AmerGen

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RS-01-255

November 8, 2001

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

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station

References: (1) Letter from J. M. Heffley (AmerGen Energy Company, LLC) to U.S. NRC, "Request for License Amendment for Extended Power Uprate Operation," dated June 18, 2001

(2) Letter from J. B. Hopkins (U.S. NRC) to O. D. Kingsley (Exelon Generation Company, LLC), "Clinton Power Station, Unit 1 – Request For Additional Information (TAC No. MB2210)," dated November 5, 2001

In Reference 1, AmerGen Energy Company, LLC (i.e., AmerGen) submitted a request for changes to the Facility Operating License No. NPF-62 and Appendix A to the Facility Operating License, Technical Specifications (TS), for Clinton Power Station (CPS) to allow operation at an uprated power level. The proposed changes in Reference 1 would allow CPS to operate at a power level of 3473 megawatts thermal (MWt). This represents an increase of approximately 20 percent rated core thermal power over the current 100 percent power level of 2894 MWt. The NRC, in Reference 2 requested additional information regarding the proposed changes in Reference 1. Attachment A to this letter provides the information requested in NRC Questions 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 7.1, 7.2, and 7.3 of Reference 2. Responses to the remaining NRC questions in Reference 2 will be provided separately.

A portion of the information in Attachment A is proprietary to the General Electric Company, and AmerGen requests that it be withheld from public disclosure in accordance with 10 CFR 2.790, "Public Inspections, Exemptions, Requests for Withholding," paragraph (a)(4). The proprietary information is indicated with sidebars. Attachment B provides the affidavit supporting the request for withholding the proprietary information in Attachment A from public disclosure, as required by 10 CFR 2.790(b)(1). Attachment C contains a non-proprietary version of Attachment A.

Rec'd 2/12/02

A001
Add: M. Chawla - 0103

Should you have any questions related to this information, please contact Mr. T. A. Byam at (630) 657-2804.

Respectfully,

K. A. Ainger

K. A. Ainger
Director – Licensing
Mid-West Regional Operating Group

Attachments:

Affidavit

Attachment A: Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station (Proprietary version)

Attachment B: Affidavit for Withholding Portions of Attachment A from Public Disclosure

Attachment C: Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station (Non-proprietary version)

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Clinton Power Station
Office of Nuclear Facility Safety – Illinois Department of Nuclear Safety

bcc: Clinton Power Station Project Manager – NRR
Manager of Energy Practice – Winston & Strawn
Director – Licensing, Mid-West Regional Operating Group
Manager – Licensing, Clinton Power Station (MWROG)
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Brenda Fore, Clinton Power Station (Electronic Copy)
Document Control Desk Licensing (Hard Copy)
Document Control Desk Licensing (Electronic Copy)
Ron Frantz, Clinton Power Station (NSRB Coordinator)

STATE OF ILLINOIS	)	
COUNTY OF DUPAGE	)	
IN THE MATTER OF	)	
AMERGEN ENERGY COMPANY, LLC	)	**Docket Number**
CLINTON POWER STATION, UNIT 1	)	**50-461**

SUBJECT: **Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station**

AFFIDAVIT

I affirm that the content of this transmittal is true and correct to the best of my knowledge, information and belief.

K. A. Ainger
K. A. Ainger
Director – Licensing
Mid-West Regional Operating Group

Subscribed and sworn to before me, a Notary Public in and for the State above named, this 8th day of November, 2001.

Timothy Byam
Notary Public

" OFFICIAL SEAL "
Timothy A. Byam
Notary Public, State of Illinois
My Commission Expires 11/24/2001

ATTACHMENT B

Affidavit for Withholding Portions of Attachment A from Public Disclosure

General Electric Company

AFFIDAVIT

I, **George B. Stramback,** being duly sworn, depose and state as follows:

(1) I am Project 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 Attachment 1 to letter GE-CPS-AEP-070, *Proprietary Content – RAI 5.1,* dated November 2, 2001. The proprietary information in Attachment 1 (*GE-CPS-AEP-070, Proprietary Content RAI 5.1,* (GE Company Proprietary)), is identified by bars marked in the margin adjacent to the specific material.

(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), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions 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 cost or price information, production capacities, budget levels, or commercial strategies of General Electric, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, of potential commercial value to General Electric;

e. 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 both paragraphs (4)a. and (4)b., above.

(5) 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 further details regarding the GE proprietary report NEDC-32989P, *Safety Analysis Report for Clinton Power Station Extended Power Uprate,* Class III (GE Proprietary Information), dated June 2001, which contains detailed results of analytical models, methods and processes, 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.

STATE OF CALIFORNIA)
) ss:
COUNTY OF SANTA CLARA)

George B. Stramback, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at San Jose, California, this 2nd day of November 2001.

George B. Stramback
General Electric Company

Subscribed and sworn before me this 2nd day of November 2001.

TERRY J. MORGAN
Commission # 1304914
Notary Public - California
Santa Clara County
My Comm. Expires May 18, 2005

Notary Public, State of California

<u>ATTACHMENT C</u>

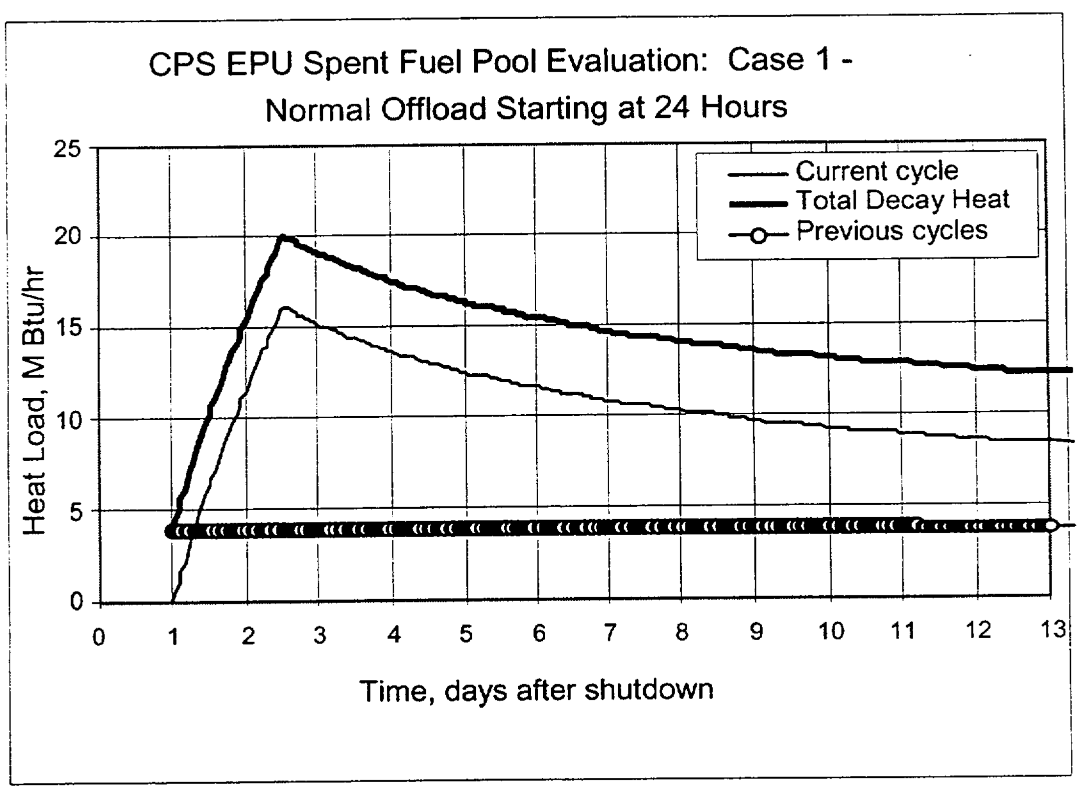
Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station (Non-Proprietary)

<u>Question</u>
5.1 As a result of plant operations at the proposed extended power uprate (EPU) level, the decay heat load for any specific fuel discharge scenario will increase. In Section 6.3.1 of the Safety Analysis Report (SAR) for Clinton Power Station (CPS) EPU, AmerGen (licensee) stated that EPU does not adversely affect the capability of the fuel pool cooling and cleanup system (FPCCS) to keep the spent fuel pool (SFP) temperature at or below the design temperature and maintain adequate SFP cooling during normal refueling and under full-core offload conditions. However, AmerGen did not provide the detailed discussion of its SFP cooling evaluations in the SAR, please provide the following information for both pre-EPU and EPU conditions.

5.1a SFP heat loads and the corresponding peak calculated temperatures during planned (normal) partial and/or full-core offload outages and unplanned (abnormal) full-core offload outages for pre-EPU and EPU conditions. A planned offload is the offload of fuel assemblies to the SFP for any expected (or planned) reason (e.g., refueling outage). An unplanned offload is the offload of fuel assemblies to the SFP due to an unforeseen condition (e.g., unexpected shutdown that includes an offload).

<u>Response</u>
5.1a The following Figures 5.1a-1 through 5.1a-4 show the calculated response of the SFP for partial and full-core offloads for EPU conditions.

Figure 5.1a-1
Batch Offload SFP Decay Heat Load



Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station (Non-Proprietary)

Figure 5.1a-2
Full Core Offload SFP Decay Heat Load

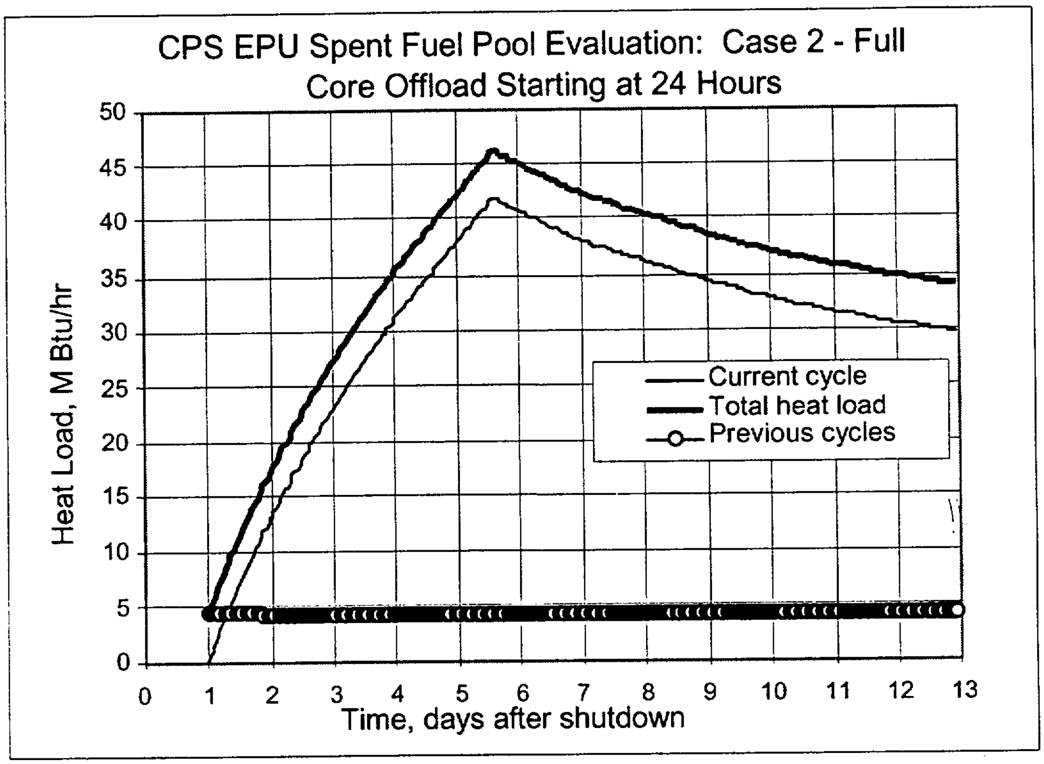


Figure 5.1a-3
Batch Offload SFP Temperature

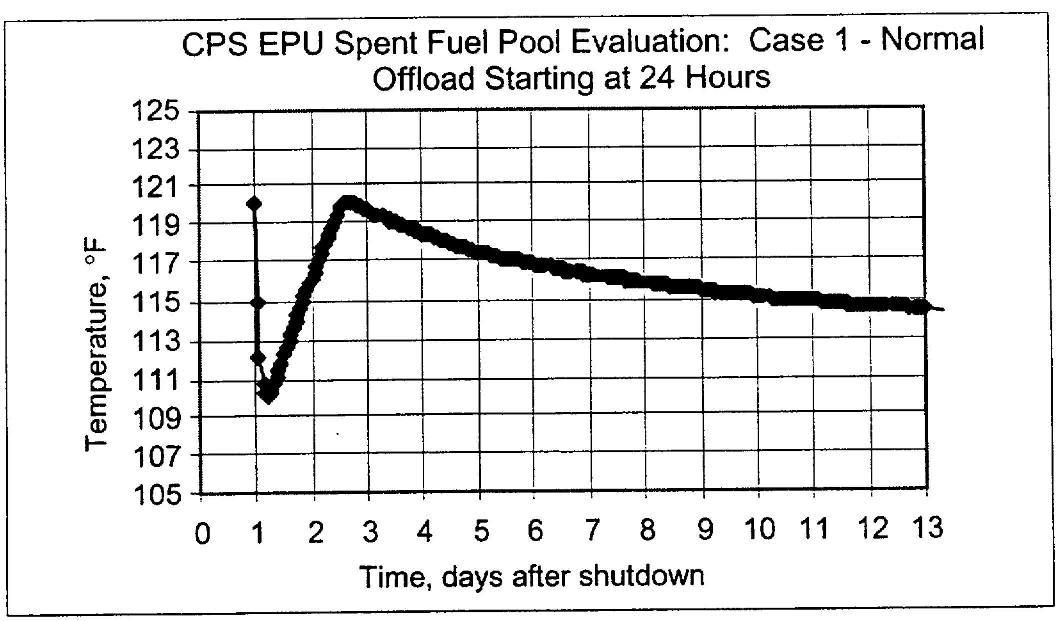
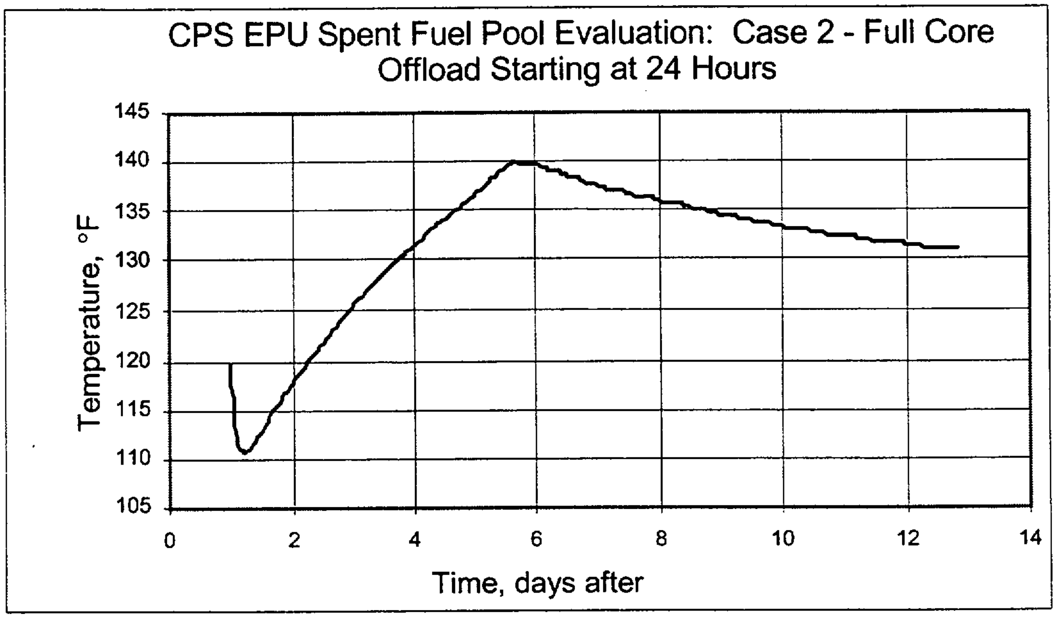


Figure 5.1a-4
Full Core Offload SFP Temperature



Question
5.1b Assumptions used in the SFP thermal-hydraulic analysis (i.e., fuel assemblies "in-reactor" hold time, number of the previously discharged spent fuel assemblies (SFAs) in the SFP, ultimate heat sink temperature, etc.) for each scenario.

Response
5.1b The following Tables 5.1b-1 and 5.1b-2 indicate both inputs and assumptions used in development of the EPU SFP analysis. The table also provides a comparison to the current licensed thermal power (CLTP).

Table 5.1b-1 - Inputs

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Table 5.1b-2 - Assumptions

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The following definitions are used throughout this analysis.

Item	Offload Scenario	Definition	Basis
1	Batch	Maximum Normal Heat Load	One batch of 208 fuel bundles offloaded to an almost full SFP, i.e., pool is loaded with1690 bundles with sufficient reserve for additional full core offload (624 cells). The 1690 bundles are offloaded in ten batches, discharged at 18-month intervals.
2	Full Core	Maximum Abnormal Heat Load	The batch offload case, all of which have cooled for 18 additional months, along with the full core offload that has been operated for 18 months

Question

5.1c For the planned refueling outages (with either partial or a full-core offload), discuss how the most severe single failure (e.g., failure of: a FPCC system train, a residual heat removal system train, emergency diesel generator, etc.) has been identified and accounted for in the SFP thermal-hydraulic analyses. (A single failure need not be assumed for the unplanned full-core offload events.)

Response

5.1c The accident conditions are initiated at the peak SFP temperature for partial and full-core offload scenarios, by assuming that the entire FPCCS cooling capacity is lost. The results of the analysis are shown in Figures 5.1c-1 and 5.1c-2.

Figure 5.1c-1
Batch Offload SFP Temperature for Accident Condition

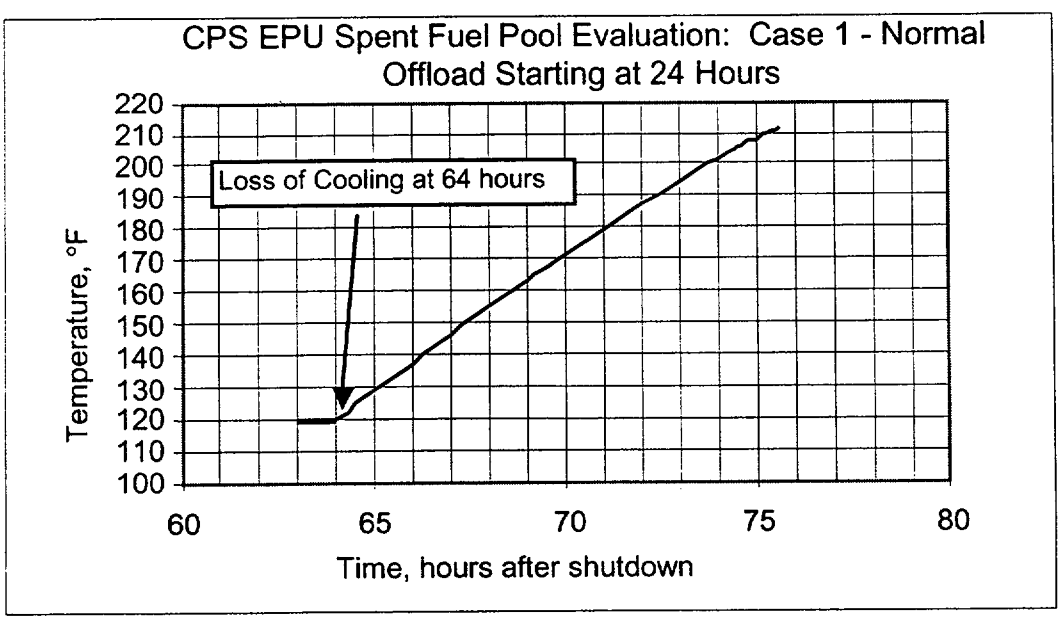
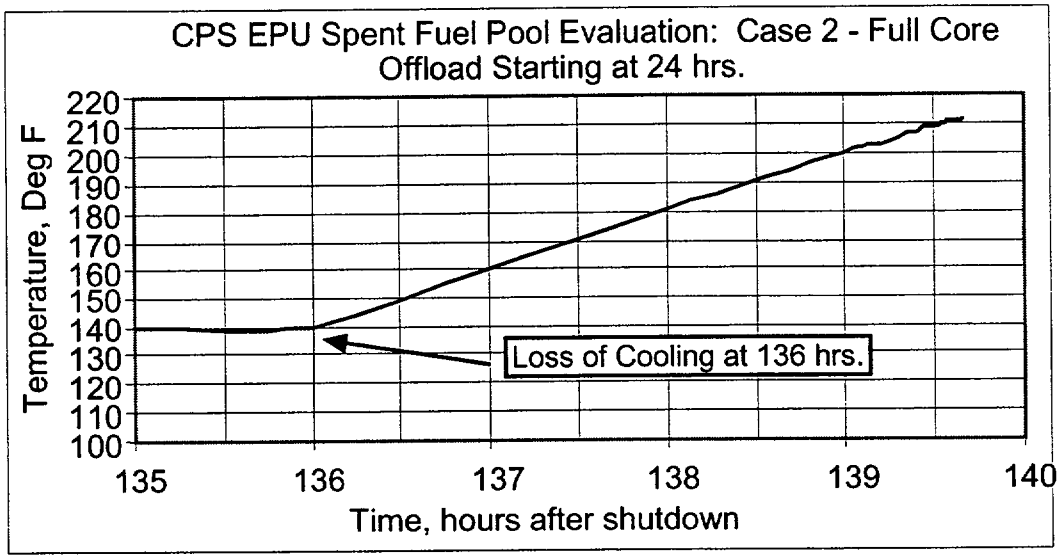


Figure 5.1c-2
Full Core Offload SFP Temperature for Accident Condition



Question
5.1d Since the residual heat removal (RHR) system provides supplemental cooling, when needed, to maintain the SFP below 150°F, prior to a planned or unplanned full-core offload event, how many trains of FPCC system and RHR system are required to be operable and available for SFP cooling?

Response
5.1d As specified in the assumptions listed above (i.e., Table 5.1b-2), for the batch offload one train of FPCCS is assumed available. For the full-core offload, both trains are assumed to be available. For both scenarios, the RHR system is assumed to be available for FPC assist mode, if needed.

Question
5.1e For the planned refueling outages (with either partial or a full-core offload), if the calculated peak SFP temperature is above 150°F, provide thermal stress analyses to demonstrate that the SFP structure can withstand the new high temperature for the duration of time during which the SFP temperature is above 150°F. Mechanical and Civil Engineering Branch (EMEB) has the primary review responsibility for structural thermal stress analyses.

Response
5.1e As demonstrated in the graphs above (i.e., Figures 5.1a-3 and 5.1a-4), the SFP temperature does not exceed 150°F for the planned refueling outage heat load, for either partial or full-core offload.

Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station (Non-Proprietary)

Question

5.2 Section 9.1.3.3.a of the CPS Updated Safety Analysis Report (USAR) states that if the SFP water temperature rises above 120°F, the FPCC heat exchanger cooling media may be transferred by operator from the component cooling water (CCW) system to the shutdown service water system to increase the heat removal capability of the FPCC system. Also, Section 9.1.3.3.b of the CPS USAR states that if it appears that the SFP water temperature will exceed 150°F when the reactor is in a cold shutdown condition, the operator may connect the FPCC system to the RHR system to provide supplemental cooling to the SFP. Discuss the provisions that have been established in the plant operating procedures to ensure that the shutdown service water system and the RHR system will be properly aligned for SFP cooling, when needed.

Response

5.2 CPS procedure 3312.03, "RHR – Shutdown Cooling (SDC) & Fuel Pool Cooling and Assist (FPC&A)," provides detailed lineup and operating instructions to place RHR in the fuel pool cooling assist mode provided the following conditions exist.

- The reactor is in cold shutdown condition and is in the refueling mode.
- An abnormal heat load has been produced in the pools and it appears that the pool water temperature will exceed 150°F.
- This mode shall not be used when subsystem A of the low pressure coolant injection mode of RHR is required to be operable.

CPS procedure 3317.01, "Fuel Pool Cooling and Cleanup (FC)," requires a series of actions to be performed to respond to increasing temperatures in the SFP or in the FC system. All actions start with Radiation Protection personnel being alerted to monitor the Fuel Building area for increasing radiation levels or evidence of airborne activity. Further actions depend on the initial conditions at the time of the increasing temperature. Actions include increasing cooling flow, placing additional cooling trains in service, shifting cooling water sources, or aligning RHR to provide supplemental cooling. Procedures prohibit reactor startup when SFP temperature is greater than 150°F or when portions of the RHR system are needed to cool the SFP.

Question

5.3 Section 9.1.3.1.2.k of the CPS USAR states that "Refueling is typically done in the late fall, winter or early spring. During these times of the year, lake (ultimate heat sink) temperatures are low. Heat sink temperatures for service water and CCW are typically less than 60°F and 80°F, respectively. Under these conditions, with the vessel disassembled and the reactor pool flooded up to greater than 23 feet, the SFP cooling system alone can remove the core residual heat and maintain the SFP temperatures within limits."

Since the heat removal capability of the SFP cooling system is a function of the lake temperature, and the decay heat load is a function of the SFAs "in-reactor" hold time prior to being discharged from the reactor, AmerGen can alternately opt to perform a cycle-specific SFP thermal-hydraulic evaluation prior to every planned offload using the actual conditions at the time of the offload. The "in-reactor" hold time for offload can be *adjusted, as long as the time is not shorter than what is assumed for the fuel handling accident.*

If AmerGen opts to perform a cycle-specific SFP thermal-hydraulic evaluation prior to every planned offload using the actual conditions at the time of the offload, please provide the following information:

5.3a The calculated SFP peak temperatures at various lake water temperatures (i.e., 40°F, 60°F, 80°F, 90°F, 95°F, etc.) and their corresponding SFAs "in-reactor" hold time required; coincident time after reactor shutdown; and coincident decay heat load. Coincident time is the time after reactor shutdown at which the SFP water reaches its temperature limit of 150°F. For the case with the highest decay heat load, also provide the "time-to-boil" and maximum boil off rate.

Response
5.3a As listed above in the inputs (i.e., 5.1b-1), the lake temperature used for this analysis is the maximum design temperature of 95°F. As listed above in the assumptions (i.e., Table 5.1b-2), for a partial offload the fuel bundle transfer is completed in 37 hours. For a full-core offload the fuel bundle transfer is completed in 110 hours. The analysis results are shown on Table 5.3a-1.

Table 5.3a-1

Item	Offload Scenario	Parameter	Unit	EPU
1	Batch	Peak heat load trend	Mbtu/hr	19.9
2	Full Core	Peak heat load trend	Mbtu/hr	46.2
3	Batch	Peak SFP temperature with FPCCS	°F	120
4	Batch	Time of peak SFP temperature after shutdown with FPCCS	hr	64
5	Batch	Peak evaporation loss	gpm	1.3
6	Full Core	Peak SFP temperature with FPCCS	°F	140
7	Full Core	Time of peak SFP temperature after shutdown with FPCCS	hr	136
8	Full Core	Peak evaporation loss	gpm	2.7
9	Batch	Time to boil (from peak pool temperature)	hr	11.6
10	Batch	Boil-off rate at 212°F	gpm	75.8
11	Full Core	Time to boil (from peak pool temperature)	hr	3.7
12	Full Core	Boil-off rate at 212°F	gpm	96

Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station (Non-Proprietary)

Question
5.3b Discuss the provisions established or to be established in plant operating procedures to required evaluations being performed to determine/establish SFAs "in-reactor" hold time required prior to discharge SFAs from the reactor to ensure that the SFP operating temperature limit of 150°F will not be exceeded.

Response
5.3b The analysis supporting the SFP operating temperature limit of 150°F assumes that moving irradiated fuel from the reactor core to the SFP is restricted for the first 24 hours after reactor shutdown. This is consistent with CPS Operational Requirements Manual Section 2.6.1, "Decay Time – Refueling Operations," that requires the reactor to be subcritical at least 24 hours prior to moving irradiated fuel in the reactor pressure vessel. This requirement thus restricts any movement of irradiated fuel from the reactor pressure vessel to the SFP during this period. This analysis confirms that compliance with the ORM operating restriction regarding moving irradiated fuel to the SFP prevents the operating temperature limit of 150°F from being exceeded. Therefore no core specific heat load analysis is required prior to performing refuel operations. As discussed in response to Question 5.2 above, CPS procedure 3312.03 provides the required system lineup and operating instructions to place RHR in the fuel pool cooling assist mode should it appear that the SFP water temperature will exceed 150°F.

Question
5.4 In order to determine whether adequate controls exist to ensure the guidance of Standard Review Plan, Section 9.1.3, "Spent Fuel Pool Cooling and Cleanup System," are met, the NRC staff needs to understand the provisions established or to be established in plant operating procedures to monitor and control the SFP water temperature during full-core offload events. Information should include:

5.4a How often the SFP water temperature will be monitored during planned and unplanned core off-load outages.

Response
5.4a In addition to alarms associated with FPCCS performance, SFP water level and temperature have indications both locally and in the Main Control Room. A dual channel recorder in the Main Control Room continuously provides an indication of the SFP temperature.

Question
5.4b The setpoint of the high water temperature alarm for the SFP.

Response
5.4b The setpoint of the SFP high water temperature alarm in the Main Control Room is 150°F.

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Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station (Non-Proprietary)

Question

5.4c Information supporting a determination that there is sufficient time for operators to intervene in order to ensure that the temperature limit of 150°F will not be exceeded.

Response

5.4c Based on the graph above for the worst case scenario, (i.e., a full-core offload with a complete loss of SFP cooling starting at the peak SFP temperature of 140°F as described in Figure 5.1c-2), the amount of time for operator action to prevent exceeding 150°F SFP temperature is greater than 30 minutes. Since a system malfunction that would initiate a loss of cooling is annunciated in the Main Control Room, sufficient response time remains for the operators to take actions to mitigate the temperature rise.

Question

5.4d The mitigative actions (i.e., prohibit fuel handling, aligning other systems to provide SFP cooling, etc.) to be taken in the event of a high SFP water temperature alarm.

Response

5.4d CPS procedure 3317.01, "Fuel Pool Cooling and Cleanup (FC)," requires a series of actions to be performed to respond to increasing temperatures in the SFP or in the FC system. All actions start with Radiation Protection personnel being alerted to monitor the Fuel Building area for increasing radiation levels or evidence of airborne activity. Further actions depend on the initial conditions at the time of the increasing temperature. Actions include increasing cooling flow, placing additional cooling trains in service, shifting cooling water sources, or aligning RHR to provide supplemental cooling. Procedures prohibit reactor startup when SFP temperature is greater than 150°F or when portions of the RHR system are needed to cool the SFP.

Question

5.5 In the unlikely event that there is a complete loss of SFP cooling capability, the SFP water temperature will rise and eventually reach boiling temperature. Provide the time to boil (from the pool high temperature alarm caused by loss-of-pool cooling to boiling) and the boil-off rate (based on the highest heat load from the planned or unplanned full core off-load). Also, discuss sources and capacity of makeup water and the methods/systems (indicating system seismic design Category) used to provide the makeup water.

Response

5.5 The parameters for the SFP regarding performance after a complete loss of cooling are given in the table in the response to Question 5.3a.

The normal source for makeup to the FC surge tanks is the cycled condensate (CY) system. This non-seismic system has a capacity of 400,000 gallons from the cycled condensate storage tank. The RHR system can be used to supply water to the upper containment pools, which connect directly to the spent fuel pool in the fuel building. RHR is a safety-related seismic category 1 system with a capacity of 5050 gallons. The emergency supply of makeup water to the SFP is from the SX system. This supply is a virtually unlimited source (i.e., from the cooling lake) and is seismic category 1.

Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station (Non-Proprietary)

Question

5.6 With regard to the CCW system, in Section 6.4.3 of the SAR AmerGen stated that the only increases in heat loads due to EPU are the operation of the reactor recirculating pumps at higher power level, and an increase in the fuel pool coolers heat load. Based upon a service water temperature of 92°F, the CCW system has sufficient heat removal capacity to accommodate the increased heat load due to EPU. However, Section 9.1.3.1.2.g in the CPS "USAR" states that the design temperature for service water is 95°F. Also, Table 9.2.8 of the USAR indicates that the design service water inlet temperature for the CCW heat exchangers is 95 °F. Please provide detailed discussion to clarify the discrepancy.

Response

5.6 The design temperature of 95°F, as specified in the USAR, is the upper temperature limit for the SX system. During an evaluation of EPU impact on the CCW system, it was determined that the SX design temperature of 95°F would result in a CCW heat exchanger outlet temperature operating parameter being exceeded.

The SX system provides a backup to the CCW system as described in USAR Section 9.2.1.2 to assure that cooling water is available to the FPCCS heat exchangers and pump motors under all modes of plant operation. The CCW system is not required to assure safe shutdown of the plant and failure of this system does not compromise any safety-related system or component. A CCW heat exchanger outlet temperature of 105°F is an assumed maximum operating parameter in the spent fuel bulk temperature analyses. Meeting this parameter ensures that the mean temperature difference for heat load transfers assumed in both the maximum normal and abnormal heat load analyses (e.g., partial and full-core offload with no spent fuel pool cooling) is maintained.

During the impact evaluation of EPU conditions on CCW, it was determined that an SX temperature of 95°F would result in a CCW heat exchanger outlet temperature of 106.6°F. This is 1.6°F greater than the CCW temperature assumed in the spent fuel pool bulk temperature analyses for this operating parameter. To ensure that the operating parameter can be maintained for the spent fuel bulk temperature analyses, the CCW evaluation was performed for EPU conditions assuming a maximum SX temperature of 92°F. This inlet temperature resulted in a CCW heat exchanger outlet temperature of 103.6°F at EPU conditions.

The SX temperature assumption used in the impact evaluation of EPU for CCW does not change the design value of the SX system. The SX temperature of 92°F used in the EPU evaluation is based upon the historical peak recorded temperature of the CPS cooling lake. Currently, plant operating procedures for the CCW system ensure that CCW heat exchanger outlet temperature is maintained less than 105°F. An abnormal temperature on the CCW heat exchanger outlet header of greater than 105°F would require plant personnel to place additional CCW heat exchangers and pumps in service, secure non-essential CCW system loads, or transfer the FPCC system heat exchangers to the SX system, as necessary. These actions ensure the design basis temperature assumptions for the FPCCS maximum normal and abnormal heat load analyses are met.

ATTACHMENT C

Additional Information Supporting the License Amendment Request to Permit Uprated Power Operation at Clinton Power Station (Non-Proprietary)

Question

7.1 For power uprates, the GE setpoint methodology discussed in GE document NEDC-32989P has been used to determine the acceptability of changing the setpoint. Therefore, this methodology should be referenced in the basis section of the Technical Specification. Also, confirm that this methodology has been used for both balance of plant (BOP) as well as nuclear steam supply system (NSSS).

Response

7.1 The General Electric (GE) setpoint methodology was used for the determination of the following nuclear steam supply system setpoints.

- Main Steam Line High Flow isolation
- Turbine Control Valve (TCV) Fast Closure scram, Turbine Stop Valve (TSV) Closure scram, and Recirculation Pump Trip (RPT) bypasses
- Control Rod Block Pattern Control Rod Withdrawal Limiter High Power Setpoint
- Control Rod Block Pattern Control Rod Withdrawal Limiter Low Power Setpoint

There were no trip setpoints required to be revised for the balance-of-plant (BOP) instruments to support extended power uprate (EPU).

Question

7.2 Table 5.1 of NEDC-32989P provides changes in the analytical limit for certain plant parameters for the current and power uprate condition. Provide instrument setpoints and allowable values at both the current and uprate power conditions for the instrument identified in Table 5.1.

Response

7.2 Table 7.2-1 below provides the allowable values and analytical limits at current and EPU conditions for those setpoints potentially impacted by EPU.

Table 7.2-1
Analytical Limits and Allowable Values for Setpoints

Parameter	License Condition	Nominal Trip Setpoints	Allowable Values	Analytical Limits
Average Power Range Monitor (APRM) Calibration Basis (MWt)	Current	N/A	N/A	2894
	EPU	N/A	N/A	3473

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Parameter	License Condition	Nominal Trip Setpoints	Allowable Values	Analytical Limits
APRM Simulated Thermal Power Scram				
Two Loop Operation (TLO) Fixed (% Rated Thermal Power (RTP))		No change	No change	No change
Single Loop Operation (SLO) Fixed (% RTP)		No change	No change	No change
TLO Flow Biased (% RTP)(2)	Current	$0.66\ W_D + 67$	$0.66\ W_D + 67$(2)	NA(1)
	EPU	$0.58\ W_D + 56$	$0.55\ W_D + 62$(2)	NA(1)
SLO Flow Biased (% RTP)(2)	Current	$0.66\ (W_D - \Delta W) + 48$	$0.66\ (W_D - \Delta W) + 51$(2)	NA(1)
	EPU	$0.58\ (W_D - \Delta W) + 37$	$0.55\ (W_D - \Delta W) + 42.5$(2)	NA(1)
APRM Neutron Flux Scram		No change	No change	No change
Reactor Vessel High Pressure Scram (psig)		No change	No change	No change
High Pressure Anticipated Transient Without Scram (ATWS) RPT (psig)		No change	No change	No change
Reactor Vessel Water Level – Low (inches above vessel zero)		No change	No change	No change
Safety Relief Valve Setpoints (psig) (safety mode / relief mode)		No change	No change	No change
TSV and TCV Scram and RPT Bypasses	Current	181.1 psig	191.7 psig	40% RTP
	EPU	166.4 psig	180.1 psig	33.3% RTP
Main Steam Line High Flow Isolation	Current	≤ 170 psid	≤ 178 psid	142.2% rated steam flow (RSF) 181 psid
	EPU	126% RSF 279 psid	127% RSF 284 psid	130% RSF 313.8 psid

Parameter	License Condition	Nominal Trip Setpoints	Allowable Values	Analytical Limits
Main Steam Line Tunnel High Temperature Isolation (°F)		No change	No change	No change
Main Steam Line Turbine Building High Temperature Isolation (°F)		No change	No change	No change
Feedwater Flow / Recirculation Upshift Interlock		*No change*	*No change*	No change
Low Steam Line Pressure MSIV Closure (Run Mode)		No change	No change	No change
Reactor Core Isolation Cooling Steam Line High Flow Isolation Auxiliary Building Drywell		No change	No change	No change
Control Rod Block Pattern Control Rod Withdrawal Limiter for Low Power Setpoint and High Power Setpoint Functions	Current			
	LPSP	138 psig	175 psig	35% RTP
	HPSP	361.6 psig	400 psig	70% RTP
	EPU			
	LPSP	138 psig	158 psig	29.2% RTP (No Change in MWt; Does change % RTP)
	HPSP	463 psig	471 psig	70% RTP (No change in % RTP; Does change MWt)

Notes:

(1) The Analytical Limit is not applicable since no limiting safety analysis credits this function.

(2) W_D is percent recirculation drive flow where 100% is the drive flow required to achieve 100% core flow at 100% power, and ΔW is the difference between the TLO and SLO drive flow at the same core flow. The current value of ΔW is 8% and is not changed for EPU.

Question

7.3 Sections 5.1 and 5.2 provide the discussion on the effect of power uprate on the NSSS and BOP systems. However, a discussion of the effect of power uprate on instrumentation and control is lacking. This discussion should include all the changes to instrumentation and control required because of the changes in the setpoints (not covered by the Table 5.1), instrumentation scaling changes, obsolescence, or the changes in the control philosophy.

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Response
7.3 The following instrumentation and control functions were impacted by power uprate.

- APRM Flow Biased Simulated Thermal Power Scram (TLO)

  The slope value for the EPU flow biased simulated thermal power Allowable Value scram curve is calculated based on the re-scaling of the power to flow map's "% Power" axis. APRM average power, as indicated on the curve, is re-scaled such that 100% will be equivalent to 120% of the current licensed thermal power (CLTP) level. The corresponding offset value was calculated to maintain the existing margin between the maximum extended load line limit analysis (MELLLA) rod line and the flow biased Allowable Value trip curve at the point of minimum required flow for operation at rated power. This minimum required flow increases from the current requirement of 75% core flow to 99% core flow for EPU.

  The Allowable Value flow biased curve resulting from this methodology has a slope of 0.55. The existing trip reference card slope adjustment range is specified as 0.55 to 0.75. A conservative slope of 0.58 was chosen for the nominal trip setpoint curve to accommodate existing hardware capabilities. A corresponding offset value of 56 was calculated to satisfy the requirement of maintaining the existing margin between the MELLLA rod line and the trip curve at the point of minimum required flow for operation at rated power. This results in a nominal trip setpoint curve of 0.58W + 56. This curve yields a conservative (lower) setpoint for core flows less than 99%. The nominal trip setpoint curve of 0.58W + 56 reaches the flow biased clamped limit nominal trip setpoint of 111% at approximately 95% core flow.

  There are no changes in operational or control philosophy for the EPU flow biased APRM simulated thermal power trip curve. The only hardware changes that will be made are adjustments to the slope and offset settings of the trip reference card.

- APRM Flow Biased Simulated Thermal Power Scram (SLO)

  The EPU slope value for the APRM flow biased simulated thermal power Allowable Value scram curve at single loop operation was calculated based on the re-scaling of the power to flow map's "% Power" axis. APRM average power is scaled such that 120% of CLTP will be equivalent to 100% of EPU rated thermal power.

  The Allowable Value SLO flow biased curve resulting from this methodology is "0.55 ($W - \Delta W$) + 42.5". The existing trip reference card slope adjustment range is specified as 0.55 to 0.75. In order to achieve a higher probability of successfully implementing a new SLO flow biased nominal trip setpoint curve, a slope of 0.58 was chosen.

  It is necessary to ensure the chosen 0.58 SLO flow biased nominal trip setpoint curve is conservative relative to a SLO flow biased nominal trip setpoint curve with a 0.55 slope. It should be noted that Technical Specifications do not require the clamped flow biased nominal trip setpoint function be operable for SLO. This results in the SLO flow biased nominal trip setpoint curve not being clamped for the entire range of licensed core flows. Therefore, in order to ensure the implemented SLO flow biased nominal trip setpoint is more conservative than a curve with a 0.55 slope, the corresponding offset value for the 0.58 slope curve is calculated with core flow set equal to the maximum licensed core flow of 107%. The resulting offset value is 37. Therefore, the actual SLO flow biased nominal trip setpoint curve to be implemented for EPU is "0.58 (W - ΔW) + 37". This curve yields a more conservative (lower) setpoint than a SLO flow biased nominal trip setpoint curve with a slope of 0.55 for core flows less than 107%.

This methodology results in the EPU SLO flow biased nominal trip setpoint curve being equal to or less than the CLTP setpoint curve in terms of MWt verses percent core flow for core flows up to the license limit of 107%.

There are no changes in operational or control philosophy for the EPU SLO flow biased APRM simulated thermal power trip curve. The only hardware changes that will be made are adjustments to the slope and offset settings of the trip reference card.

- Bypass of Turbine Control Valve (TCV) Fast Closure Scram, Turbine Stop Valve (TSV) Closure Scram and Recirculation Pump Trip (RPT) Scram

  The analytical limit for this function remains the same in terms of MWt but was re-scaled in units of percent RTP. The new nominal setpoint for this function is equivalent to 30% of the EPU RTP. The turbine first stage pressures associated with the nominal setpoint, allowable value and analytical limit change from CLTP conditions to EPU conditions because of the physical characteristics of the new high pressure turbine. No hardware or calibration range changes are required for this function. The existing calibration range bounds the expected first stage pressure at the valve wide open (VWO) conditions for the new high pressure turbine. The only hardware changes that will be made are adjustments to the nominal trip setpoint. There are no changes in operational or control philosophy associated with this function other than the change in setpoint.

- Main Steam Line High Flow Isolation

  The new analytical limit of 130% of EPU rated steam flow was selected to be sufficiently below flow restrictor choke flow. The main steam line high flow differential pressure transmitters are required to be re-scaled from "- 50 to + 250 psid" to "0 to 300 psid" to support the new nominal trip setpoint and allowable value. No other hardware changes other than setpoint adjustment are required.

  There will be a lower percent RTP value at which a MSIV can close without exceeding the high flow setpoint in the operational steam headers.

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- Control Rod Block Pattern Control Rod Withdrawal Limiter

  Low Power Setpoint (LPSP)
  The analytical limit for this function stays the same in terms of MWt and is re-scaled in terms of percent RTP. The turbine first stage pressure associated with the analytical limit changes due to the new high pressure turbine. The existing calibration range for the turbine first stage pressure transmitters associated with this function bound the analyzed allowable value and trip setpoint pressures and will not be changed. The existing setpoint value is still acceptable relative to the new analytical limit and allowable value and will be retained. No changes in control philosophy for this function are required.

  High Power Setpoint (HPSP)
  The analytical limit for this function stays the same in terms of percent RTP and therefore increases in terms of MWt. The turbine first stage pressures associated with the nominal setpoint, allowable value and analytical limit change from CLTP conditions to EPU conditions because of the physical characteristics of the new high pressure turbine and the change in the relationship between percent RTP and MWt. No hardware or calibration range changes are required for this function. The only hardware changes that will be made are adjustments to the nominal trip setpoint. There are no changes in operational or control philosophy associated with this function other than the change in setpoint.