UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 24 1980

FCTC:RHO
71-6698

Nuclear Assurance Corporation
ATTN: Mr. C. R. Johnson
24 Executive Port West
Atlanta, GA 30329

Nuclear Fuel Services, Inc.
ATTN: Mr. Larry Wiedemann
P. O. Box 124
West Valley, NY 14171

Gentlemen:

This refers to your application dated May 21, 1980, as amended, requesting a modification of the Model No. NFS-4 packaging.

In connection with our review, we need the information identified in the enclosure to this letter.

Please advise us within thirty (30) days from the date of this letter when this information will be provided. The additional information requested by this letter should be submitted in the form of revised pages. If you have any questions regarding this matter, we would be pleased to meet with you and your staff.

Sincerely,

Charles E. MacDonald

Charles E. MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle and
Material Safety

Enclosure: As stated

cc w/encl:
Duke Power Company
ATTN: Mr. W. O. Parker, Jr.
422 South Church Street
Charlotte, NC 28242

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Nuclear Assurance Corporation
Model No. NFS-4 Packaging

NOV 24 1980
Encl to ltr dtd: ________

1. The application should be revised to address all the normal and accident condition load combinations specified in Regulatory Guide 7.8. It appears that several of the load combinations specified in Regulatory Guide 7.8, but not included in the Safety Analysis Report, would produce higher stresses than those calculated in the application. In making this revision, the following should be noted:

a. The stresses that result from fabrication (see B.9 in Reg. Guide 7.6) should be included in all load combinations.

b. The stresses due to differential thermal expansion (both longitudinal and radial) of the lead and the steel shells should be included in all load combinations.

2. The application does not adequately describe the numerical results of the analyses or show that the stresses are within the limits specified in Regulatory Guide 7.6. The application should be revised to provide the following information:

a. A sketch of the containment vessel showing the points at which the maximum stresses are expected to occur for various load cases and load combinations.

b. A tabulation of the stresses calculated at each of these points for each load case that was analyzed.

c. A tabulation of the combined stresses at each of these points for each load combination specified in Regulatory Guide 7.8.

d. An explicit comparison for each load combination showing that the stresses at each point meet all the applicable limits specified in Regulatory Guide 7.6.

e. An explicit comparison showing that the range of stresses at each point are within the limits specified in C.3, C.4, and C.7 of Regulatory Guide 7.6. State the stress concentration factors used for C.3 and C.7.

3. The application should be revised so that the allowable stress values for the containment vessel are based upon static material properties in accordance with C.1 of Regulatory Guide 7.6 (i.e., allowable stress values for the containment vessel should not be based upon dynamic material properties).

4. The application should be revised to explicitly show that the containment vessel shell is not subject to buckling under any of the load combinations specified in Regulatory Guide 7.8. This should include evaluation of potential buckling during the process of installing the lead shielding (e.g., See Figure 2-64 and 2-65). In making this revision, the following should be noted:

8. The application states (pgs. 2-173 and 2-182) that portions of the kinetic energy would be dissipated by crushing (i.e., compression) of steel components in the impact limiters. If a significant fraction of the total kinetic energy is considered to be dissipated by this mechanism, show that the metal components would compress axially, rather than buckle and deform at lower levels of force and energy.

9. Show that the impact forces would not cause the impact limiters to become detached from the cask before the limiters have deformed in the intended manner. Provide a free-body sketch of the impact limiter showing the magnitude, direction and location of all external forces and reactions that act on the impact limiter under corner and oblique drop orientations (pg. 2-188).

10. The discussion (pg. 2-189) of how the impact limiters were modeled for corner impact conditions is not clear. The application states that two models were used for this analysis (one for the axial direction and one for the transverse direction). Describe how the results of these two analyses were combined. Clarify the discussion of spar constraints in 2.7.1.3.1. considering that the analysis of end impact was based upon an applied force-line relationship (pg. 2-171) and the analysis of side impact represented the impact limiters with a specific force-deformation relationship (2-181). Also, the model for side impact represented only the stiffness of the outer shell.

11. Justify that the cask can adequately be represented as a beam for the purpose of side drop impact analysis. Describe how shear stresses are considered in the analysis. Justify the appropriateness of omitting the additional stiffness that would be provided by the lead and the inner shell (pg. 2-181). Provide additional sketches, narrative and free-body diagrams of the inner and outer shells to clarify the bending stress calculations on pages 2-105 and 2-185.

12. Evaluate the stresses in the bottom end plate, the closure lid, and the closure bolts and show that these components will perform adequately under the normal and accident conditions in 10 CFR Part 71. Revise the drawings to specify the torque to which the closure lid bolts are tightened. Note that there is apparently a typographical error for the material specified in Item 10 on Drawing 302-211-F1, Rev. 0, Sheet 1.

13. Evaluate the adequacy of the materials of construction of safety related components for cold temperature service conditions.

14. Evaluate whether the copper fins attached to the inside of the outer shell will perform as intended considering that the outer shell was heated to approximately 2000°F during fabrication (pg. 2-116). Describe the method used to attach the fins to the shell.

a. The assumption (pgs. 2-12 and 2-102) that the inner shell cannot buckle in axial compression unless the outer shell also buckles is not valid.

b. If stresses in the shell exceed yield values, possible inelastic buckling should be evaluated.

c. Where applicable, the combined effects of axial load, external pressure, and bending should be considered in the buckling evaluation of the shell.

d. The revised application should include the buckling load calculations and should show explicitly that the applied loads on the inner shell are less that the calculated buckling loads. The analysis should consider the ovality and straightness limits requested in the application.

e. The revised application should justify the adequacy of the calculated margins against buckling considering any uncertainties in the data or the methods used for analysis.

5. Revise the analyses of differential thermal expansion under normal and accident conditions and during cool-down after lead pour to consider differential expansion/contraction of the steel shells and the lead. Note that the assumption (pgs. 2-120) that there will be no interaction between the lead and the steel shells in the axial direction is not valid and does not consider the bond between the lead and the fins or the possible effects of friction (e.g., see pg. 2-172).

6. What were the temperatures of the inner and outer shells at the time of lead pour? How were these temperatures measured or estimated? Discuss the extent to which the stresses in the shells during lead pouring and during cool-down are sensitive to changes in these values. Justify the assumption (pg. 2-86) that the shells were essentially stress-free at the time of the lead pour. Why was the lead-pour procedure (and shell pre-heat temperature) revised after completing the lead pour for the first cask? Note that the revised application should show that the shell stresses during lead pour and cool-down are within the limits specified in Regulatory Guide 7.6 and that the inner shell was not subject to buckling during this process.

7. Provide calculations and sketches showing how the force-deformation relationship was determined for the impact limiters under end, side, and corner impact orientations. Show that the impact limiters have adequate energy absorbing capability to dissipate the kinetic energy of the cask. Describe the method that was used to determine a force-time relationship for analysis of end impact (pg. 2-171).

15. Show that the neutron shield tank and the expansion tank will maintain their integrity under the normal conditions of transport in 10 CFR 71. Consider the increased pressure that would result from the one-foot drop test. Confirm that the shield tank burst valve is rated at 100 psig (pg. 3-62).

16. Provide a drawing showing the features and dimensions of the fuel basket.

17. State the g-load factors that were used to analyze the cask for the effects of normal shock and vibration. Justify that these factors are appropriate. Note that the values listed in Table 2-20 are vibration levels of the deck of the vehicle, not the vibratory response of the cask. Your ref. 2-20 (pgs. 21, 22 and 23) lists shock response spectra for the cask.

18. The evaluation of puncture (pg. 2-196) is not clear or sufficiently detailed. The revised application should provide sketches and additional narrative describing the details of the analysis. This should include sketches showing the orientation of the cask and component relative to the pin, the assumptions used in the analysis, a discussion showing how the kinetic energy from the 40-inch drop was dissipated and an evaluation showing that the outer shell would not fail in the local vicinity of the pin. Also, evaluate the package for a 40-inch drop onto the pin with the cask oriented so that its longitudinal axis is in a vertical position (i.e., the top end of the cask contacts the pin).

19. The application does not address the adequacy of the design for the Dresden fuel assemblies discussed on pages 1-13 and 1-14.

20. Identify all changes to the previously approved design that are incorporated in Drawing No. 301-211-F1, Rev. 0, Sheets 1-5.

21. Revise Drawing No. 301-221-F1, Sheet 5 to show the tolerances on dimensions and shape of the containment vessel by using the symbols and conventions defined in ANSI Y14.5-1973, "Dimensioning and Tolerancing." The 3% ovality limit in Table 1-1 is not consistent with the 2% limit stated on the drawings.

22. Provide any record, operating experience, or other information which indicates that the shape of the inner shell of any of the existing NFS-4 packagings may have been distorted by either the fabrication process or during service.