UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 16, 2021

Mr. Wren Fowler
Director, Licensing Engineering
NAC International
3930 East Jones Bridge Road, Suite 200
Norcross, GA 30092

SUBJECT: SECOND REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE MODEL NO. OPTIMUS-L TRANSPORT PACKAGE

Dear Mr. Fowler:

By letter dated September 9, 2020, NAC International (NAC) submitted an application for approval of the Model No. OPTIMUS-L transport package. On February 23, 2021, NAC submitted responses to the staff's observations identified in its acceptance letter dated December 1, 2020. On June 15, 2021, NAC responded to staff's first request for additional information dated April 27, 2021.

The staff has determined that further information is needed to complete its technical review. The information requested is listed in the enclosures to this letter. We request you provide this information by October 15, 2021. If you are unable to meet this deadline, you must notify us in writing no later than September 27, 2021, of your new submittal date and the reasons for the delay. The staff will then assess the impact of the new submittal date and notify you of a revised schedule.

Please reference Docket No. 71-9390 and EPID No. L 2020 LLA 0202 in future correspondence related to this request.

Sincerely,

Signed by Saverot, Pierre
on 08/16/21

Pierre Saverot, Project Manager
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9390
EPID - L-2020-LLA-0202

Enclosure:
Second Request for Additional Information

Second Request for Additional Information
Model No. OPTIMUS-L Transport Package
Docket No. 71-9390
Revision No. 0

By letter dated September 9, 2020 (Agencywide Documents Access and Management System Package Accession No. ML20266G182), NAC International (NAC) submitted an application for approval of the Model No. OPTIMUS-L transport package. The application is for a new package design for shipment of transuranic waste and irradiated fuel waste.

On February 23, 2021, NAC submitted responses to the staff's observations identified in its acceptance letter dated December 1, 2020. On June 15, 2021, NAC submitted responses (ADAMS Accession No. ML21179A640) to staff's request for additional information dated April 27, 2021 (ADAMS Accession No. ML21111A067).

This second request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission (NRC) staff in connection with its review of the application.

Each individual RAI describes information needed by the staff to complete its review of the application and to determine whether the applicant has demonstrated compliance with the regulatory requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71.

1.0 GENERAL INFORMATION

1-1 Clarify the following: (i) the maximum activity limit and how to ensure that the activity in the package does not exceed the limit, (ii) when the shield inserts assembly (SIAs) are needed inside the CCV for the contents that require additional shielding, (iii) the shielding function provided by the polyurethane layer, (iv) the unit used in Table 1.2.3 of the revised application. Also, provide the specifications for the secondary container required for shipment of authorized contents.

On page 1.2.9 of the application under the condition for "Maximum Quantity of TRU Waste Contents per Package," the applicant states: "6. Total quantity of radioactive material can exceed 3,000 A_2." However, it is not appropriate to define contents in terms of A_2 because an A_2 value does not tell the nature of the source, i.e. neutron or gamma, nor the energy spectra of the content, and the A_2 value is determined by the weighted average of the A_2 value of individual isotopes in the contents (Appendix A of 10 CFR 71).

Page 1.1-1 of the revised application states: "A Shield Insert Assembly (SIA) may be included inside the CCV for contents that require additional shielding." Page 1.2-7 of the application, Revision 20A, August 2020, further states: "Optionally, additional gamma shielding is provided on the package side and bottom by a carbon steel SIA. Shielding credit for the SIA is taken only for NCT, conservatively assuming that the contents escape the secondary container cavity and the SIA following the HAC free drop." In addition, the applicant provided dose rates for a few sample nuclides in the package that require the use the SIA. These statements appear to be contradictory regarding the use of SIA. Although the SIA is required only for some contents, it is not "optional" because it is credited in the shielding analyses.

Page 1.1-1 and page 1.2-2of the revised application states: “The polyurethane foam on the side of the OP is only credited for shielding under NCT.” However, it is not clear what shielding function does the polyurethane provide, i.e., neutron shielding or gamma shielding or both.

Table 1.2-3 of the revised application (SAR Revision 21B) provides the activity limits for some nuclides. However, it is not clear what these activity limits are for: for the entire package, per unit volume, or per unit weight (e.g. gram of wastes)?

The revised application appears to indicate that the contents must be loaded in a secondary container before they can be loaded into the cavity of the OPTIMUS-L packaging. However, it is not clear if there is any qualification requirement(s) or specifications for the secondary containers, such as specialty bag, bucket, steel drum, its geometric shape, and dimensions. Licensing drawings, along with the specifications and qualifications for the secondary container(s) shall be provided as well.

The staff needs this information to determine compliance with the requirements of 10 CFR 71.33, 71.47, 71.51 and 71.89

4.0 CONTAINMENT REVIEW

4-1 Address, in detail, the information related to inerting of the OPTIMUS-L package, as described below, or, alternatively, remove the discussion of the inerting process from the application.

a. Clearly demonstrate that the inerting process will prevent the development of flammable gas mixtures in any confined area of the OPTIMUS-L package for the duration of the transport period.

b. Provide a detailed evaluation or analysis to demonstrate that no flammable gas mixtures will be generated (considering the worst-case concentrations of hydrogen or any other flammable gases, and oxygen) during shipment.

c. Provide a detailed description of the configuration of the secondary container and explain how (e.g., injection path, port orientation) helium is introduced effectively to the innermost packaging or other confined areas within the containment system of the OPTIMUS-L package.

d. Demonstrate that the inert fill gas either effectively occupies the cavity of the cask containment vessel (CCV) or is in uniform concentration through the CCV.

e. Discuss how the concentrations of combustible gases would be quantitatively analyzed, and

f. Provide detailed information on the different steps of the inerting process in Chapter 7 of the application.

This information is required by staff to determine compliance with 10 CFR 71.43(d).

5.0 SHIELDING REVIEW

5-1 Explain why the activity limits presented in Table 1.2-3 were revised to higher values or revise the activity limits as necessary.

In RAI 5-1, dated April 27, 2021, the staff requested the applicant to revise Table 1.2-3 or add a new table in Chapter 1 of the application that includes activity limits per single package basis in compliance with regulations. 10 CFR Part 71 does not allow for an array of packages to be certified. In its response to the RAI, the applicant states that the content limits determined using Method 2 are for a single package and Table 1.2-3 has been revised to contain only the values calculated using Method 2. However, comparing the values presented in the revised Table 1.2.3 in the revised application (Revision 21B, May 2021) to the values presented in the previous version of the application, the staff notes that the activity limits are also revised to higher values.

If the activity limits in the previous version were determined using Method 2, there should not be any changes because Method 2 is for single package. As such, it is not clear why these activity limits were revised to higher values.

The staff needs this information to determine compliance with the requirements of 10 CFR 71.33(b)(1), 10 CFR 71.47, and 10 CFR 71.51.

5-2 Demonstrate that it is appropriate to calculate the dose rate at one meter from the outer pack (OP) of a package under hypothetical accident conditions (HAC) or recalculate the dose rate for the package under HAC.

In RAI 5-3, dated April 27, 2021, the staff requested the applicant to justify the assumption for the dose rate calculation for the package under HAC as bounding to all plausible scenarios. In its response, the applicant states: “It is also noted that the offset provided by the OP [outer pack] is based on 35% of the foam thickness in each direction considering 65% crush from HAC and this crush is applied globally, when only the side experienced foam deformations to this degree.”

Page 5.3-1 of the revised application further states: “As discussed in Chapter 2, the OP provides sufficient protection for the CCV so that it remains undamaged based on the sequence of HAC tests. Thus, for the HAC model the nominal CCV is modeled undamaged, and *the 1-meter dose rate is measured from the surface of the OP shell*.” The application further states: “For the HAC model, the foam of the OP credited for NCT is removed from the model. This bounds the maximum damage to the OP resulting from the HAC drop and puncture tests, as discussed in Chapter 2. Otherwise, the package geometry for the HAC and NCT shielding models is identical.” Figure 5.3-5 confirmed that the dose rate for the package under HAC is calculated at one meter from the OP.

As such, it appears that the applicant assumed that the OP shells would retain their geometric shapes and dimensions under both drop and thermal tests. Based on the licensing drawing 541, Revision 3, the OP is made of an inner shell and an outer shell. The inner shell is made of 14 gauge ASTM (American Society for Testing and Materials) A240 standard Type 304 or Type 316 stainless steel and the thickness for a 14 gauge is 0.0749 inches. The outer shell is also made of ASTM A240 standard Type 304 or Type 316 stainless steel and the thickness is 3/16 inches. The space between the inner and outer shells is filled with polyurethane foam. Because polyurethane foam is flammable [Ref. 1, 2, 3] and may be completely burned out under thermal test as specified in 10 CFR 71.73(c)(4), it is not clear if the 3/16” outer shell would be able to support the

weight of the package after 30 minutes of 800°C fire. If not, the HAC dose rate at 1-meter from the surface of the OP shell may be not justified.

The staff needs this information to determine compliance with the requirements of 10 CFR 71.51.

References:

1. McKenna, S.T., Hull, T.R., "The fire toxicity of polyurethane foams." Fire Sci Rev 5, 3 (2016).
2. OSHA Hazard Information Bulletins: "Fire Hazard of Polyurethane and Other Organic Foam Insulation Aboard Ships and in Construction," Occupational Safety and Health Administration, May 10, 1989. https://www.osha.gov/publications/hib19890510.
3. Prasad, K. R.; Kramer, R.; Marsh, N.; Nyden, M. R., "NUMERICAL SIMULATION OF FIRE SPREAD ON POLYURETHANE FOAM SLABS," Fire Research Division, National Institute of Standards and Technology, Gaithersburg, Maryland, March 17, 2009. https://www.nist.gov/publications/numerical-simulation-fire-spread-polyurethane-foam-slabs.

5-3 Explain how the radiations from the decay products of the various nuclides in the contents were accounted for.

Table 1.2-3 of the application provides the radioactivity limits for the nuclides that are in the TRU wastes or irradiated uranium wastes. The applicant performed shielding analyses for the package containing these wastes and provided a list of the constituent nuclides in the wastes and corresponding dose rate for each of the nuclides. Appendix G (CN-16007-512 R02) of the application provided additional individual constituent nuclides in the wastes. However, it is not clear if the radiations from the decay products in each of the nuclides have been considered in determining the allowable contents.

The staff needs this information to determine compliance with the requirements of 10 CFR 71.33, 10 CFR 71.47, 10 CFR 71.51, and 10 CFR 71.89.

5-4 Verify the accuracy of the dose rate data shown in Table 5.1-2 of the revised application and revise as necessary.

Table 5.1-2 of the revised application provided new dose rates for the package under NCT and HAC for a few important nuclides. However, the staff's calculation indicates that the dose rate at 1 meter from the package under HAC is much higher than the one provided in the table. Although the data shows that the dose rate of the package under HAC is still within the dose rate limit of 10 CFR 71.51, the estimated dose rate of the package under HAC may provide some useful information for the first responder to design their response plan and hence should be as accurate as possible.

The staff needs this information to determine compliance with the requirements in 10 CFR 10.71.51.

7.0 OPERATING PROCEDURES

7-1 Revise the operating procedures to delete all references to using Method 1 for determining the allowable contents.

In Attachment 7.5-1 of the revised application, the operating procedures reference Method 1 as a mean for determining the allowable contents. Because Method 1 has been determined to be an unusable method, it shall be deleted from the operating procedures.

The staff needs this information to determine compliance with the requirements of 10 CFR 71.33, 10 CFR 71.47, 10 CFR 71.51, and 10 CFR 71.89.

7-2 Provide specific instructions in the operating procedures for determining the dose rate from the quantity limits for the isotopes in the TRU wastes in the OPTIMUS-L package.

Page 5.2-1 of the revised application states: "With the dose rate contribution of each isotope calculated, compliance is verified by summing the contribution from all isotopes in the TRU waste container inventory." Although the applicant provided Equation 4 in the revised application for checking compliance with the dose rate limits and Table 5.4-6 for dose rate per curie for individual nuclides, it is not considered a requirement because it is neither referenced by the CoC nor by the operating procedures.

In addition, the definition and qualification of contents cannot be left to the users of this package to decide. The operating procedures need to include specifications of contents or a specific method that can ensure the contents will not exceed the approved design limits.

The staff needs this information to determine compliance with the requirements of 10 CFR 71.33, 71.47, 71.51, and 71.89.

7-3 Revise the operating procedures to include the restrictions and requirements for the authorized contents as specified in Section 1.2.2 of the application.

Section 1.2.2 of the application provides a list of restrictions on the allowable contents and loading operations. Since these restrictions are imperative to ensure safety and most of the items on this list are directly related to operational restrictions, it appears to be more appropriate to include these restrictions in the operating procedures instead of CoC.

The staff needs this information to determine compliance with the requirements of 10 CFR 71.33, 71.47, 71.51, and 71.89.