

Jill Caverly - Draft UMS Amendment 5 RAI

72-1015

From: Jill Caverly
To: internet:tdanner@nacintl.com
Date: 04/16/2007 11:20 AM
Subject: Draft UMS Amendment 5 RAI

Dear Tom:

I have attached a draft RAI for the NAC-UMS Amendment 5. As we discussed on the phone earlier today, this is a DRAFT version and may be revised before the final version is signed.

Let me know if you have any questions.

Thank you,
Jill

Jill S. Caverly, P.E.
Project Manager
Division of Spent Fuel Storage
and Transportation, NMSS
U.S Nuclear Regulatory Commission
Phone: 301-492-3332

Request for Additional Information
NAC International
Docket 72-1015, Amendment No. 5
Request for an Amendment to Certificate of Compliance No. 1015
for the NAC-UMS Universal Storage System

Under cover letter dated September 22, 2006, NAC International (NAC), submitted a request for an amendment to Certificate of Compliance (CoC) No. 1015 for the NAC-UMS Universal Storage System to incorporate high burnup PWR fuel as approved contents and implement changes to the technical specifications. In addition, other changes have been requested including removal of tamper indicating devices, changes to leak testing requirements, changes to the reporting requirements, elimination of an impact test for support disk material, and make optional the use of structural lid and shield lid threaded plugs and dowel pins.

The information requested in this RAI is needed by the staff to complete its review of the amendment request and to determine whether the proposed plan has demonstrated compliance with regulatory requirements.

Additional information requested include the following:

General

G-1 Wherever the shield lid to canister shell is mentioned in the Safety Analysis Report (SAR), CoC, or Operating Instructions, a minimum three pass weld should be indicated.

Normally helium (He) leak testing is required on all welds that form a part of the confinement barrier. An exception from the He-leak testing has been requested on this weld. In order to have an exception, the weld must have at least three passes.

This information is needed to meet the regulatory requirements of 10 CFR 72.236(1) and 10 CFR 72.24(l)(1) that requires confinement of radioactive material be maintained under normal, off-normal, and accident conditions.

Chapter 1 - General Description

1-1 Revise definitions of intact and damaged fuel to cover potential structural damage.

On page 1-3, and Table 2.1.1-1, Appendix A of the SAR, there appears to be an incongruity between the definitions of intact fuel and damaged fuel. For example, applying the current definitions, an assembly with missing or damaged grid spacers would be considered intact. If this is intended, assemblies with missing grid spacers should be analyzed as the limiting case.

This information is needed to meet the requirements of 10 CFR 72.122 that requires damaged fuel be canned.

Note: See also RAI TS-1

Chapter 3 - Structural Evaluation

- 3-1 Update Section 3.3.2, "Fracture Toughness Considerations," and Section 11.2.16, "Fuel Rods Structural Evaluation for Burn-up to 60,000 MWd/MTU," by deleting calculations pertaining to BWR high burn-up damaged fuel.

The amendment request to include high burn-up fuel is for PWR fuel only.

This information is needed to meet the regulatory requirements of 10 CFR Part 72.11 requiring completeness and accuracy of the information.

Chapter 4 - Thermal Evaluation

- 4-1 Adjust the moles in Table 4.4.5-1, for the new maximum burnup of 60 GWd/MTU. State the burnup in the caption where the moles are applicable.

It is unclear whether the moles of fission gas in the table are for a burnup of 60 GWd/MTU.

This information is needed to meet the regulatory requirements of 10 CFR 72.236(1) and 10 CFR 72.24(l)(1) that requires confinement of radioactive material be maintained under normal, off-normal, and accident conditions. Also, 10 CFR 72.11 requires completeness and accuracy of information.

- 4-2 Justify that the thermal analyses satisfy appropriate temperature limits and cycling temperature differentials (per ISG-11) for proposed fuel loadings, consistent with the operational procedures. Verify Chapters 4, 8, 11, and proposed technical specifications for canister drying, are consistent in this manner.

It does not appear that thermal cycling limits have been addressed in the thermal analyses. This information is needed to meet the regulatory requirements of 10 CFR Part 72.11 requiring completeness and accuracy of the information.

Chapter 5 - Shielding Evaluation

- 5-1 Provide additional information explaining why the existing source term evaluation and dose rate evaluation, which is based on a burnup of 40,000 MWd/MTU, is bounding for the higher burnup of 60,000 Mwd/MTU.

This amendment requests burnup for PWR fuel increase from 40,000 MWd/MTU to 60,000 MWd/MTU. However, the source term evaluation in SAR Section 5.2, "Source Specification," does not provide any information on what the source term would be for PWR fuel with the higher burnup. Please provide additional clarification in the SAR to explain the limiting dose rate based on the design basis calculations from Rev 0 of the SAR.

This information is necessary to determine compliance with 10 CFR Part 72.104 and 72.106.

- 5-2 Verify that the SCALE version 4.3 is still a reasonable approach to the determine fuel depletion and source term. Verify that no new bugs or problems with this version of the code have been identified that could adversely impact the design basis.

According to the information in SAR Section 5.2, code sequences from the SCALE 4.3 code package were used to determine the fuel depletion and source term. The most current version of the SCALE code is 5.1 which updates a number of the code sequences and revises several libraries to reflect the most recent data.

This information is necessary to determine compliance with 10 CFR Part 72.104 and 72.106.

Chapter 7 - Confinement

- 7-1 Revise Section 7.0 of the SAR to remove any statements to the effect that the NAC-UMS System confinement boundary is leaktight as defined by ANSI N14.5-1997, "American National Standard for Radioactive Materials – Leakage Tests on Packages for Shipment."

ANSI N14.5-1997 defines leaktight as a degree of containment achieved by demonstration of a leakage rate less than or equal to 1×10^{-7} ref.cm³/s, of air at an upstream pressure of 1 atmosphere (atm) absolute (abs), and a downstream pressure of 0.01 atm abs or less. Since the entire confinement boundary is no longer tested to this criterion, it does not meet the definition of leaktight. Note that, although not considered leaktight, final closure welds that meet the provisions of Interim Staff Guidance 18 (ISG-18), "The Design/Qualification of Final Closure Welds on Austenitic Stainless Steel Canisters as Confinement Boundary for Spent Fuel Storage and Containment Boundary for Spent Fuel Transportation," are considered to have no credible leakage during storage.

This information is needed to ensure that the cask system confinement boundary final closure weld complies with the provisions of ISG-18, in lieu of leakage rate testing.

- 7-2 Revise Section A5.5 of the Technical Specifications, "Radioactive Effluent Control Program," to remove the reference to LCO 3.1.5, "CANISTER Helium Leak Rate."

LCO 3.1.5 is being removed from the Technical Specifications and, therefore, cannot be given as a justification that there are no radioactive effluents from the NAC-UMS® System. This section should include a revised justification, e.g., the provisions of ISG-18, combined with leak testing of the vent and drain port covers.

This information is needed to ensure that the cask system will continue to meet the requirements of 10 CFR 72.126(d) for effluent control.

Chapter 8 - Operating Procedures

- 8-1 Revise the vent and drain port cover weld leakage rate test procedures to comply with the provisions of ANSI N14.5-1997.

ANSI N14.5-1997, Section 8.1, states that "Tests shall be designed to preclude false acceptance; this includes assuring the presence of a tracer gas and a driving pressure." If the vent and drain port valves are closed at the time of the leak test, there will be no helium available to test the vent and drain port cover weld integrity. Either clarify the test procedure ensuring the presence of a tracer gas behind the confinement weld to be tested, or use a different type of test that does not require a tracer gas.

This information is needed to ensure that the NAC-UMS System will meet the confinement requirements of 10 CFR 72.104 and 10 CFR 72.126.

Chapter 11 - Accident Analysis

- 11-1 Revise Chapter 11 of the SAR to clarify the definitions of intact fuel and damaged fuel using current data for high burn-up PWR fuel.

In the analysis presented in Section 11.2.16 to justify the adequacy of the fuel rods (cladding) for PWR high burn-up fuel, it is unclear whether an assembly with missing or damaged grids is considered intact fuel or damaged fuel. If it is designated as damaged fuel, then special damaged fuel canisters are required to be used.

This information is needed to meet the requirements of 10 CFR Part 72.122 that mandates damaged fuel to be canned.

- 11-2 In Section 11.3, provide additional information for Reference 61, "Mechanical Properties of Irradiated Zircaloy" including the year of publication, and details of journal and/or conference at which the paper was published.

It is unclear which "paper" by Geelhood and Beyer has been referenced for the source of modulus of elasticity for the irradiated zirconium alloy cladding.

This information is needed to ensure that regulatory requirements of 10 CFR 72.11 which call for completeness and accuracy of information are met.

- 11-3 Remove the reference to BWR fuel in Section 11.2-16.

The amendment request to include high burn-up fuel is for PWR fuel only.

This information is needed to ensure that regulatory requirements of 10 CFR 72.11 which call for completeness and accuracy of information are met.

- 11-4 Provide revised calculations for the structural evaluation of high burn-up fuel cladding for all evaluations in which the flexural rigidity (EI) of the fuel pellet has been used in the computation of the flexural rigidity of the fuel rod. The revised calculations must only

take credit for the flexural rigidity of the fuel cladding in the computation of fuel rod bending stiffness.

In Section 11.2.16 of the Amendment Request, the calculations pertaining to the structural evaluation of high burn-up fuel cladding for axial loading (end drop) references the methods and calculations in Section 11.2.15.1.5 of the FSAR, and for lateral loading (side drop) references Section 11.2.15.1.6 of the FSAR. The structural evaluations in the referenced sections compute the flexural rigidity (EI) of the fuel rod as the sum of the flexural rigidity of the cladding and 50 percent of the flexural rigidity of the fuel pellets. The fuel in high burn-up fuel rods is highly fractured and granular, and the rim region between the cladding and the granular fuel is comprised of even finer particles. In addition, during the cooling of the rods after their removal from the reactor the fuel tends to shrink more than the cladding, widening the interface between the granular particles and between the fuel and cladding. Under these conditions, it is not physically possible for the fuel to possess bending stiffness, and the NRC Staff knows of no basis for making such an assumption.

This information is needed to assure the requirements of 10 CFR Part 72.122(b), which requires all SSCs important to safety to be designed to withstand postulated accidents, are met.

- 11-5 Provide the appropriate pages in Reference 47 (Clough and Penzien) in Section 11.2.15.1.5, to document the derivation of the DLF. Include a complete description of the equations used to compute first extensional mode frequency and first lateral mode frequency. Also, provide the basis and documentation for the vertical acceleration of 37.9g that corresponds to the first buckled mode shape. Provide the same information for the calculation of the 4.3g acceleration in Section 11.2.15.1.6.

In Section 11.2.16 of the Amendment Request, the calculations pertaining to the structural evaluation of high burn-up fuel cladding for axial loading (end drop) references the methods and calculations in Section 11.2.15.1.5 of the FSAR, and for lateral loading (side drop) references Section 11.2.15.1.6 of the FSAR. No documentation, calculations, or ANSYS input and output files have been provided to substantiate these values.

This information is needed to meet the requirements of 10 CFR Part 72.11 establishing the completeness and accuracy of the information.

- 11-6 Provide a calculation that is consistent with the initial conditions of a 60g loading in Section 11.2.15.1.6, Side Drop Evaluation.

In Section 11.2.16 of the Amendment Request, the calculations pertaining to the structural evaluation of high burn-up fuel cladding for axial loading (end drop) references the methods and calculations in Section 11.2.15.1.5 of the FSAR, and for lateral loading (side drop) references Section 11.2.15.1.6 of the FSAR. The calculation states that the evaluation is for a 60g loading, but then proceeds to perform a displacement limited analysis to calculate cladding stresses that has nothing to do with the 60g loading.

This information is needed to meet the requirements of 10 CFR Part 72.11 demonstrating the completeness and accuracy of the information.

11-7 Clarify the short term cladding limits used in the accident analyses for high burnup fuel.

There appears to be a mis-reference to 570°C as the short term cladding limit for high burnup fuel, instead of 400°C.

This information is needed to meet the regulatory requirements of 10 CFR Part 72.11 requiring completeness and accuracy of the information.

Technical Specifications (TS)

- TS-1 Modify the definitions of intact fuel and damaged fuel to add the restriction that: "A fuel assembly with missing fuel rods shall not be classified as an intact fuel assembly unless solid filler rods are used to displace an amount of water equal to that displaced by the original fuel rods."

The current definitions of intact and damaged fuel are not supported by the current criticality analysis. The stated restriction was a part of the definition in a previous amendment. It appears that the definitions were modified to account for the inclusion of Maine Yankee (MY) fuel that was considered intact with the exception of a number of fuel rods missing from the fuel rod array of several assemblies. In that amendment (Amendment 1), the applicant provided an analysis to support the inclusion of these assemblies and restricted them to the corner locations of the PWR spent fuel basket. However, no analysis has been provided to support loading generic PWR or BWR assemblies that are missing fuel rods as intact fuel. Under the current definitions of intact and damaged fuel, PWR and BWR assemblies missing any number of fuel rods in any location of the fuel rod array could be loaded as intact fuel. The current criticality analysis does not support such a condition.

The staff also notes that Table B2-2 of Appendix B to the CoC contains a footnote for PWR assemblies that "Fuel rod positions may be occupied by burnable poison rods or solid filler rods." However, no such footnote is given in the following table (Table B2-3) for BWR assemblies. Also, the word "may" does not connote a requirement. Therefore, the definitions should be modified as described.

This information is needed to confirm compliance with 10 CFR 72.236(a) and (c).

- TS-2 Change Section 3.2 of Appendix B to the CoC to include dimension controls for the PWR and BWR baskets.

The basket geometry is a primary means of controlling system reactivity for a spent fuel storage cask in all phases of operation. Changes to the basket configuration can therefore impact the system reactivity (k -effective or k_{eff}). As the applicant's analysis has indicated, system reactivity increases when the fuel assemblies are shifted toward the center of the basket and, for the PWR basket, the width of the flux traps is reduced. Thus, it is important to establish a dimension control in each basket type that maintains a minimum spacing between each fuel assembly and/or a minimum flux trap size and is

consistent with the dimensions of the model used in the criticality analysis. These dimension controls will clarify fundamental design requirements for future operations under this amendment.

This information is needed to confirm compliance with 10 CFR 72.124(b) and 72.236(c).

- TS-3 Change the TS to clarify that the descriptions of allowable contents and configurations given in Section B 2.1.2 of Appendix B to the CoC apply only to MY fuel.

In Section B 2.1.2 of Appendix B to the proposed CoC, the applicant adds the statement that preferential loading of high burnup fuel only applies to MY fuel. It is staff's understanding that all descriptions of allowable contents and configurations in Section B 2.1.2 are applicable only to MY fuel. For example, the information provided in Sections B 2.1 and B 2.1.1 do not indicate that preferential loading is an option, or a requirement, for non-MY fuel, high burnup or otherwise. Thus, the need for adding the proposed statement is not clear. Further, addition of the proposed statement seems to imply that other items described in Section B 2.1.2 are being, or can be, interpreted (by the applicant or cask users) as being applicable to other allowable fuel contents besides MY fuel. These items include descriptions of the loading of consolidated fuel, damaged fuel, and fuel debris. The current criticality analysis only supports the loading of MY fuel in these fuel configurations; the analysis does not support the loading of other fuel assemblies in these configurations. If the applicant wants any of the descriptions of allowable contents and configurations given in Section B 2.1.2 to apply to any non-MY fuel, the applicant needs to provide the necessary analyses to support that condition.

This information is needed to confirm compliance with 10 CFR 72.236(a) and (c).

- TS-4 Clarify the footnote in Table B2-1 of the proposed TS to reference the maximum decay heat for site-specific configurations controlled elsewhere in the TS.

The footnote to item "e" indicates decay heats may be higher for site-specific configurations.

This information is needed to meet the regulatory requirements of 10 CFR Part 72.11 requiring completeness and accuracy of the information.