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Center for Nuclear Waste Regulatory Analyses

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March 7, 1997
Contract No. NRC-02-93-005
Account No. 20-5708-561

U.S. Nuclear Regulatory Commission
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Subject: Review of Low-Temperature Oxidation of Carbon Steels and Low-Alloy Steels for Use as High-Level Radioactive Waste Package Materials, by Sylvain Larose and Robert A. Rapp, CNWRA 97-003 [Intermediate Milestone (IM) 5708-561-775]

Dear Dr. Leslie:

Enclosed is the subject report, which is the product of a study conducted in the Container Life and Source Term (CLST) Key Technical Issue (KTI) in FY96 as part of an augmented scope of work. We sent Kien Chang a draft report for review on September 27, 1996 and received verbal approval. In FY97, the Center for Nuclear Waste Regulatory Analyses (CNWRA) activities in the CLST KTI were deferred and hence activities in finalizing the draft report slowed down. We also had to obtain copyright permission from a variety of journals and books for reproduction of the figures included in the enclosed report. The final report that is being submitted to you with this letter has incorporated the revisions based on the technical, programmatic, and editorial reviews performed at the CNWRA. No other new scope of work was performed in FY97 in the Evolution of Near-Field Environment (ENFE) KTI. As reflected in the Program Manager's Periodic Report (PMPR) for period 5 (February 27, 1997), the old milestone number (IM 20-5708-571-640) has been changed to a new number (IM 20-5708-561-775).

The objective of the investigation was to survey the literature on low-temperature oxidation of carbon and low-alloy steels and determine the rates and mechanisms of oxidation. The CNWRA contracted with Professor Robert A. Rapp at The Ohio State University, a highly recognized researcher in the area of oxidation and high-temperature corrosion, to perform the survey. He was assisted by Dr. Sylvain Larose also at The Ohio State University. Their report was edited by Dr. Gustavo Cragolino at the CNWRA.

The report concludes that the rate of dry oxidation and intergranular oxide penetration for carbon and low-alloy steels at the anticipated repository temperatures is negligibly low. The report also concludes that the kinetics of oxidation of carbon steel, such as A 516 steel proposed to be used as the outer overpack material in the

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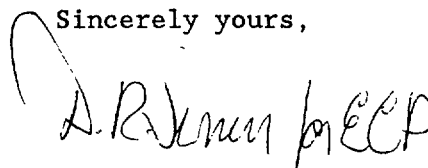


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current waste package design, is controlled through a parabolic law kinetics by the transport of cationic species outward from the metal rather than by the diffusion of oxygen inward from the atmosphere.

Based on a number of discussions with Nuclear Regulatory Commission staff, we believe that the subissue of dry oxidation in CLST KTI can be resolved through the use of this survey as well as focused experiments. We will be pleased to be of further assistance in conducting the experiments to resolve this issue. If you have further questions on this report, please contact Dr. Cragolino at (210) 522-5539 or me at (210) 522-5540.

Sincerely yours,



English Pearcy, Manager
Geohydrology and Geochemistry

NS/lrs

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