October 28, 1993

Docket No. 50-309

Mr. Charles D. Frizzle, President
Maine Yankee Atomic Power Company
83 Edison Drive
Augusta, Maine 04336

Dear Mr. Frizzle:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION--MAINE YANKEE PROPOSED AMENDMENT TO RERACK SPENT FUEL STORAGE POOL (TAC NO. M85794)

The staff has reviewed your request to increase the capacity of the spent fuel storage pool and amend the Maine Yankee Technical Specification accordingly. Based on its review, the staff has prepared the enclosed request for additional information (RAI).

The staff is prepared to issue a Safety Evaluation (SE) in support of this amendment request, within 30 days of receiving a satisfactory response to this RAI. Complete and comprehensive responses will aid us in completing our review and preparation of an SE on this schedule.

The requirements of this letter affect fewer than 10 respondents, and therefore are not subject to the Office of Management and Budget Review under P.L. 96-511.

Sincerely,

Original signed by R. Eaton for:
Edouard H. Trottier, Project Manager
Project Directorate I-3
Division of Reactor Project - I/II
Office of Nuclear Reactor Regulation

Enclosure:
Request for Additional
Information

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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Sincerely,

for

Edouard H. Trottier, Project Manager
Project Directorate I-3
Division of Reactor Project - I/II
Office of Nuclear Reactor Regulation

Enclosure:
Request for Additional
Information

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REQUEST FOR ADDITIONAL INFORMATION
SPENT FUEL POOL STORAGE RACK APPLICATION AT
MAINE YANKEE

LIST OF QUESTIONS

1. In constructing the acceleration and the displacement time histories from the ground response spectra, demonstrate that the time history of the acceleration bound the design ground response spectra. Provide the maximum ground response velocities in three orthogonal directions at SFP slab level (Page 3-3, Ref. 1).

2. It is stated that local rack deformation under uplift or impact loads is considered permissible to the extent that subcriticality of the array is maintained and resultant damage to stored fuel is minimized. Provide specific values for the local deformations allowed and discuss how these values are obtained and justify why such limits are adequate (Page 3-4).

3. It is stated that "nonlinear properties for impact springs and elemental damping values include local rack flexibility and fuel rod beam flexibility ----". Provide a detailed discussion of the meaning of this sentence and also provide quantitative values together with corresponding analytical expressions for such nonlinear parameters and discuss how these values are obtained and why it is justifiable to use such values (Page 3-5).

4. It is stated that the buckling load of the cell is obtained by a large deflection theory. Discuss the theory and demonstrate that the formulation of the theory and corresponding numerical method are such that a small change in input does not lead to a large change in result (Ref. 2, Page 367). Provide a verification of ANSYS code with experiments, if any, regarding the large deflection/buckling theory for plate and shell elements. Also, discuss how the boundary conditions of the compressive member are treated in view of the fact that there are no positive lateral supports. Thus, for a case of a lateral load as in safe shutdown earthquake (SSE) load, an out of plane deformation is a possibility when the cross section of the rack is considered as a thin honeycomb cross section deforming in a diamond shape rather than rigid rectangular cross section. What are the margin from the critical buckling loads for the cells as well as the rack under the worst load conditions (Page 3-7)?

5. Provide a drawing of a rack base support assembly with dimensions as well as stress and displacement distribution. Discuss how the allowable membrane plus bending stress of 23600 psi in Table 3-5 is justifiable since the presence of compressive stresses is most likely and beam column failure mode is a possibility (Page 3-7).

6. In page 3-11, a static analysis is discussed. Please provide numerical values for the loadings considered with a discussion as to how the load relates to corresponding parameters of the SSE analysis. Provide the results of the static analysis and associated margins from the allowable values. Also provide the same information for a dead weight alone when the gravity load is applied in a horizontal direction assuming a static problem for 1.0 g horizontal acceleration (Page 3-11).

7. It is stated that "a value of 4% in the range of 18 to 33Hz is assigned to the models for the DBE and 2% for the OBE." Provide a basis for the damping values and discuss how the frequency dependent dampings are treated in the calculational scheme (Page 3-19).

8. Discuss and justify 10% damping for fuel to cell interaction analysis in context of governing equation. Please discuss impact analysis: (1) between fuel and cell, and (2) between rack feet and concrete slab (Page 3-19).

9. Discuss what is meant by effective stiffness and mass properties of a beam element and provide numerical examples and how these values are used in the rack analysis (Page 3-11).

10. Discuss difference between single rack and multirack analyses in terms of resulting displacements and reactions. Also, discuss the key procedures and assumptions for developing three dimensional multi-rack model and provide a basis for considering it as the bounding case. Discuss sensitivity of the modelling in terms of difference in responses between, for example, two rack and three rack multi-rack analyses (Page 3-14).

11. Discuss the difference in location and distribution of peak fluid pressure on the rack during the fluid and rack interaction between the 3-D single and multi-rack analyses cases. Also, provide results of any existing experimental study that verifies the simulation of the fluid coupling utilized in the numerical analyses (Page 3-19).

12. It is stated that the rack evaluations bound the sliding friction by using both minimum and maximum value of the static frictions of 0.2 and 0.8. Provide a technical basis for the statement (Page 3-22).

13. It is stated that all computer programs utilized in performing the rerack analysis were verified. Provide the code verification documents (both experimental and analytical) which apply to the current usage for rack responses (e.g. nonlinear dynamic analysis and large deformation buckling analysis). Also, provide information with reference to the code quality assurance (QA) program and discuss whether the QA was reviewed and approved by the NRC staff. Also, indicate whether or not the QA documentation is available for a staff audit. The report also stated that the ANSYS code was reviewed and approved by the NRC. Please provide the reference for the approval. Discuss the extent to which the

the current rack application is consistent with the capability and limitation of the ANSYS code (Page 3-24).

14. It is stated that "due to the large number of iterations required, several iterations of the first second of the response are performed with varying time steps to establish the longest time step producing a valid result." Please explain the statement particularly regarding how one determines "a valid result" (Page 3-23).

15. Provide any verification of the ANSYS code with physical experiments simulating rack responses to an earthquake. The experiment should include a substantial variation of the parameters and input forcing function to see corresponding changes in rack responses. The experiment should address overall response of a rack as well as addressing each component of parameters such as damping, stiffness, gap sizes and hydrodynamic mass etc. and different forcing functions (Page 3-23).

16. Discuss how a model analysis was performed in view of many nonlinear elements in the model (Page 3-23).

17. It is stated that "MYAPCO is performing confirmatory analysis of the spent fuel pool walls to address all design basis loads-----". Please provide a summary of the analysis results and indicate any change in safety margin of the pool structure (Page 4-4).

18. It is stated that new rack configuration does not affect existing SFP bundle drop structural consideration. Describe briefly what the previous bundle drop analysis consisted of. Discuss Maine Yankee's fuel handling experiences including adverse incidents such as dropping and damaging the fuel assembly, if any (Page 4-4).

19. No detailed quantitative information were provided in the submittal for the pool liner analysis. Provide the following:

    a) Analytical approaches or methodologies,
    b) Loading conditions,
    c) Failure (tear and rupture) criteria,
    d) Material properties used including concrete bearing strength and friction between the pedestal and liner, and
    e) A summary of the findings.

20. Describe a plan, specifications, and procedures for the post operating basis earthquake inspection of fuel racks gap configurations. Provide a justification as to why such specification including tolerance are adequate.

REFERENCE:

1. Licensing Report for Maine Yankee Atomic Power Company "High Density Spent Fuel Pool Reracking Project" Rev. 0, January 1993 (Attachment E to Maine Yankee January 25, 1993 letter to NRC).

2. E. Issacson and H. B. Keller "Analysis of Numerical Methods," John Wiley, 1966.