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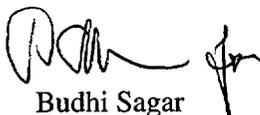
U.S. Nuclear Regulatory Commission  
ATTN: Deborah A. DeMarco  
Office of Nuclear Material Safety and Safeguards  
Two White Flint North  
Mail Stop 8 D37  
Washington, DC 20555

Subject: Submittal of Abstract Preliminary Analyses of HLW Container Response to Basaltic Magmatic Events

Dear Mrs. DeMarco:

Enclosed is an abstract for presentation at the November 2001 Materials Research Society meeting. This abstract is based on work conducted as part of the Container Life and Source Term and Igneous Activity KTI projects. Waste package response to igneous events directly affects risk calculations for the proposed Yucca Mountain repository system. Work presented in this report evaluates a range of challenging physical conditions that likely impact waste package performance during igneous events, and provides an important technical basis for review of U.S. Department of Energy total-system performance assessments. This presentation supports NRC goals by demonstrating that the review methods used by the NRC for licensing decisions are based on the best possible models and data, which have been reviewed and discussed by international experts in materials science. Presentation of this work also supports public confidence that the NRC independently develops a wide range of techniques to evaluate safety issues. Following programmatic acceptance by the NRC, this abstract will be submitted to the organizing committee for presentation at the November meeting in Boston, Massachusetts. If you have any questions please contact Dr. Brittain Hill at (210) 522-6087 or me at (210) 522-5252.

Sincerely,



Budhi Sagar  
Technical Director

BS:jg

Enclosure

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2001 MRS Fall Meeting Symposium JJ: Scientific Basis for Nuclear Waste Management  
Invited Paper: We were invited by Gustavo Cragolino

## PRELIMINARY ANALYSES OF HLW CONTAINER RESPONSE TO BASALTIC MAGMATIC EVENTS

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The proposed Yucca Mountain repository site has a 1:1000 probability of disruption by basaltic magma during the next 10,000 years. Basaltic magmas have temperatures of approximately 1100°C, a density of 2600 kg/m<sup>3</sup>, fluid pressures on order 0.1–10 MPa, and flow velocities on order 1–100 m/s. Integrity of HLW containers likely would be affected by basaltic magmatic events in several ways. High temperature exposure of the materials can result in creep and stress rupture. Creep rate and mode of stress rupture is determined by the homologous temperature (temperature divided by melting point) and homologous stress (stress divided by elastic modulus). Deformation maps and high temperature creep data of alloys similar to alloy 22 and type 316 NG stainless steel will be used along with preliminary calculations of stress levels and temperatures of the container wall to determine the potential for creep and stress rupture. Exposure to high temperatures (600 to 1100°C) for days to months also will precipitate second phase particles in the alloy (carbides, nitrides, and intermetallics) that can cause loss of ductility upon cooling to ambient temperatures. Secondary phases may then adversely affect mechanical integrity of containers during seismically induced loading. Finally, acidic gases produced from basaltic magma can cause high temperature corrosion. Depending upon gas chemistry, high temperature corrosion can be in the form of oxidation, sulfidation, and molten salt corrosion. The rate of corrosion for container materials in hot gases will be estimated based on effects of gas chemistry and temperature on alloy compositions similar to the proposed container materials. Reported experience with magma-metal interactions will be used as an additional source of information in this evaluation.

This work, supported by U.S. Nuclear Regulatory Commission (Contract NRC-02-97-009), is an independent product of CNWRA that does not necessarily reflect NRC views or regulatory positions.