Enclosure 1

NAC INTERNATIONAL

RESPONSE TO THE

UNITED STATES
NUCLEAR REGULATORY COMMISSION

REQUEST FOR ADDITIONAL INFORMATION

March 2020

FOR REVIEW OF THE CERTIFICATE OF COMPLIANCE NO. 1031, AMENDMENT NO. 9

(TAC NO. L24757 DOCKET NO. 72-1031)

April 2020

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THERMAL EVALUATION

4.1 Provide technical bases that support temperature variations larger than 65°C (117°F) during vacuum drying-cooldown cycling.

Section 4.11.2.2 of the SAR provides analysis results during vacuum drying and cooldown phases that exceeds the 65°C (117°F) Interim Staff Guidance No. 11 (ISG-11), Revision No. 3, " Cladding Considerations for the Transportation and Storage of Spent Fuel," acceptance criteria during thermal cycling. Per ISG-11 Revision 3, the intent of the thermal cycling acceptance criteria is to limit precipitation of radial hydrides (during loading operations) that could result in fuel cladding failure. The staff needs this information to verify cyclic vacuum drying and cooldown will not result in cladding property changes that could challenge the cladding intended functions.

This information is needed to determine compliance with 10 CFR 72.236(b) and 72.236(f)

NAC International Response to Thermal Evaluation RAI 4.1:

Thermal cycles during system drying operations that exceed 65°C are restricted to no more than 10 cycles for spent fuel with burnup greater than 45 GWd/MTU, as stated in Chapter 9, "Operating Procedures," Section 9.1.1, "Loading and Closing the TSC Using Standard MTC," Step 58, of the SAR, and as required by Technical Specification 5.2c, in Appendix A of the CoC.

This restriction has been in place since the initial issuance of the MAGNASTOR license and is discussed by the staff in the Amendment 0 SER, Revision 0, Section 4.1, "Spent Fuel Cladding," which includes the following statement regarding ISG-11.

"Thermal cycles during system drying operations that exceed 117°F (65°C) will be restricted to no more than 10 cycles for spent fuel with burnup greater than 45 GWd/MTU, as required by Technical Specification 5.2c, in Appendix A of the CoC. The thermal cycling

NAC International Response to Thermal Evaluation RAI 4.1 (cont.):

criterion is an alternative to ISG-11 that has been justified as explained in Chapter 8, "Materials Evaluation," of the SAR. The staff found this alternative acceptable, as stated in Section 8.0 of this SER."

The subject amendment request does not remove or modify the thermal cycle restrictions and as such, the associated technical justification and resulting acceptability of this criterion as an alternative to ISG-11 remains valid.

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4.2 Add a limiting condition for operation to the technical specifications (TS) to specify the duration for a second vacuum drying stage.

Section 4.11.2.2 of the SAR states that, based on maximum fuel temperature after 24-hour vacuum drying and the 24-hour cooldown, the allowable time for a second vacuum drying is determined as 12 hours, as shown in SAR Table 4.11-6. However, the 12-hour time duration for the second drying stage is not identified in the TS. This time needs to be incorporated in the TS to ensure cask users have the appropriate controls in place during loading operations to avoid exceeding any applicable temperature limits.

This information is needed to determine compliance with 10 CFR 72.236(b) and 72.236(f)

NAC International Response to Thermal Evaluation RAI 4.2:

The applicable Technical Specification (TS) section for the allowable second vacuum drying time is specified in LCO 3.1.1, Item 2. For the PWR system with maximum heat load of 35.5 kW, the allowable second vacuum drying time is 11 hours, which is more limiting than the allowable time of 12 hours for the second vacuum drying as calculated in SAR Section 4.11.2.2. Therefore, the time limit for the second vacuum drying stage specified in LCO 3.1.1 is conservative and remains applicable to the MAGNASTOR system for preferential loading of B&W 15×15 fuel. No revision is required for the Technical Specification.

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SHIELDING EVALUATION

5.1 Provide shielding calculations based on bounding source terms rather than the decay heat.

In Section 6.2 of the Calculation Package No. 30076-5002 Rev. 0, the applicant states: "The design input Pattern Y has the higher peripheral total (i.e., "C" location) heat load, 24.1 kW for Pattern Y versus 23.2 kW in Pattern X. However, the symmetric Pattern X in Table 6-1 is bounding at 34.6 kW versus 33.2 kW in Pattern Y, 23 kW in Pattern Z, and 23.4 kW in Pattern Z'. Due to the small heat load difference in Pattern X and Y, both were evaluated for maximum dose rates with Pattern X dose rates being bounding and listed here. However, patterns Z and Z' are not evaluated for maximum dose rates due to lower heat loads." However, the staff notes from the data presented in the calculation package that Pattern Y has higher dose rates than Pattern X at location "C".

Based on a study published in NUREG/CR-6700, "Nuclide Importance to Criticality Safety, Decay Heating, and Source Terms Related to Transport and Interim Storage of High-Burnup LWR Fuel," there is very little or essentially no overlap between the isotopes that are important to shielding and the ones important to decay heat. Therefore, it is not clear that using the bounding decay heat correlates to a bounding source term. Therefore, the shielding calculations should be based on the source terms rather than decay heat.

This information is needed to determine compliance with 10 CFR 72.236(d).

NAC International Response to Shielding Evaluation RAI 5.1:

NAC has revised Calculation 30076-5002 (now at Revision 2 status) to include the maximum dose rate results from the Z and Z' patterns. As shown in the updated calculation, maximum dose rates are significantly lower for the Z and Z' pattern than X and Y patterns.

Where similar results may be expected, NAC has generated comparison dose rates as documented for the X and Y pattern. These patterns contained very similar total heat load, in particular in the critical peripheral basket position, and therefore were expected to produce and did compute similar maximum dose rates. Variations in the results are minor, primarily due to heat load/dose distribution differences versus total heat/dose in a basket region, with these differences having no safety implications.

NAC International Response to Shielding Evaluation RAI 5.1 (cont.):

While NRC review noted that Pattern Y has higher dose rates in the C position, that difference was calculated to be 0.2 mrem/hr (radial maximum detector location) versus the ~53 mrem/hr value calculated for each of the X and Y patterns. Given similar, but slightly lower total heat load, but a larger number of above average assemblies in Pattern X, this shift was expected. In no way does this minor difference invalidate the argument that the large reduction in heat load for the Z and Z' pattern will result in lower dose rates.

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TECHNICAL SPECIFICATIONS

13.1 Revise the TS to correct the following discrepancies.

a. Typo on page B2-5 "Reduced Col Times" should be "Reduced Cool Times."

b. It appears that the listing of B2/B3 and B1 in Table B2-8 in the revised TS submitted with Amendment No. 9 have been reversed. As submitted, the more than four of the B3 locations may have up to 1800 W, however, in previous approved versions of the TS, Table B2-2 shows that only four B3 locations are authorized to load up to 1800 W

c. It is not clear whether the note listed at the bottom of Table B2-8 in the revised TS submitted with Amendment No. 9 is the same as the "Note 1" listed in the Table.

d. The note at bottom of page B2-5 in the revised TS submitted with Amendment No. 9 has 2 loading patterns labeled F and no loading pattern labeled "E"

e. Table B2-8 in the revised TS submitted with Amendment No. 9 shows that loading patterns G and H may have 900 W decay heat, however Table B2-2 does not show a 900 W decay heat in it the loading patterns G and H.

f. The footnotes in Table B2-10 in the revised TS submitted with Amendment No. 9 are inconsistent. The footnote for the 74 rod configuration of the 9×9 fuel assembly changed from "(a)" to "(i)" and it is listed at "(i)" at the page, however, for the 91, 92, and 96 fuel rod patters for the 10×10 fuel assemblies is still listed as "(a)."

g. The revised Table B2-1 item I.C, in the TS submitted with Amendment No. 9 appears to be missing the link to Table B2-5 for the nonfuel hardware cool times.

h. The revised Table B2-1 item I.E and II.F, in the TS submitted with Amendment No. 9 appears to be missing that low-enriched axial end blankets are authorized.

i. Table B2-5, Note 1 (regarding minimum cooling time for the WE14×14 fuel assemblies) in the revised TS submitted with Amendment No. 9 appears to have been deleted.

NAC International Response to Technical Specifications RAI 13.1:

a. Typo on page B2-5 was revised to "Reduced Cool Times". Replacement page B2-5 is provided.
b. The nomenclature used to describe the preferential load patterns fuel cell locations was expanded for the TMI Submittal. In the Amendment 8 CoC, "B1" contained 1300 Watts and "B2" contained 1800 Watts. The TMI submittal changed the "B2" location to a "B1" and the "B1" locations were divided up into "B2" and "B3" locations. When Table B2-2 was created, the locations and heat loads were not updated accordingly. For loading pattern "C", the "B1" location should be 1800 Watts and the "B2" and "B3" locations should be 1300 Watts. Replacement page B2-5 is provided.
c. The note at bottom of Table B2-8 in the revised TS submitted with Amendment No. 9 was intended to be "Note 1" listed in the Table. The Note has been given a number to agree with the Note listed in the table. Replacement page B2-10 is provided.
d. Typo on page B2-5 was revised to first "Note F" to "Note "E". Replacement page B2-5 is provided.
e. Table B2-2 is correct as written. Table B2-8 should have entries in the 950 row for heat loads for Patterns G and H. Replacement page B2-10 is provided.
f. Typo on page B2-15 with numbering of the footnote for Table B2-10. Footnote should be "(a)" and the entry for the 74-rod configuration should also be "(a)". Replacement page B2-15 is provided. .
g. Table B2-1 item I.D, did have a reference to Table B2-5 for additional cool times for nonfuel hardware in the Amendment 8 CoC. That information is now in Table B2-1 item I.E; however, a reference to Table B2-5 was missing from the Amendment 9 submittal. Replacement page to correct the missing reference is provided. Replacement page B2-3 is provided.
h. The "low enriched axial blankets and end blankets" has been removed from the description in I.E and II.F. This was removed because the blankets used at TMI are greater than 6 inches and are low enriched. The descriptions in I.E and II.F have been revised adding "Low enriched and annular fuel pellet end blankets are permitted without a restriction on length."
i. The notes from Table B2-5 Amendment 8 CoC were reorganized for the TMI Amendment. The information, which was previously presented in Table B2-5 on RCC's and the minimum cool times for WE 14 14 and CE 16 16 can now be found in the embedded table in I.H. No changes necessary.