HLWYM HEmails

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To: Xihua He
Subject: Crevice corrosion report
Attachments: CNWRA 2005 ccreport comments 102005.wpd

Attached is the file I showed you this morning. Let me know if you have questions.

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1. The results shown in figure 3-4 are expected if the initiation of crevice corrosion occurs sequentially rather than simultaneously. The crevice corrosion propagation kinetics for each site will be affected by stifling and arrest and repassivation of all crevice sites is expected. Post est depth measurements for this test are not out of the ordinary compared with the other tests (Table 3-2).

2. If localized corrosion is possible it is unlikely there will be a single initiation site given the large size and the number and surface area of the of possible crevice corrosion sites for each waste package. The single crevice specimen was constructed to better understand the initiation, propagation, stifling and arrest of crevice corrosion. Specifically, the single crevice specimen was designed to avoid the complex response that was observed with the multiple crevice assembly shown in Figure 3–4.

3. The question of maximum kinetics for localized corrosion propagation is complex but probably insignificant to the expected damage to the waste packages as a result of crevice corrosion. The objective of the work included here was to address the time dependent propagation rates. The maximum propagation rates are expected immediately after crevice corrosion initiation. As time and the penetration depth increases, the potential drop also increases and the propagation rate decreases. This is shown in Figure 3-2. With increased time, the increased depth leads to stifling and eventually arrest of the active crevice corrosion sites. Equation 3-1 is based on the results obtained from multiple tests. All of these tests have an initial period where the propagation rate is controlled by diffusion. For the results obtained in this work, the maximum crevice corrosion penetration rates can be determined by the maximum penetration depths obtained in each test. These data are shown in Figure 3-7 and are used to obtain the parameters for Equation 3-1.

4. Nevertheless, the results of the comparison of penetration depth using microscopic and current integration techniques add confidence that the current and potential transients can be used as indicators of active crevice corrosion, stifling, and arrest.

REPORT page 3-11 replace: “A possible explanation... deeper corroding sites. This finding...propagation of crevice corrosion” with the following:

Arrest and repassivation of crevice corrosion likely occurs because the potential drop into the crevice increases with penetration depth. The potential drops for deep penetrations are large enough to reduce the E_{corr} within the crevice close to or below the E_{rcrev} for crevice corrosion even thought the specimen is galvanically coupled to the large area cathode plate.

5. Text modified for clarity. The large potential drop as a result of crevice corrosion initiation and propagation eventually becomes too large and continued propagation is not possible even though the specimen is galvanically coupled to the large plate that can serve as a cathode.