UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Gaithersburg, Maryland 20899

WM DOCKET CONTROL CENTER

'86 MAR 17 P12:34

WM Record File WM-RES A4171 NMS

WM Project 10,11,16
Docket No.
PDR ✓
LPDR B, N, S

Distribution:
K Wick
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Everett Wick
Engineering Branch
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Wick,

Enclosed are replies to two requests for general technical assistance rendered under Task 4 of FIN A-4171-6, "Evaluation and Compilation of DOE Waste Package Test Data," on the following two topics:

"SDS Liner Qualification as a High Integrity Container -- Hanford Burial," prepared by Nuclear Packaging, Inc.

MCC-1P -- "Static Leach Test Method," Materials Characterization Center, August 24, 1984.

In our comments on the report entitled "Submerged Demineralizer System Liner Qualification as a High Integrity Container," which you requested in your letter of February 6, 1986, you will find that most of our comments are directed at Appendix B, the corrosion assessment report of the container vessel. In general, these comments are requests for clarification of statements that are important in evaluating the proposed container design; however, two points must be investigated further. The first deals with the use of a graphite fiber seal in a valve that could cause galvanic corrosion if in contact with electrolyte, and the second concerns an assumed pit density of one pit per square foot which is just low enough to not cause perforation of the container in the first three hundred years.

The authors have taken a conservative approach to their design, and appear to be considering all possible failure modes. Clarification of the two major points indicated above will put us in a better position to assess the long-term integrity of the waste container.

In our comments on the "Static Leach Test Method" of MCC-1P, which you requested in your letter of February 27, 1986, you will find that we view selected unresolved issues to be sufficiently important to require that they be resolved before the method is recommended for approval.

Should you either have question concerning these responses or require further input from us on these topics, please contact me.

Sincerely,

Charles G. Interrante
Corrosion Group

2 Enclosures

2882

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March 6, 1986

Comments on MCC-1P, Static Leach Test Method

The comments of the negative voters have been addressed. The evaluation of the response to these comments follows below. It is recommended that the test method not be approved until the issues and comments designated with an asterisk (*) are resolved. The following issue and comments can be handled by statements added to the Scope, 1.0, of the test method; Issue 4, Member A, Comment 1, Member C, comment 2. The changes recommended in Issues 1 and 3 should improve the precision and bias data of Issue 6.

COMMENTS

General Issues:

* Issue 1 - Specimen surface finish - The response was to cut specimens with a 200 grit to 400 grit size diamond saw and not polish.

The review comment is that the diamond saw could have variable pressure, varied wear and be tilted during cutting. It would be better to polish with 600 grit SiC paper to provide a more uniform surface. This is a rough polish and and should not be difficult to do. More uniform and improved surface preparation should lower the variance in the results.

Issue 2 - Fluoride Analysis - Agree with response.

* Issue 3 - Oxygen Fugacity - E_h - The response was not to require measuring the value of E_h.

The review comment is that the effect of the solution oxidizing potential, E_h, on the leaching behavior can be minimized by deaerating the test solution with a dry inert gas such as argon, and isolating the container to prevent oxygen diffusion. The amount of dissolved oxygen is the most significant factor contributing to E_h prior to testing in pure water as prescribed by the test. Deaeration could improve the reproducibility of the results.

* Issue 4 - Use of data for repository conditions - The response was that a statement limiting the use of the data is in the Uses and Limitations Section, 3.0.

The review comment is that an additional sentence should be put in the scope to indicate that this is a screening test and that data are not directly applicable to repository conditions. This statement also should remain the the Uses and Limitations Section, 3.0.

Issue 5 - Teflon cleaning - Agree with response.

* Issue 6 - Precision and Bias and the lack of use of the MCC-1 data in making the estimates. - The response was that the CEC round robin data has now been published and that because the CEC data was generated by researchers familiar with MCC-1, the CEC round robin gave a good estimation of precision attainable with MCC-1.

The review comment is that discrepancies between laboratories are an indication of inadequate specification of experimental procedures. These inadequacies are evidenced by both the MCC-1 round robin and the NBS-MCC discrepancy. These inadequacies cannot be dismissed by reference to "inexperienced laboratories", a difference between NBS and MCC procedures thought to be the cause, or an estimate of bias obtained from the NBS-MCC discrepancy. Rather, more work needs to be done on tightening the experimental procedures so that the sources of error are understood and brought under control.

Specific Comments

Member A

* Comment 1 - Regarding radiation induced effects - The response was that the statement requiring the use of teflon containers in tests and that the dose not exceed 10^4 rad was inserted in Section 3.0 on Uses and Limitations.

The review comment is that a statement should be added to the scope indicating that the radiation dose of the leach container should not exceed 10^4 rad. The statement also should remain in the Uses and Limitations Section.

Comment 2 - Regarding periodic measurement of the pH - Agree with the response. However, if the system is disturbed for any other reason, the pH should be measured. It would be desirable to have the pH values if taking the measurements did not disturb the system.

Member B

Comment 1 - Regarding porosities of test materials - Agree with the response.

Member C

* Comment 1 - Regards the lack of data on reference materials submitted to MRB for approval - The response was that that a D5 data package for MCC-1 tests of ARM-1 glass will be submitted to MRB in early 1986.

The review comment is that results from the MRB on the D5 data package are needed before a decision can be reached on this comment.

* Comment 2 - Regards the test's applicability to radioactive samples -The response was that teflon leach vessels are required and that radiation doses should not exceed 10^4 rad. Although there is no data available on use of the method with radioactive samples, there is no reason to believe that the method would not be appropriate.

The review comment is that some experience should be available with radioactive material or a sentence should be added to the scope stating that this information is missing.

Member D

Comment 1 - Editorial - Agree with response

Comment 2 - Regards E_h - See above response to General Comment, Issue 3.

Comment 3 - Editorial - Agree with response

Comment 4 - Editorial and revision - Agree with response

Comments 5 through 8 - Editorial - Agree with response

Comment 9 - Regards E_h - Agree with response

Comment 10 - Editorial - Agree with response

Member F

Comment 1 - Editorial - Agree with response

Comment 2 - Regards specimens for surface analysis - Editorial and additional material. Agree with response.

Member G

Comments 1 and 2 - Editorial - Agree with response

Comment 3 - Regards deleting all mention of fused quartz and metal containers. This was done. Agree with response.

Member H

Comment 1 - Editorial - Agree with response.

Comment 2 - Regards long term tests without adding water - The method was not changed to allow this. Agree with response.

Review of "Submerged Demineralizer System Liner Qualification as a High Integrity Container"

Page 4-1, item 2: Is the graphite fiber seal in contact with soil or any electrolyte? Graphite is known to be noble (more negative) in electrical potential to most metals as indicated in the Galvanic Series in sea water. This difference in potential can cause the surrounding metal to behave as an anode, causing it to preferentially go into solution.

Page 4-1, last paragraph: Graphite is not very reactive, but, like gold, it can cause other metals to behave as anodes causing them to corrode sacrificially as described above.

APPENDIX B

Corrosion Assessment of Submerged Demineralizer Sytstem Vessels For Burial as High-Integrity Containers at the Hanford Commercial Waste Disposal Site

Page 7, Figure 3: The location of the Hanford site should be indicated on this soil map, and the ID symbols must be made readable so that one can have a better understanding of the arguments made by the authors.

Page 11: Figure 4 is illegible.

Page 13: Figure 5 is illegible.

Page 14, Table 5: It is not clear what the concentration of soluble ions is, and I suspect that the (x 1000) in the heading should not be there. Thus, the chloride concentration at this Hanford site is probably 2 meq per 100 g of soil.

Page 17, 2nd paragraph: As a general rule, with many exceptions, a soil is considered noncorrosive well above 5,000 ohm-cm, and not 1,000 ohm-cm as the authors state in this document (Romanoff, J. Am Water Works, vol.56, no.9, p1129, Sept 1964).

Same paragraph, last sentence: "Stainless steel is also highly suceptible to pitting in stagnent, deaerated seawater". This condition is very similar to the condition in which the high integrity container will be buried -- stagnant, poorly aerated, and in the presence of appreciable chloride, so it seems that the authors should conclude that the stainless steel would be highly susceptible to pitting in this proposed burial environment.

Page 22, last paragraph: Ten percent of the failures were in contact with asphalt, which is rich in carbon. This lends some support to the question of using graphite in the plug of the quick-disconnect valve.

Page 24, section entitled "Other Underground Stainless Steel Corrosion Information": It is not at all clear how the authors arrived at the pitting value of 16 mils, shown on the top of page 27. They suggest that the value was obtained from Tables 7 and 8 for "304 SS in soils similar to Hanford sandy loam", but we could not identify the "similar soils". It is important to point out that the NBS Circular 579 pit depth data that the authors reference is a minimum pit depth where there was perforation of a wall thickness of the 304 SS specimen. Thus, the actual penetration would be much greater than the value cited.

Page 27, first paragraph: "Degradation of the sensitized austenitic stainless steels was also negligible". The authors site reference 32 which, in fact, reports a weight loss of 68 mg/sq dm and pit depths of 12 mils in eight years for sensitized 304 SS in Sagemoor Sandy Loam, and this we don't believe is negligible degradation.

Page 31, first paragraph: The authors assume a pit density of 1 pit/sq ft, a pit aspect ratio of one, and uniformly deep pits, which allows them to calculate that the pits will develop to a depth of 200 mils in 300 years on a 375 mil wall. The authors do not describe any justification for this assumption, and it is not at all clear how this pit density (1 pit/sq ft) or the other associated assumptions were arrived at. If we assume 1 pit per 2 sq ft, which deviates from their assumption by only a factor of two, then the container will perforate well within the 300 year time period. The authors should justify their assumptions.