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

December 21, 1999

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE UMS UNIVERSAL STORAGE SYSTEM (TAC NO. L22979)

Dear Mr. Thompson:

By application dated July 16, 1999, as supplemented on October 20 and November 16, 1999, NAC International, Inc. (NAC) requested approval of an amendment, under the provisions of 10 CFR Part 72, Subpart K, to the proposed Certificate of Compliance for the UMS Universal Storage System. 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 within 45 days of the date of this letter to support the likely completion of rulemaking by Maine Yankee's April 16, 2001, scheduled loading date. If you are unable to meet the RAI response milestone, you must notify us in writing, at least 2 weeks prior to the expected response date, of your new submittal date and the reasons for the delay. We will then assess the impact of the new submittal date and publish a revised schedule.

If you have any comments or questions concerning this request, you may contact me at (301) 415-8580. Please refer to Docket No. 72-1015 and TAC No. L22979 in future correspondence related to this request.

Sincerely,

ORIGINAL SIGNED BY /s/
Timothy J. McGinty, Project Manager
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. Len Tremblay
Yankee Atomic Electric Company

Mr. George Zinke
Maine Yankee Atomic Power Company

Mr. Scott Bauer
Arizona Public Service Company

Mr. Paul Bemis
Stone and Webster Eng. & Construction

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NAC UMS UNIVERSAL STORAGE SYSTEM
DOCKET NO. 72-1015
TAC NO. L22979

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 proposed 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.

ENCLOSURE

CHAPTER 1 GENERAL DESCRIPTION

Terminology

The amendment is requesting the storage of many different fuel configurations. Responses to the following questions will provide necessary clarity to the SAR. For consistency, modify the terminology in Chapters 1.0, 2.0, 5.0, 6.0, and other applicable sections (e.g., the definitions in Chapter 12, etc.) which use this terminology.

1-1 Modify definitions No. 5 and 6 of "intact fuel assembly" to indicate that these types of fuel assemblies will be placed inside a Maine Yankee fuel can since they contain damaged fuel.

Interim Staff Guidance (ISG) No. 1 defines damaged fuel and specifies that it should be canned. It is unclear whether intact fuel assemblies containing damaged fuel will be placed directly in the transportable storage canister (TSC), without being placed in a Maine Yankee fuel can.

1-2 Add definitions for intact fuel rod and damaged fuel.

It is unclear whether the application complies with the definition of damaged fuel as described in ISG-1, "Damaged Fuel".

1-3 Redefine fuel debris to include it as a classification of damaged fuel.

The definition of Fuel Debris includes an individual fuel rod which may not have cladding defects. Otherwise, the Fuel Debris definition falls into the category of damaged fuel. All Fuel Debris should be classified as Damaged Fuel, and Damaged Fuel should be canned in accordance with ISG-1.

1-4 Modify the definition of consolidated fuel to specify whether this type of fuel will contain damaged fuel.

It is unclear whether Consolidated Fuel contains damaged fuel rods, and it should be characterized with respect to ISG-1 and the necessity for canning.

1-5 Modify the definition of Maine Yankee Fuel Can so it does not imply that the Maine Yankee Fuel Can functions as a confinement boundary.

Section 72.11 requires that the SAR contain complete and accurate information. The words "to provide confinement" imply the fuel can may be intended to serve as a confinement boundary. It is unclear whether this is the purpose of the fuel can.

1-6 The meaning of the definitions for "skeleton damage" and "handled by normal means" is not clear and is not consistent with the guidance in ISG-1.

Section 72.11 requires that the SAR contain complete and accurate information. Without clear criteria for establishing "skeleton damage" and "handled by normal means," the inclusion of such criteria in the definition of an intact fuel assembly is meaningless and the connection with the definition of damaged fuel assembly is arbitrary. It is also unclear how fuel assemblies with skeleton damage can be handled by normal means.

Section 1.8.2 Site-Specific Spent Fuel License Drawings

1-7 Submit license drawings for the consolidated fuel lattice referenced in SAR Section 2.1.3.1.3

Drawings should be submitted for configuration control to ensure that a structural restraint is provided to maintain the configuration of consolidated fuel in its analyzed envelope. Information relative to materials of construction, general arrangement, dimensions of principal structures, systems, and components important to safety, in sufficient detail to support a safety finding, should be included in the SAR per 10 CFR 72.24(c)(3).

1-8 Clarify which NAC-UMS canister assembly components are used in conjunction with the Maine Yankee fuel can.

The tabulation presented in Drawing 790-501 does not include the Maine Yankee fuel can. A site-specific tabulation would provide the requested clarification.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

CHAPTER 2 PRINCIPAL DESIGN CRITERIA

2-1 Specify the minimum enrichment for the Maine Yankee spent fuel and how enrichment was used to calculate the decay heat loading for Maine Yankee.

The last sentence in SAR Section 2.1.1 states that fuel that does not meet the enrichment and burnup limits of Tables 2.1.1-2 and -3 must be separately evaluated to establish loading limits. It is apparent that the Maine Yankee spent fuel burnup exceeds the 45 GWD/MTU limit, but it is not apparent whether the enrichment value utilized in the decay heat loading is bounding. Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

2-2 Add “Fuel Debris” to the “Site Specific Spent Fuel Configuration” entries in SAR Table 2.1.3.1-1.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

2-3 Provide a safety analysis of the two lattices, CF1 and CA3, in the current Maine Yankee fuel inventory for damaged fuel rods.

SAR Page 2.1.3-4 states that the two lattices for damaged fuel rods could be loaded in the Maine Yankee fuel can. The safety analysis of the fuel lattices, however, is not presented in the SAR to ensure that the lattices are capable of maintaining the damaged fuel rods in their analyzed configuration under the design basis loading conditions. Complete information, including the deceleration g-loads associated with the cask end drop accident during the operation of lifting the Vertical Concrete Cask should be provided in the SAR, per 10 CFR 72.24(d), for evaluating the cask structural performance.

2-4 Clarify the contents and configurations of individual intact or damaged fuel rods in a Maine Yankee fuel can.

The SAR states that a Maine Yankee fuel can may contain individual intact or damaged fuel rods and that these fuel rods must be placed in a rod-type structure, which may be a guide tube. However, this section of the SAR fails to adequately specify (i) how many individual fuel rods may be placed in guide tubes, (ii) the dimensions and compositions of the non-guide-tube rod-type structures that house individual fuel rods, and (iii) the allowed loadings of individual fuel rods in the non-guide-tube rod-type structures. In particular, additional information is needed on the dimensions, compositions, and allowed loadings of the rod-type structures in the CF1 and CA3 lattices. Clarification is also needed on whether the CF1 and CA3 lattices are the only rod-type structures, other than guide tubes, that will contain individual intact or damaged fuel rods.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

2-5 Clarify the contents and configurations of fuel debris in a Maine Yankee fuel can.

The SAR does not limit the quantities or configurations of fuel debris that may be loaded into a Maine Yankee fuel can. Any structures that limit the configuration of fuel debris in a fuel can should be described in enough detail to permit a criticality analysis.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

2-6 Provide a safety analysis of the two consolidated fuel lattices to be used to house the fuel rods taken from three fuel assemblies as discussed in SAR Section 2.1.3.1.3.

SAR Page 2.1.3-4 states that two lattices are used for this purpose. The safety analysis of the fuel lattices, however, is not presented in the SAR to ensure that the lattices are capable of maintaining the damaged fuel rods in their analyzed configuration under the design basis loading conditions. Complete information, including the deceleration g-loads associated with the cask end drop accident during the operation of lifting the Vertical Concrete Cask should be provided in the SAR, per 10 CFR 72.24(d), for evaluating the cask structural performance.

2-7 With respect to Note 3 for SAR Table 2.1.3.1-1, submit license drawings and a safety analysis for the stainless steel fuel spacer used to load the design basis standard 14x14 fuel assemblies plus the Control Element Assemblies in a Class 2 pressurized water reactor (PWR) cask configuration.

The structural integrity of the stainless steel spacer should be demonstrated for the design basis loading conditions, including the deceleration g-loads associated with the cask end drop accident during the operation of lifting the Vertical Concrete Cask. Per 10 CFR 72.24(d), complete information should be provided in the SAR for evaluating the cask structural performance.

2-8 With respect to Note 3 for SAR Table 2.1.3.1-1, evaluate the effects of the resulting vertical shifting of center-of-gravity locations of the TSC components on the determination of design basis decelerations for the cask.

The effects of vertical shifting of center-of–gravity locations of the TSC components should be evaluated for the corresponding change of deceleration g-forces. Per 10 CFR 72.236(m), to the extent practicable in the design of storage casks, consideration should be given to compatibility with cask operations, including removal of the stored spent fuel from a reactor site, transportation, and ultimate disposition.

CHAPTER 4 THERMAL

4-1 Justify the assumption that only 25% of the fuel rods in a damaged fuel assembly lose configuration and fall to the bottom of the fuel can, or provide a revised thermal analysis which considers 100% rod failure and reconfiguration.

As defined in the application, a damaged fuel assembly is one with cladding defects greater than hairline cracks & pinhole leaks, and/or damage to the skeleton, and may or may not be handled by normal means. The ruggedness of this damaged fuel assembly under normal, off-normal, or accident conditions is not quantified. Therefore, assuming a 25% failure of rods appears to be an unjustified assumption and more rods could possibly fail since there is no structural analysis of damaged fuel to substantiate this assumption. Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

4-2 Provide a Table(s) showing cooling time limits as functions of burnup and initial enrichment.

The last sentence of Section 4.5.1.2 states that the maximum decay heat is combined with the dose rate limits of Chapter 5 to establish cool time limits as a function of burnup and initial enrichment. However, this information is not provided for the Maine Yankee spent fuel but was done for the design basis fuel in Table 2.1.1-3. Also, it would be helpful to identify for each cooling time entry whether it was determined from a thermal or shielding basis. Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

4-3 Provide a copy of the reference for the statement in Section 4.5.1.2.1 that "Combustion Engineering places a maximum oxide layer thickness limit of 120 microns on fuel for incore operations."

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

4-4 List Reference 36, cited in Section 4.5.2.2.1, in Section 4.6 "References" and submit it for staff's review.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

4-5 In the second paragraph of Section 4.5.1.2.2.1, correct the reference from Table 4.5.1-3 to Table 4.5.1.2-3 (editorial).

CHAPTER 5 SHIELDING

5-1 Describe the fuel assemblies with variable radial enrichment and axial blankets. Describe how enrichment varies, what axial blankets are, and what axial blankets are made of.

SAR Section 2.1.3.1.5, "Maine Yankee Spent Fuel with Unique Design," describes fuel assemblies with variable radial enrichments and axial blankets. SAR Section 5.6.1 states that these components do not result in additional sources without providing any supporting information. This information is necessary to ensure that the cask design establishes adequate criteria for radiation protection in accordance with 10 CFR 72.126.

5-2 Provide a source term evaluation using site-specific information based on the spent fuel at Maine Yankee. Additionally, provide the basis as to why 3.7 wt. % is the minimum initial enrichment, since a lower initial enrichment will result in a higher neutron source term and, therefore, a higher overall source term.

SAR Section 5.6.1.1, "Fuel Source Term Description," states the bounding fuel has been determined to be a CE 14 x 14 assembly with a nominal burnup of 40,000 MWd/MTU and an initial enrichment of 3.7 wt. % U-235 and is based on data provided in Table 2.1.1-1. This table provided generic data for the various types of PWR fuel. The site-specific fuel evaluation should be based upon site-specific parameters. This information is necessary to ensure that the cask design establishes adequate criteria for radiation protection in accordance with 10 CFR 72.126.

5-3 Explain what is meant by the statement in Section 5.6.1.4.1, "Only the storage cask dose rate limit is adjusted to account for Control Element Assemblies (CEAs) inserted in fuel assemblies."

Technical Specification 3.2.2 limits the average surface dose rate on the side of the concrete cask to less than or equal to 50 mrem/hr. The additional CEA source results in localized peak near the bottom of the cask. This information is necessary to ensure that the cask design establishes adequate criteria for radiation protection in accordance with 10 CFR 72.126.

CHAPTER 6 CRITICALITY

6-1 Justify the SAR Section 6.6.1.3 assumption that only 25% of the fuel rods in a damaged Maine Yankee fuel assembly are damaged.

The justification should include information on how many of the fuel rods in each damaged assembly are known to be damaged or intact, respectively. Axial shifting or relocation of damaged fuel rods (and material from damaged rods) should be considered in showing that the allowed contents are within the analyzed safety basis with regard to axial coverage of fissile material by the Boral panels.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

6-2 Justify the statement (Section 6.6.1.3.1) that the accident scenarios described in Sections 11.1 and 11.2 will not result in release of fuel material from damaged fuel rods.

The requested justification should include information on the durability of damaged fuel rods and damaged fuel assemblies. Consideration should be given to individual damaged fuel rods in tube structures as well as damaged rods within the fuel lattice of a damaged Maine Yankee fuel assembly.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

6-3 Clarify the SAR Section 6.6.1.3.2 reference to the "screened canister." The staff assumes that this refers to the fuel can, not the canister. The SAR should be corrected accordingly.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

6-4 Clarify how axial poison coverage is evaluated for fuel debris (and fuel material from damaged fuel rods) in the Maine Yankee fuel can.

The SAR provides no information on axial dimensions and structures in the fuel can that contain and axially locate fuel debris (or damaged fuel rods) in relation to the fuel basket poisons. Any analysis assumptions regarding the potential for damaged fuel rods, or fuel material escaping from damaged fuel rods, to relocate to positions below (or above) the ends of the Boral panels should be stated and justified. The applicant should clearly show that criticality analysis models represent the most reactive credible arrangements of fissile materials and poison panels within the basket.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

CHAPTER 8 OPERATING PROCEDURES

8-1 Revise the preferential loading of Maine Yankee fuel provisions of SAR Section 8.1.4.1 to reflect loading tables which provide limits for decay heat on a per assembly basis as a part of the Technical Specifications (see related RAI 12-3). This information is requested in accordance with the provisions of 10 CFR 72.24(d).

CHAPTER 11 ACCIDENTS

11-1 Submit the LS-DYNA analyses performed to account for the three sets of concrete material properties on SAR Page 11.2.15-3, and discuss how the results were evaluated to arrive at a single set of maximum cask decelerations on SAR Page 11.2.15-4 for the PWR Class 1 and Class 2 cask configurations.

The SAR is not clear as to whether a sensitivity analysis was performed by considering three sets of soil properties for determining maximum cask decelerations. Per 10 CFR 72.24(d), complete information should be provided in the SAR for evaluating the cask structural performance.

11-2 Considering sectional (primary membrane and membrane-plus-bending), in lieu of nodal, stresses in the support disk ligaments, reevaluate normalized stress ratios in SAR Table 11.2.15.1.2-1 for the Maine Yankee consolidated fuel.

The PWR support disk ligaments are evaluated with sectional stresses for the design basis spent fuel assemblies. When normalized stress ratios are considered in comparing relative structural performance, a consistent evaluation basis should be maintained throughout the SAR, including that for the Maine Yankee consolidated fuel. Complete and consistent information should be provided in the SAR, per 10 CFR 72.24(d), for evaluating the cask structural performance.

11-3 Clarify the SAR statement on Page 11.2.15-5, "This study shows that a consolidated fuel lattice can be located in any position of the PWR basket, based on structural loading considerations."

Under a side drop, stresses in the support disk ligaments appear to be governed predominantly by the locally applied equivalent inertia load of a spent fuel assembly. As a result, because of the relatively large weight of the consolidated fuel lattice, some of the normalized stress ratios for the 12 fuel tube locations are expected to exceed 1.00, the stress ratio for the Base Case. Complete and consistent information should be provided in the SAR, per 10 CFR 72.24(d), for evaluating the cask structural performance.

11-4 Provide a stress summary table for a representative corner-location case to demonstrate adequate stress margins for the corner-location preferential loading of the consolidated fuel.

An evaluation of normalized stress ratios, in SAR Table 11.2.15.1.2-1, alone may not be sufficient to substantiate the SAR conclusion, and explicit stress margins should be considered for the evaluation. Complete and consistent information should be provided in the SAR, per 10 CFR 72.24(d), for evaluating the cask structural performance.

11-5 Justify the SAR Section 11.2.15.1.4 use of a friction coefficient of 0.5, between the broom-finish concrete surface and the cask bottom plate, for evaluating cask seismic stability against tipover and sliding.

Sufficient basis should be provided for selecting the friction coefficient for cask seismic stability analysis. Section 72.24(d) requires complete information be provided in the SAR for evaluating the cask structural performance. If a cask sliding evaluation program is to be used to demonstrate the design friction coefficient by testing under the administrative control, the test standards and acceptance criteria should be considered part of the evaluation program.

CHAPTER 12 TECHNICAL SPECIFICATIONS

12-1 There are two different definitions of "intact fuel assembly" and "damaged fuel assembly" in SAR Appendix 12A, Section A 1.1. Correct the inconsistency.

Section 72.11 requires that the SAR contain complete and accurate information.

12-2 Append post-irradiation cooling time and average burnup per assembly information for fuels having burnups greater than 45,000 MWd/MTU to Table 12B2-4, as appropriate.

Section 72.11 requires that the SAR contain complete and accurate information. The post-irradiation cooling times and average burnups per assembly can be found in Table 12B2-4, as referenced in Table 12B2-1. However, Table 12B2-4 does not contain the cooling time and average burnup per assembly for fuels having burnups greater than 45,000 MWd/MTU. This information is requested in accordance with the provisions of 10 CFR 72.24(d).

12-3 Include Tables 4.5.1.2-3, -4, and -5 in SAR Appendix 12B, as appropriate.

These tables define the maximum heat load per canister and the canister heat load distribution limits for the Maine Yankee site specific fuel. Without these tables included in the technical specifications it isn't clear how these heat load limitations would be maintained. See related RAI 12-2. This information is requested in accordance with the provisions of 10 CFR 72.24(d).

12-4 Change "burnup above 45,000 MWd/MTU" to "burnup from 45,000 to 50,000 MWd/MTU".

Throughout this chapter it would appear that any burnup above 45,000 is permissible, when in fact, an upper limit of 50,000 MWd/MTU is apparently the limit being requested. This information is requested in accordance with the provisions of 10 CFR 72.24(c)(3).

12-5 Add "Fuel Debris" to the "Site Specific Spent Fuel Configuration" entries in SAR Table 12B2-6.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

12-6 With respect to SAR Table 12B2-7:

(a) Explain the basis for limiting the acceptance of Maine Yankee fuel assemblies with axial end blankets to those having variable enrichment between the end blankets and a nominal enrichment in the end blanket of 2.6 wt% ^{235}U. Clarify whether the intent is to exclude assemblies that have (i) uniform enrichment between the end blankets or (ii) end blankets with a nominal enrichment that differs from 2.6 wt% ^{235}U.

(b) For assemblies with axial end blankets, specify the limiting annular blanket dimensions that affect the criticality analysis. Such dimensions should include the annulus radius and axial length of the blankets.

Per 10 CFR 72.24(c), the application must provide information relative to materials of construction, general arrangement, and dimensions of principal structures, systems, and components important to safety in sufficient detail to support a safety finding.

12-7 Clarify, in Item 6 of SAR Section 12B 3.4.2, the use of "minimum thickness" for specifying the upper-layer subsoil configuration for the ISFSI pad.

On the basis of the analysis presented in SAR Section 11.2.15, it appears that the maximum, in lieu of minimum, subsoil thickness should be specified for site parameter evaluation. Complete and consistent information should be provided in the SAR, per 10 CFR 72.24(d), for evaluating the cask structural performance.

High Burnup Fuel Issues

Section 72.122(h)(1) requires that spent fuel cladding must be protected from degradation that leads to gross ruptures, or the fuel must otherwise be confined so that degradation of the cladding will not impose operational safety problems. Further, Section 72.122(l) requires that the storage system must be designed to allow ready retrieval of the spent fuel from the storage system for further processing or disposal.

For spent fuel having burnups less than 45,000 MWd/MTU (hereafter referred to as low burnup fuel), there is sufficient experimental data to support the long-term and short-term temperature limits that protect the fuel from gross ruptures. Thus, the staff has generally approved storage of spent fuel with burnup up to 45,000 MWd/MTU. However, there is limited data to show that the cladding of spent fuel with burnups greater than 45,000 MWd/MTU (hereafter referred to as high burnup fuel) will remain undamaged during the licensing period. Limited information suggests increased cladding oxidation, increased hoop stresses, and changes to fuel pellet integrity with increasing burnup. These burnup dependent effects could potentially lead to failure of the cladding and dispersal of the fuel during dry cask storage, transfer, and handling operations.

In accordance with ISG-11, the following RAI questions must be addressed by the applicant before high burnup fuels can be approved in the NAC-UMS Storage System.

HB-1 Estimate and justify the concentration of hydrogen absorbed by the cladding during reactor operation.

The amount of hydrogen in the Zircaloy cladding may result in changes to the mechanical properties and creep behavior of high burnup fuel. This information is needed to determine how the mechanical properties and creep behavior of fuel with burnups up to 50,000 MWd/MTU differ from the properties and behavior of fuels with burnups less than 45,000 MWd/MTU.

HB-2 Estimate the changes in the mechanical properties (i.e., tensile strength, yield strength, ductility, fracture toughness, uniform elongation, etc.) of cladding that contains hydrogen concentrations at the levels estimated in the response to the previous RAI question. In the discussion, the analysis should address the mechanical properties that are affected by each of the following:

a. the potential for dissolution of the hydrides during the short-term higher temperatures encountered during the vacuum drying and transfer operations,
b. the subsequent re-precipitation and/or re-orientation of the hydrides as the temperature decreases during storage, and
c. the effects of hydriding on the creep behavior of the cladding.

HB-3 Calculate the amount of creep strain in the cladding after 20 years of storage. The calculation should be performed using creep equations and creep phenomena that are supported by experimental data. Consideration of the increase in creep stain associated with vacuum drying and storage temperatures above 300°C should be included in the calculation.

HB-4 Describe and justify the potential failure modes and the quantities of failed rods, if any, that are likely to occur during storage if the calculated cladding creep strain exceeds the creep strain capacity of the cladding material. This assessment should include a discussion of the most likely failure modes of the cladding under internal rod pressure conditions and the relatively high temperatures experienced during vacuum drying and storage.

Dual-Purpose Canister

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

DP6-1 For the Maine Yankee contents, provide an analysis of the most reactive configurations of damaged fuel and fuel debris under normal and accident conditions of transport.

The requested analysis should consider the nonuniform preferential flooding configurations made possible by the obstruction of drain holes at the top or bottom of the Maine Yankee fuel can. The staff notes that the 250-mesh wire screen covering the drain holes can retain a significant head of water as a result of surface-tension effects. Fuel debris and rubble from damaged fuel will tend to accumulate over the drain holes in a flooded package, further obstructing the free flow of water. Therefore, uneven flooding may result when water densities and levels inside the Maine Yankee fuel can vary independently from those outside the fuel can.

In evaluating the configurations of Maine Yankee damaged fuel and fuel debris, the applicant's analysis should explicitly consider the potential axial locations of fissile materials in relation to the ends of the basket poison panels.

Section 71.55(b) requires evaluation of the most-reactive credible configurations of package contents and materials as well as moderation by water to the most reactive credible extent.