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

Dresden Nuclear Power Station, Units 2 and 3
Renewed 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
Renewed Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: Response to Request for Additional Information Related to Potential Loss of Spent Fuel Pool Cooling

Reference: Letter from P. L. Hiland (U.S. NRC) to M. J. Pacilio (Exelon Nuclear), "Dresden Nuclear Power Station, Units 2 and 3; and Quad Cities Nuclear Power Station, Units 1 and 2 – Request for Additional Information Related to Potential Loss of Spent Fuel Pool Cooling (TAC No. ME6761)," dated November 25, 2013

In the referenced letter, the NRC requested information to better understand the reliability of the spent fuel pool cooling systems, the expected response to their loss, and the safety significance of the spent fuel pool cooling function at Dresden Nuclear Power Station (DNPS), Units 2 and 3, and Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2. In response to this request, Exelon Generation Company, LLC (EGC) is providing the attached information.

The referenced letter requested EGC's written response to be submitted by February 24, 2014. However, on February 19, 2014, the NRC granted EGC's request to extend the due date to March 10, 2014.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Mr. Kenneth M. Nicely at (630) 657-2803.

Respectfully,

Patrick R. Simpson
Manager – Licensing

Attachment: Response to Request for Additional Information

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector – Dresden Nuclear Power Station
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

NRC Request 1

Describe the ability to maintain forced cooling of the spent fuel pool (SFP) using installed equipment following a design-basis earthquake with consequential loss of offsite power. Please consider SFP configurations encountered during routine refueling and normal operating conditions. The normal SFP cooling system and the SFP cooling assist mode of the residual heat removal system should be considered at a minimum, and, if a sustained loss of forced SFP cooling is expected, identify the expected range of times for the pool to reach saturation conditions.

Response

The Spent Fuel Storage systems are described in Section 9.1.2 of the Dresden Nuclear Power Station (DNPS) and Quad Cities Nuclear Power Station (QCNPS) Updated Final Safety Analysis Reports (UFSARs). The design objectives of the spent fuel storage systems are to provide a fuel storage pool which is safe for underwater storage of fuel assemblies, provide a storage pool for underwater storage of reactor vessel internals, and provide adequate protection against the loss of water from the fuel pools. DNPS and QCNPS are both designed with two SFPs (i.e., one for each unit). At QCNPS, the Unit 1 and Unit 2 SFPs are connected by a double-gated transfer canal. The DNPS Unit 2 and Unit 3 SFPs are not connected. To avoid unintentional draining of the SFPs, there are no penetrations that would permit the SFPs to be drained below a safe storage level. The four SFPs are designed to withstand earthquake loadings of a Class I structure. The plant original licensing basis applies Class I to structures and equipment which a failure could cause a significant release of radioactivity (i.e., offsite dose in excess of 10 CFR 100 requirements). The SFP cooling systems were not licensed as Class I.

The DNPS design includes two SFP cooling systems (i.e., one system for each unit's SFP). Each system consists of two circulating pumps, two heat exchangers, a filter, a deep-bed demineralizer, and the required piping, valves, and instrumentation. The system cools the SFPs by transferring the decay heat from the spent fuel to the reactor building closed cooling water (RBCCW) system. Each SFP cooling pump, and the RBCCW system pumps, are powered by a Class I electrical bus and therefore can be powered by an onsite Emergency Diesel Generator (EDG) in the event offsite power is lost. The Shutdown Cooling System (SDCS) can be aligned to augment SFP cooling when needed. The condensate transfer system provides normal makeup water to the SFPs.

The QCNPS design includes two SFP cooling systems (i.e., one system for each unit's SFP). Each system consists of two circulating pumps, two heat exchangers, filter-demineralizers, surge tanks, skimmers, and associated piping, valves, and instrumentation. The system cools the SFPs by transferring the decay heat from the spent fuel to the RBCCW system. The two SFPs are normally connected by an open transfer canal. This configuration allows either SFP cooling system to provide cooling to both SFPs. The two station fuel pool cooling systems have cross-tie capability (i.e., one unit SFP cooling system can be aligned to support the opposite SFP). Each SFP cooling pump, and the RBCCW system pumps, are powered by a Class I electrical bus and therefore can be powered by an onsite EDG in the event offsite power is lost. The Residual Heat Removal (RHR) system can be aligned to augment SFP cooling when needed. The RHR system is a Class I system with a Class I power supply. The condensate transfer system provides normal makeup water to the SFPs.

Based on the plant design as discussed above, a sustained loss of forced SFP cooling is not expected. However, Sections 9.1.2 of the DNPS UFSAR and 9.1.3 of the QCNPS UFSAR provide information concerning SFP temperature response assuming a complete loss of SFP cooling.

In addition, detailed information regarding a postulated loss of forced SFP cooling was previously submitted in References 1 and 2 for both DNPS and QCNPS. References 3 and 4 document the results of the NRC's review of this information. In summary, the calculations of SFP temperatures following core offloads for extended power uprate (EPU) conditions credited evaporative cooling. Both DNPS and QCNPS have a SFP makeup capacity far in excess of the calculated boil-off rate for the EPU.

Station procedures govern operation of the SFP cooling system at DNPS and QCNPS following a loss of offsite power, and provide direction for providing makeup water in response to loss of inventory events. Plant personnel are trained to use these procedures. It is important to note that the various plant procedures related to loss of SFP cooling or loss of SFP inventory do refer plant personnel to the guidelines for use of the 10 CFR 50.54(hh)(2) equipment, even if the cause of the event is not a loss of a large area of the plant. More specifically, procedures that govern response to a loss of SFP inventory direct operators to inspect the status of the SFP and its cooling systems, and trigger a procedural pathway that explicitly leads to consideration of the use of the 10 CFR 50.54(hh)(2) equipment.

As discussed above, the condensate transfer system provides normal makeup water to the SFPs at both DNPS and QCNPS. Examples of alternative makeup strategies described in current plant procedures include:

- SFP refill using contaminated demineralized water hoses,
- SFP refill using clean demineralized water hoses,
- SFP refill using the condensate system,
- SFP refill using the fire protection system,
- SFP fill/spray from outside the building using diesel fire pump (DFP) and portable pump,
- SFP fill/spray from outside the building using DFP, portable pump and fire truck,
- SFP refill by cross-tying the SFP cooling systems from the opposite unit,
- SFP refill by using SFP filter back flush,
- SFP refill by overfill of skimmer surge tank and overflow back into pool,
- SFP fill using Blitz monitors on refuel floor, and
- Enhance natural circulation/spray elevated release.

The diversity of alternative SFP makeup sources discussed above provide additional assurance of the ability to maintain SFP inventory and cooling (e.g., via feed and bleed strategies). The alternative makeup sources also use diverse power sources (e.g., offsite power, EDGs, station blackout diesel generators, dedicated self-powered pumps) and water supplies (e.g., condensate system water, fire protection system water, river water, etc.).

NRC Request 2

If the response to the above request determines that the SFP would experience a sustained loss of SFP forced cooling, describe the expected changes in environmental conditions within each affected secondary containment ventilation zone. Address the expected response of operators to manage environmental conditions, consistent with existing procedures, and describe the survivability of ventilation systems, such as the standby gas treatment system. Identify any secondary containment areas that could experience a harsh environment (i.e., an environment significantly more severe than the environment that would occur during normal plant operation with respect to radiation, temperature, humidity, or submergence of equipment as a result of accumulated condensate) as a result of the sustained loss of SFP forced cooling.

Response

As discussed above, a sustained loss of forced SFP cooling is not expected due to the diverse methods available, including the ability to use systems powered from an onsite EDG. Abnormal operating procedures exist to respond to a loss of SFP cooling event, which provide direction for establishing SFP makeup and feed and bleed techniques to remove decay heat.

NRC Request 3

If the response to the above request identifies harsh environmental conditions in any area of the facility secondary containment, describe the effect of these environmental conditions on important-to-safety electrical equipment within those areas necessary to maintain the integrity of the reactor coolant pressure boundary, the capability to shut down the reactor and maintain it in a safe shutdown condition or the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure.

Response

As discussed above, a sustained loss of forced SFP cooling is not expected due to the diverse methods available, including the ability to use systems powered from an onsite EDG.

Information regarding the environmental effects of high temperature in the SFP was previously submitted to the NRC in Reference 5 for DNPS and QCNPS. This information was submitted in response to NRC letters to DNPS and QCNPS (i.e., References 6 and 7, respectively) regarding the NRC's detailed review of spent fuel storage pool safety issues. The information in Reference 5 described SFP cooling capabilities and indicated that the spectrum of contingency actions available to restore cooling allow the operators the capability to adequately prevent unacceptable consequences.

NRC Request 4

If the response to the above request identifies that electrical equipment necessary to shut down the reactor and maintain safe shutdown conditions could be adversely affected by a sustained loss of SFP forced cooling potentially resulting from a design-basis event, describe any corrective actions that will be implemented at the affected facility and the basis for concluding that those actions would acceptably resolve the described condition.

Response

As discussed above, a sustained loss of forced SFP cooling is not expected due to the diverse methods available, including the ability to use systems powered from an onsite EDG.

References

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, Dresden Nuclear Power Station and Quad Cities Nuclear Power Station," dated August 13, 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, Dresden Nuclear Power Station and Quad Cities Nuclear Power Station," dated September 5, 2001

3. Letter from L. W. Rossbach (U.S. NRC) to O. D. Kingsley (Exelon Generation Company, LLC), "Dresden Nuclear Power Station, Units 2 and 3 – Issuance of Amendments for Extended Power Uprate (TAC Nos. MB0844 and MB0845)," dated December 21, 2001

4. Letter from S. N. Bailey (U.S. NRC) to O. D. Kingsley (Exelon Generation Company, LLC), "Quad Cities Nuclear Power Station, Units 1 and 2 – Issuance of Amendments for Extended Power Uprate (TAC Nos. MB0842 and MB0843)," dated December 21, 2001

5. Letter from J. B. Hosmer (Commonwealth Edison Company) to U.S. NRC, "Response to NRC Final Report on Spent Fuel Storage Pool Safety Issues," dated November 18, 1996

6. Letter from J. F. Stang (U.S. NRC) to I. Johnson (Commonwealth Edison Company), "Resolution of Spent Fuel Storage Pool Safety Issues: Issuance of Final Staff Report and Notification of Staff Plans to Perform Plant-Specific, Safety Enhancement Backfit Analyses – Dresden Nuclear Power Station (TAC No. M88094)," dated September 26, 1996

7. Letter from R. M. Pulsifer (U.S. NRC) to I. Johnson (Commonwealth Edison Company), "Resolution of Spent Fuel Storage Pool Safety Issues: Issuance of Final Staff Report and Notification of Staff Plans to Perform Plant-Specific, Safety Enhancement Backfit Analyses – Quad Cities Nuclear Power Station (TAC No. M88094)," dated September 25, 1996