MAY 5 1988

Dr. Charles G. Interrante, Program Manager
Metallurgy Division - Corrosion Section
National Bureau of Standards
U.S. Department of Commerce
Gaithersburg, MD. 20899

Dear Dr. Interrante:

We have reviewed NBS' Monthly Letter Report for March 1988 for FIN A-4171, "Evaluation and Compilation of DOE Waste Package Test Data." Our comments are presented below.

1. As previously requested, where document reviews are not completed by the time of preparation of the MLR, we request that NBS include some indication in the MLR of how far along each review is. It is not sufficient to state that "the review is continuing". Because we are aware of the resource constraints, we wish to provide guidance on whether certain reviews should be discontinued in order to complete others which are of more central interest. If no work was done on certain documents, the MLR should so state.

2. As stated for the last two months, Task 2 (Identification of Additional Data Required) should specifically state what has been accomplished each month, even if no additional data needs have been identified. It is not sufficient to state that studies are continuing. In the next MLR, please include at least a preliminary list of additional data and tests judged necessary for evaluating DOE waste package designs.

3. With respect to the forthcoming report on the work on corrosion behavior of Zircaloy cladding, release of the final report would be expedited if NRC comments were processed along with those from NBS internal reviews. Comments on the draft report attached to the current MLR will be submitted shortly.

4. The review of the Wilson report (LLNL) states that new observations support the previous data suggesting grain boundary oxidation as the initial stage in the oxidation of spent fuel. The review should state what was observed that permitted this conclusion. If this information was not in the document reviewed, we suggest that the reviewer contact the investigator(s) for additional information.

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5. The search strategy used to identify relevant documents requires that the fields searched have the words "waste package" or "canister" in them. NBS should consider whether other strategies should be used.

6. On page 18, Kass (LLNL) noted that the use of titanium in tuff may be quetionable. Why?

7. The questions on the effects of hydrogen uptake on mechanical properties should be added to the list of data needed.

8. On page 21, how can hydrogen bubble formation in copper be prevented?

9. The assertion that copper serves as a catalyst in the breakdown of radiolytically-formed peroxide should be explained. At least two reactions must be formulated.

10. What is the basis for identifying 80 ppm of ammonia or other nitrogen-bearing species as the upper limit for avoiding cracking problems in candidate alloys?

11. On page 22, reactions are presented for copper. The first shows copper as reducing hydrogen ions to hydrogen gas. What drives this reaction? One can place a strip of pure copper in hydrochloric acid and no hydrogen will be evolved. If there is some reaction which provides a sink for hydrogen, then reaction (2) could proceed as indicated. What is this reaction? Finally, what are the reactions leading to reduction of sulfates to sulfides? Are biochemical reactions involved?

12. On page 23, was it intended that the two reactions at the bottom of the page be identical?

13. On page 24, the conclusion drawn by Werme (SKB) that "...from radiation, reactions will never be limited by the rate of supply of oxygen, under Canadian conditions.." appears to be an important one. Such conclusions should be flagged and made readily accessible to a database search. It is also important to enter into the document review whether NBS agrees with this conclusion or not. Whichever position NBS believes is warranted by the data presented, NBS should note in the review the basis for their position. If more data are needed, NBS should, under Task 2, define a task for doing this.

14. The conclusion in the Lam paper (Ontario Hydro Research Division) that pitting in sulfide corrosion of copper appeared to be initiated at grain boundaries should similarly be flagged. Is pitting in stainless steels also initiated at grain boundaries?

15. On page 26, the De Bruyn Paper (Belgium) stated that short term tests conducted under "equilibrium" conditions will be extrapolated to very long times to make performance predictions. How will this be done?

16. On page 26, the Marsh paper (UK) apparently stated that "...frightening levels of hydrogen production are expected (from carbon steel in an anoxic environment..." What are these levels and how much different would they be for an oxic environment?

17. On page 27, define the acronym PFTE. Also, what is an "unlimited distribution"?

18. On page 27, the statement is made that the maximum hydrogen content in steel was calculated to be 0.125 wppm at an assumed temperature of 100°C, and such a modest level would not cause embrittlement of carbon steel. However, the calculated levels appear to be average values. The partial pressure of hydrogen under these conditions was given as 1365 atm. Since the water with which the steel is reacting is outside the steel, how are such partial pressures generated? If they do exist, would there not be a migration of hydrogen into the steel, possibly nonuniformly as for example along grain boundaries?

19. On page 28, the Kass paper states that 304L SS is more susceptible to martensite transformation than 316L SS. Does any one know why?

20. On page 28, we prefer not to say "...sensitization, due to welding of 304..." First, "due to" implies an explanation, which appears to be more involved with carbide precipitation. Second, in the light of the Brookhaven report on stress corrosion cracking which we discussed recently, there appears to be some question whether welding always results in sensitization. Kass also states that sensitization is unlikely if carbon is less than 0.015 wt%. This seems to agree with the Brookhaven work. Kass also concludes that sensitization is probably a non-issue. This too should be flagged and validated.

21. On page 28-29, Kass states that weld embrittlement may be an issue. The concern is from the high ferrite content of the weld metal due to sigma phase formation. More information is needed on this subject.

22. Russel (LLNL) notes that if spent fuel is wet (despite screening to avoid this), radiation effects within the canister may cause problems. Thus, one atmosphere argon is the (current) choice for the inside of the canister. It would seem this would simply reduce, not eliminate, the partial pressure of radiolytically produced oxygen, hydrogen, and other species. Internal corrosion would merely be slowed.

23. Stahl (SAIC) discussed a dual container concept, the outer one to meet short-term requirements and the inner one to meet long-term requirements. Does NBS have any comments on the viability of this concept?

24. On page 31, the King paper is reported as describing the corrosion of copper by an equation in which chloride ions attach themselves to a copper atom. This is incomplete, as it does not explain how copper atoms get oxidized.

Actions resulting from this letter are considered to be within the scope of FIN A-4171. No changes in costs or delivery of contracted products are authorized. Please notify me immediately if you feel this letter will result in additional costs or delay in delivery of contracted products.

Sincerely,

C. H. Peterson

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