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Exelon Nuclear

RS-01-038

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U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Dresden Nuclear Power Station, Units 1 and 2
Facility Operating License Nos. DPR-2 and DPR-19
NRC Docket Nos. 50-10, 50-237, and 72-37

Subject: Request for Additional Information for the HI-STORM 100 Cask System Exemption Request

References:

(1) Letter from R. M. Krich (Exelon Generation Company, LLC) to US NRC, "Request for Exemption from 10 CFR 72.212, 'Conditions of general license issued under 10 CFR 72.210,' and 10 CFR 72.214, 'List of approved spent fuel storage casks,' Regarding the Conditions of Use for the HI-STORM 100 Cask System and for the HI-STAR 100 Cask System," dated January 11, 2001

(2) Letter from R. M. Krich (Exelon Generation Company, LLC) to US NRC, "Request for Exemption from 10 CFR 72.212, 'Conditions of General license issued under 10 CFR 72.210,' and 10 CFR 72.214, 'List of approved spent fuel storage casks,' Regarding the Conditions of Use for the HI-STORM 100 Cask System," dated January 11, 2001

(3) Letter from C. P. Jackson (US NRC) to R. M. Krich (Exelon Generation Company, LLC), "Dresden Independent Spent Fuel Storage Exemption Requests," dated January 29, 2001

(4) Letter from R. M. Krich (Exelon Generation Company, LLC) to US NRC, "Request for Additional Information for the HI-STORM 100 Cask System Exemption Request," dated February 16, 2001

(5) Letter from C. P. Jackson (US NRC) to R. M. Krich (Exelon Generation Company, LLC), "Dresden Independent Spent Fuel Storage Exemption Requests (Docket No. 72-37 and TAC No. L23273)," dated February 28, 2001

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In letters dated January 11, 2001, (References 1 and 2), we requested NRC approval of a temporary exemption from the requirements of 10 CFR 72.212, "Conditions of general license issued under 10 CFR 72.210," and 10 CFR 72.214, "List of approved spent fuel storage casks," in accordance with 10 CFR 72.7, "Specific exemptions," for the HI-STORM 100 cask system produced by Holtec International, Inc. (i.e., Holtec).

In the Reference 3 letter, the NRC identified specific information needed to begin the review of the temporary exemption requests. Specifically, we were requested to provide additional information related to the HI-STORM 100 exemption request, which was provided in the Reference 4 letter. In the Reference 5 letter, we were requested to provide further additional information. The additional information is provided in the enclosure to this letter.

If you have any questions about this letter, please contact K. M. Root at (630) 663-7292.

Respectfully,

R. M. Krich
Director - Licensing
Mid-West Regional Operating Group

Enclosure - Additional Information Related to the HI-STORM 100 Cask System
Exemption Request (Docket No. 72-37 and TAC No. L23273)

ENCLOSURE

Additional Information Related to the HI-STORM 100 Cask System Exemption Request (Docket No. 72-37 and TAC No. L23273)

References:

(1) Letter from R. M. Krich (Exelon Generation Company, LLC) to US NRC, "Request for Exemption from 10 CFR 72.212, 'Conditions of general license issued under 10 CFR 72.210,' and 10 CFR 72.214, 'List of approved spent fuel storage casks,' Regarding the Conditions of Use for the HI-STORM 100 Cask System and for the HI-STAR 100 Cask System," dated January 11, 2001

(2) Letter from R. M. Krich (Exelon Generation Company, LLC) to US NRC, "Request for Exemption from 10 CFR 72.212, 'Conditions of General license issued under 10 CFR 72.210,' and 10 CFR 72.214, 'List of approved spent fuel storage casks,' Regarding the Conditions of Use for the HI-STORM 100 Cask System," dated January 11, 2001

(3) Letter from C. P. Jackson (US NRC) to R. M. Krich (Exelon Generation Company, LLC), "Dresden Independent Spent Fuel Storage Exemption Requests," dated January 29, 2001

(4) Holtec International, Inc. letter, "USNRC Docket No. 72-1014; HI-STORM 100 Certificate of Compliance 1014; HI-STORM 100 License Amendment Request 1014-1, Revision 1, Supplement 1," dated October 6, 2000

(5) Letter from C. P. Jackson (US NRC) to R. M. Krich (Exelon Generation Company, LLC), "Dresden Independent Spent Fuel Storage Exemption Requests (Docket No. 72-37 and TAC No. L23273)," dated February 28, 2001

(6) Holtec International, Inc. letter, "USNRC Docket No. 72-1014; HI-STORM 100 Certificate of Compliance 1014; HI-STORM 100 License Amendment Request 1014-1, Revision 1, Supplement 1," dated October 6, 2000

In the Reference 1 and Reference 2 letters, in accordance with 10 CFR 72.7, "Specific exemptions," we requested NRC approval of a temporary exemption from the requirements of 10 CFR 72.212, "Conditions of general license issued under 10 CFR 72.210," and 10 CFR 72.214, "List of approved spent fuel storage casks," for the HI-STORM 100 cask system produced by Holtec International, Inc. (i.e., Holtec).

In the Reference 3 letter, we were requested to provide additional information related to the HI-STORM 100 exemption request, which was provided in the Reference 4 letter. In the Reference 5 letter, we were requested to provide further additional information. The additional information is provided below.

NRC Question 1

"Provide a docketed reference that describes the evaluation methods for the structural, thermal and criticality analyses that are referred to in the exemption application as approved by the NRC. It should be noted that the NRC has not generically approved the Holtec methodologies and the applicability of the methodology to the revised parameters needs to be confirmed."

Response to NRC Question 1

The evaluation methods are described in the HI-STORM 100 Final Safety Analysis Report (FSAR), Revision 0, submitted by Holtec International, Inc. (i.e., Holtec) letter dated July 20, 2000. NRC letter dated May 4, 2000, approved this revision of the HI-STORM 100 FSAR by issuance of Certificate of Compliance (CoC) No. 1014 for the HI-STORM 100 cask system. Specifically, the references are FSAR Chapter 3, "Structural Evaluation," Chapter 4, "Thermal Evaluation," Chapter 5, "Shielding Evaluation," and Chapter 6, Criticality Evaluation." This is to confirm that these methodologies are applicable to the evaluation of the revised parameters discussed in Reference 2.

NRC Question 2

"Evaluate and document the effect of the increased uranium mass on the calculated effective thermal conductivity of the fuel assembly and the results of the thermal calculations."

Response to NRC Question 2

The heat generated in a fuel assembly is dissipated by radiative and conductive heat transfer. The materials principally contributing to heat dissipation by conductive heat transfer are the helium gas, the fuel cladding (i.e., Zircaloy), and the fuel (i.e., uranium dioxide (UO_2)). The principal effect of adding uranium mass to a fuel assembly is the replacement of the helium gas by a solid material. Because solids conduct heat at a much higher rate than gases, the increased uranium mass is a positive contributor to conductive heat transfer. Radiative heat transfer is governed by the external surface area, temperature, and emissivity of the fuel cladding. Since UO_2 is completely enclosed inside the fuel cladding, the uranium mass increase does not influence the governing parameters associated with radiative heat transfer in the fuel space outside of the fuel rods. Therefore, the net effect of the increased uranium mass is to increase the calculated effective thermal conductivity of the fuel assembly. The result of the thermal calculation is that the higher fuel conductivity leads to a lower peak cladding temperature (PCT). Therefore, the increased uranium mass is bounded by the calculations in the HI-STORM 100 FSAR, Revision 0.

NRC Question 3

"Provide a calculation for the 6x6A 'Thin Clad' peak temperature limits."

Response to NRC Question 3

The bounding fuel cladding stress is calculated using Lame's formula for hoop stress as described in the HI-STORM 100 FSAR, Section 4.3.1.1, "Cladding Temperature Limits," and as defined below.

Hoop Stress = Pr/t

where:

P = Theoretical Bounding Rod Pressure (MPa)

r = Average Fuel Rod Radius (inches)

t = Fuel Rod Cladding Thickness (inches)

Substituting:

P= 7.54 MPa, for all Dresden 6x6 fuel
(Reference: HI-STORM 100 FSAR, Revision 0, Table 4.3.6, "Bounding Values of Fuel Cladding Stress for BWR SNF")

r = 0.5318/2 = 0.2659 inches for Dresden 6x6A thin clad fuel
(Reference: Reference 6 Table 4.3.6, "Bounding Values of Fuel Cladding Stress for BWR SNF")

t = 0.0213 inches for Dresden 6x6A thin clad fuel
(Reference: Reference 6 Table 4.3.6)

Hoop Stress = 7.54 (0.2659/0.0213) = 94.1 MPa

This stress value is consistent with the stress value in Reference 6 for Dresden Unit 1 thin clad fuel. Based on this stress value, the values of the PCT limits for various cooling times for this fuel assembly array/class are interpolated from Table 3.1, "Maximum Allowable Initial Storage Temperatures at Initial Cladding Stresses for 5-, 6-, 7-, 10-, and 15-yr Fuel Ages," of the Pacific Northwest Laboratory (PNL) Report No. 6189, "Recommended Temperature Limits for Dry Storage of Spent Light Water Reactor Zircaloy-Clad Fuel Rods in Inert Gas," dated May 1987, prepared for the Department of Energy. PNL Report No. 6189 is referenced in the Safety Evaluation issued with CoC No. 1014 for the HI-STORM 100 cask system.

NRC Question 4

"Provide the 'Set B' parameters for the concrete pad finite element model."

Response to NRC Question 4

As a result of a clarifying discussion with the NRC on February 26, 2001, the following response is provided. The concrete pad finite element model for the Set B parameters uses the same finite element grid as that for the Set A parameter configuration. The Set A parameters are specified in Design Features Item 3.4.6.b of CoC No 1014 for the HI-

STORM 100 cask system. The difference in concrete thickness is reflected in a smaller element thickness for those elements representing the concrete pad. All other parameters (i.e., length, width, material types) are identical to those used for the Set A parameters. The concrete compressive strength is reflected in the parameters input into the material type.