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Dr. Martin J. Steindler, Chairman
 Materials Review Board
 Chemical Technology Division
 Argonne National Laboratory
 9700 South Cass Avenue
 Argonne, IL 60439

Dear Dr. Steindler:

In compliance with the objectives of this ad hoc panel, I am enclosing my comments concerning the scope and quality of the MCC Corrosion Program based on the presentation at the November 8-9, 1984 meeting.

Again, let me express my appreciation on behalf of the NRC, for extending us the invitation to provide a representative to the Panel, and on behalf of myself for the opportunity to serve with such a distinguished group of experts.

If you have any questions, please contact me at (301) 427-4540.

Sincerely,

Original signed by

Thomas L. Jungling
 Engineering Branch
 Division of Waste Management

Enclosure:
 As stated

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COMMENTS ON THE MATERIAL CHARACTERIZATION CENTER CORROSION PROGRAM

To provide a starting point for these comments, I will first address the three questions posed by the DOE in the July 11, 1984 letter (Attachment to MRB-350), then provide comments on corrosion mechanisms, long-term predictability and time constraints.

1. Are all the corrosion mechanisms that are likely to be operative in the repository environments being addressed, either by the MCC or included among the "key data" to be reviewed by the MRB?

The corrosion mechanisms likely to be operative in the repository are not being addressed, i.e., forms of localized corrosion with the exception of stress corrosion cracking (MCC 104), which is still in the development stage.

2. Are the tests being developed by the MCC and those proposed by the projects adequate to quantify the corrosion or penetration rates associated with those mechanisms?; and

The tests that are being developed are almost exclusively for uniform corrosion. Uniform corrosion tests may be inadequate to quantify the corrosion or penetration rates associated with the likely corrosion mechanisms. More information on the tests proposed by the projects is needed to evaluate their ability to quantify corrosion rates.

3. Are the quality of the MCC work and the MCC/project interactions adequate to assure development and review of "key data" of sufficient scope and quality to show compliance with NRC and EPA criteria?

Interaction between the MCC and the projects, in order to assure the development of key licensing data seems to be lacking for all three projects, to some degree. Interaction between the basalt (BWIP) and Salt (ONWI) projects and the MCC appears to exist, however, the MCC has been limited thus far to developing uniform corrosion tests which will not provide the critical corrosion data. Of greater concern is the apparent absence of formal interaction between the MCC and the Nevada Nuclear Waste Storage Investigation (NNWSI).

The quality of the MCC work must be evaluated in terms of the test procedures which have been developed and made available. The tests have the potential to demonstrate compliance with the NRC and EPA criteria, however, the scope of the tests appears to be limited,

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partially by financial constraints and partially by MCC's desire to establish prototypic tests. Prototypic tests may not reflect time-dependent changes in the alloy composition and properties as well as waste package induced changes in the environmental conditions, which may result in more severe conditions for corrosion.

Corrosion Mechanisms

It was apparent from the MCC presentation that their emphasis has been towards uniform corrosion. While uniform corrosion tests are very useful in characterizing a large group of materials for performance in the particular environment they will not provide licensing relevant data on the more likely corrosion failure modes, i.e., localized corrosion. These mechanisms which include pitting, crevice corrosion, stress corrosion cracking, intergranular and environmental effects, such as hydrogen-embrittlement, have not received the attention by the MCC that will be necessary to demonstrate the long-term performance required by the NRC. The adequacy with which the individual repository projects are addressing the concern of localized corrosion could not be determined in the context of this meeting, since very little information seemed to be available to the MCC.

The tests currently under development by the MCC are directed towards simulating the expected repository environment (prototypic tests), which appear to be adequate for the determination of the initial uniform corrosion rate. However, in conjunction with some of these tests the MCC is examining the test specimens for pitting corrosion. The chances of developing an accurate idea of the extent or rate of pitting seems small in these relatively short-term tests in the relatively benign environments, especially for materials which may possess long incubation periods. As presented, this is the only type of test planned to study pitting corrosion. The same argument is true for other forms of localized corrosion, i.e., the material may possess a long incubation period in the prototypic environment, and a short-term test may therefore exhibit no susceptibility. By neglecting localized corrosion mechanisms, the type of data likely to be essential at licensing time may not be available, to predict with reasonable assurance that the waste container will survive the containment period.

Long-term Predictability

As a result of the time constraints, the prediction of long-term performance will probably require accelerated testing and time extrapolations of short-term test results. Extrapolations for uniform corrosion rates may be accomplished with

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with reasonable agreement in the technical community, however, this may prove difficult, if not impossible for various localized mechanisms. Therefore, unless it has been determined that the reference material is not susceptible to the particular failure mechanism, development of an accelerated test or a technically accepted means for extrapolating short-term results, will be needed. This is obviously not going to be an easy task, so an understanding of the need for, as well as the capabilities and limitation of using accelerated tests/time extrapolations to predict performance is necessary. These items need to be addressed in the MCC activities.

Time Limitations

There are approximately five years in which to collect corrosion data before licensing. A portion of that time will be devoted for the MCC to develop standard test procedures and the review of those procedures by the MRB. It seems imperative that, if the DOE still intends to utilize the MCC and MRB, the MCC begin concentrating on localized corrosion processes.

Conclusion

The ultimate conclusion reached from the MCC presentations, is that the program is currently working on standard test procedures which may yield a minimum of useful corrosion data applicable to licensing. That is, the emphasis of the tests now under development will probably provide data inadequate to demonstrate the long-term performance of the waste container.