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EXPECTED PERFORMANCE OF ALLOY 22 IN THE POTENTIAL YUCCA MOUNTAIN REPOSITORY

PRELIMINARY DRAFT
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Expected Performance of Alloy 22 in the Potential Yucca Mountain Repository

Alloy 22 as the corrosion resistant barrier for the waste package was selected based on a comprehensive screening and testing program considering service under a wide range of repository conditions. Results from the extensive on-going testing programs confirm the excellent performance expected from this alloy under repository relevant conditions.

During the Nuclear Waste Technical Review Board meeting in Carson City (August 1-2, 2000), preliminary results from work sponsored by the State of Nevada were presented. The work was reported as scoping studies intending to investigate additional failure mechanisms of Alloy 22. These results suggest that under certain aggressive conditions (environments containing high levels of lead and mercury, high temperatures, low pH values and high stresses), Alloy 22 exhibits stress corrosion cracking. Localized corrosion (pitting and crevice corrosion) was also observed in some of the test specimens. However, the investigators prefaced their presentation with the indication that these test conditions do not represent repository relevant operating environments.

The deleterious effects of high levels of lead, mercury and certain other impurities potentially present in the water have been known for a long time and are well documented in the corrosion literature. For example, the developer of Alloy 22 presented a paper in 1986 that addressed the effect of lead in concentrated brines on stress corrosion cracking of Alloy 22. The highly concentrated environments discussed by the State of Nevada sponsored work (e.g. presence of several percents of lead and mercury) are not considered credible scenarios even with the evaporation and full concentration of the Yucca Mountain (J-13 type) water expected to contact the hot waste packages. For instance, the measured levels of lead in J-13 water are in the range of 2 to 3 parts per billion. Concentration of the water to realistic and conservative limits will result in much lower levels (about 100 to 150 parts per million) than the 30,000 parts per million used by the State of Nevada investigators.

Nevertheless, Yucca Mountain Project has recognized that stress corrosion cracking and localized corrosion in Alloy 22 are possible under extreme conditions and the designs of the waste package and the drip shield account for these potential degradation modes. For example, the drip shield of highly corrosion-resistant titanium, which is not susceptible to the effects of lead, protects the waste package from dripping water that could otherwise lead to concentration of harmful impurities on the surface of the waste package. Also, the waste package fabrication process includes stress mitigation to preclude stress corrosion cracking.

The preliminary results and any future results of the work published by the State of Nevada investigators will be reviewed to ensure that if relevant materials performance issues are identified, they will be accounted for by the Yucca Mountain Project.

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