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May 15, 2017

U.S. Nuclear Regulatory Commission
11555 Rockville Pike
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Attention: Document Control Desk

Subject: Submission of NAC Responses to NRC's Request for Additional Information to NAC's Request for Certificate of Compliance (CoC) No. 9225 for the NAC-LWT

Docket 71-9225

References:

1. USNRC CoC No. 9225, Revision 67, Model No. NAC-LWT Package, Dated October 14, 2016
2. USNRC CoC No. 9225, Revision 64, Model No. NAC-LWT Package, Dated June 24, 2015
3. ED201500112, Submission of NAC-LWT Safety Analysis Report (SAR), Revision 44 Incorporating Highly Enriched Uranyl Nitrate Liquid (HEUNL) and the SLOWPOKE Fuel Core Approved Application, August 18, 2015
4. ED20160104, Submission of a Request for a Revision to Certificate of Compliance (CoC) No. 9225 for the NAC-LWT Cask Incorporating Changes to the Authorized NRU/NRX Fuel Content, December 23,2016
5. NRC Letter, Request for Additional Information for Review of the Model No. NAC-LWT, April 7, 2017

NAC International (NAC) hereby submits responses to the NRC's Request for Additional Information (RAIs) presented in Reference 5. The responses contained in Enclosure 1 did not result in any additional changes to the SAR. Enclosure 1 does not include a formal response to the Observation presented in Reference 5. However, NAC recognizes a later edition of ANSI N14.5 has been released. NAC is currently evaluating the latest revision and is awaiting formal NRC endorsement via a revision to Regulatory Guide 7.4. Note, this submittal does not contain any proprietary information.

Approval of the NAC-LWT CoC is requested by June 30, 2017 in support of anticipated NAC-LWT transport projects. In accordance with NAC's administrative practices, upon final acceptance of this application, the NAC-LWT SAR Revision 16B changed pages will be reformatted and incorporated into the next revision of the NAC-LWT SAR.

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If you have any questions regarding this letter, please feel free to contact me on my direct number at 678-328-1236.

Sincerely,

Wren Fowler
Director, Licensing
Engineering

Enclosures
Enclosure 1 – NAC Responses to NRC's Request for Additional Information

Enclosure 1

RAI Responses

No. 71-9225 for the NAC-LWT Cask

NAC INTERNATIONAL

RESPONSES TO THE

UNITED STATES NUCLEAR REGULATORY COMMISSION

REQUEST FOR ADDITIONAL INFORMATION

FOR REVIEW OF THE CERTIFICATE OF COMPLIANCE NO. 9225, NAC-LWT PACKAGE TO INCORPORATE DAMAGED NRU/NRX FUEL

(TAC NO. L25177 DOCKET NO. 71-9225)

May 2017

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NAC INTERNATIONAL RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

CRITICALITY EVALUATION

6-1 Clarify if the definition of damaged fuel proposed to be added to the CoC includes cladding and provide updated analyses as necessary. From staff evaluations of the broken rod configuration, removing the cladding, as is typically done with LWR damaged SNF within a damaged fuel can, increases reactivity significantly. The staff recognizes that inserting damaged fuel in the caddy would reduce reactivity, but does not have enough information to determine if the decrease is enough to off-set the reactivity increase due to removing the cladding. NUREG-1617, Section 6.5.2, "Spent Nuclear Fuel Contents" states in part "If the contents include damaged fuel, the maximum extent of damage should be specified and shown to be bounded by the criticality analysis." Therefore, the applicant should clarify if the proposed damaged fuel content has cladding present or if there is a possibility of shipping bare fuel material. If the proposed damaged fuel includes the cladding, this needs to be specified within the definition of damaged fuel and within the CoC. If it is the applicant's intent to request approval of bare fuel material, it should provide a criticality safety evaluation demonstrating that the presence of the caddy reduces reactivity enough to account for the increase in reactivity due to lack of cladding or that the package would be subcritical under both normal conditions of transport and under hypothetical accident conditions.

This information is needed to verify that the package will remain subcritical per the requirements of 10 CFR 71.55(b)(1), 71.55(d)(1), and 71.55(e)(1).

NAC International Response to Criticality Evaluation RAI 6-1:

The NRU/NRX material are aluminum based fuels that are not expected to experience a fuel to cladding separation, which is contrary to uranium oxide fuels where there is a potential for separation. As indicated in the Chapter 1 definition for undamaged (aluminum based) fuel, some loss of clad (< 5%) is acceptable to account for mechanical or corrosion damage. No further bulk removal of cladding is expected for the NRU/NRX damaged fuel but localized removal may occur (i.e., mechanical damage that would result in the fuel being classified as damaged). This minor amount of cladding damage will not significantly impact system reactivity.

NAC INTERNATIONAL RESPONSE
TO
REQUEST FOR ADDITIONAL INFORMATION

CRITICALITY EVALUATION

6-2 Justify that loading a lower amount of damaged fuel from that contained within an assembly is bounded by the criticality analyses for undamaged fuel. The criticality analyses for the undamaged NRU/NRX fuel are based on a single assembly within a basket tube. The words "up to the equivalent number of a fuel assembly" were added to the definition of undamaged NRU/NRX fuel, indicating that less than a full assembly may be loaded. If less fuel is loaded this could increase reactivity by increasing the amount of moderation. NUREG-1617, Section 6.5.2, "Spent Nuclear Fuel Contents" states "Because of the additional moderation, the contents with less fissile material might be more reactive." Therefore, the applicant should justify that the current criticality analyses for undamaged fuel remain bounding for both the proposed damaged and undamaged fuel contents if less fuel than what is contained in an assembly is loaded. Otherwise, the applicant should provide a criticality analysis for the most reactive case. Alternatively, the staff may condition the certificate of compliance to specify that fuel equivalent to a full assembly must be loaded in each tube for both the damaged and undamaged NRU/NRX fuel.

This information is needed to verify that the package will remain subcritical per the requirements of 10 CFR 71.55(b)(1), 71.55(b)(2), 71.55(d)(1), 71.55(e)(1), and 71.55(e)(2).

NAC International Response to Criticality Evaluation RAI 6-2:

Damaged Fuel Discussion

The evaluation presented in Section 6.7.3.5 is based on a maximum number of fuel rods, which is then broken into sections and reconfigured. The maximum reactivity condition, as documented in Section 6.7.3.5, is the maximum number physically located at given cask elevation. The modeled active fuel height for this broken rod scenario simply conserves the linear length of the active fuel region. A reduced number of fuel rods, therefore, would limit (i.e., reduce) the active fuel height being modeled. Thus, increasing neutron leakage and decreasing reactivity. The study submitted with the undamaged fuel application, not modified for the damaged fuel submittal, contains an H/U study which decreases the fuel height stack (i.e., leakage) and decreases the H/U ratio (i.e., placing more fuel into a given elevation). This study determined that decreases in leakage offset the loss in moderation and the larger number of rods at an elevation are bounding (i.e., maximum reactivity). Any postulated removal of rods from the system results in a lower number of rods segments at a given data point along with a reduction in active fuel height (i.e., increased neutron leakage and lower reactivity).

Therefore, the analysis presented in the SAR envelops any reduced number of rods. Based on the results in Figure 6.7.3-14 and -15 which are discussed in Section 6.7.3.5, system reactivity rises drastically as the fuel column height gets smaller (i.e., moving fuel to higher fuel density elevation with lower H/U) and is near flat as the number of rod segments approaches its maximum. Thus, indicating the system is relatively insensitive to the number of rods in this analysis region.

Undamaged Fuel Discussion

As seen by comparing the results in Sections 6.7.3 and 6.7.5, the damaged fuel configuration is significantly higher in reactivity than the undamaged configuration. Collapsing the fuel region height takes k_{eff} from 0.7 to 0.9. A reduction in the number of rods would shift the analysis further to the left of 6.7.3-14 and -15 (i.e., the lowest number of rods is the nominal number, which would be reduced by removal of fuel material). Based on the data shown which is based on mass conservation (i.e., by active fuel length change), rod removal will decrease system reactivity. Based on information presently in the SAR, it is demonstrated that an underload (i.e., less than one assembly) is an acceptable payload.