Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.28787

# The Behavior of Iron and Radionuclide from Oxalic Acid-Based Chemical Decontamination

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The primary coolant systems of nuclear reactors contain structural materials that undergo high-temperature oxidation and radiolytic degradation, leading to the formation of radioactive corrosion oxide layers. These oxide layers present environmental and occupational health risks during maintenance and decommissioning. A major radionuclide associated with these oxide layers is cobalt-60 (Co-60), which originates from the activation of structural materials. Co-60 has a long half-life (~5.27 years) and emits high-energy gamma radiation, posing significant radiation exposure risks to workers and potential contamination hazards to the environment. Therefore, effective decontamination strategies are essential to mitigate radiation exposure and minimize environmental contamination. Oxalic acid (OA)-based chemical decontamination processes are widely employed due to their efficiency in dissolving corrosion oxide layers. However, OA also induces corrosion of structural materials, resulting in increased concentrations of dissolved metal ions such as ferrous ions. This degradation not only affects system reliability but also increases the demand for cation exchange resins in wastewater treatment, ultimately generating substantial secondary radioactive waste. To address this issue, this study explores the application of imidazole (IM) and 1-butyl-3-methylimidazolium chloride ([BMIM]Cl) as corrosion inhibitors in OA-based decontamination solutions. Under simulated decontamination conditions, [BMIM]Cl exhibited superior inhibition efficiency, reducing the corrosion depth and rate of carbon steel by approximately 36%. By effectively minimizing metal dissolution, [BMIM]Cl significantly decreases the consumption of ion exchange resins, leading to a reduction in secondary radioactive waste generation. The findings of this study highlight [BMIM]Cl as a promising candidate for improving the sustainability of chemical decontamination processes, offering an innovative approach to reducing the environmental footprint of nuclear waste management. In this study, the behavior of iron and radionuclide from OA-based chemical decontamination will be elucidated.