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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 Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation at Dresden Nuclear Power Station and Quad Cities Nuclear Power Station

References: (1) Letter from R. M. Krich (Commonwealth Edison Company) to U. S. NRC, "Request for License Amendment for Power Uprate Operation," dated December 27, 2000

(2) Letter from K. A. Ainger (Exelon Generation Company, LLC) to U. S. NRC, "Additional Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation at Dresden Nuclear Power Station and Quad Cities Nuclear Power Station," dated August 7, 2001

(3) Letter from K. A. Ainger (Exelon Generation Company, LLC) to U. S. NRC, "Additional Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation at Dresden Nuclear Power Station and Quad Cities Nuclear Power Station," dated August 13, 2001

In Reference 1, Commonwealth Edison (ComEd) Company, now Exelon Generation Company (EGC), LLC, submitted a request for changes to the operating licenses and Technical Specifications (TS) for Dresden Nuclear Power Station, Units 2 and 3, and Quad Cities Nuclear Power Station, Units 1 and 2, to allow operation at uprated power levels. In telephone conference calls on July 3, 2001, and July 17, 2001, between representatives of EGC and Mr. L. W. Rossbach and other members of the NRC, the NRC requested additional information regarding these proposed changes. The first portion of this information was provided in References 2 and 3. The Attachment to this letter provides the remainder of the requested information.

A001

Should you have any questions related to this letter, please contact Mr. Allan R. Haeger at (630) 657-2807.

Respectfully,

K. A. Ainger

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

Attachments:

Affidavit
Attachment: Additional Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation

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

STATE OF ILLINOIS	)	
COUNTY OF DUPAGE	)	
IN THE MATTER OF	)	
EXELON GENERATION COMPANY, LLC	)	**Docket Numbers**
DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3	)	**50-237 AND 50-249**
QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2	)	**50-254 AND 50-265**

SUBJECT: Additional Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation at Dresden Nuclear Power Station and Quad Cities Nuclear 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 14th day of

August, 2001.

Vicki L Farbo

Notary Public

OFFICIAL SEAL
VICKI L FARBO
NOTARY PUBLIC STATE OF ILLINOIS
MY COMMISSION EXP. NOV. 4, 2001

Attachment
Additional Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation
Dresden Nuclear Power Station, Units 2 and 3
Quad Cities Nuclear Power Station, Units 1 and 2

This attachment contains responses to NRC Questions 34, 35, 36, 37, 38, and 39. Responses to NRC Questions 1 through 33 were provided in previous submittals (References 1 and 2).

Question
34. Section 4.1.1.2 on Containment Airspace Temperature response notes that the limiting accident for drywell airspace temperature is the small steam line break. Provide the peak drywell airspace temperature and the peak drywell shell temperature for the limiting case. Include an assessment of the impact of the EPU, e.g., are changes (if any) principally due to different codes or due to the increased power. Provide additional detail if the peak drywell airspace temperature is significantly above the drywell shell temperature structural limit (i.e. more than the 10°F exceedance for the DBA-LOCA for 10 seconds).

Response

The steam line break analysis at extended power uprate (EPU) conditions was performed for four break sizes: 0.01, 0.1, 0.3 and 0.75 ft^2. The results for these break sizes are summarized as follows:

Break Size (ft^2)	Peak Drywell Airspace Temperature (°F)	Peak Drywell Shell Temperature (°F)
0.01	257.9	213.3
0.1	325.4	273.9
0.3	337.9	275.4
0.75	337.7	277.9

The steam line break analysis was also performed for the pre-EPU power using the same computer code (i.e., SHEX) as used for the EPU to assess the impact of EPU on the peak drywell airspace and shell temperature responses. The results show that the difference between the EPU and pre-EPU results is within 1°F for both peak drywell airspace and shell temperature. Peak drywell temperature occurs early in the event, before drywell spray initiation which occurs at 600 seconds, and, therefore, is relatively insensitive to the power level.

For steam line breaks, the drywell airspace temperature increases rapidly right after initiation of the break, and high airspace temperature is maintained until the drywell spray is initiated at 600 seconds into the event. For instance, for the 0.75 ft^2 steam line break, a drywell airspace temperature of approximately 330°F is reached about 30 seconds into the event, and then rises slowly to the peak temperature. However, the drywell shell temperature stays below the limit of 281°F throughout the event, as explained below.

As specified in Appendix A of NUREG-0588 (Reference 3), the Uchida heat transfer correlation was used for steam line break accidents while in the condensing mode. This mode is applicable early in the event when the steam is superheated. After the condensation mode, a natural convection heat transfer coefficient was used in the analysis, as specified in NUREG-0588. Condensation heat transfer results in a rapid heatup of the drywell shell. The shell heatup rate decreases as the shell temperature approaches the steam saturation temperature, which is around 277°F corresponding to the drywell airspace steam partial pressure of 47 psia. Once the shell temperature increases above the saturation temperature, the primary heat transfer mode becomes natural convection, which is much less efficient than condensation heat transfer. This transition occurs around 400 seconds for a 0.75 ft^2 steam line break. The shell temperature continues to increase since the airspace temperature stays around 330°F. But, the shell temperature increase in the natural convection mode is relatively small (approximately 1°F/200 seconds). Consequently, right after the drywell spray is initiated at 600 seconds into the event, the drywell shell temperature peaks at 277.9°F. Thereafter, the drywell airspace temperature decreases rapidly due to spray, and the shell temperature also decreases.

Question

35. Section 4.1.1.2 on Containment Airspace Temperature response provides the peak value of wetwell airspace and suppression pool temperatures during a DBA-LOCA. Is the DBA-LOCA the limiting DBA/transient for these parameters? If not, provide the details of the limiting accident/transient considering the effects of EPU.

Response

Review of the results for the design basis accident loss of coolant accident (DBA LOCA) and steam line breaks analyzed at EPU conditions shows that the DBA LOCA is the limiting event for the wetwell airspace and suppression pool temperatures.

Question

36. Section 4.4, "Main Control Room Atmosphere Control System" (MCRACS)

36A. Explain how the increase in heat gain to the control room as a result of EPU for both normal and emergency modes is insignificant.

36B. Part of the second paragraph reads as follows: "The effect of EPU in combination with a 24 month fuel cycle on the post-LOCA iodine loading on the control room charcoal filter was evaluated. The post-LOCA iodine releases collected on the control room intake filters following EPU was estimated using the 0-2 hr X/Q values for the entire duration of the event, assuming no deposition or holdup of iodines in the main steam lines or in the secondary containment."

Provide the reference which serves as the basis for the evaluation and its assumptions, as noted above.

36C. State the filter efficiencies, for HEPA and charcoal filters of the MCRACS, which continue to be effective under EPU conditions.

36D. State what regulatory requirements continue to be met by MCRACS performance under EPU conditions (e.g., 10 CFR 50, Appendix A, General Design Criteria 19).

36E. Provide an example of calculated total iodine loading on MCRACS charcoal filters under EPU conditions and how these results compare with the allowable limit of 2.5 mg/gm of activated carbon, identified in Regulatory Guide 1.52.

<u>Response</u>
36A. The increases in heat loads due to EPU do not impact the MCRACS since these increases occur outside the control room areas. EPU does not change the way in which the plant systems operate. Thus, the major control devices in the control room remain unchanged. The small electrical currents transmitted to some indicating devices in the control room increase due to higher process temperature and electrical loads. The minor associated heat load increases from these signals have an insignificant effect on the pre-EPU design margin of the MCRACS in both normal and emergency modes.

36B. During a loss of coolant accident (LOCA), iodine is released to the environment via leakage through the main steam lines (MSL), and via leakage into secondary containment, which is released to the environment via the standby gas treatment system (SGTS). The iodine loading for the control room charcoal filter is estimated by quantifying the post-LOCA iodine release via the MSL leakage pathway and the SGTS release pathway and then addressing iodine concentrations resulting from atmospheric dispersion.

The leakage entering into the secondary containment is transported to the SGTS where it is treated by filtration before being released to the environment. The SGTS effluents are then dispersed in the atmosphere and enter the control room intake and into the control room filter. Similarly, containment leakage through the main steam isolation valves (MSIVs) is transported untreated to the control room intakes.

Listed below are the major assumptions used in this evaluation.

- There is no deposition or plateout of iodine in the MSLs. This is conservative as it results in a greater inventory of iodine available for adsorption on the control room filters.

- No credit is taken for holdup of iodine in the MSL or secondary containment. This is conservative as it increases the estimated iodine releases.

- No credit is taken for radioiodine decay. This maximizes both the containment source and the inventory accumulated in the control room filter.

- The 0 to 2 hour X/Qs are used to estimate air concentrations at the control room filter inlet for the duration of the LOCA. This assumption maximizes iodine concentrations at the control room filter inlet.

- The control room intake flowrate is increased 10% over design to account for equipment variation. This maximizes the potential deposition on the control room filters.

- The control room filters are online for the entire duration of LOCA. This is conservative as it maximizes the iodine inventory on the filters.

- To maximize the control room filter inventory, 100% filter efficiency is assumed.

The core inventory is evaluated at 2% above the EPU rated thermal power in accordance with guidance of Regulatory Guide 1.49 (Revision 1), "Power Levels of Nuclear Power Plants."

Other design input utilized in the assessment, in addition to the Technical Specifications MSIV and containment leak rates, include the following.

- The design flow of 2000 cfm through the control room filters
- The control room atmospheric dispersion factors for the 0 to 2 hour time period for releases via MSIV leakage (1.29E-3 m^3/s) and SGTS (7.00E-4 m^3/s)
- Data on the control room charcoal filters (two banks of six trays each in series, a nominal flow rate per tray of 333 cfm, and a minimum of 46 pounds of 8 X 16 mesh charcoal per tray)

The iodine loading on the control room filters for Dresden Nuclear Power Station (DNPS) and Quad Cities Nuclear Power Station (QCNPS) is calculated to be 2.15E-3 and 2.26E-3 mg of iodine per gram of charcoal, respectively. This is a small fraction of the 2.5 mg of iodine per gram of charcoal design limit identified in Regulatory Guide 1.52 (Revision 2), "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants." The control room charcoal filter efficiency is, therefore, not impacted by EPU and a 24 month fuel cycle operation at DNPS and QCNPS.

36C. The 99% filter efficiency associated with the MCRACS high-efficiency particulate air (HEPA) and charcoal filters continues to be effective under EPU conditions.

36D. Existing commitments to regulatory requirements and guidelines included in the design bases for the MCRACS are unchanged for EPU. These requirements and guidelines include 10 CFR 50, Appendix A, General Design Criterion 19, "Criterion 19 – Control room," Regulatory Guide 1.52 (Revision 2) and Standard Review Plan Section 6.4, "Control Room Habitability System."

36E. This information is provided in the response to Question 36B.

<u>Question</u>
37. Section 4.5, "Standby Gas Treatment System"

37A. Part of the second paragraph reads as follows: "Despite the increase in iodine loading as a result of EPU and 24-month fuel cycles, test work at high iodine loading supports iodine removal efficiencies in excess of 99% at 60 mg/gm". Briefly explain the test work at high iodine loadings (on SGTS charcoal filters) that supports iodine removal efficiencies in excess of 99% at 60 mg/gm of activated carbon. State filter efficiencies, for HEPA and charcoal filters of the SGTS, which continue to be effective under EPU conditions.

37B. State what regulatory requirements continue to be met by SGTS performance under EPU conditions.

37C. Part of the third paragraph reads as follows: "The amount of cooling airflow needed to limit the adsorber temperature increase due to fission product decay heating is affected by EPU. The required minimum airflow increases from 48 cfm to 74 cfm, well below the available design flow of 300 cfm." Briefly describe how the required minimum airflow increase (from 48 cfm to 74 cfm) was determined.

<u>Response</u>
37A. The calculated post-LOCA total stable and radioactive iodine loading on the SGTS charcoal filters, evaluated with 2 percent additional margin in accordance with Regulatory Guide 1.49 (Revision 1) and 24 month fuel cycle operation, increases from the pre-EPU value of 6.0 milligrams of iodine per gram of charcoal (mg/gm) to 11.8 mg/gm for EPU. An industry study demonstrated that removal efficiencies over 99% for elemental iodine, which comprises 91% of the evaluated inventory, can be achieved with charcoal loadings as high as 60 mg/gm, even under adverse waterlogged conditions. The inlet concentration (nearly 200 mg/m^3) was very high for these tests, compared to approximately 0.3 mg/m^3 for a typical boiling water reactor (BWR).

For organic iodine, which comprises only 4% of the evaluated inventory, an industry study demonstrated 99% removal efficiencies are achieved with loadings as high as 4.4 mg/gm. This is approximately a factor of ten higher than the evaluated organic loading of 0.47 mg/gm for EPU. Therefore, both the elemental and organic charcoal loadings for EPU conditions are well below values that yield at least 99% removal efficiency from actual testing. Thus, the increased loadings from EPU are not sufficient to invalidate the design basis iodine removal efficiency of 95%. The design basis HEPA filter efficiency of 99% for removal of particulate iodine is unaffected by the small increase in loading resulting from uprate conditions.

37B. The testing and maintenance criteria of Regulatory Guide 1.52 (Revision 2) continue to be met in accordance with plant regulatory commitments.

37C. The fission product inventory for EPU conditions is affected by the increase in thermal power and the change to 24 month cycle GE14 fuel. Conversion of the fission product inventory to thermal heat rates, combined with a heat balance assuming no heat loss through the walls of the SGTS housing, determined the required airflow to maintain system temperature below 200°F to be conservatively less than 74 scfm. With the maximum allowable operating temperature of 250°F for components and the available cooling airflow of 300 cfm, no increase in cooling airflow is required as a result of EPU.

Attachment
Additional Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation
Dresden Nuclear Power Station, Units 2 and 3
Quad Cities Nuclear Power Station, Units 1 and 2

Question

38. Section 6.6, "Power Dependent Heating, Ventilation, and Air Conditioning"

38A. Provide an example showing how the increase in feedwater process temperature and the increase in the recirculation pump motor horsepower are within the margins of the heating, ventilation, and air conditioning (HVAC) system cooling capacity.

38B. Provide an example showing how the ECCS pump room coolers have adequate capacity to maintain the design basis ECCS room temperature.

38C. Explain how the heat load resulting from a temperature increase of approximately 9 degrees-F in the condensate pump area is accommodated by cooling systems, such that environmental operating temperature remains within design limits.

38D. The fifth paragraph reads as follows: "Based on a review of design basis calculations and environmental qualifications design temperatures, the design of the HVAC is adequate for the EPU."

Provide a worst-case example demonstrating how based on a review of design basis calculations and environmental qualification design temperatures, the total heat load increase is within the design margin at EPU conditions. State where the comparison with evaluations at EPU conditions is documented and would be available to the staff for review upon request.

Response

38A. The HVAC system is designed for heat loads from the recirculation pumps at QCNPS and DNPS of 1,870,000 BTU/hr and 2,190,000 BTU/hr, respectively. At EPU the expected heat load from the pump motors is 1,573,840 BTU/hr for both stations, providing a margin of approximately 296,000 BTU/hr for QCNPS and approximately 616,000 BTU/hr for DNPS.

At EPU the feedwater temperature increase is 13.8°F. The associated increase in feedwater piping heat load is 10,439 BTU/hr for each unit. The feedwater piping and the recirculation pump motors are in the same space and are cooled by the same cooling system. The margin in the HVAC design for the recirculation pump motor heat load is sufficient to compensate for the increase in feedwater piping heat load.

38B. The QCNPS residual heat removal (RHR) room heat load increases from 319,798 BTU/hr to 335,800 BTU/hr due to EPU, well within the room cooler capacity of 570,000 BTU/hr.

The high pressure coolant injection (HPCI) rooms at DNPS and QCNPS are unaffected by EPU since there are no process temperature, electrical or other heat load changes that affects the pre-EPU design heat loads.

38C. The operation of the fourth condensate/booster pump, as required for EPU operation, causes an increase in the heat load in this room. Since the cooling capacity of the ventilation system is not being changed, the pre-EPU design room temperature may be exceeded during times when the outdoor air is at the design temperature, but this will not be for extended periods of time. The normal operation of the non-safety related pumps in this area is not affected, based on a review of the motor insulation ratings, which exceed the EPU temperatures.

As discussed in Reference 4, all equipment in the EQ program affected by this temperature increase has been evaluated and is acceptable.

38D. Refer to the response to Question 38C for discussion of the worst case area temperature increase during HVAC operation. In several reactor building areas, the post-LOCA temperature increase is a few degrees due to higher EPU heat loads. The secondary containment is isolated post-LOCA and the HVAC systems for the general areas do not operate. The equipment in all such areas in the EQ program has been evaluated and found acceptable, as documented in the site EQ program documentation.

<u>Question</u>
39. Explain significant differences in the design and operation of the Dresden and Quad Cities HVAC systems and how such differences may impact the system evaluations at EPU conditions.

<u>Response</u>
The EPU evaluations for the ECCS related HVAC systems were performed separately for DNPS and QCNPS. Thus, any site differences were captured in the evaluations. The principal difference in the ECCS room coolers is that DNPS does not take credit for the operation of the LPCI and Core Spray room coolers. This was discussed in Reference 1.

The other HVAC systems are similar enough for normal operations that they could be evaluated together. The evaluations determined that no changes in the operation or configuration of these systems were required for EPU, and that all of the systems continued to meet design requirements.

Attachment
Additional Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation
Dresden Nuclear Power Station, Units 2 and 3
Quad Cities Nuclear Power Station, Units 1 and 2

<u>References</u>

1. Letter from K. A. Ainger (Exelon Generation Company, LLC) to U. S. NRC, "Additional Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation at Dresden Nuclear Power Station and Quad Cities Nuclear Power Station," dated August 7, 2001

2. Letter from K. A. Ainger (Exelon Generation Company, LLC) to U. S. NRC, "Additional Plant Systems Information Supporting the License Amendment Request to Permit Uprated Power Operation at Dresden Nuclear Power Station and Quad Cities Nuclear Power Station," dated August 13, 2001

3. "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," NUREG-0588, November 1979, (Rev. 1) July 1981

4. Letter from R. M. Krich (Exelon Generation Company, LLC) to U. S. NRC, "Additional Electrical Information Supporting the License Amendment Request to Permit Uprated Power Operation at Dresden Nuclear Power Station and Quad Cities Nuclear Power Station," dated July 23, 2001