May 5, 2002

Mr. Thomas C. Thompson
Director of Licensing
Engineering & Design Services
NAC International, Inc.
3930 East Jones Bridge Road
Norcross, GA 30092

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE UMS UNIVERSAL STORAGE SYSTEM (TAC NO. L23404), AMENDMENT #3

Dear Mr. Thompson:

By application dated January 15, 2002, as supplemented February 4 and March 13, 2002, NAC International, Inc. (NAC) requested approval of an amendment, under the provisions of 10 CFR Part 72, to Certificate of Compliance No. 1015 for the NAC-UMS Universal Storage System. Specifically, a revision was requested to the Certificate of Compliance to incorporate enhanced design features. Enclosed is the staff's request for additional information (RAI) for the continued review of the amendment request.

Your full and complete response to the enclosed RAI is necessary by July 7, 2002, to support the schedule provided to you on March 14, 2002. If you are unable to meet the RAI response milestone, you should notify us in writing, at least 2 weeks prior to the expected response date, of your new submittal date and the reasons for the schedule delay. We will then assess the impact of the new submittal date and publish a revised schedule.

Please note that in accordance with 10 CFR 2.790(b)(1)(ii), submittals containing proprietary information must include, in order, (1) a nonproprietary version, (2) an affidavit, and (3) the proprietary version with appropriate markings. Documents not conforming to the above may be placed in the Public Document Room.

Please note that the new Project Manager for this amendment will be Steve Baggett. He may be reached at (301) 415-8584 if you have any comments or questions concerning this request.

Please refer to Docket No. 72-1015 and TAC No. L23404 in future correspondence related to this request.

Sincerely,
/RA/ original signed by /s/

Rebecca L. Karas, Project Manager
Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 72-1015
TAC No. L23404

Enclosure: RAI on NAC-UMS Storage System

cc: Attached List

Please refer to Docket No. 72-1015 and TAC No. L23404 in future correspondence related to this request.

Sincerely,
/RA/ original signed by /s/
Rebecca L. Karas, Project Manager
Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
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Docket No. 72-1015
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Enclosure: RAI on NAC-UMS Storage System

cc: Attached List

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NAC UMS UNIVERSAL STORAGE SYSTEM
DOCKET NO. 72-1015
TAC NO. L23404

REQUEST FOR ADDITIONAL INFORMATION

This document titled Request for Additional Information (RAI), contains a compilation of additional information requirements, identified to-date by the U.S. Nuclear Regulatory Commission (NRC) staff, during its review of NAC International's application for approval of an amendment to the Certificate of Compliance (CoC) for the NAC UMS Universal Storage System (NAC-UMS) under 10 CFR Part 72. This RAI follows the same format as NAC's Safety Analysis Report (SAR).

Each individual RAI describes information needed by the staff for it to complete its review of the application and the SAR and to determine whether NAC has demonstrated compliance with the regulatory requirements.

CHAPTER 1 GENERAL DESCRIPTION

Section 1.2.1.4 Transfer Cask

1.1 Clarify descriptions of the standard transfer cask and the advanced configuration standard transfer cask on Page 1.2-8 and in any other SAR language to clearly identify the major differences, if any, between the two transfer cask configurations.

The SAR is not consistent in describing transfer cask configurations. For instance, page 2.3-4 states, "The transfer cask is provided in the standard configuration or in a 100-ton configuration." However, a number of SAR citations of the transfer cask appear to suggest three, rather than two, different transfer cask configurations. This is required to ensure compliance with 10 CFR 72.236.

1.2 Provide a description of how the neutron shield for the 100-ton transfer cask is filled and drained. Describe the precautions that are in place to ensure the neutron shield cavity is filled when needed.

Since the 100-ton transfer cask uses water as a neutron shield, more information is necessary to evaluate if the design is adequate to protect occupational workers from unnecessary radiation exposure.

Section 1.8 Licensing Drawings

1.3 Justify, for note 21 of SAR Drawing No. 790-560, the maximum allowable canister weight of 103,000 lbs for which the 3/4-inch thick stiffener plates were used at the trunnion joint to improve its load-carrying capabilities.

The trunnion has not been analyzed for the maximum canister weight of 103,000 lbs. Accurate design features must be presented to ensure compliance with 10 CFR 72.236.

1.4 Revise SAR Drawing No. 790–562 to note the optional rebar type for the Vertical Concrete Cask

Use of optional ASTM A706 rebars, as described in the SAR text and listed in Tables 1.2-1 and 3.3-6, should also be specified in the bill of materials of the drawing. This is required to ensure compliance with 10 CFR 72.236.

CHAPTER 2 PRINCIPAL DESIGN CRITERIA

2.1 Revise, in SAR Table 2-1, the local concrete temperature criterion of $\leq$ 300^{o}F for the normal condition.

For normal conditions, Section A.4.1 of Reference 4, ACI 349-95, allows increased temperatures for local areas not to exceed 200^{o}F. Appropriate design criteria must be considered to ensure compliance with 10 CFR 72.236.

CHAPTER 3 STRUCTURAL EVALUATION

Section 3.4.3.4.1 100-Ton Transfer Cask - Vertical Lift

3.1 Revise the SAR text and the Figure 3.4.3.4.1-2 trunnion-shell node map for which high local stresses are considered relieved by local material yielding. Revise stress summaries in Tables 3.4.3.4.2-1 through 3.4.3.4.2-6, as appropriate.

The region for local primary membrane stress consideration, per ASME Code, Subparagraph NB-3213.10, should be based on appropriate discontinuities of the trunnion-shell joint. Because stiffener plates are used only in the cask meridional direction, the local stress region in the circumferential direction is not expected to be as wide as that in the meridional direction. Appropriate criteria must be considered in stress evaluation to ensure compliance with 10 CFR 72.236.

Section 3.4.4 Normal Operating Conditions Analysis

3.2 Provide a summary table to compare the values previously used with the revised temperatures, component weights, and stress allowables considered in the SAR Section 3.4.4 stress evaluations of the system components.

Section 3.4.4 contains numerous reevaluations of loading conditions and stress allowables for the cask system components, such as the canister, basket, and Vertical Concrete Cask. A summary table comparing the present bases and criteria with those used previously will facilitate staff review to ensure compliance with 10 CFR 72.236.

CHAPTER 4 THERMAL

4.1 Justify the “no limit” on time duration for vacuum drying as shown in Table 4.4.3-5, “Maximum Limiting Component Temperatures in Transient Operations for the Reduced Heat Load Case for PWR Fuel,” and Table 4.4.3-8, “Maximum Limiting Component Temperatures in Transient Operations for BWR Fuel.” Short term operations like fuel transfer are not intended to be indefinite. Unless the steady state temperature is below the long term allowable then “no limit” time durations are inappropriate. It may be more appropriate to change the time period to some value indicative of a short term operation.

As an example, from Calculation EA790-3206, “Thermal Analysis for UMS Transfer Cask/Canister for PWR Fuel” Rev. 3, on pages B66 and B71, the steady state maximum fuel temperatures under vacuum conditions are 804.6°F and 737.8°F, corresponding to decay heat loadings of 11 kW and 8 kW, respectively. Both of these temperatures exceed the maximum long term allowable temperatures (which vary between 630°F and 700°F) as shown on Table 4.4.7-5, “Maximum Allowable Cladding Temperature for PWR and BWR Fuel Assemblies.” This is required to ensure compliance with 10 CFR 72.236.

4.2 Justify the “no limit” on time duration for a helium filled canister in the transfer cask as shown in Tables 4.4.3-5, 4.4.3-6, 4.4.3-7 and 4.4.3-8.

All of these tables have steady state temperature values for the fuel and/or heat transfer disks that exceed their long term temperature limits. A transfer cask loaded with a helium filled canister is not intended to be used for an indefinite time as a substitute for a concrete overpack. Therefore, it may be more appropriate to change the time period to some value indicative of a short term operation. This is required to ensure compliance with 10 CFR 72.236.

4.3 Add to Chapter 4 of the SAR a description of the non-site specific preferential loading restrictions for the NAC-UMS. Include the basis for this loading pattern and explanations of how the older, cooler fuels with lower cladding temperature limits are met.

Section B2.1.2 of Chapter 12, Operating Controls and Limits, describes the preferential loading for the NAC-UMS (non-site specific). As stated therein, fuels that are less than 7 years cooled must be loaded with the hottest fuel in the center, and the coolest on the perimeter. Fuels that are 7 years cooled and longer have no preferential loading restrictions. However, no description is provided in Chapter 4 to explain this operational restriction. This is required to ensure compliance with 10 CFR 72.236.

4.4 Add to the description in Section 4.4.1.3 of the SAR for the 100-ton cask, where it discusses heat transfer in the horizontal position, the impact of the non-conservative heat transfer effects of the increase in insolation and the decrease in natural convective heat transfer when comparing it to the vertical orientation.

This is required to ensure compliance with 10 CFR 72.236.

4.5 The third paragraph in Section 4.4.1.3 needs to reflect the variance in times for the transfer operations of draining, vacuum drying and helium in canister as reflected in Tables 4.4.3-5 through 4.4.3-8.

As written, the subject paragraph references specific times for these transfer operations without clearly stating what point is being made. This is required to ensure compliance with 10 CFR 72.236.

CHAPTER 5 SHIELDING EVALUATION

Section 5.1 Discussion and Results

5.1 Clarify the apparent discrepancy between the meanings of wet and dry canister conditions for the 100-ton transfer cask shielding evaluations.

On page 5.1-4 of the SAR, it's written that the wet canister condition has a dry neutron shield, however the next sentence indicates that the wet canister condition occurs after the neutron shield is filled. This information is necessary to clarify the meanings of wet and dry canister conditions and to ensure compliance with 10 CFR 72.236.

5.2 Provide the dose rates for the bottom shield doors of the 100-ton transfer cask.

The dose rates for the bottom shield doors of the 100-ton transfer cask are not included in the SAR. The SAR indicates the dose rates at the bottom shield doors are similar for both the standard and 100-ton transfer casks. However, the 100-ton transfer cask has 0.25 inches less low alloy steel in the bottom doors which will result in slightly higher dose rates. This is required to ensure compliance with 10 CFR 72.236.

Section 5.2.2 100-Ton Transfer Cask Source Description

5.3 Provide justification for using 0.8 g/kg as the ^{59}Co impurity level in the non-fuel hardware of the assemblies instead of 1.2 g/kg.

According to the lower value of 0.8 g/kg was used to compensate for the decreased amount of shielding to be used in the 100-ton transfer cask. Using the 0.8 g/kg value results in lower occupational dose rates. A value of 0.8 g/kg would be appropriate if the only fuel assemblies to be used in conjunction with the 100-ton transfer cask had stainless steel hardware. Since this is an amendment to the general license, the value should also reflect an appropriate value for fuel assemblies with inconel hardware. Maine Yankee fuel records for 1991 was cited as one of the reasons for using the 0.8 g/kg value. However, Maine Yankee fuel assemblies are a 14x14 design, and the design basis PWR fuel for this transfer cask is CE 16x16. Also, ORNL/TM-6051 lists the ^{59}Co impurity level as 4.7 g/kg. This is required to ensure compliance with 10 CFR 72.236.

5.4 Describe the precautions that are in place to ensure fuel assemblies containing non-fuel hardware such as thimble plug inserts are not loaded into a canister in a 100-ton cask. Also, include a complete list of the non-fuel hardware which is not to be inserted into fuel assemblies.

It is stated in several locations in the SAR that fuel without any extra non-fuel hardware such as thimble plug inserts can be loaded in canisters which are used in conjunction with the 100-ton transfer cask. Additionally, the definition of "Standard Fuel" in the Technical Specifications includes several non-fuel components. This is required to ensure compliance with 10 CFR 72.236.

5.5 In SAR Table 5.2-18, "Design Basis PWR 5-year Hardware Photon Spectrum," and Table 5.2-21, "Design Basis BWR 5-year Hardware Photon Spectrum," verify that the

Group 8 energy values cited in the γ/sec/kg and MeV/sec/kg columns are correct. The values listed appear to be inconsistent with the rest of the values in the tables. Also in Table 5.2-21, "Design Basis BWR 5-year Hardware Photon Spectrum," verify the units for the values in the last two columns. Both columns have the same units.

This information is needed for ensuring the SAR is clear and error-free and to ensure compliance with 10 CFR 72.236.

Section 5.4.2.3 100-Ton Transfer Cask Three-Dimensional Dose Rates

5.6 Provide an explanation as to why the CE 16x16 and GE 8x8 fuel assemblies yield the maximum dose rates and are therefore considered the design basis fuel for the 100-ton transfer cask.

The design basis fuel assemblies for the 100-ton transfer cask are different for those assemblies specified for the standard transfer cask and the concrete overpack. This information is necessary to determine if the source term evaluation is adequate and to ensure compliance with 10 CFR 72.236.

CHAPTER 6 CRITICALITY

6.1 Provide a benchmark analysis in Section 6.5 of the SAR in which the critical benchmark modeling for MONK8A was performed by the same analyst or group of analysts who performed the UMS analysis, using modeling techniques and code input options similar to those used in the UMS analysis. As a minimum, provide assurance that the critical benchmarks were performed using modeling techniques and code input options similar to those employed by NAC analysts in modeling the UMS.

It is not clear that the data used to calculate the bias and uncertainty associated with the calculations performed using MONK8A were obtained from critical benchmarks modeled by NAC analysts. Individual modeling techniques and selection of code input options are possible sources of uncertainty due to the analyst, and should be considered in the establishment of calculation bias and uncertainty. The establishment of bias and uncertainty is discussed further in Section 5.2 of NUREG/CR-5661, "Recommendations for Preparing the Criticality Safety Evaluation of Transportation Packages." While originally developed for use in evaluating fissile materials transportation packages, this reference presents principles which are also applicable to criticality evaluations of spent fuel storage containers. This is required to ensure compliance with 10 CFR 72.236.

CHAPTER 9 ACCEPTANCE CRITERIA & MAINTENANCE PROGRAM

9.1 Explain why different ASME Code addendum editions are specified in individual SAR chapters for the fabrication and visual inspection of the canister and fuel basket welds.

Chapter 9 of the SAR considers the 1997 addenda while other SAR chapters, such as Chapters 2 and 3, reference the 1995 addenda. Consistent design criteria are required to ensure compliance with 10 CFR 72.236.

CHAPTER 10 RADIATION PROTECTION

Section 10.3.1 Estimated Collective Dose for Loading a Single Universal Storage System

10.1 Explain how the occupational exposures for the 100-ton transfer cask were determined.

Based on the shielding evaluation, it appears the occupational exposures are under-estimated. Additionally, if the higher ^{59}Co impurity level of 1.2 g/kg is used to determine the source term, the occupation doses from working around the 100-ton transfer cask will be significantly higher. This information is necessary to determine if the occupational dose evaluation is adequate and to ensure compliance with 10 CFR 72.236.

CHAPTER 11 ACCIDENT ANALYSIS

Section 11.2.8 Earthquake Event

11.1 Considering the minimum friction coefficients of 0.35 and 0.40, recalculate safety factors for cask sliding by comparing the maximum earthquake acceleration levels, for which the cask will not slide, to the two design earthquake levels of 0.26 g and 0.29 g, respectively.

The safety factor should be demonstrated by considering the maximum earthquake level for which the cask will not slide, rather than the minimum friction coefficient afforded between the cask and the pad. This needs to be considered to ensure compliance with 10 CFR 72.236.

Section 11.2.16 100-Ton Transfer Cask Side Drop

11.2 Provide a SAR discussion on the operational controls needed to ensure that the loaded 100-ton transfer cask will not be subject to conditions susceptible to cask end-drop and tip-over accidents.

During the up- and down-ending operations, the 100-ton transfer cask may also be susceptible to cask end-drop and tip-over accidents. The SAR should either provide results of analyses to demonstrate that the cask will continue to serve its function after the accident or establish criteria for controlling transfer cask operations to preclude those accident scenarios. Comprehensive evaluation of the transfer cask structural performance is required to ensure compliance with 10 CFR 72.236.

11.3 Reevaluate the side drop of the100-ton transfer cask for both PWR and BWR configurations by noting that: (1) a much higher filter cutoff frequency than 50 Hz should be considered in calculating applicable cask impact responses for the support disks evaluation, and (2) a sufficient number of locations on the transfer cask should be considered for determining the governing (individual or envelope) impact response spectra for the support disks.

Comprehensive side drop analysis of the transfer cask is required to ensure compliance with 10 CFR 72.236. Additionally, (1) in accordance with the modal properties on SAR page 11.2.16-6, dynamic load factors (DLFs) may markedly be affected by modal frequencies up to about 371 Hz and 211 Hz for the PWR and BWR support disks, respectively; and (2) impact responses at different cask locations are expected to be non-uniform, because of the spatial dependence of mode shape amplitudes.

11.4 With respect to the desired roll-off or attenuation rate of the LS-POST Butterworth filter, revise, as appropriate, the SAR discussion on the criteria for selecting the low-pass cut-off frequency in processing cask impact response data.

The staff notes that the order of the Butterworth filter must be selected for an acceptable attenuation rate by considering frequencies of all dominant modes of vibration of the support disk. For instance, considering the PWR support disk with the highest dominant frequency of 371 Hz, the cut-off frequency for processing the cask impact response may have to be much higher than 371 Hz, depending on filter properties. Appropriate support disk performance features must be considered in processing analytical data to ensure compliance with 10 CFR 72.236.

11.5 Describe the radiological impact from this event.

The radiological impact from this event is not included in the SAR. This information is necessary to adequately evaluate the impact from this event and to ensure compliance with 10 CFR 72.236.

CHAPTER 12 OPERATING CONTROLS AND LIMITS

12.1 Add appropriate controls to ensure that only fuel assemblies (no non-fuel hardware components) can be loaded in a canister being used with the 100-ton transfer cask. Also justify the change to the definition in Technical Specification A 1.1 for STANDARD FUEL to include certain non-fuel components.

Changing the definition of STANDARD FUEL to include non-fuel components may imply that these components are appropriate for use with both transfer casks, unless a specific control is in place elsewhere in the Technical Specifications to ensure that even those components listed in the STANDARD FUEL definition are not used with the 100-ton transfer cask. This is required to ensure compliance with 10 CFR 72.236.

12.2 Add a Limiting Condition for Operation (LCO) for dissolved boron concentration consistent with that provided in NUREG-1745, “Standard Format and Content for Technical Specifications for 10 CFR Part 72 Cask Certificates of Compliance.” Additionally, include an LCO for canister/cask water temperature, consistent with the listed NUREG.

As requested, control of the boron concentration is located in the administrative programs section (A 5.4). However, when credit is taken for soluble boron in the criticality calculations, it is required to include an LCO for dissolved boron concentration and an LCO for water temperature. This is required to ensure compliance with 10 CFR 72.236.

12.3 Explain the change to include the last sentence under “Applicable Safety Analysis” on page 12C3-20, with respect to when loading operations are allowed to resume following initiation of cooling air flow to the transfer cask.

This sentence appears to conflict with the Required Action and Completion time, A2.2, of LCO A 3.1.4. This is required to ensure compliance with 10 CFR 72.236.