January 22, 2001

Mr. Thomas C. Thompson, Director
Licensing & Competitive Assessment
NAC International, Inc.
655 Engineering Drive
Norcross, GA 30092

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE UMS UNIVERSAL STORAGE SYSTEM (TAC NO. L23217), AMENDMENT #2

Dear Mr. Thompson:

By application dated October 17, 2000, as supplemented, 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 allow uncanistered damaged fuel rods and to incorporate non-standard fuel components as approved contents. 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 March 26, 2001, to support the schedule provided to you on December 13, 2000. 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.

If you have any comments or questions concerning this request, you may contact me at (301) 415-3711. Please refer to Docket No. 72-1015 and TAC No. L23217 in future correspondence related to this request.

Sincerely,
/RA/ original signed by /s/
Rebecca L. Karas, Project Engineer
Spent Fuel Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 72-1015

Enclosure: RAI on NAC-UMS Storage System

cc: Mr. George Zinke
Maine Yankee Atomic Power Company

If you have any comments or questions concerning this request, you may contact me at (301) 415-3711. Please refer to Docket No. 72-1015 and TAC No. L23217 in future correspondence related to this request.

Sincerely,
/RA/ original signed by /s/
Rebecca L. Karas, Project Engineer
Spent Fuel Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No. 72-1015

Enclosure: RAI on NAC-UMS Storage System

cc: Mr. George Zinke
Maine Yankee Atomic Power Company

Distribution:
Docket NRC File Center PUBLIC NMSS r/f SFPO r/f WHodges
EWBrach SO'Connor SShankman NJensen

OFC	SFPO	E	SFPO		SFPO		SFPO		SFPO	
NAME	RLKaras		VTharpe		TMcGinty		MBurgess		RParkhill	
DATE	1/12/01		1/12/01		1/12/01		1/16/01		1/12/01	
OFC	SFPO		SFPO		SFPO		SFPO		SFPO	
NAME	EKeegan		SWhaley		DTang		CBrown		EEaston	
DATE	1/12/01		1/12/01		1/16/01		1/12/01		1/16 /01	
OFC	**OGC**		**SFPO**							
NAME	**STreby**		**SBaggett**							
DATE	**1/21/01**		**1/22/01**							

C = Cover E = Cover & Enclosure N = No copy OFFICIAL RECORD COPY G:\NAC\UMSS\Maine Yankee\Amendment 2\RAI\raicvr2.wpd

NAC UMS UNIVERSAL STORAGE SYSTEM
DOCKET NO. 72-1015
TAC NO. L23217

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 first round 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

Terminology

1.1 Clarify the description of Uncanned Damaged Fuel on page 1-5 to state that only Maine Yankee fuel, as described in the proposed definition, is allowed.

The analyses provided in the SAR are only for Maine Yankee 14x14 fuel assemblies with up to 24 damaged rods per canister. While it may be inferred from the current definition that this is only Maine Yankee fuel, it is not specifically stated. This is required to ensure compliance with 10 CFR 72.236.

CHAPTER 3 STRUCTURAL

Section 3.4.1.1 Component Operating Environment

3.1 Demonstrate that the control elements, non-fuel items, including startup sources, instruments or thimble plugs to be inserted into the fuel assembly are non-reactive with the fuel and internal fuel components when exposed to the various environments of a spent fuel cask. The evaluation should be comprehensive and specifically consider the effects of oxides on the fuel, elevated temperatures, and high radiation (including neutrons).

In accordance with 10 CFR 72.122 (h)(1), which is applicable to an applicant for a general or site-specific license, the spent fuel cladding must be protected from degradation that leads to gross ruptures. The concern is whether any degradation of control elements, non-fuel items, including startup sources, or instruments or plug thimbles could affect the integrity of the cladding.

CHAPTER 4 THERMAL

Section 4.5.1.1.12 Fuel Debris from the Failure of 24 Fuel Rods not in a Maine Yankee Fuel Can

4.1 Indicate the heat load used in the Maximum Temperature analysis. Page 4.5-10 references an assembly heat load used in the analysis of 0.113 kW, versus the previous heat load of 0.131 kW. If the heat load used was 0.113 kW, justify the reduction in the assumed heat load per assembly.

In accordance with 10 CFR 72.236(a) and (f), specifications must be provided for the spent fuel to be stored in the spent fuel storage cask, including minimum acceptable cooling time of the spent fuel prior to storage in the spent fuel storage cask, and maximum heat that is designed to be dissipated. In addition, the spent fuel storage cask must be designed to provide adequate heat removal capacity without active cooling systems. The concern is whether the correct values were used in the analysis that demonstrates that the design temperatures of the cask are not exceeded.

4.2 Demonstrate that an applicant for a general or site-specific license will be able to meet the requirements of 10 CFR 72.122(h)(1) and 10 CFR 72.122(l).

The regulations require that the fuel assemblies be retrievable. Justification must be provided to ensure that the uncanned damaged fuel remains structurally intact, is not grossly ruptured under normal and off-normal conditions, and therefore remains retrievable on an assembly basis.

Section 4.5.1.1.13 Standard Fuel Assemblies with Inserted Startup Sources and Other Non-Fuel Items

4.3 Indicate the heat load and thermal properties for each of the non-fuel items. Describe how the heat load will be calculated for assemblies containing non-fuel items, and how this heat load is accounted for when determining maximum assembly loading and maximum vacuum-drying time.

In accordance with 10 CFR 72.236(a) and (f), specifications must be provided for the spent fuel to be stored in the spent fuel storage cask, including minimum acceptable cooling time of the spent fuel prior to storage in the spent fuel storage cask, and maximum heat that is designed to be dissipated. In addition, the spent fuel storage cask must be designed to provide adequate heat removal capacity without active cooling systems. The concern is that sufficient information is provided to demonstrate that the design temperatures of the cask are not exceeded.

4.4 Provide supporting information regarding the request to include “a 24-inch segment of an in-core instrumentation (ICI) thimble” within a standard assembly. The application cover letter mentions this item, but there is no thermal analysis of the change.

In accordance with 10 CFR 72.236(a) and (f), specifications must be provided for the spent fuel to be stored in the spent fuel storage cask, including minimum acceptable cooling time of the spent fuel prior to storage in the spent fuel storage cask, and maximum heat designed to be dissipated. In addition, the spent fuel storage cask must

be designed to provide adequate heat removal capacity without active cooling systems. The concern is that sufficient information is provided to demonstrate that the design temperatures of the cask are not exceeded.

CHAPTER 5 SHIELDING

Section 5.6.1.4.6 Additional Non-Fuel and Neutron Source Material

5.1 a. Provide an evaluation as to how the additional neutron source material, In-Core Instrumentation (ICI) thimble segment and Control Element Assembly (CEA) fingertips identified in SAR Section 5.6.1.4.6 meets the definition of "Spent Nuclear Fuel" given in 10 CFR 72.3.

b. Provide a description of the following components, include source strengths and a description of its use as a component at a reactor operating facility:
1. Boronometer
2. ICI string segment
3. Sb-Be sources
4. Pu-Be sources

Components which might be stored with the spent fuel must be described to allow staff to evaluate the impact to the dose rates in accordance with 10 CFR 72.236(d). Additionally, the components to be placed in a cask with spent fuel must meet the definition of "Spent Nuclear Fuel" specified in 10 CFR 72.3.

CHAPTER 6 CRITICALITY

Section 6.5.2 SCALE 4.4 Validation in Accordance with NUREG/CR-6361

6.1 Provide a justification for including additional benchmarks in the validation for SCALE 4.4 which were not used in the validation for SCALE 4.3.

The proposed SAR change states that additional "benchmarks with zircaloy clad fuel are also considered" without any further justification. Any new, additional benchmarks to be used in the validation for SCALE 4.4 must have a valid justification for their inclusion. The only difference between this amendment and the previous version of the SAR is allowing damaged fuel to be uncanned. It appears that if any new benchmarks are required for this amendment that they would deal only with the additional fuel configurations and fuel-water mixtures considered in the flux traps. To correctly establish the bias and uncertainty, benchmarks are to be characteristic of the package design. Not all benchmarks with zircaloy clad fuel are necessarily applicable to the specific package in question. Also, note that it appears that some of the new experiments are not zircaloy clad - experiments 69 and 70, Table 6.5.2-1 are listed as stainless steel clad. This is required to ensure compliance with 10 CFR 72.236(c).

6.2 Describe in greater detail how the Upper Subcritical Limit (USL) was determined for the Pressurized Water Reactor (PWR) fuel. Also, describe the relevance of a new USL for Boiling Water Reactor (BWR) fuel since this amendment is only for 14x14 PWR fuel.

The validation does not list the bias and uncertainty associated with the USL determination, nor does it appear to include any uncertainty due to modeling approximations. Note that only biases that increase keff should be applied. This is required to ensure compliance with 10 CFR 72.236(c).

6.3 Update Table 6.5.2-1 to include the titles of the critical experiments as was done in Table 6.5.1-1.

This is needed to identify the critical experiments so that their applicability to the amendment can be determined (specifically fuel-water mixtures in the flux traps) and to ensure compliance with 10 CFR 72.124.

6.4 Provide a table of correlation coefficients in Section 6.5 for the SCALE 4.4 Validation, similar to Table 6.5.1-2 for the SCALE 4.3 validation.

The correlation coefficients are not given for the SCALE 4.4 validation. This is required to ensure compliance with 10 CFR 72.124.

6.5 Change B-10 loading in Table 6.5.2-2 from 0.25 to 0.025 for the UMS design basis fuel.

The correct value is 0.025 g/cm^2.

Section 6.6.1.3.3 Fuel Debris from 24 Fuel Rods not in Maine Yankee Fuel Cans

6.6 Justify not considering dispersal of damaged fuel, either as a fuel-water mixture or as loose fuel pellets, in the active fuel region of the fuel basket in Section 6.6.1.3.3.

The calculational models are not adequately justified as being the most bounding scenario for uncanned damage fuel. Since the fuel is not contained in a can which confines it to a specific basket cell, the fuel could be located anywhere in the canister. Also, note that individual fuel pellets dispersed throughout the canister or broken rods located beside other rods may be more reactive than what has been considered in the amendment. This is required to ensure compliance with 10 CFR 72.236(c).

6.7 Justify the use of a 20%-80% fuel-water mixture versus some other value.

The use of this value is not justified as bounding the most reactive possible scenario. This is required to ensure compliance with 10 CFR 72.236(c).

6.8 Provide KENO input files for the most limiting dispersed pellet case and also the dispersed homogenous mixture of fuel and moderator case discussed.

The input files were not provided. This is required to ensure compliance with 10 CFR 72.236(c).

6.9 Describe how the calculations in Section 6.6.1.3.3 were performed, and any associated uncertainties, for the cases where fuel is homogenously mixed with the moderator and where fuel pellets are dispersed in various areas of the canister.

While different fuel elements can be modeled in the same cask by using Dancoff correction factors, SCALE (i.e., NITAWL) does not correctly handle a "double heterogeneity" scenario with fuel in different configurations (intact in the fuel rod and fuel dispersed in the water in the same model). This is required to ensure compliance with 10 CFR 72.236(c).

6.10 Provide color figures of the following calculation models that clearly identify the different model regions and the location of the view. Also provide axial (side) views where appropriate;

a) with pellets in flux traps, guide tubes, and hardware zones (figures 6.6.1-4 through 6.6.1-8) and
b) dispersed fuel (figures 6.6.1-9 through 6.6.1-13).

The figures provided are difficult to assess, do not identify the different material regions and locations within the basket, and do not include dimensions. This is required to ensure compliance with 10 CFR 72.236(c).

CHAPTER 11 ACCIDENTS

Section 11.2.15.1.5 Buckling Evaluation for Maine Yankee High Burnup Fuel Rods

11.1 Verify the lowest axial vibration frequency of 218.9 Hz and the corresponding dynamic load factor (DLF) of 0.244 for the high burnup fuel rod.

The reported axial vibration frequency and DLF appear to be associated with those calculated previously for the fuel rod with a nominal outer diameter of 0.440 inches. In the revised calculation, at a reduced clad outer diameter of 0.434 inches, the SAR reports a modified lowest lateral vibration frequency of 25.9 Hz, which is different from the 26.3 Hz based on the nominal clad outer diameter of 0.440 inches. Therefore, the calculated axial vibration frequency and DLF are also expected to be different from those reported values. This information is needed to assure compliance with 10 CFR 72.236(m).

Section 11.2.15.1.6 Buckling Evaluation for High Burnup Fuel with Mechanical Damage

11.2 Considering appropriate cross sectional properties of the high burnup fuel rod, revise the fuel rod structural performance evaluation.

The calculation of flexural rigidity, EI, was based on the nominal clad outer diameter of 0.440 inches. A reduced clad thickness should be considered for fuel rod stress evaluation for the side drop loading condition. This information is needed to assure compliance with 10 CFR 72.236(m).

CHAPTER 12 Operating Controls and Limits

Appendix 12A Technical Specifications for the NAC-UMS System

Section 12A 1.1 Definitions

12.1 Describe in detail the methods used for Maine Yankee uncanned damaged fuel to determine the number of failed fuel pins in each assembly, and justify how those methods adequately ensure that the number of failed fuel pins for that assembly is properly determined. Additionally, provide appropriate controls, such as the controls described in 12A 5.6, "Verification of Oxide Layer Thickness on High Burnup Fuel," to ensure that those methods will be used to determine the number of pins that are damaged for all damaged assemblies to be stored uncanned.

With canned damaged fuel, 100% of the rods are assumed to be damaged, thus many different methods (reactor records, sipping, visual, etc.) may be used to determine if one or more pins in an assembly are damaged. In that case, the number of pins that are actually damaged in the assembly is not critical to the safety analysis. ISG-1 describes the minimum acceptable methods for demonstration of fuel condition. This guidance was developed under the assumption that damaged fuel would be canned. However, under this proposed amendment, the maximum number of pins that could be damaged in an assembly (and therefore the canister) must be known. The structural, thermal and criticality analyses all assume a maximum of 24 uncanned damaged pins are loaded into a canister. For this amendment, the determination of the fuel condition must be on a pin basis, and not an assembly basis, as assumed in ISG-1. The applicant must demonstrate that the methods for determining the number of pins that are damaged are reliable and provide reasonable assurance that the maximum number of uncanned damaged pins per canister bounded by analysis is not exceeded. Additionally, no controls have been presented to ensure that specific method(s) will be used to determine the number of damaged fuel pins. Similar controls do exist for the verification of oxide layer thickness (Section 12A 5.6). This information is needed to ensure compliance with 10 CFR 72.236.

Section 12A 3.1.6 Concrete Cask Heat Removal System

12.2 Explain how deletion of Required Action B.2.2 maintains adequate assurance that corrective action can be taken to restore cooling to the canister upon failure of the heat removal system, including a description of the actions that would be taken, or justify why events which could exceed the time allotted to clear the vents are not credible.

The Federal Register Notice (65 FR 62581), published on October 19, 2000, for the addition of NAC-UMS to the list of approved spent fuel storage casks included a response to comment H-3, which stated the NRC's judgement was that the use of the transfer cask to provide a means of cooling should remain an option. This information is needed to ensure compliance with 10 CFR 72.236(a).

Dual-Purpose Canister

During the course of its review, the staff identified issues that, while not directly relevant to storage, may be applicable to the intended transportation of the stored contents. These issues are not required to be addressed to obtain a 10 CFR Part 72 Certificate of Compliance.

DP4.1 Demonstrate that the uncanned damaged fuel maintains its configuration for all design basis events including accidents or, thermally analyze the reconfigured uncanned damaged fuel for its impact on seal temperature and intact cladding temperature considering normal and accident conditions, including relocation of the fuel to the center of the cask or to a position near the seals.

This information is required to assure compliance with 10 CFR 71.33(a)(5)(v) and (7) and 71.35(a). Sections 71.33(a)(5)(v) and 71.33(a)(7) require that the application provide information regarding the structural and mechanical means for the transfer and dissipation of heat and the maximum amount of decay heat. Section 71.35(a) requires demonstration that the package satisfies the standards specified in 10 CFR Part 71, Subparts E and F. The concern is that the rubblized fuel may result in temperatures exceeding design limits, when the cask is placed on its side for shipment.

DP6.1 Justify not considering dispersal of damaged fuel, either as a fuel-water mixture or as loose fuel pellets, in the active fuel region of the fuel basket during transportation.

The calculational models are not adequately justified as being the most bounding scenario for uncanned damage fuel. Since the fuel is not contained in a can which confines it to a specific basket cell, the fuel could be located anywhere in the canister. Also, note that individual fuel pellets dispersed throughout the canister or broken rods located beside other rods may be more reactive than what has been considered in the amendment. This is required to ensure compliance with 10 CFR 71.55.