THE AEROSPACE CORPORATION



50-5 437

Post Office Box 92957, Los Angeles, California 90009, Telephone: (213) 648-5000

24 April 1979

Mr. Andrew Marchese, MS-268 Division of Project Management U.S. Nuclear Regulatory Commission Washington, D.C. 20555

Dear Andy:

I have enclosed a list of items to be addressed by Harbison and Walker Refractories and by Offshore Power Systems at the 7-8 May 1979 Meeting in Jacksonville. Copies of the questions have been sent to Dr. D. Walker and Mr. Paul Schlett.

Sincerely,

Dave

D. G. Swanson Member Technical Staff Materials Sciences The Ivan A. Getting Laboratories

DGS:fr Enclosure



7905030339

3903000

An Equal Opportunity Employer GENERAL OFFICES LOCATED AT 2350 EAST EL SEGUNDO BOULEVARD, EL SEGUNDO, CALIFORNIA Items to be Addressed by Harbison and Walker Refractories

and

Offshore Power Systems at the 7-8 May 1979 Meeting

I. Questions Specifically Keyed to OPS Report No. 36A 59

1. Page III-8, Line 13

How will locking the bricks into the ladle steel shell help when the shell will melt on contact with the molten core debris?

2. Page III-8, Lines 18, 22

What is the difference between chemically bonded and burned MgO?

What is the melting temperature and porosity of each type of brick?

Can we obtain samples of each brick?

3. Page III-12, Line 3

Please define a static list.

A value of 0.50° seems very small; what would be the consequences of a $20^{\circ} - 30^{\circ}$ list?

What is the worse list possible and how can it arise?

Are the sidewalls thick enough to cope with a large list?

A related question concerns the extent of lateral erosion. Is the wall thickness great enough to cope with a lateral erosion that is equal to the vertical erosion?

4. Page IV-11, Line 3

Do they have a reason for believing that iron oxides will be mixed in with UO₂ instead of being in a separate layer on top of the molten iron?

What are the implications if this occurs?

Page IV-11, Line 3 (continued)

What are the other constituents of the molten core, and in what quantities are they present?

Can you provide a best estimate of the melt composition and the type of steel?

5. Page V-5, c-11, Line 2

Why is a substantial layer of iron oxide unlikely?

Do you have any data?

What is the industry experience and can you provide references?

6. Page V-7, Line 2

Can you cite a specific data, reports, etc., and supply these to us?

7. Page V-7, b-iii, Line 1

UO2 is heat-generating and, consequently, it isn't clear that it will freeze quickly. Have you performed any calculations to determine whether freezing will occur?

Can you provide a copy or report on any calculations performed in this area?

8. Page V-8, c-iii, Line 4

What materials are used in this application that are less susceptible to thermal shock than Harklase brick?

9. Page V-15

Can you provide any references to reports on the metal industry experience with MgO brick floatup?

Can you provide any references for the industrial experience with the thermal shock and mechanical shock resistance of MgO bricks?

10. Appendix C, Table 1

What is the porosity of TOPEX-S?

II. Harbison and Walker Letter

11. Section 1.

Will a mortar be used in the joints?

Will a mortar be used anywhere?

What are the properties of any mortars proposed for use?

12. Section 4.

What is the inert, ceramic fibrous material and what is it to be used for?

13. Section 6.

What are the physical and chemical properties of the HAMIX-FE-MgO ramming mix?

14. Section 9.

Can they provide more details on the brick layout, the initial spacing between bricks and the design temperature range?

At what temperature will spacings between bricks close?

What is the maximum temperature, if any, before the bricks are destroyed by thermal expansion?

Will low-temperature melts go through the spaces between bricks?

Will the brick layout be such that spacings for successive layers will not be directly over each other?

What is the effect of the loss of one or more bricks on the arch?

What is the probability of brick loss through cracking or other means due to normal use or manufacturing defects?

15. Section 10.

How is Harklase treated to increase hydration resistance?

III. General Questions

16. We are concerned that moisture may collect in the core ladle. Is there a provision for a sensor to detect moisture and is there a drain?

Will water degrade the MgO bricks?

Is a steam explosion possible when molten UO₂ comes into contact with soaked bricks?

- 17. Can thermocouples be inserted in the core ladle to provide a means of locating the progress of a melt front?
- 18. Please provide copies, where available, of the phase diagrams for all combinations of MgO and the expected constituents of molten core debris. Please estimate the melting temperature of MgO brick in the presence of these constituents and provide us with the basis for this estimate. Please estimate the expected temperature of the molten core debris and advise us of the methods used in this estimate.