2018 MRS Fall Meeting - Session Details

Description

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The Department of Energy's Environmental Management cleanup effort is focused on developing and implementing innovative and high impact technologies and solutions that positively impact the overall mission lifecycle by: (1) reducing lifecycle costs; (2) accelerating lifecycle schedules; (3) mitigating mission uncertainties, vulnerabilities, and risks; and (4) minimizing the mortgage associated with long-term, post-closure and post-completion stewardship. Pacific Northwest National Laboratory and its partnering institutions, are focused on reducing risk and uncertainty across the integrated flowsheet which includes safe waste storage, retrieval, pretreatment, immobilization, disposal, and tank closure. In this presentation, an overview of the major Hanford flowsheet unit operations will be provided and examples of specific projects focused on reducing risks and uncertainties will be explored.
For example, a key issue of Hanford tank waste processing and disposal is that, although radionuclides (e.g., technetium) drive the disposal risk for the low-activity flowsheet, the presence of 'benign' elements (e.g., aluminum) dictate processing limits or rates in both retrieval and pretreatment unit operations and have other potential downstream negative impacts. Thus, safe, cost-effective, and efficient waste processing depends on a fundamental understanding of aluminum chemistry in high ionic strength, highly alkaline solutions where water activity is low. Once the waste has been retrieved, processed, and immobilized, controlling the behavior of risk driving elements (e.g., Tc and/or I for low-activity waste) in the waste form and the environment becomes essential for waste form disposal or tank closure.
With respect to low-activity waste form disposal, material solutions must demonstrate that the risk driving radioactive elements will be contained in a manner wholly consistent with statutory requirements. Modelling future performance remains a challenge for performance assessment (PA) formalism. An appealing option is to perform an inverse PA (IPA) and look far into the past. Archeological artifacts, analogous to wasteform materials (i.e. glass and concrete) that have been left by our ancestors and exposed to the environment for thousands of years can be used to check for comprehensiveness as well as to validate and refine predicted wasteform durability. An IPA describes the features, events and processes that have influenced the corrosion of a material over time and can help establish the most likely scenarios that should be included in PA for the future. An IPA for ancient glass from a hillfort at Broborg, Sweden (ca. 400-575 AD), used to fortify the fort walls will also be one of the key focal points of this presentation.

Tags