September 28, 2006

Mr. Christopher M. Crane
President and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3, AND QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 - CORRECTION OF SAFETY EVALUATION FOR AMENDMENT DATED SEPTEMBER 11, 2006 (TAC NOS. MB6530, MB6531, MB6532, MB6533, MC8275, MC8276, MC8277 AND MC8278)

Dear Mr. Crane:

On September 11, 2006, the Nuclear Regulatory Commission (NRC) issued Amendment Nos. 221 and 212 to Renewed Facility Operating Licenses DPR-19 and DPR-25 for Dresden Nuclear Power Station, Units 2 and 3 and Amendment Nos. 233 and 229 to Renewed Facility Operating Licenses DPR-29 and DPR-30 for Quad Cities Nuclear Power Station, Units 1 and 2, respectively. The amendments were in response to your application dated October 10, 2002, as supplemented by letters dated March 21, March 28, August 4, September 15 and October 31, 2003, and June 30, August 6, September 3, September 10, September 22, November 2 and November 5, 2004, and March 3, August 22, September 3 and September 27, 2005, and February 17 and May 25, 2006.

The amendments adopted the alternative source term methodology by replacing the accident source term described in Technical Information Document 14844 with an accident source term as prescribed in Title 10 of the *Code of Federal Regulations* Section 50.67. This letter transmits a correction to the NRC staff’s safety evaluation (SE) associated with the aforementioned amendment numbers. This includes a clarification of the NRC staff’s review of aerosol settling modeling methodology and correction of administrative errors.

The NRC staff has resolved these errors by correcting the appropriate sections in the SE, which did not impact the conclusions of the NRC staff’s original SE. The corrected SE pages are included as an enclosure to this letter and replace the associated pages in the original NRC staff’s SE.

If there are any questions concerning this matter, please contact John Honcharik at (301) 415-1157.

Sincerely,

/RA/

Daniel S. Collins, Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-237, 50-249, 50-254, and 50-265

Enclosure:
Corrected SE pages 9, 11, and 12

cc w/encls: See next page

If there are any questions concerning this matter, please contact John Honcharik at (301) 415-1157.

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Enclosure:
Corrected SE pages 9, 11, and 12

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DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3, AND

QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 -

CORRECTION TO SEPTEMBER 11, 2006, SAFETY EVALUATION

PAGES 9, 11, AND 12

Enclosure

48 psig. Exelon did not credit any reduction in drywell pressure or the MSIV leakage rate of 150 scfh after 24 hours following the postulated LOCA. Leakage rates were held constant for the entire duration of the accident (30 days) for conservatism.

The licensee's analysis does take credit for aerosol and iodine removal in the main steam lines. The licensee's iodine removal modeling assumes conservative well-mixed control volumes. Only the volumes associated with horizontal runs of seismically qualified main steam line piping are included in the modeling of aerosol deposition. The licensee assumes two aerosol settling volumes (nodes) for two unbroken main steam lines; one node between the RPV and the inboard MSIV, and the other node between the inboard and outboard MSIVs. The licensee conservatively assumed that the broken main steam line does not have the volume between the RPV and inboard MSIV available for iodine or aerosol removal, thus assuming only one aerosol settling node between the inboard and outboard MSIVs. The licensee's main steam line modeling is conservative because it minimizes aerosol deposition credit.

Exelon's modeling of aerosol settling is based on the methodology used by the NRC staff in its review of the implementation of an AST at the Perry Nuclear Power Plant (Perry) (ADAMS Accession Number ML021840462). The aerosol settling model is described in a report, AEB-98-03, "Assessment of Radiological Consequences for the Perry Pilot Plant Application Using the Revised (NUREG-1465) Source Term," which was prepared by the NRC Office of Nuclear Regulatory Research. AEB-98-03 gives a distribution of aerosol settling velocities that are estimated to apply in the main steam line piping. The model used in the Perry assessment assumed aerosol settling may occur in the main steam lines upstream of the outboard MSIV, at the median (50th percentile) settling velocity given by the Monte Carlo analysis described in the AEB-98-03 report. Exelon used the same aerosol settling model as described in AEB-98-03, but used the 40th percentile settling velocity for Dresden and Quad Cities to be more conservative. Exelon assumed, as approved for Perry by the NRC staff, that settling would occur in one settling volume between the inboard MSIV and the outboard MSIV for the main steam line, which has been assumed broken inside the drywell. For the remaining two unbroken main steam lines, aerosol settling is assumed to occur in two settling volumes, one between the reactor vessel and the inboard MSIV, the other volume between the two closed MSIVs. Exelon used only the horizontal pipe projected area (pipe diameter times length) for determining the aerosol deposition rates and removal efficiencies.

The NRC staff expressed a concern that the removal through aerosol settling was overestimated by modeling two settling volumes with the same settling velocity in each, when the settling would be expected to be at a lesser rate for the later sections of piping and at a later time considering that the larger and heavier aerosols would have already settled out of the main steam line atmosphere in upstream sections of piping. However, as stated above, Exelon did not credit any reduction in drywell pressure or the MSIV leakage rate after 24 hours. Leakage rates were assumed to be held constant for the entire duration of the accident for conservatism. Given this information, the NRC staff finds the Dresden and Quad Cities main steam line aerosol settling model to be reasonably conservative.

The NRC staff acknowledges that aerosol settling is expected to occur in the main steam line piping but because of recent concerns with aerosol sampling and its characteristics used in AEB-98-03 and lack of further information, the NRC staff is concerned with how much atmosphere. Since aerosols and particulate radionuclides are not expected to become airborne on release from the ECCS, they are not included in the ECCS source term. These assumptions are consistent with the guidance provided in RG 1.183.

The analysis considers the equivalent of 2 gallons per minute (gpm) ECCS fluid leakage starting at the onset of the LOCA. This leakage rate includes a factor of 2 multiplier over the applicable plant procedure limit, in accordance with guidance provided in RG 1.183, to address increases in the leakage due to normal material degradation between surveillance tests. Exelon assumed 10 percent of the iodine in the ECCS leakage becomes airborne and is available for release. As was assumed for the primary containment leakage pathway, the fission products in the containment atmosphere are further mitigated by dilution in the secondary containment and by the SGT system filtration. Consistent with the guideline provided in RG 1.183, the licensee assumed leakage from the primary containment would mix with the reactor building free air with no more than 50 percent mixing efficiency. The leakage enters the environment via the SGT system as a filtered elevated release. Exelon has taken no exception or departure from the guidance provided in RG 1.183 for evaluating the radiological consequence resulting from this fission product release pathway.

3.1.1.4 Suppression Pool Post-LOCA pH Control

The regulatory guidance in RG 1.183 provides that the iodine released to the containment includes 95 percent cesium iodide, 4.85 percent elemental iodine, and 0.15 percent iodine in organic forms. This iodine species assumption is only applicable if the suppression pool water is maintained at a pH of 7.0 or higher to ensure against elemental iodine re-evolution. Exelon proposes to use the standby liquid control system (SLCS) to inject sodium pentaborate to the RPV, where it will mix with ECCS flow and spill over to the drywell and then to the suppression pool. Sodium pentaborate, which is a base, will neutralize acids generated in the post-accident primary containment environment. The SLCS at Dresden and Quad Cities consists of two positive displacement pumps, each capable of injecting 40 gpm into the reactor vessel. Credit for the SLCS in the radiological analyses is based on operation of one SLC pump, manually initiated, and injection of the required amount of sodium pentaborate in the reactor and its transport to and mixing with the suppression pool water within 24 hours after initiation of the accident. The SLCS is manually initiated from the main CR. The licensee provided additional information regarding the SLCS and suppression pool pH control in its letters dated March 21 and 28, 2003, and June 30, August 6 and September 10, 2004.

3.1.1.4.1 pH Analysis

The NRC staff evaluated the licensee’s proposed methodology for controlling the suppression pool pH after a LOCA, which is needed in order to meet 10 CFR 50.67. After a LOCA, several acidic species are introduced into the suppression pool. The main sources of acidic species are hydrochloric and nitric acids. Hydrochloric acid is generated by a decomposition of cable Hypalon and PVC insulation. Only the insulation on the cables exposed directly to radiation fields are decomposed. Nitric acid is produced by irradiation of water and air in the radiation environment existing in the containment after a LOCA. The only significant source of basic species is cesium hydroxide released from damaged fuel. With these chemical species and without the buffering action of sodium pentaborate, the pH in the suppression pool water will drop below seven in about one day. However, after adding a sufficient amount of buffer, the pH in the suppression pool could be maintained above seven for 30 days.

By letter dated March 28, 2003, the licensee responded to a request for additional information (RAI) by providing clarifying information on the methods being proposed in their request. The calculations, included in the licensee's response, demonstrated how the minimum amount of sodium pentaborate needed to produce the required suppression pool pH was determined. This analysis showed that upon the initiation of the injection, a minimum of 3769.4 pounds of sodium pentaborate will be delivered into the suppression pool within 24 hours following a LBLOCA. The sodium pentaborate solution injected to the suppression pool will be supplied by the SLCS. Although the primary function of the SLCS is to introduce negative reactivity to the core in the event of a control rod mechanism failure, Exelon proposes to inject sodium pentaborate solution into the reactor for suppression pool pH control after a LOCA. The AST analysis specifies manual initiation of SLCS. In a letter dated August 6, 2004, the licensee provided the time sequence for SLCS initiation, and its transport and mixing with the suppression pool water. The time sequence provides for manual SLCS initiation and injection to start 2 hours after the beginning of the accident. Injection is completed when an adequate volume of sodium pentaborate solution is introduced into the suppression pool in about 4 ½ hours, well within the 24 hours assumed in the LOCA analyses. The licensee also provided the NRC staff with the necessary information needed to validate its claims. The NRC staff performed independent calculations to support its conclusion. The NRC staff evaluated the basis and input data for the different calculations made by the licensee, the chemical species that were being credited in the report and the implementation of the SLCS for the purposes described in their request. The licensee's results were found to be conservative and acceptable. The analysis done by the licensee was done only for Dresden, Unit 2 but the licensee properly demonstrated that this analysis bounded the analyses for the other Dresden unit and both units in Quad Cities. Also, there is a provision for the SLCS pumps, valves, and controls to be powered from diesel generators in the absence of normal power. The proposed TS change submitted by the licensee requires the SLCS to be maintained in an operable status whenever the reactor is in Mode 1 (run), 2 (start-up), or 3 (hot shutdown).

The licensee described the methodology for controlling the post-LOCA pH in the suppression pool water above seven. The methodology relies on using buffering action of sodium pentaborate, introduced into the suppression pool from the SLCS. The licensee provided analyses justifying that 3769.4 pounds of sodium pentaborate will ensure that pH in the suppression pool will stay above seven for 30 days after a LOCA. The licensee also determined that the SLCS could be activated when the plant is in Modes 1, 2, or 3. The NRC staff found the licensee's pH analyses in support of the application of an AST methodology to be acceptable. The acceptance was justified by the results of the NRC staff's review of the analysis provided by the licencee, thus concluding that the methodology presented in the licensee's submittal will ensure the suppression pool pH will stay basic for the period of 30 days after a LOCA.

3.1.1.4.2 Standby Liquid Control System

The proposed change extends the Applicability of TS 3.1.7 from Modes 1 and 2 to Modes 1, 2, and 3, and adds Required Action C.2. This action requires the plant be placed in Mode 4 (cold shutdown) in 36 hours if SLCS can not be restored within the required time. These changes implement the AST methodology regarding the use of SLCS to buffer the suppression pool following a LOCA involving fuel damage.

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