Request for Additional Information (Structural)
Docket No. 72-1015
NAC International
Certificate of Compliance No. 1015 for Model No. NAC-UMS
Amendment No. 10

1. Provide responses to the following requests related to safety analysis report (SAR) subsection 11.2.16.1, "PWR Fuel Rod Evaluation," Revision 23A (Reference 1):

    a. Identify the parameter that was incorrectly specified in the computation of bending stress in the ANSYS finite element (FE) model of the structural analyses for a fuel rod under the non-mechanistic tip-over accident condition and provide the material properties and dimensions of the fuel rod in Reference 2.

    b. Provide the input parameters (i.e., material properties and dimensions) used in the revised tip-over analysis of a fuel rod in Reference 1.

    c. An ANSYS two-dimensional (2-D) elastic beam element (BEAM3) was used to represent a single fuel in drop analyses. Explain why the ANSYS 2-D elastic beam element (BEAM3), which is a legacy beam element in the ANSYS FE program, was used rather than using an ANSYS 3-D elastic beam element (i.e., BEAM188, BEAM189).

    d. A fuel rod is a three dimensional (3-D) structural component in X-, Y- and Z-directions, not a 2-D component in X- and Y-directions. Justify that why the 2-D analyses are more realistic and conservative than 3-D analyses to characterize the performance of a fuel rod under drops (end, flat horizontal and oblique).

    The application (Reference 1) was submitted to amend Reference 2. The main change contained in the application is to correct a licensing basis deficiency initially reported to the NRC on March 10, 2023 (Reference 3). The report identified that a parameter used in the computation of bending stress in the FE model used to structurally evaluate a fuel rod under the non-mechanistic tip-over accident condition was incorrectly specified, and, as a result, non-conservative stresses were calculated. The ANSYS FE program was used for the fuel rod analyses. The staff needs additional detailed information related to the ANSYS FE model and analyses to complete the review.

    This information is needed by the staff to determine compliance with Title 10 of the Code of Federal Regulations (10 CFR) Section 72.122 and 72.236.

2. Provide the reasons for deleting a design consideration (i.e., 33 inches of grid spacing) in the revised calculation package and provide the maximum stress intensity and corresponding margin of safety against yield strength for two fuel rods (14X14 and 17X17) with the grid spacing of 33 inches.

The revised calculation package, #71160-2026, in Enclosure 1 of the application (Reference 1) shows that one of the assumptions/design considerations in subsection 4.2 was deleted. The statement of the deleted design consideration is following: *The bounding grid spacing for the grid closest to the bottom of the fuel assembly is 33 inches which bounds the dimensions for the positioning of the lowest grid.* As a result, the applicant provided the maximum stress intensity and corresponding margin of safety against yield strength of two fuel rods (14X14 and 17X17) with only two grid spacings (60 inches and 29.5 inches).

However, a case study in the final SAR (Reference 4) indicates that the grid spacing of 33 inches is the most critical grid spacing among those three grid spacings (60, 33 and 25 inches) considered in the fuel rod analysis under end drop, as can be seen in Tables 1(a) and (1b) below. Therefore, the applicant is requested to provide: (i) reasons for deleting the grid spacing of 33 inches in the fuel rod analysis, and (ii) the maximum stress intensity and corresponding margin of safety against yield strength for two fuel rods (14X14 and 17X17) with the grid spacing of 33 inches.

Table 1(a) - Case Study for Enveloping Cross-Sectional Moment of Inertia of Pressurized Water Reactor (PWR) Fuel
Rods and Grid Spacing at the Bottom of Fuel Assembly (Reference 4)

Case	Lowest Grid Spacing (inches)	Cross-Sectional Moment of Inertia	Fuel Rod OD (inch)	Fuel Clad Thickness (w/o Oxide Effect) (inch)
1	60	Minimum	0.36	0.021
2	33	Minimum	0.36	0.021
3	25	Minimum	0.36	0.021

Table 1(b) - Calculated Maximum Stress Intensity and Margin of Safety
of PWR Fuel Rods from the Case Study (Reference 4)

Case	Maximum Stress Intensity (ksi) at Midspan of Lowest Grid Spacing	Margin of Safety Against Yield Strength
1	22.80	2.05
2	34.80	1.00
3	17.00	3.09

This information is needed by the staff to determine compliance with 10 CFR 72.122 and 72.236.

References:

1. NAC Submission of an Amendment Request for the NAC International Universal Storage System (UMS) Amendment No. 10, Docket No. 72-1015, October 10, 2023:

- Enclosure 1 - Supporting Calculations for NAC-UMS FSAR, Amendment 10, Revision 23A,
- Enclosure 2 - List of FSAR Changes for NAC-UMS FSAR, Amendment 10, Revision 23A, and
- Enclosure 3 - FSAR Changed Pages and LOEP for NAC-UMS FSAR, Amendment 10, Revision 23A.

2. U.S. Nuclear Regulatory Commission (NRC) Certificate of Compliance (CoC) No. 1015 for the NAC International Universal Storage System (UMS) System, Amendment No. 9, July 22, 2022.

3. ED20230029, 10 CFR 72.242 Reportable Licensing Basis Non-Mechanistic Tip-over Evaluation Deficiency for the NAC-UMS and MAGNASTOR Dry Cask Storage Systems, March 10, 2023.

4. NAC-UMS System Final Safety Analysis Report (FSAR), Revision 15, NAC International, October 2021.