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U. S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: Request for Additional Information Regarding a Proposed License Amendment to Revise Technical Specification 3.4.15, "RCS Leakage Detection Instrumentation"

Reference: Letter from Kenneth A. Ainger (Exelon Generation Company, LLC) to NRC, "Request for Technical Specifications Change, Revision to Technical Specification 3.4.15, 'RCS Leakage Detection Instrumentation,'" dated August 15, 2003

In the referenced letter, Exelon Generation Company, LLC (EGC) requested NRC approval of a proposed license amendment to Appendix A, Technical Specifications, of Facility Operating License Nos. NPF-72, NPF-77, NPF-37, and NPF-66 for Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, respectively. The proposed amendment would revise Technical Specification (TS) 3.4.15, "RCS Leakage Detection Instrumentation," to require one containment sump monitor and one containment atmosphere particulate radioactivity monitor to be operable in Modes 1, 2, 3 and 4. The current TS 3.4.15 requires one containment sump monitor and one containment atmosphere radioactivity monitor (gaseous or particulate) to be operable.

During the course of the NRC's review of the proposed amendment, a number of questions/issues were raised. The NRC has requested that EGC provide additional information to resolve these questions/issues. This information is provided in Attachment 1 to this letter.

Should you have any questions concerning this letter, please contact J. A. Bauer at (630) 657-2801.

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

Executed on ____________________ ________________________________

Kenneth A. Ainger
Manager, Licensing

Attachment 1: Response to Request for Additional Information Regarding a Proposed License Amendment to Revise Technical Specification 3.4.15, “RCS Leakage Detection Instrumentation”

**ATTACHMENT 1**

**Response to Request for Additional Information (RAI)**
**Regarding a Proposed License Amendment to Revise Technical Specification 3.4.15,**
**"RCS Leakage Detection Instrumentation"**

***NRC RAI No. 1***

*The capability of the particulate radioactivity monitor to detect a one gpm leak within an hour is discussed on page 5, of Attachment I "Evaluation of Proposed Change" of the August 15, 2003, License Amendment Request. It is stated that "using a source term based on representative real-time data, with no fuel defects, and varying ambient background level, the particulate channel detectors could have a setpoint at which the detectors are capable of detecting a one gpm leak in one hour. It is also stated that "because the minimum detectable activity of the detector is in close tolerance to the desired setpoint, numerous false positive indications would be realized if the monitors were set to alarm a one gpm leak in one hour. Therefore, alarm setpoints are set as low as practicable based on a statistical analysis of the monitor's trend."*

*A. Please explain how the statistical analyses of the monitor trends were used in determining the selected setpoints for each of the four Byron/Braidwood stations units. Also, explain why the setpoint values selected are considered to be "as low as practicable" for the intended application.*

Response to RAI No. 1 (A)

Background trends for the particulate channels for the four units were monitored for a period of 28 days. These background data were broken down by one-minute trends for that timeframe, and an average, standard deviation, maximum, and minimum value obtained. Based on the current reactor coolant system (RCS) activity levels, the ALERT setpoint was set at four-sigma above the average to minimize the potential for false indications. Note that setting the ALERT setpoint to four-sigma above the average reduced the spurious alarms to approximately one per week and is considered "as low as practicable." The HIGH setpoint was set at a multiple of four times the ALERT setpoint.

*B. The time required to detect a 1 gpm leak is given as a range (3.6 to 7.3 hours). Please explain how the time required to detect the 1 gpm leak was calculated, include discussion of the assumed source term, containment atmosphere mixing assumptions, radionuclide transport modeling, ambient background, and the detector setpoints for which the leak detection time calculated is based.*

Response to RAI No. 1 (B)

The time required to detect a one-gallon per minute (gpm) leak was calculated as described in the following text. The RCS concentration was sampled daily for 28 days over a period of stable reactor operation (i.e., full power). The average RCS concentration was calculated for this time-period. The activity in 60 gallons of RCS water (i.e., one gpm leak for 60 minutes) was assumed to enter the containment from the RCS. The partition fraction of 0.1%, specified in Updated Final Safety Analysis Report (UFSAR) Table 12.2-47, "Calculated Airborne Activities for Design Basis Leak Rate in Containment Building," was used to calculate the amount of particulate matter which entered the containment atmosphere from the RCS. This amount of activity was assumed to be evenly dispersed throughout the containment volume (i.e., 7.93E10 cubic centimeters) with the containment ambient background assumed to be zero counts. The detector response was calculated for each isotope to determine how the calculated atmospheric concentration would respond in units of uCi/cc on the detector. This detector response for a one gpm leak was compared to the ALERT setpoint (i.e., four sigma above the average background value as noted above). The number of hours to detect a one gpm leak was calculated by dividing the detector response for a one gallon leak into the ALERT setpoint. This value is the number of hours to detect a one gpm leak. This calculation methodology is conservative, as it does not take into account ambient background.

*C. Please explain the reason for not including the range of 3.6 to 7.3 hours in the TS bases.*

Response to RAI No. 1 (C)

The time to detect a one gpm leak (i.e., 3.6 to 7.3 hours) was not included in the TS bases because these values were calculated values based on the actual RCS radionuclide concentration and detector backgrounds for the four units at Braidwood and Byron Stations at the time of the submittal. The actual time to detect a one gpm leak will change daily as the unit-specific RCS radionuclide concentration changes and background conditions in the containment vary; therefore, it would be inaccurate to site a specific numerical range of values.

**NRC RAI No. 2**

*In section 5.2.5.2 of the Byron/Braidwood UFSAR, it is stated that the Containment Radiation Monitoring system draws a continuous sample of the containment atmosphere and routes the sample stream through a fixed filter, a charcoal filter, and a gas chamber, where measurements are taken of the level of air particulate radioactivity and gaseous radioactivity inside the containment. The practice of purging at power, results in periodic reductions in the airborne radioactivity concentrations inside the containment.*

*A. Describe what impact containment purges have on the ability of the particulate radiation monitor to detect a reactor coolant system leakage of 1 gpm. Specifically, how do the purge[s] impact[s] the time required to detect the leak.*

Response to RAI No. 2 (A)

Containment venting occurs approximately every 48 hours. During these venting activities, approximately 4-5% of the containment volume is released to the environment by administratively opening the 1/2VQ004/5 containment mini purge valves and allowing containment pressure to decrease. Typical venting evolutions reduce containment pressure from approximately 0.9 psig to 0.1 psig over the course of about one hour. No fans or make-up air are used. If a one gpm leak were to develop during a containment venting evolution, approximately 5% of the activity released to the containment could be released to the environment, and not be available for the containment atmosphere radiation monitors to detect. This is a conservative calculation, as it assumes the activity released to the containment instantaneously becomes a homogeneous mixture. As a result, the containment activity concentration could be conservatively reduced by approximately 5%; therefore, it would take approximately 5% longer to detect a one gpm RCS leak.

B. *When the reactor is started up after being shutdown for an extended period of time, the concentration of particulate radiation in the coolant will be low since it results primarily from the activation of corrosion products and fission products from fuel contamination or defects. Please discuss how reduced reactor coolant radionuclide concentrations, for periods of plant operation immediately following refueling or other extended outages, affect the RCS leakage detection system capability of detecting a 1 gpm leak.*

Response to RAI No. 2 (B)

The ability to detect a one gpm leak in one hour with this detector is inversely proportional to the activity in the RCS. If the activity in the RCS increases by a factor of two, the leakage detection time will be reduced by a factor of two. Conversely, during periods of low RCS activity, the time to detect a one gpm leak would be correspondingly longer. For example, if RCS activity decreased by a factor of 10, the leakage detection time will be increased by a factor of ten.

UFSAR Section 5.2.5.2.1, "Radiation Monitor Sensitivity/Response Time," also addresses this issue and states the following.

> "The detection of RCS leakage using radiation monitors ultimately relies on the quantity of isotopes that are contained in the RCS. For the situation where there is little or no activity (such as when there are no fuel leaks and/or at startup), then these monitors may not satisfy the 1 gpm leakage detection goal (since there is little or no activity to detect). Other methods of RCS leakage detection specified in RG 1.45 ['Reactor Coolant Pressure Boundary Leakage Detection Systems'] would be necessary as discussed in subsection 5.2.5 ['Detection of Leakage Through Reactor Coolant Pressure Boundary'] and Appendix A1.45 ['Reactor Coolant Pressure Boundary Leakage Detection Systems'].
>
> Given the above limitations, the containment radiation monitor setpoints are set as low as practicable, considering the background radiation levels and the objective of detecting a 1 gpm leak in one hour. The monitor setpoints are periodically reviewed and changed as necessary within the limitations discussed."