Exelon Generation
4300 Winfield Road
Warrenville, IL 60555

www.exeloncorp.com

Exelon.
Nuclear

10 CFR 50.90

RS-04-152

October 11, 2004

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

Dresden Nuclear Power Station, Units 2 and 3
Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249

Quad Cities Nuclear Power Station, Units 1 and 2
Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: Additional Information Supporting the License Amendment Request for Activation of the Trip Outputs of the Oscillation Power Range Monitor System

Reference: Letter from Keith R. Jury (Exelon Generation Company, LLC) to U. S. NRC, "License Amendment Request - Activation of the Trip Outputs of the Oscillation Power Range Monitor System," dated February 27, 2004

In the referenced letter, Exelon Generation Company, LLC (EGC) requested changes to the Technical Specifications (TS), Appendix A, of Facility Operating License Nos. DPR-19 and DPR-25 for Dresden Nuclear Power Station (DNPS), Units 2 and 3, and Facility Operating License Nos. DPR-29 and DPR-30, for Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2. The proposed changes incorporate into the TS the Oscillation Power Range Monitor (OPRM) instrumentation.

In a teleconference on August 31, 2004, between Mr. R. Koontz and other members of the NRC and Mr. A. Haeger and other members of EGC, the NRC requested additional information regarding the proposed changes. The attachment to this letter provides the requested information.

If you have any questions, please contact Mr. David Gullott at (630) 657-2819.

A001

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 11th day of October 2004.

Respectfully,

Patrick R. Simpson

Patrick R. Simpson
Manager, Licensing

Attachment

Attachment
Additional Information Supporting the License Amendment Request for Activation of the Trip Outputs of the Oscillation Power Range Monitor System

Question

1. *A) On page 7 of Attachment 1 of the amendment request, it is stated that "The Oscillation Power Range Monitor (OPRM) instrumentation design ... is consistent with the topical report design." Describe any differences between the Dresden and Quad Cities design and the topical report design.*

   B) In item 2.1 on page 8 of Attachment 1 of the amendment request, it is stated that "Only the Period Based Detection Algorithm (PBDA) ... is used to demonstrate protection of the MCPR safety limit. The other two algorithms are included as defense-in-depth features." Expand on this description and describe how these three algorithms are applied to the plant operations in terms of automatic protection and scram.

   C) Item 2.2 on page 8 of Attachment 1 of the amendment request refers to Reference 3, NEDO-32465-A. Describe any deviations from Reference 3 with regard to item 2.2.

Response:

A) There are no differences between the Dresden Nuclear Power Station (DNPS) and Quad Cities Nuclear Power Station (QCNPS) OPRM systems and the design described in the topical report regarding the OPRM system approved by the NRC in Reference 1.

B) Three separate algorithms for detecting stability related oscillations are included in the Boiling Water Reactor Owners Group (BWROG) Stability Long-Term Solution Option III solution - the period based detection algorithm (PBDA), the growth rate algorithm (GRA), and the amplitude based algorithm (ABA). Each algorithm examines a different aspect of an oscillation. OPRM trip setpoints are provided for each algorithm. All three algorithms perform calculations based on OPRM cell signals to determine if a trip is required and will provide a reactor trip. However, only the PBDA algorithm is required to ensure compliance with the safety limit for minimum critical power ratio (MCPR). The GRA and ABA algorithms offer defense-in-depth by providing protection for oscillation characteristics that have not been observed and are not expected to occur ("unanticipated oscillations"). The GRA and ABA algorithms are not needed to ensure compliance with the safety limit MCPR; therefore, they are not part of the licensing basis for the Option III solution. The design objective of the GRA and ABA algorithms is to limit the size of "unanticipated oscillations." Regardless of the very low probability of these "unanticipated oscillations," it is considered prudent to provide defense-in-depth protection against this type of oscillation. The defense-in-depth provided by the GRA and ABA offers a high degree of assurance that fuel failure will not occur as a consequence of stability related oscillations.

C) As discussed in response to Question 3 below, there are no deviations from the methodology described in NEDO-32465-A (Reference 2) for determining the PBDA scram setpoints. Treatment of uncertainties remains unchanged. The methodology assumes no failed local power range monitor (LPRM) sensors, which continues to be a conservative assumption.

Question

2. *Provide detailed procedures to verify the accuracy of trip set-points for the new OPRM instrumentation based on available data of the system calibration tests during normal operation as well as the shutdown and subsequent startup from refueling outages.*

Response:

The OPRM trip setpoints are entered into the OPRM system as digital, configurable parameters. Since the settings are digital, they possess no drift component as in an analog setting. All OPRM setpoints will be validated against the approved setpoints identified in the associated design and licensing documents.

The accuracy of the OPRM system signal processing is verified by performance of the following surveillance tests.

DNPS

- DIS 0700-37, "Oscillation Power Range Monitor (OPRM) Calibration" - This procedure satisfies the Channel Calibration, Channel Functional Test, and Logic System Function Test Surveillance Requirements with established overlaps to the rest of the RPS Surveillance Testing. The frequency of this test will be every 24 months.
- DIS 0700-38, "Oscillation Power Range Monitor (OPRM) Functional Test" - This procedure satisfies the Channel Functional Test Surveillance Requirement. Its frequency will be 6 months except for when the Channel Calibration is scheduled.
- DIS 0700-39, "Oscillation Power Range Monitor (OPRM) Response Time Test" - This procedure satisfies the staggered Response Time Testing Surveillance Requirement. Its frequency will be every 24 months on a staggered test basis.

QCNPS (These procedures correspond to the DNPS procedures described above and are conducted at the same frequency.)

- QCIS 0700-15, "Oscillation Power Range Monitor (OPRM) Calibration and Functional Test"
- QCIS 0700-16, "Oscillation Power Range Monitor (OPRM) Functional Test"
- QCIS 0700-17, "Oscillation Power Range Monitor (OPRM) Response Time"

These surveillance tests, which satisfy proposed Technical Specifications (TS) Surveillance Requirements (SRs) 3.3.1.3.1, 3.3.1.3.2, and 3.3.1.3.5, verify all internal voltage, resistance and time references to National Institute of Standards and Technology traceable standards. This calibration of the system's internal references assures proper and accurate digital processing of the OPRM trip algorithms that digitally monitor the changes in normalized LPRM cell averages.

In addition, the recirculation flow signals, that are used in part to determine when to automatically arm the OPRM trip logic, are calibrated as part of the 24-month TS SR 3.3.1.3.4, which is implemented by the following surveillance procedures.

DNPS

- DIS 0700-01, "Calibration of Flow signal to OPRMs"
- DIS 0700-02, "Flow Bias Adjustments"

QCNPS

- QCIS 0700-04 and 0700-37, "Unit 1(2) Recirculation Drive Flow (High Flux Flow Bias) Calibration"
- QCIPM 0200-11, -25, -26, -27, "Unit 1(2) Division I(II) APRM and RBM Reactor Recirculation Drive Flow Gain Adjustment"

Similarly, the simulated thermal power value within the neutron monitoring system, also used to automatically arm the OPRM trip logic, is calibrated as necessary throughout plant operation to a calculated calorimetric heat balance and at least weekly in accordance with TS SR 3.3.1.1.2 via performance of the following surveillance procedures.

DNPS

- DOP 0700-09, "APRM System Gain Adjustment"

QCNPS

- QCOS 0700-06, "APRM Flow Biased High Flux (Heat Balance) Calibration Test"

Question

3. *Provide a detailed description of the methodology for calculation of the plant-specific delta critical power ratio/initial critical power ratio vs. oscillation magnitude (DIVOM) correlation and the OPRM setpoints for Technical Specification (TS) 3.3.1.3. Also, provide a detailed description of the procedure to generate the OPRM Period Based Algorithm Allowable Value and Confirmation Counts for future cycles. Identify any plant-specific differences from the generic values specified in NEDO-32465-A such as PBDA period confirmation setpoints in Table 3-1, PBDA trip setpoints in Table 3-2, and the generic DIVOM curve slope. Provide specific values for OPRM scram setpoints and the DIVOM correlation for the next cycle.*

Response:

The BWROG Stability Long-Term Solution Option III methodology for establishing the OPRM PBDA trip setpoints is described in the NRC approved topical report NEDO-32465-A (Reference 2). For plant/cycle-specific application, the methodology described in NEDO-32465-A remains unchanged, with the exception that a plant/cycle-specific DIVOM curve slope is used in place of the generic DIVOM curve slope. The acceptability of utilizing a plant/cycle-specific DIVOM curve is documented in Reference 3.

The methodology for developing the DIVOM curve is described in Section 4.4 of NEDO-32465-A. For plant/cycle-specific application, the methodology for developing the DIVOM curve is described in Section 4.4 of NEDO-32465-A except that plant and cycle-specific parameters (e.g., core power and flow, core loading, cycle energy, fuel types, etc.) are utilized in place of the generic fleet parameters. The values of other OPRM system parameters, such as the PBDA period confirmation setpoints in Table 3-1 of NEDO-32465-A, remain within their original acceptable range. The current values of these setpoints have been established based on recent industry operational experience of the Option III OPRM system. The PBDA setpoints in Table 3-2 of NEDO-32465-A remain unchanged. As described in Section 4.4.4 of NEDO-32465-A, TRACG analyses will be performed to determine the relationship between the hot bundle oscillation magnitude and the change in critical power ratio (CPR), i.e., the DIVOM correlation. These analyses will utilize plant and cycle-specific inputs/parameters as described above.

The OPRM PBDA trip setpoints will be determined by applying the plant/cycle-specific DIVOM to the process for initial applications described in Section 5 of NEDO-32465-A. In this process, the final minimum critical power ratio (FMCPR) is calculated from the initial minimum critical power ratio (IMCPR) based on the following equation:

$$FMCPR = IMCPR - IMCPR * \left\{ \frac{\Delta CPR}{IMCPR} \right\}$$

The FMCPR is then compared to the safety limit MCPR (SLMCPR). If the FMCPR is greater than the SLMCPR, the OPRM PBDA trip setpoints are acceptable.

The evaluations of the initial plant/cycle-specific DIVOM correlation and OPRM PBDA trip setpoints for DNPS or QCNPS have not been completed at this time. Therefore, these values are not yet available. Exelon Generation Company, LLC (EGC) will provide the DNPS and QCNPS initial DIVOM correlation and OPRM PBDA trip setpoints for information once the evaluations are complete. This is expected to be available for DNPS in approximately mid-November 2004 and approximately mid-January 2005 for QCNPS.

For future cycles, a reload review process consistent with that described in Section 6 of NEDO-32465-A will be utilized. An evaluation of the applicability of the previous cycle DIVOM curve to the upcoming cycle will be performed. If required, a new DIVOM curve will be calculated. Once the appropriate DIVOM curve is established, the same process for determining the OPRM PBDA trip setpoints, as described above, is applied.

Question

4. *Describe the functional relationship between the Interim Corrective Actions (ICAs) and Actions A.3 and B.1 stated in TS 3.3.1.3 for OPRM. Provide a detailed description of the alternate method to detect and suppress thermal hydraulic instability oscillation stated in TS 3.3.1.3 Actions A.3 and B.1 and identify the documentation for the alternate method and its application to the plant operation with respect to operator training.*

Response:

The alternate method to detect and suppress thermal hydraulic instability (THI) contains the same required actions currently in effect at DNPS and QCNPS relative to THI monitoring and avoidance. These actions are based on the Interim Corrective Actions (ICAs) for instability prevention recommended by the BWROG and committed to in the Commonwealth Edison Company (now EGC) response (Reference 4) to NRC Generic Letter 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in BWRs." The alternate method maintains the same guidance on how and when to monitor for THI, and contains detailed power-to-flow operating maps that depict "Immediate Exit" and "Immediate Scram" regions of high power and low flow to enable manual operator actions for preventing plant operation in areas where the potential for THI is increased. These actions are currently proceduralized; they have been and will continue to be included as part of training for licensed operators. Following NRC approval of the requested changes, the current procedural guidance will be modified to require entry to the procedural guidance in response to inoperability of the OPRM system and to follow the guidance until the OPRM trip function can be returned to an operable status.

Question

5. *The proposed Surveillance Requirement (SR) 3.3.1.3.2 mentions the Core Operating Limits Report (COLR) and the OPRM setpoints for the trip function. Provide the rationale for not specifying core operating limit parameters for OPRM trip setpoints in TS 3.3.1.3. Provide an example of the new COLR format for the next cycle.*

Response:

The rationale for not including the core operating limits parameters in the TS is consistent with that applied to other core limits that are calculated or verified on a cycle-specific basis, such as the average planar linear heat generation rate in TS 3.2.1, the minimum critical power ratio in TS 3.2.2, and the linear heat generation rate in TS 3.2.3. This is consistent with the guidance in Generic Letter 88-16, "Removal of Cycle-Specific Parameter Limits from Technical Specifications." It is also consistent with the TS approved by the NRC for the OPRM system in Reference 1. The DNPS and QCNPS COLR formats will be similar to the sample provided for Peach Bottom Atomic Power Station in Reference 5.

Question

6. *On page 12 of Attachment 1 of the amendment request, it is stated that "Administrative procedures will be provided for manually bypassing OPRM instrumentation channels or protective functions, and for controlling access to the OPRM functions." Provide a more specific description of these administrative controls for controlling access to the OPRM functions.*

Response:

Access to the OPRM internal functions will be controlled by procedures. Procedures will be written in a manner that limits access to one OPRM channel at a time. Currently, the only procedures envisioned that will allow access to the OPRM internal functions are the three calibration and test procedures described in the first portion of the response to Question 2 and the procedure used to adjust setpoints and other internal parameters, performed by the System Engineer. The System Engineer will require a password to access the menu that allows changing of setpoints and parameters; this password is not distributed to non-engineering personnel.

All procedures will contain a requirement to obtain and document an Operations Senior Reactor Operator's permission before accessing OPRM functions. These controls are similar to those in place for other instrumentation functions with multiple channels.

Attachment
Additional Information Supporting the License Amendment Request for Activation of the Trip Outputs of the Oscillation Power Range Monitor System

Question

7. *On page 7 of Attachment 1 of the amendment request, it is stated that "There are no allowable values in the proposed TS associated with the OPRM trip function.... These are treated as nominal setpoints and do not include additional allowances for uncertainty." Please explain.*

Response:

BWROG Stability Long-Term Solution Option III is implemented utilizing the OPRM system. The OPRM system is a digitally-based system. As such, the OPRM system and its components are not subject to calibration error, setpoint drift or measurement uncertainty attributable to typical analog systems. Furthermore, the input signals to the OPRM system (i.e., LPRM signals) are continuously self-normalized such that the OPRM PBDA amplitude setpoint is based on a relative comparison to a value of unity (one). Therefore, the OPRM system is not subject to uncertainty due to LPRM drift or inoperability. The PBDA confirmation counts are discretely determined and counted by the digital system. Because of these factors, the OPRM system utilizes analytically determined trip setpoints and allowable values are not required.

References

1. Letter from U. S. NRC to R. A. Pinelli (BWR Owners' Group), "Acceptance of Licensing Topical Report CENPID-400-P, 'Generic Topical Report for the ABB Option III Oscillation Power Range Monitor,'" dated August 16, 1995

2. NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications," dated August 1996

3. BWROG-03048, "Utility Commitment to NRC for OPRM Operability at Option III Plants," dated September 30, 2003

4. Letter from J. C. Brons (Commonwealth Edison Company) to U. S. NRC, "Response to Generic Letter 94-02 (BWR Stability)," dated September 9, 1994

5. Letter from M. P. Gallagher (Exelon Generation Company, LLC) to U. S. NRC, "Response to Request for Additional Information – License Amendment Request - Activation of the Trip Outputs of the Oscillation Power Range Portion of the Power Range Neutron Monitoring System," dated September 13, 2004