AmerGen Energy Company, LLC
Clinton Power Station
R.R. 3 Box 228
Clinton, IL 61727-9351

AmerGen[SM]
An Exelon/British Energy Company

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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 Request for Amendment to Technical Specifications 3.2.2, "Minimum Critical Power Ratio (MCPR)," Addition of a New Surveillance Requirement

References: (1) Letter from Keith R. Jury (AmerGen Energy Company, LLC) to U.S. NRC, "Request for Amendment to Technical Specification 3.2.2, Minimum Critical Power Ratio (MCPR), Addition of a New Surveillance Requirement," dated July 31, 2002

(2) Letter from Keith R. Jury (AmerGen Energy Company, LLC) to U.S. NRC, "Additional Information in Support of Request for Amendment to Technical Specification 3.2.2, Minimum Critical Power Ratio (MCPR), Addition of New Surveillance Requirement, dated March 7, 2003

In Reference 1, AmerGen Energy Company (AmerGen), LLC submitted a request for a change to Appendix A, Technical Specifications (TS), of Facility Operating License No. NPF-62 for Clinton Power Station (CPS). Specifically, the proposed change would add a surveillance requirement to TS 3.2.2, "Minimum Critical Power Ratio (MCPR)," that would require determination of the MCPR limit following performance of control rod scram time testing. The new Surveillance requirement (SR) will require determination of the operating limit MCPR based on the scram time results. The operating limit MCPR can be revised as a result of the use of "Option B" scram times and the cycle specific analysis performed in support of the current operating cycle. Reference 2 provided, at the request of the NRC, a copy of the GE proprietary report documenting the CPS cycle-specific analysis for the Option B scram times.

On July 8, 2003, the NRC provided AmerGen with a set of questions for discussion in support of their review of the referenced amendment request. Following a conference call on July 28, 2003 in which these questions were discussed, the NRC requested a formal response to the subject questions. Attachment 1 to this letter provides the requested information.

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

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

Respectfully,

8/28/03
Executed on

Keith R. Jury
Keith R. Jury
Director – Licensing and Regulatory Affairs
AmerGen Energy Company, LLC

Attachment: Additional Information Supporting the Request for Amendment to Technical Specifications 3.2.2, "Minimum Critical Power Ratio (MCPR)," Addition of a New Surveillance Requirement

ATTACHMENT 1

Additional Information Supporting the Request for Amendment to Technical Specifications 3.2.2, "Minimum Critical Power Ratio (MCPR)," Addition of a New Surveillance Requirement

Question 1

Please provide a table to show the scram time using Option A and Option B for Clinton and identify their advantage and disadvantage for safe power operation. Also, provide the rationale for the change of the scram time calculation method for Clinton with respect to adding SR 3.2.2.2 in a different surveillance frequency within 72 hours and the basis for using 72 hours frequency, and clarify that this change is a common practice for all BWR/6 plants.

Response 1

Option A analysis utilizes the Technical Specification (TS) scram speeds as required in TS Table 3.1.4-1, "Control Rod Scram Times." Option B analysis utilized a mean scram speed based on the actual scram time history at Clinton Power Station (CPS). The mean scram speeds are documented in Table 3.3, "Analytical Scram Times at 1050 psig," from GE Report GE-NE-0000-0000-7456-01, dated February 2003.

Both methodologies yield an operating limit that ensures no fuel damage results during anticipated operational occurrences and that the Safety Limit Minimum Critical Power Ratio (MCPR) is not exceeded. The Option A methodology provides a more restrictive MCPR operating limit for pressurization events since Option A scram times are typically slower than the actual scram times. Measured scram times typically will produce a lower MCPR operating limit for pressurization events. The Option B analysis yields a less restrictive operating limit based on the actual scram times associated with the CPS control rod drives and therefore provides additional operating flexibility.

Proposed Surveillance Requirement (SR) 3.2.2.2 does not change the scram time calculation method. The purpose of this SR is to require the evaluation of the scram time test results to determine the applicable MCPR operating limit. Once the scram times are determined from testing the operating limit is determined in accordance with the Option B methodology. Proposed SR 3.2.2.2 is based on the standard improved Technical Specifications for the BWR/4 (i.e., NUREG-1433, "Standard Technical Specifications, General Electric Plants, BWR/4"). The frequency proposed in SR 3.2.2.2 (i.e., 72 hours) is consistent with the standard TS. Clinton followed the BWR/4 standard TS for this submittal since the BWR/6 plants have historically not been limited by pressurization events. With the implementation of GE14 fuel, however, pressurization events became more limiting. CPS is the first BWR/6 plant to complete the Option B analysis and therefore, the proposed changes are not consistent with the other BWR/6 plants. It is consistent, however, with the methodology implemented by several BWR/4 plants.

Question 2

Please describe the relationship between scram times and MCPR operating limits. Also, describe how to obtain control rod scram time and faster scram time and clarify that SR 3.1.3.4 is used for the criterion to obtain the scram time in the testing.

ATTACHMENT 1

Additional Information Supporting the Request for Amendment to Technical Specifications 3.2.2, "Minimum Critical Power Ratio (MCPR)," Addition of a New Surveillance Requirement

Response 2

Equation (4) on page 10 of GE-NE-0000-0000-7456-01 describes the linear relationship between the MCPR operating limit and the average scram time τ_{ave} (i.e., average scram time to the 20 percent insert position). This will be illustrated using a simplified example based on the data provided in the GE report.

When the Option B methodology is used, the MCPR operating limit is adjusted (i.e., decreased, to be less restrictive) as actual plant scram times are demonstrated to be faster than the TS limits and therefore reflecting a decrease in the average scram times to the 20 percent insert position. This methodology is a linear adjustment between two limits. For example, at the slowest end, the TS scram time limits are assumed to represent the core average (i.e., τ_A).

Table 3.7, "ODYN Option A Statistical Adder Data," on page 8 of GE-NE-0000-0000-7456-01, provides the Option A and Option B MCPR operating limits for several transients. The Option A operating limit MCPR is based on a τ_{ave} equal to a τ_A at 1050 psig pressure. For the same event, if the maximum allowable improvement in the average scram time were used, (i.e., if τ_{avg} were equal to τ_B), then the MCPR operating limit required could be reduced to the value provided in Table 3.7. In each case, the cumulative cycle scram time surveillance results would yield a lower MCPR operating limit for Option B. For each transient evaluated, the MCPR operating limit improvements associated with the measured average scram times are provided as an "adder" in Table 3.7. These are approximate values because reactor pressure interpolation, and the conservatisms used for establishing the τ_B limit are also pertinent.

The methodology limits the amount of improvement to the $OLMCPR_{New}$ value, as defined in equation (4) on page 10 of the GE report, such that average scram times faster than the τ_B value cannot be credited, since they would fall outside of the statistically valid range of values.

Control rod scram times can be obtained in either one of two methods: 1) by individually scramming a control rod and measuring the time using the process computer and the Transient Analysis Recording system, or 2) by automatic data acquisition during an automatic reactor scram. A control rod is timed from "full out" to "full in" with the times recorded at rod notch positions 43, 29 and 13 to ensure compliance with the surveillance requirements.

For individual rod scram timing, the affected rod is isolated from the control rod drive (CRD) system hydraulic charging water header. The data acquisition computer is then prepared and the local rod scram test switches, the single rod insertion (SRI) switches, are actuated. This simultaneously sends a signal to Transient Analysis Recording system computer to give it a timing "start" signal, and interrupts power to the local (i.e., individual) rod scram pilot solenoid valves, initiating the pneumatic isolation and venting of the air pressure which holds the hydraulic scram valves closed. This initiates rod motion, which is monitored by the computer, allowing timing of the rod position signals from the time of the start signal. The computer reports the rod timing to notches 43, 29, 13, and "full-in", as well as interpolating the scram time speed requirements as a function of measured reactor pressure. These times are printed out and entered into the surveillance data sheets for review and approval by a senior licensed operator, to assure compliance with the TS surveillance requirements.

The second method of data acquisition is a fully automatic capture of the full core scram initiation and all fully withdrawn control rod positions versus time. The Transient Analysis Recording system computer has the capability to capture this data if it is properly configured and functioning prior to the scram. In this case, if a full core scram occurs for any reason, and the surveillance conditions are met (i.e., reactor pressure is above 950 psig), then the data can be used to satisfy the TS surveillance requirements. In this case, the CRD charging water header is not isolated from the drives, however since all of the rods are scramming (versus only one control rod in the case of the single rod scram), there are no measurable biases in the control rod drive scram performance. The faster scram times for the BWR/6 plants is a direct result of the control rod drive systems' mechanical design. It is not a reflection of the test methodology.

Control rod scram time testing is performed in accordance with CPS TS Limiting Condition for Operation (LCO) 3.1.4, "Control Rod Scram Times." SR 3.1.4.1, SR 3.1.4.2, SR 3.1.4.3, and SR 3.1.4.4 require that the control rods are scram time tested at various pressures and under various conditions. SR 3.1.4.1 requires that each control rod scram time is within the required limits with reactor steam dome pressure ≥ 950 psig prior to exceeding 40% rated thermal power (RTP) after fuel movement within the reactor vessel and prior to exceeding 40% RTP after each shutdown in excess of 120 days. SR 3.1.4.2 requires a representative sample of control rods to be scram time tested to verify that the scram times are within required limits with the steam dome pressure ≥ 950 psig every 120 days cumulative operation in Mode 1. SR 3.1.4.3 requires verification that each affected control rod scram time is within the required limits with any reactor steam dome pressure prior to declaring the control rod operable following work on the control rod or control rod drive system that could affect scram time. SR 3.1.4.4 requires verification that each affected control rod scram time is within the required limits with the reactor steam dome pressure ≥ 950 psig prior to exceeding 40% RTP after work on the control rod or the control rod drive system that could affect scram time. SR 3.1.3.4 ensures control rod operability by requiring a control rod to have a scram time to notch 13 of less than 7 seconds. This surveillance is performed in conjunction with the scram time test SRs in LCO 3.1.4.

Question 3

Provide clarification that: (1) prior to the introduction of GE14 fuel, the BWR/6 TS scram speed was used to determine the MCPR operating limit (Option A); (2) use of Option A methodology limited the severity of the operating limits for pressurization event such that non-pressurization events became limiting; and (3) with the introduction of 9x9 and 10x10 fuel types, the pressurization events have become limiting.

Response 3

As stated in the Amendment Request, CPS has been utilizing the Option A analysis for determining the MCPR operating limit since the initial operating cycle. This methodology was used to determine the current cycle MCPR operating limit. The Option B analysis was completed for the current cycle but has not been implemented. Implementation of this method for determining MCPR operating limit will not occur until approval of this amendment request.

The changes to the Technical Specifications are being requested to take advantage of the conservatisms in the physical properties of the CRD system. While these conservatisms were not constraining with the older fuel and core designs, the newer fuel and core designs have resulted in these conservatisms becoming unnecessarily constraining.

As shown in the response to Question 2 above, the use of the Option A analysis methodology *increases* the evaluated severity of core-wide pressurization events because it assumes the worst-case (i.e., slowest) scram times allowed for operation. Actual plant scram speeds are typically faster than this minimum, and therefore the use of the Option A methodology serves as a large conservatism.

In the past, core designs typically had non-pressurization events as their limiting MCPR cases because the very rapid BWR/6 scram insertion rates made the core-wide events of much lesser impact.

As the fuel rod diameter has decreased with 9x9 and 10x10 fuel, the heat transfer time from fuel rod to coolant has decreased. This results in a relatively greater increase in the delta-CPR from pressurization transients than does for local events such as a rod withdrawal error. This has caused the newer core designs to reduce the MCPR margin gap between pressurization and non-pressurization events such that the excess conservatism is now impacting operational flexibility.