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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:

Enclosed are three sets of comments based on the reviews of the corrosion programs at BWIP, NNWSI and SRP. I hope these comments will be useful in preparing the final report.

Sincerely,

Original signed by

Thomas L. Jungling
Engineering Branch
Division of Waste Management

cc: Wally B. Seefeldt

Enclosures:
As stated

WM Record File 109.6
WM Project 1
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Enclosure 1

Materials Review Board
Ad Hoc Corrosion Review - BWIP

Response to DOE Questions

- ° Q1. 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?

- ° Part 1: Are all corrosion mechanisms ... being addressed ... by the MCC ...?

The one mechanism which appears to be neglected is the initiation stage of crevice corrosion. It was stated that crevice corrosion was being examined in conjunction with pitting corrosion. This may be sufficient in studying the propagation of the crevices but the initiation stage occurs by a different mechanism and should be addressed separately. Intuitively, it seems conceivable that the potential for crevice corrosion would be highly likely due to uneven contact of the packing material.

- ° Part 2: Are all the corrosion mechanisms ... being addressed, ... [or] included among the "key data" to be reviewed by the MRB?

Based on BWIP's definition of "key data" as data generated on the most probable corrosion mode, i.e., uniform corrosion, they do intend to submit some of this data generated by the MCC to the MRB. However, this appears to be only a small percentage of the licensing data that they plan to submit to the NRC. Therefore, one must conclude that data on all the plausible corrosion mechanisms will not be reviewed by the MRB.

- ° Q2. Are the tests being developed by the MCC and those proposed by the project adequate to quantify the corrosion or penetration rates associated with those mechanisms?

Some tests may prove to be adequate in evaluating the particular mechanism, e.g., pitting and stress corrosion cracking, although the work is preliminary and minimal data has been generated to date. However, the uniform corrosion test has generated data which indicates a change in the corrosion rate and, presumably, the mechanism with increasing temperature but there has not been an attempt to determine phenomenologically, the

basis for the change. This data is not well enough understood to be used to quantify corrosion rates for the repository application.

- ° Q3. 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?

As mentioned above the only interaction described between BWIP and the MCC/MRB will be the review of some uniform corrosion test procedures and data. This is certainly not sufficient to show compliance with the regulatory criteria. Within the BWIP the only determination whether their data is of adequate quality is if it was generated by a properly QA'ed test procedure. It was inferred that all such data would be submitted to the NRC as licensable data and that the NRC would subsequently determine the adequacy.

To their credit they do possess a methodology to determine the performance of the waste package involving experimental tests, predictive models and performance analyses. However, within this methodology they lack a mechanism to determine the quality of the experimental procedures or the data generated by these procedures. Such a mechanism would be an independent external review of the test procedures similar to the initial intent of the MCO system.

Specific Comments

- ° A relatively new waste package conceptual design was presented at the meeting. Although it was envisioned at the outset that design changes would occur as part of an iterative process, each change could affect the relevance of the previous testing, in that the appropriate test parameters may be different. Therefore, the overall design should be determined early so only minor changes need subsequently take place. Fortunately, the new design presented appears to be a more conservative design than the previous ones, which could minimize the environmental impact.
- ° The emphasis of the current testing is on a reducing environment, which may not be conservative based on the uncertainty in measuring, directly, the redox potential of the groundwater. It would be a safer and more conservative approach to bound the expected conditions with some tests at a higher oxidizing potential.

ENCLOSURE 2

Materials Review Board
Ad Hoc Corrosion Review - NNWSI

Responses to DOE Questions

- ° Q1. 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?;
- ° Part 1: Are all the corrosion mechanisms ... being addressed ... by the MCC ...?

It appears that the NNWSI has recognized all of the possible corrosion mechanisms, although by their admission they still consider their experimental work as scoping/screening.

- ° Part 2: Are all the corrosion mechanisms ... being addressed, ... [or] included among the "key data" to be reviewed by the MRB?

Since, as mentioned above, they are still performing screening-type experiments they have not generated any "key data" for licensing as yet. Furthermore, they have not yet made the decision of how to approach the generation of "key data". It was indicated that this approach will be described in a document to be released this fall. Finally, NNWSI currently has no intentions to submit any test plans or data to the MCC/MRB organization.

- ° Q2. Are the tests being developed by the MCC and those proposed by the project adequate to quantify the corrosion or penetration rates associated with those mechanisms?

The corrosion experiments being performed by the NNWSI appear to be adequate in quantifying, for the duration of the test, the susceptibility of the metal to the particular form of corrosion. However, there was no documented approach presented which could demonstrate that the short-term data could be extrapolated to show compliance with the NRC containment objective. The approach described simply consisted of testing in a geochemical environment which represented the bounds of the

anticipated conditions. Unfortunately, this approach provides no mechanism for demonstrating long-term performance.

- ° Q3. 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?

The quality of many of the individual experiments is technically sound. However, there appears to be a lack of focus on the ultimate goal, i.e., they have not developed a rationale with which they could take the data collected and develop a case for licensing nor did they present any rationale outlining what data they will need to collect for licensing. As the project now exists it does not appear that the data will be of a sufficient scope to be used in licensing. The key items missing are the approaches for prediction of performance and what data is needed to make the predictions.

Specific Comments

- ° The choice of an austenitic stainless steel may potentially provide problems in demonstrating long-term performance. Since austenitic stainless steels typically fail by localized corrosion mechanisms which may possess long incubation periods, their susceptibility to a particular environment may not be detected in a relatively short-term test. Therefore, a short-term test, i.e., on the order of 10 years, which does not produce a failure may not extrapolate to reliable service for the 300-1000 year time period necessary. It was evident that a clear rationale to deal with this problem has not been developed.
- ° There is still considerable uncertainty in the expected environmental parameters which will remain, at least until an exploratory shaft is constructed (probably late in 1986). Noting this fact, it may prove that the current range of environmental parameters is inadequate to bound the actual repository conditions. This may be especially true during the early period where high temperatures and radiation fields may coexist temporarily with the presence of liquid water.
- ° The review of a particular test method for its adequacy and relevancy for generating license quality data does not extend beyond the waste package group at LLNL. It appears that in the wake of the rejection of the MCO system, they have not perceived a need to go to any independent experts to review their testing program.

Enclosure 3

Materials Review Board
Ad Hoc Corrosion Review - SRP

Responses to DOE Questions

- ° Q1. 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?;
- ° Part 1: Are all the corrosion mechanisms ... being addressed ... by the MCC ...?

All the likely corrosion mechanisms have been identified by the SRP but at this point hydrogen embrittlement for the reference steel alloy has been given only minimal attention. This failure mode may play a significant role, especially for welded closures.

- ° Part 2: Are all the corrosion mechanisms ... being addressed, ... [or] included among the "key data" to be reviewed by the MRB?

As indicated at the meeting one test procedure may be given to the MRB by the end of FY85, while eleven others original intended for submittal are on indefinite hold.

- ° Q2: Are the tests being developed by the MCC and those proposed by the project adequate to quantify the corrosion or penetration rates associated with those mechanisms?

Of the tests presented by the SRP, only the uniform corrosion tests appear adequate to quantify corrosion rates. The only pitting test described in any detail, consisted of mechanically drilled holes to simulate pits. This procedure has the inherent problem that the solution environment within an artificial pit does not simulate the environment that would be found in an actual growing pit.

As mentioned previously, the possibility of hydrogen embrittlement in the reference steel is not being examined in enough detail to provide any quantitative results as to the corrosion rates or failure rates.

- ° Q3. 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?

The main use of the MCC seems to be the development and maintenance of quality assurance procedures. In addition to this, they have been given the task of preparing a number of SRP test procedures into the format required for an MRB review. These tasks alone will not assure the development of data of sufficient scope or quality to show compliance with regulatory criteria.

The SRP attitude toward the MRB is one of apprehension and avoidance. They have rationalized that since an MRB review may take months, waiting for the completed review would slow their program. On the other hand, proceeding with a yet unapproved test procedure has the risk of jeopardizing the data collected should the MRB not grant approval. Therefore, they conclude that the safest approach is to avoid an MRB review, generate the data and allow the NRC to judge the quality of the work at licensing time. It appears that in their current thinking, the NRC provides the path of least resistance.

Specific Comments

- ° The selection of the primary and secondary container materials seems to have been made apriori with little thought as to the possibility of the need to change the selections in the future. Their own program is well on the way towards disqualifying Ti-Code 12, the secondary material, as a result of the combination of, its susceptibility to hydrogen problems and the amounts of hydrogen likely to be generated in a salt repository. However, even in light of this, the SRP management continues to defend it as a viable material.

- ° There does not appear to be any documented procedure or plan detailing what corrosion data is needed and how it will be obtained. After identifying the likely corrosion modes they have simply been performing corrosion tests relevant to the particular mode with little regard as to how that data will be used. As was stated at all three projects, the DOE has requested that such a Program Plan be completed by the fall of this year.
- ° Another deficiency which appears to be peculiar only to the Salt Repository Project is the lack of a technically competent materials individual at the policy decision level. In the SRP the policy decisions are made within the Battelle Columbus Laboratories while the technical work is performed by the contractor, Pacific Northwest Laboratories. Fortunately, it appears that those who will make the policy decisions have attempted to obtain technical advice by way of a corrosion consultant.
- ° On the subject of data adequacy, one SRP manager gave the impression that he felt tests performed under an NRC approved QA program was both necessary and sufficient to develop a credible data base. Questioned further on how they would determine whether the tests that were being used were generating adequate and relevant data for licensing, they replied that heavy reliance would be placed on expert opinion. However, they currently have no independent group of experts to make this determination and have only recently acquired the services of an expert consultant.
- ° Likewise, on the issue of long-term performance, they currently have no specific approach towards demonstration but rather expressed the belief that a "preponderance of scientific opinion" would be sufficient. This approach demonstrates a lack of thought as to what could be and what should collect to present a defensible case for licensing.