section 3.2.5.1.1)
The ECCS-LOCA will be performed for all the statepoints in the upper boundaries of the expanded operating domains (e.g., MELLLA+ 80 percent and 55 percent core flow statepoint). The plant-specific application will report the limiting ECCS-LOCA results as well as the rated power and flow results. The SRLR will include both the limiting statepoint ECCS-LOCA results and the rated conditions ECCS-LOCA results.

HC Implementation
As discussed previously, HCGS is not implementing MELLLA+. Therefore, this Limitation is not applicable to the HCGS EPU license application.

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9. Transient LHGR 1 (Section 3.2.6.5.1)
Plant-specific EPU and MELLLA+ applications will demonstrate and document that during normal operation and core-wide AOOs, the T-M acceptance criteria as specified in Amendment 22 to GESTAR II will be met. Specifically, during an AOO, the licensing application will demonstrate that the: (1) loss of fuel rod mechanical integrity will not occur due to fuel melting and (2) loss of fuel rod mechanical integrity will not occur due to pellet–cladding mechanical interaction. The plant-specific application will demonstrate that the T-M acceptance criteria are met for the both the UO2 and the limiting GdO2 rods.

HC Implementation
Based on the most limiting event analyzed for HCGS EPU, there was [[ ]] margin to the TOP screening criteria (fuel melt) and there was [[ ]] margin to the MOP screening criteria (pellet-cladding mechanical interaction) for the most limiting rod type. Therefore, the Thermal-Mechanical acceptance criteria are met and HCGS is in compliance with this Limitation.

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10. Transient LHGR 2 (Section 3.2.6.5.1)
Each EPU and MELLLA+ fuel reload will document in the SRLR the calculation results of the analyses demonstrating compliance to transient T-M acceptance criteria.

HC Implementation
PSEG will confirm that HCGS Cycle 15 complies with the transient T-M acceptance criteria, and will provide the results to the NRC.

---

11. Transient LHGR 3 (Section 3.2.6.5.2)
Unlike TRACG, nodal void reactivity bias with exposure cannot be incorporated into the ODYN 1D transient model. To account for the impact of the void history bias, plant-specific EPU and MELLLA+ applications will demonstrate an equivalent to 10 percent margin to the fuel centerline melt and that the 1 percent cladding circumferential plastic

strain acceptance criteria due to pellet-cladding mechanical interaction for all of limiting AOO transient events, including equipment out-of-service. Limiting transients in this case, refers to transients that will result in higher TOP and MOP. If the void history bias is incorporated into the transient model within the code, then the additional 10 percent TOP and MOP margin is no longer required. This holds for TRACG, which has the capability to incorporate void reactivity bias in the 3D nodal void reactivity response surface.

HC Implementation
The results documented in response to Limitation 9 above demonstrate that the HCGS EPU submittal is in compliance with this Limitation. PSEG will also confirm that HCGS Cycle 15 complies with this Limitation.

---

12. Application of 10 Weight Percent Gd (Section 3.2.6.5.6)
Before applying 10 weight percent Gd to licensing applications, including EPU and expanded operating domain, the NRC staff needs to review and approve the T-M LTR demonstrating that the T-M acceptance criteria specified in GESTAR II and Amendment 22 to GESTAR II can be met for steady-state and transient conditions. Specifically, the T-M application must demonstrate that the T-M acceptance criteria can be met for TOP and MOP conditions that bounds the response of plants operating at EPU and expanded operating domains at the most limiting statepoints, considering the operating flexibilities (e.g., equipment out-of-service).

Before the use of 10 weight percent Gd for modern fuel designs, NRC must review and approve TGBLA06 qualification submittal. Where a fuel design refers to a design with Gd-bearing rods adjacent to vanished or water rods, the submittal should include specific information regarding acceptance criteria for the qualification and address any downstream impacts in terms of the safety analysis. The 10 weight percent Gd qualifications submittal can supplement this report.

HC Implementation
The fuel designs in HCGS cycle 15 utilize no more than 6.0% w/o gadolinia. Therefore, this Limitation is not applicable to the HCGS EPU license application.

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13. Part 21 Evaluation of GSTR-M Fuel Temperature Calculation 1 (Section 3.2.6.5.8)
GENE will include the GSTR-M Part 21 report as an Appendix in the "-A" version of LTR NEDC-33173P.

HC Implementation
LTR NEDC-33173P is a GENE document and is not controlled by PSEG. GENE is responsible for issuing the approved version of the LTR. Therefore, this Limitation is not applicable to the HCGS EPU license application.

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14. Part 21 Evaluation of GSTR-M Fuel Temperature Calculation 2 (Section3.2.6.5.8)
Any conclusions drawn from the NRC staff evaluation of the GENE's Part 21 report will be applicable to the GSTR-M thermal-mechanical assessment of this SE. GENE submitted the T-M Part 21 evaluation, which is currently under NRC staff review. Upon completion of its review, NRC staff will inform GENE of its conclusions.

HC Implementation
The HCGS EPU license application does not rely upon the NRC's evaluation of GE's Part 21 report (MFN -7-040). Therefore, this Limitation is not applicable to the HCGS EPU license application.

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15. LHGR and Exposure Qualification (Section 3.2.6.5.9)
The conclusions of the plenum fission gas and fuel exposure gamma scans have been submitted for NRC staff review and approval, and revisions to the T-M methods will be included in the T-M licensing process. This revision will be accomplished through Amendment to GESTAR II or in T-M LTR review. Once the T-M LTR and its application are approved, future license applications for EPU and MELLLA+ referencing LTR NEDC-33173P must utilize these revised T-M methods.

HC Implementation
The HCGS EPU license application does not rely upon the ongoing T-M licensing review. Therefore, this Limitation is not applicable to the HCGS EPU license application.

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16. Void Reactivity 1 (Section 4.4)
The void reactivity coefficient bias and uncertainties in TRACG for EPU and MELLLA+ must be representative of the lattice designs of the fuel loaded in the core.

HC Implementation
The EPU transient analyses presented in NEDC-33076P (PUSAR) were not performed utilizing the TRACG methodology. The HCGS Cycle 15 transient analyses will not be performed utilizing the TRACG methodology. Therefore, this Limitation is not applicable to the HCGS EPU license application.

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17. Void Reactivity 2 (Section 4.4)
A supplement to TRACG /PANAC11 for AOO is under NRC staff review (Reference 40). TRACG internally models the response surface for the void coefficient biases and uncertainties for known dependencies due to the relative moderator density and exposure on nodal basis. Therefore, the void history bias determined through the

methods review can be incorporated into the response surface "known" bias or through changes in lattice physics/core simulator methods for establishing the instantaneous cross-sections. Including the bias in the calculations negates the need for ensuring that plant-specific applications showing sufficient margin. For application of TRACG to EPU and MELLLA+ applications, the TRACG methodology must incorporate the void history bias. The manner in which this void history bias is accounted for will be established by the NRC staff SE approving NEDE-32906P, Supplement 3, "Migration to TRACG04/PANAC11 from TRACG02/PANAC10," May 2006 (Reference 40). This limitation applies until the new TRACG/PANAC methodology is approved by the NRC staff.

HC Implementation
The EPU transient analyses presented in NEDC-33076P (PUSAR) were not performed utilizing the TRACG methodology. The HCGS Cycle 15 transient analyses will not be performed utilizing the TRACG methodology. Therefore, this Limitation is not applicable to the HCGS EPU license application.

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18. Steady-State 5 Percent Bypass Voiding (Section 5.4)
For EPU and MELLLA+, the bypass voiding will be evaluated on a cycle-specific basis to guarantee that the void fraction remains below 5 percent at all LPRM levels when operating at steady-state conditions. The highest calculated bypass void will be included in the plant-specific SRLR.

HC Implementation
Evaluations of the HCGS EPU conditions have confirmed that the bypass voiding remains below 5% at all LPRM levels at steady state, rated power conditions. The value calculated using ISCOR is 4.5%. Therefore, the HCGS EPU submittal is in compliance with this Limitation. PSEG will also confirm that HCGS Cycle 15 complies with this Limitation and will provide the results to the NRC.

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19. Stability Setpoints Adjustment (Section 6.2)
The NRC staff concludes that the presence [of] bypass voiding at the low-flow conditions where instabilities are likely can result in calibration errors of less than 5 percent for OPRM cells and less than 2 percent for APRM signals. These calibration errors must be accounted for while determining the setpoints for any detect and suppress long term methodology.

HC Implementation
The calibration errors due to bypass voiding will be accounted for when determining the setpoints for the HCGS detect and suppress long term methodology at EPU conditions.

The calibration errors on the OPRM cells will be accounted for in the HCGS Cycle 15 analyses. Therefore, the HCGS implementation of EPU will be in compliance with this Limitation.

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20. Void-Quality Correlation 1 (Section 7.2.7)
For applications involving PANCEA/ODYN/ISCOR/TASC for operation at EPU and MELLLA+, an additional 0.01 will be added to the OLMCPR, until such time that GE expands the experimental database supporting the Findlay-Dix void-quality correlation to demonstrate the accuracy and performance of the void-quality correlation based on experimental data representative of the current fuel designs and operating conditions during steady-state, transient, and accident conditions.

HC Implementation
The additional 0.01 margin will be added to the HCGS Cycle 15 calculated OLMCPR. Therefore, the HCGS implementation of EPU will be in compliance with this Condition.

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21. Void-Quality Correlation 2 (Section 7.2.8)
The NRC staff is currently reviewing Supplement 3 to NEDE-32906P, "Migration to TRACG04/PANAC11 from TRACG02/PANAC10," dated May 2006 (Reference 40). The adequacy of the TRACG interfacial shear model qualification for application to EPU and MELLLA+ will be addressed under this review. Any conclusions specified in the NRC staff SE approving Supplement 3 to LTR NEDC-32906P (Reference 40) will be applicable as approved.

HC Implementation
The HCGS EPU license application does not rely upon the ongoing NRC review of Supplement 3 to NEDE-32906P. Therefore, this Limitation is not applicable to the HCGS EPU license application.

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22. MELLLA+ (Section 8.0)
LTR NEDC-33006P, Revision 2 (Reference 2), provides GENE safety analysis report for operation at the proposed expanded operating domains. LTR NEDC-33173P (Reference 1) provides the bases for accepting the application of GENE NRC-approved analytical methods and codes to MELLLA+ high power and low flow conditions. NRC approval of LTR NEDC-33173P does not constitute as acceptance of the implementation of MELLLA+ operation for BWRs. MELLLA+ implementation is contingent upon approval of the LTR NEDC-33006P, Revision 2 (Reference 2) and the plant-specific MELLLA+ application.

HC Implementation
As discussed previously, HCGS is not implementing MELLLA+. Therefore, this Limitation is not applicable to the HCGS EPU license application.

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23. Mixed Core Method 1 (Section 8.2)
Plants implementing EPU or MELLLA+ with mixed fuel vendor cores will provide plant-specific justification for extension of GENE's analytical methods or codes. The content of the plant-specific application will cover the topics addressed in this SE as well as subjects relevant to application of GENE's methods to legacy fuel. Alternatively, GENE may supplement or revise LTR NEDC-33173P (Reference 1) for mixed core application.

HC Implementation
Key parameters associated with GNF and legacy fuel operation in HCGS cycle 15 were presented in "Interim Methods LTR Supplement for Hope Creek Extended Power Uprate", 0000-0031-9433-IMLTR-SUP1, July 2006. This report concluded that HCGS cycle 15 is not considered a mixed core since the legacy fuel is high exposure, low reactivity fuel operating in its fourth or fifth operating cycle. In the EPU core, this legacy fuel is located on the edge of the core or in control cell locations and is operating at pre-EPU conditions. Therefore, this Limitation is not applicable to the HCGS EPU license application. Additional discussion of this report is provided in response to Limitation 26.

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24. Mixed Core Method 2 (Section 8.2)
The fuel lattice geometry cannot deviate significantly from GE lattices; particularly the performance of TGBLA06 for expanded operating domains has not been demonstrated for fuel assemblies with water crosses, square internal water channels, Gd rods simultaneously adjacent to water and vanished rods, or 11x11 lattices. The acceptability of the modified epithermal slowing down models in TGBLA06 have not been demonstrated for application to these or other geometries for expanded operating domains. Significant changes in the Gd rod optical thickness will require an evaluation of the TGBLA06 radial flux and Gd depletion modeling before being applied. Increases in the lattice Gd loading that result in nodal reactivity biases beyond those previously established will require review before the GE methods may be applied. The NRC staff did not assess the TGBLA06 upgrade for use with 11x11 and higher lattices, water crosses, water boxes, or MOX fuels at EPU conditions. For any plant-specific applications of TGBLA06 with the above fuel types, or changes as described above, GENE needs to provide assessment data similar to that provided for the GE fuels.

HC Implementation
This Limitation defines the scope of the NRC's review. Key parameters associated with GNF and legacy fuel operation in Hope Creek cycle 15 were presented in "Interim Methods LTR Supplement for Hope Creek Extended Power Uprate", 0000-0031-9433-IMLTR-SUP1, July 2006. This report concluded that Hope Creek cycle 15 is not considered a mixed core since the legacy fuel is high exposure, low reactivity fuel

operating in its fourth or fifth operating cycle. In the EPU core, this legacy fuel is located on the edge of the core or in control cell locations and is operating at pre-EPU conditions. Therefore, this Limitation is not applicable to the HCGS EPU license application. Additional discussion of this report is provided in response to Limitation 26.

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25. MELLLA+ Eigenvalue Tracking (Section 8.3)

In the first plant-specific implementation of MELLLA+, the cycle-specific eigenvalue tracking data will be evaluated and submitted to NRC to establish the performance of nuclear methods under the operation in the new operating domain. The following data will be analyzed:

- Hot critical eigenvalue,
- Cold critical eigenvalue,
- Nodal power distribution (measured and calculated TIP comparison),
- bundle power distribution (measured and calculated TIP comparison),
- Thermal margin,
- Core flow and pressure drop uncertainties, and

The MIP Criterion (e.g., determine if core and fuel design selected is expected to produce a plant response outside the prior experience base).

Provision of evaluation of the core-tracking data will provide the NRC staff with bases to establish if operation at the expanded operating domain indicates: (1) changes in the performance of nuclear methods outside the EPU experience base; (2) changes in the available thermal margins; (3) need for changes in the uncertainties and NRC-approved criterion used in the SLMCPR methodology; or (4) any anomaly that may require corrective actions.

HC Implementation

As discussed previously, HCGS is not implementing MELLLA+. Therefore, this Limitation is not applicable to the HCGS EPU license application.

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26. Plant-Specific Application (Section 8.5)

The plant-specific applications will provide prediction of key parameters for cycle exposures for operation at EPU and MELLLA+. The plant-specific prediction of these key parameters will be compared against the EPU experience base and MELLLA+ operating experience, if available. For evaluation of the margins available in the fuel design limits, plant-specific applications will also provide quarter core map (assuming core symmetry) showing bundle power, bundle operating LHGR, and MCPR for BOC, MOC, and EOC. Since the minimum margins to specific limits may occur at exposures other than the traditional BOC, MOC, and EOC, the data will be provided at these exposures.

HC Implementation

Key parameters associated with the fuel operating in a HCGS cycle 15 preliminary core design were presented in "Interim Methods LTR Supplement for Hope Creek Extended Power Uprate", 0000-0031-9433-IMLTR-SUP1, July 2006. The parameters were compared against the existing EPU experience base. This comparison demonstrated that HCGS EPU operation is bounded by the experience base. Figures 3.8.26-1 through 3.8.26-3 provide the margins available in the fuel design limits for both the limiting GE14 fuel and the legacy SVEA fuel. These figures illustrate adequate fuel thermal limit margins in the design, consistent with current design margins. It is expected that the overall results for the actual HCGS cycle 15 core design will be similar. PSEG will provide the results of the key parameters and the thermal limit margins for the actual HCGS cycle 15 core design prior to implementing EPU operation.

[[

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Figure 3.8.26-1 - HCGS EPU MFLPD vs. Cycle Exposure

[[

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Figure 3.8.26-2 - HCGS EPU MFLCPR vs. Cycle Exposure

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Figure 3.8.26-3 - HCGS EPU MAPRAT vs. Cycle Exposure

3) BWR Systems Branch (SBWB) (additional questions)

3.58 Please provide Hope Creek plant configuration information for the ECCS systems including drawings or diagrams showing the injection points in the reactor vessel for LPCI, HPCI, and core spray (Revised after conference call).

Response
An assembly drawing of the reactor vessel, annotated to show the injection points for LPCI, HPCI and core spray, is attached. The minimum HPCI flow injected through the core spray piping is provided in the response to RAI 3.51.

3.59 In PUSAR 5.3.4, the Rod Worth Minimizer LPSP in the plant Technical Specifications is kept the same value in terms of absolute power as the current set point for EPU operation. This approach is considered less conservative compared to maintaining same percentage of rated power. Please justify this approach.

Response
GE's Licensing Topical Report (LTR) NEDC-33004P-A, Revision 4, "Constant Pressure Power Uprate (CLTR)," Section 5.3.4, states that either approach is acceptable. The NRC has approved NEDC-33004P. NRC staff review of the method for establishing the LPSP is documented in section 5.4.2 of the NRC safety evaluation for NEDC-33004P (Accession Nos.: ML031190163 (Proprietary); ML031190310 (Non-Proprietary)). In either case, the sequence of control rod movement up to the Low Power Setpoint (LPSP) is not affected and the resultant control rod worths are maintained within the safety analyses assumptions.

3.60 For rod withdraw error events in subcritical / low power startup or power operation, please provide analyzed reactivity addition (CPR or peak fuel enthalpy) for CLTP and EPU conditions and justify specified acceptable fuel design limits were not exceeded for EPU conditions.

Response
The rod withdrawal error in subcritical / low power startup conditions is categorized as an infrequent event. Initial conditions for this event are not changed by Extended Power Uprate (EPU). No change in peak fuel enthalpy is expected for this non-limiting event as a direct result of EPU. No new analysis is performed for EPU – an evaluation assuming a very conservative 20% increase in the generic peak fuel enthalpy (from 60 cal/gm to 72 cal/gm) demonstrated that significant margin to the 170 cal/gm fuel damage threshold limit (SAFDL) remains.

The rod withdraw error during power operations is categorized as a limiting Anticipated Operational Occurrence (AOO) and is calculated for each cycle to demonstrate acceptable fuel operating limits. The calculated delta critical power ratio (ΔCPR) for this event at EPU conditions, as reported in the Hope Creek Power Uprate Safety Analysis Report, NEDC-33076P, is 0.17. For Cycle 14 at Current Licensed Thermal Power (CLTP) conditions, the calculated ΔCPR is 0.19. Both the CLTP and EPU rod withdraw error events have been verified to meet the required fuel design limits.

3.61 For CRDA analysis documented in PUSAR 9.2, only radiological consequences were presented. Please provide the analyzed reactivity addition (CPR or peak fuel enthalpy) for CLTP and EPU conditions and justify the specified acceptable fuel design limits were not exceeded for EPU conditions.

Response

Initial conditions for this event are not changed by EPU. No change in peak fuel enthalpy is expected for this non-limiting event as a direct result of EPU. No new analysis is performed for EPU – an evaluation assuming a very conservative 20% increase in the generic peak fuel enthalpy (from 135 cal/gm to 162 cal/gm) demonstrated that significant margin to the 280 cal/gm limit remains. Specified Acceptable Fuel Design Limits (SAFDL) do not apply to accident events – fuel damage is assumed to occur.

3.62 Question Deleted following Conference Call

3.63 For response of 3.26 of LCR H05-01, Rev. 1, please provide the justification that the "CPPU core inventory" used in the analysis (GE 14 equilibrium) bounds SVEA fuel.

Response

The CPPU core inventory for Hope Creek Generating Station was established based upon a source term generated assuming GE14 fuel, an initial bundle enrichment of ≤ 4.6 wt%, an end of cycle (EOC) core average exposure of ≤ 35 GWD/MT, a discharge bundle exposure of ≤ 58 GWD/MT, an initial bundle uranium mass of ≤ 182 Kg, and a bundle average power of ≤ 5.75 MW_t. Core inventory is a function of fuel enrichment, power density, and bundle exposure. Fuel mechanical design varies from vendor to vendor, and plays an insignificant role in the core inventory. The evaluations using the "CPPU core inventory" are bounding for both the GE 14 and SVEA-96+ fuel designs.

3.64 For response 3.27, equal initial CPR for anticipated transient without scram (ATWS) analysis was used as starting point and you concluded that EPU hot channel had a less limiting initial power to flow ratio and thus it resulted in lower PCT. Please provide numerical illustration of your reasoning process. However, in real operation, the ATWS for EPU condition could start with a different initial CPR. Using same percentage of rated power as starting point seems to be more reasonable and conclusive. Please justify your assumption - using equal initial

CPR. Also what causes more top-peaked axial power profile in CLTP condition than EPU condition?

Response

In order to bound the Abnormal Transient Without Scram (ATWS) Peak Cladding Temperature (PCT) calculation, [[ ]] During actual operation, the initial CPR will be no lower than the OLMCPR, and is typically higher than the OLMCPR as a result of designed operational margin. [[ ]] If the same hot channel power/flow conditions for the EPU analysis were applied to the CLTP analysis, a lower PCT value for CLTP would be calculated.

For the current EPU licensing analysis, the hot channel conditions are listed Table 3.64-1. This table shows the higher power to flow ratio for the CLTP condition.

The axial power shape is determined by the reference core design utilized for the analysis. Both the CLTP and EPU analyses were based on a representative GE14 equilibrium core design, developed at their respective power levels. At the analyzed end of cycle (EOC) conditions, EPU core designs are generally less top-peaked due to the impact of higher bundle powers on meeting thermal limit requirements. The impact of the difference in axial power shape between the CLTP and EPU) cases on the calculated PCT is small with respect to the large margin to the acceptance criteria of 2200°F.

Table 3.64-1

	CLTP	EPU
Hot Channel Properties		
Radial Peaking Factor (RPF)	1.425	1.380
[[		]]
Power (MBtu/hr)	20.838	23.657
Total Coolant Flow Rate (Klbm/hr)	89.17	114.58
Power/Flow Ratio (MBtu/Klbm)	0.2337	0.2065

3.65 In the sequence of events for the pressure regulator failed open (PRFO)-ATWS event listed in response 3.28, why was the boron transportation delay time (104.4 seconds) picked differently than others (86 seconds)? What are the criteria to decide PRFO is most limiting? Does the boron transportation delay time affect the results?

Response
In the initial ATWS evaluation, the boron transportation delay time was assumed to be 86 seconds for all events. [[

]] After completion of the initial analysis, the boron transportation was determined to be 104.4 seconds. Because a longer boron transportation delay time can postpone the achievement of reactor core hot shutdown, the amount of steam discharged into the suppression pool can increase. This can result in a higher peak suppression pool temperature, which would be more conservative. The boron injection is subject to both the SLCS timer delay and the transportation delay. By the time the boron reaches the reactor vessel, the reactor power has reached a semi-equilibrium condition with the completion of the recirculation pump trip and the vessel level lowered to 5' above Top of Active Fuel (TAF). Therefore, the increased boron transportation delay time adds about the same additional amount of steam to the suppression pool for all the events/conditions evaluated in the initial analysis. [[

]] with the additional 18 sec delay to demonstrate that the resulting peak suppression pool temperature and the associated peak containment pressure still meet the acceptance criteria. This 18 sec delay [[ ]] on peak pool temperature.

13) Containment and Ventilation Branch (SCVB) (additional question)

13.16 In response to the NRC staff request for additional information question 13.3 from the Containment and Ventilation Branch (SCVB), you stated that the Filtration, Recirculation, and Ventilation System's (FRVS) limiting component design temperature is 175°F. The maximum calculated area temperature of 131°F is below the 175°F FRVS temperature limit and well below the charcoal ignition temperature of 625°F.

In the Hope Creek Power Uprate Safety Analysis Report (PUSAR), Attachment 4 to the Hope Creek Extended Power Uprate application, it was stated that the maximum component temperature is approximately 168°F with normal flow conditions and, under conditions of a failed fan, charcoal temperature is maintained below the 625°F charcoal ignition temperature by water deluge.

Explain the relation between the calculated temperature of 131°F and the maximum component temperature of 168°F. Based on your analysis performed for conditions of a failed fan, is it correct to assume that charcoal temperature would exceed 625°F without activation of water deluge system?

Response

The following clarifications are provided with regard to the PSEG response to RAI 13.3 as related to post-EPU, post-accident temperatures in the FRVS system:

Temperature	Post-EPU Significance	Status
131°F	Maximum calculated post-accident area temperature in Reactor Building. It represents the maximum post-accident inlet temperature to the FRVS system.	Acceptable. Less than 148°F
148°F	FRVS system design-basis inlet temperature (selected to be high enough to bound expected inlet temperatures).	Design input value
168°F	Maximum bounding FRVS component temperature based upon generic GE analysis reported in the CLTR for AST plants, and confirmed to be applicable to Hope Creek. With normal operating system flow rates, the temperature increase within the charcoal is calculated to be approximately 17°F. The 148°F inlet + 17°F rise = 165°F (which is bounded by the 168°F temperature calculated by GE).	Design input + ΔT. Acceptable--less than 175°F
175°F	Design basis maximum temperature for FRVS components. Under post-accident, post-EPU operating conditions, there is roughly a 10°F margin to this maximum value.	FRVS train design temperature limit (with margin)
≤ 500°F	As shown in the CLTR for alternate-source-term (AST) plants, this is the maximum calculated charcoal temperature with postulated fan failure, assuming a minimum air flow of approximately 50 scfm across the filter.	Acceptable. Less than 625°F. Backed-up by deluge system. See below.
625°F	Charcoal ignition temperature.	N/A

As shown in the above table, the CLTR (NEDC 33044P, CPPU Licensing Topical Report) states that charcoal temperatures for AST plants will be less than or equal 500°F provided a minimum flow rate of approximately 50 scfm is maintained across the charcoal. However, since no minimum cooling flow is provided in the design of FRVS, the intent of the criterion is met by inclusion of a water deluge system. At Hope Creek, the water deluge system is manually actuated. Operators are alerted to high charcoal temperatures by an alarm set at 225°F and a second alarm at slightly over 300°F. Operator actions to initiate deluge are controlled by plant procedures.

11) Health Physics Branch (IHPB)

11.3 In the Hope Creek PUSAR, Section 8.4.2 (page 8-6) you state that, although activated corrosion products and fission products are expected to increase as a result of EPU, their post-EPU concentrations will not exceed the design basis concentrations. Provide the expected percentage increases in the concentrations of activated corrosion products and fission products in both the steam and in the water and compare this with the design basis concentration levels.

Supplement to Original Response

The calculation of post-EPU reactor coolant water and steam isotopic activity concentrations used ANSI/ANS-18.1-1999 methodology for an assumed core thermal power level of 3,952 MWt. The comparison with the corresponding design basis concentrations is shown in Tables 11.3-1 and 11.3-2.

Table 11.3-1
Noble Gas Activity Release Rate

Isotope	Steam Release Rate	
	Design Basis µCi/s	ANS 18.1/99 Estimate µ Ci/s
Class 1 - Noble Gases		
Kr-83m	2.9E+03	1.1E+03
Kr-85m	5.6E+03	2.1E+03
Kr-85	2.0E+01	9.0E+00
Kr-87	1.5E+04	5.6E+03
Kr-88	1.8E+04	6.5E+03
Kr-89	1.8E+02	6.5E+01
Xe-131m	1.5E+01	7.4E+00
Xe-133m	2.8E+02	1.1E+02
Xe-133	8.2E+03	3.1E+03
Xe-135m	6.9E+03	2.5E+03
Xe-135	2.2E+04	8.2E+03
Xe-137	6.7E+02	2.6E+02
Xe-138	2.1E+04	7.8E+03
Total	**97,765**	**37,423**

Table 11.3-2
Coolant & Steam Isotopic Activity Concentration

Isotope	Coolant Concentration		Steam Concentration	
	Design Basis μCi/g	ANS 18.1/99 Estimate μCi/g	Design Basis μCi/g	ANS 18.1/99 Estimate μCi/g
Class 2 – Halogens				
I-131	1.3E-02	2.0E-03	2.6E-04	4.5E-05
I-132	1.2E-01	2.0E-02	2.4E-03	4.3E-04
I-133	8.9E-02	1.4E-02	1.8E-03	3.0E-04
I-134	2.4E-01	3.7E-02	4.8E-03	8.1E-04
I-135	1.3E-01	2.0E-02	2.6E-03	4.4E-04
Br-83	1.5E-02			
Br-84	2.7E-02			
Br-85	1.7E-02			
Class 3 - Cesium, Rubidium				
Rb-89		3.9E-03		1.2E-05
Cs-134	1.6E-04	2.3E-05	1.6E-07	6.8E-08
Cs-136	1.1E-04	1.5E-05	1.1E-07	4.6E-08
Cs-137	2.4E-04	6.1E-05	2.4E-07	1.8E-07
Cs-138	1.9E-01	7.9E-03	1.9E-04	2.4E-05
Ba-137m		6.1E-05		1.8E-07
Class 4 - Water Activation Products				
N-13	4.0E-02			
N-16	4.0E+01	4.8E+01(1)	5.0E+01	2.5E+02(2)
N-17	6.3E-03			
O-19	6.9E-01			
F-18	4.0E-03			
Class 5 – Tritium				
H-3		1.0E-02		1.0E-02
Class 6 - Other Nuclides(3)				
Na-24	2.0E-03	1.7E-03	2.0E-06	5.0E-06
P-32	2.0E-05	3.4E-05	2.0E-08	1.0E-07
Cr-51	5.0E-04	2.5E-03	5.0E-07	7.6E-06
Mn-54	4.0E-05	3.0E-05	4.0E-08	8.9E-08
Mn-56	5.0E-02	2.1E-02	5.0E-05	6.2E-05
Fe-55		8.5E-04		2.5E-06
Fe-59	8.0E-05	2.5E-05	8.0E-08	7.6E-08
Co-58	5.0E-03	8.5E-05	5.0E-06	2.5E-07
Co-60	5.0E-04	1.7E-04	5.0E-07	5.1E-07
Ni-63		8.5E-07		2.5E-09
Cu-64		2.5E-03		7.5E-06
Ni-65	3.0E-04		3.0E-07	
Zn-65	2.0E-06	8.5E-04	2.0E-09	2.5E-06

Table 11.3-2
Coolant & Steam Isotopic Activity Concentration

Isotope	Coolant Concentration		Steam Concentration	
	Design Basis μCi/g	ANS 18.1/99 Estimate μCi/g	Design Basis μCi/g	ANS 18.1/99 Estimate μCi/g
Zr-97	3.2E-05		3.2E-08	
Zn-69m	3.0E-05		3.0E-08	
Sr-89	3.1E-03	8.5E-05	3.1E-06	2.5E-07
Sr-90	2.3E-04	5.9E-06	2.3E-07	1.8E-08
Y-90		5.9E-06		1.8E-08
Sr-91	6.9E-02	3.3E-03	6.9E-05	1.0E-05
Sr-92	1.1E-01	8.2E-03	1.1E-04	2.5E-05
Y-91		3.4E-05		1.0E-07
Y-92		4.9E-03		1.5E-05
Y-93		3.3E-03		1.0E-05
Zr-95	4.0E-05	6.8E-06	4.0E-08	2.0E-08
Nb-95	4.2E-05	6.8E-06	4.2E-08	2.0E-08
Mo-99	2.2E-02	1.7E-03	2.2E-05	5.1E-06
Tc-99m	2.8E-01	1.7E-03	2.8E-04	5.1E-06
Tc-101	1.4E-01		1.4E-04	
Ru-103	1.9E-05	1.7E-05	1.9E-08	5.1E-08
Rh-103m		1.7E-05		5.1E-08
Ru-106	2.6E-06	2.5E-06	2.6E-09	7.6E-09
Rh-106		2.5E-06		7.6E-09
Ag-110m	6.0E-05	8.5E-07	6.0E-08	2.5E-09
Te-129m	4.0E-05	3.4E-05	4.0E-08	1.0E-07
Te-131m		8.4E-05		2.5E-07
Te-132	4.9E-02	8.4E-06	4.9E-05	2.5E-08
Ba-139	1.6E-01		1.6E-04	
Ba-140	9.0E-03	3.4E-04	9.0E-06	1.0E-06
La-140		3.4E-04		1.0E-06
Ba-141	1.7E-01		1.7E-04	
Ce-141	3.9E-05	2.5E-05	3.9E-08	7.6E-08
Ba-142	1.7E-01		1.7E-04	
Ce-143	3.5E-05		3.5E-08	
Pr-143	3.8E-05		3.8E-08	
Ce-144	3.5E-05	2.5E-06	3.5E-08	7.6E-09
Pr-144		2.5E-06		7.6E-09
Nd-147	1.4E-05		1.4E-08	
W-187	3.0E-03	2.5E-04	3.0E-06	7.6E-07
Np-239	2.4E-01	6.7E-03	2.4E-04	2.0E-05

Table 11.3-2 Notes:

(1). The post-EPU reactor coolant N-16 concentration is expected to increase, which impacts the normal radiation exposure in the reactor building, specifically for the RWCU components. The existing 40-year normal integrated doses in the RWCU equipment rooms remain bounding due to the substantial radioactive decay associated with the protracted N-16 transit times to various RWCU components such that the resulting increase in the post-EPU N-16 related doses become negligible.

(2). The post-EPU main steam N-16 concentration includes the 5 times increase due to the Hydrogen Water Chemistry (HWC). The post-EPU N-16 related radiation exposures in the turbine building (TB) complex is calculated in H-1-ZZ-MDC-1930 using the TB radiation exposure data measured during the full scope implementation of the HWC. Therefore, the HWC related N-16 concentration increase is included in the post-EPU exposure assessment.

(3). Some of the post-EPU activated corrosion product isotopic concentrations (Class 6) (as shown shaded) may exceed their design basis isotopic concentrations. However, the gamma energy spectrums based on the design basis isotopic concentrations for the reactor coolant and main steam are considerably higher than those based on the post-EPU isotopic concentrations. Therefore, the existing plant radiation exposures based on the design basis reactor coolant and main steam isotopic concentrations are expected to be bounding for the EPU, except for various areas in the turbine building complex which are exposed to the N-16 related radiation as discussed in the Notes (1) and (2). Although there may be a post-EPU N-16 related increase in the radiation exposure, the post-EPU N-16 related radiation exposure is expected to be within the applicable radiation zone allowable dose rate limit (please see Response To RAI 11.2).

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

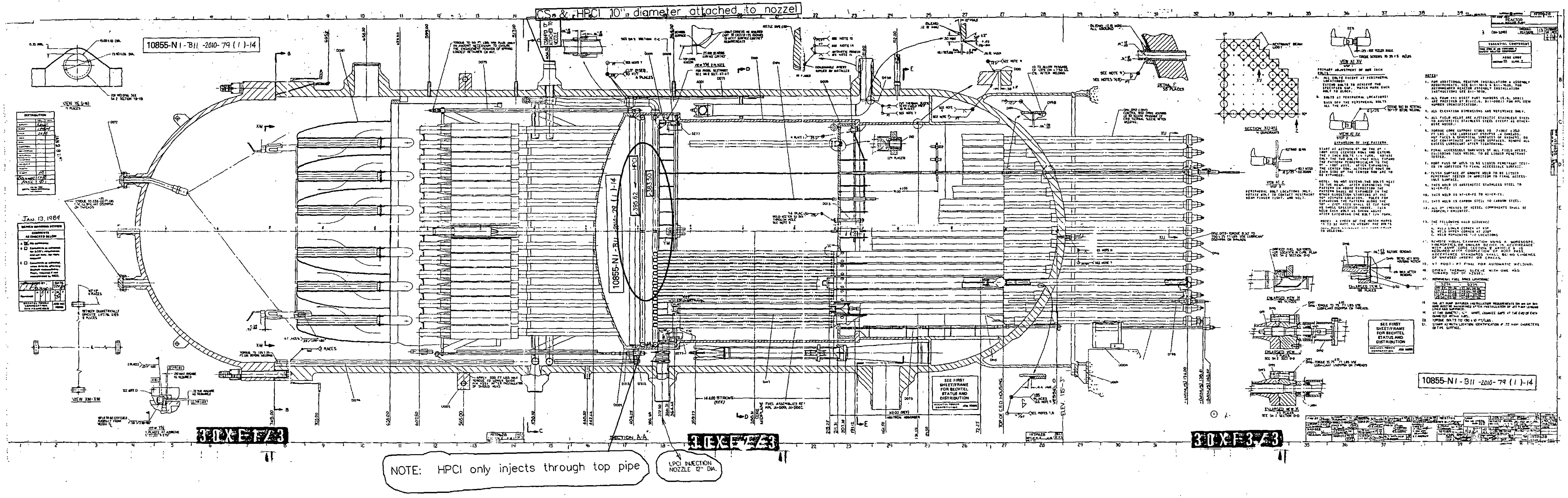
Hope Creek Generating Station
Facility Operating License NPF-57
Docket No. 50-354

Extended Power Uprate

Reactor Assembly Drawing

Question 3.58

VTD PN1-B11-2010-0079


CSs & HPCI 10" diameter attached to nozzel
10855-N1-B11-2010-79 (1)-14
JAN. 13, 1984
SECTION A-A
SEE FIRST SHEET/FRAME FOR BECHTEL STATUS AND DISTRIBUTION
NOTE: HPCI only injects through top pipe
LPCI INJECTION NOZZLE 12" DIA.