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Modelling the Corrosion of Spent Nuclear Fuel Inside a failed Waste Container

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The internationally accepted approach for the disposal of spent nuclear fuel is to seal it in corrosion-resistant metal containers and bury it in a stable deep geologic repository. If containers were to fail, and the fuel become exposed to groundwater, radiolytic corrosion of the fuel could release radionuclides to the groundwater, the critical first step in their transport into the environment. Two corrosion fronts will exist within a failed container, one on the fuel surface driven by radiolytic oxidants and a second on the carbon steel vessel sustained by water reduction. Based on an extensive series of electrochemical, corrosion and chemical dissolution studies, a finite-element based model has been developed to determine this evolution in redox conditions and its influence on fuel corrosion. Particular attention will be paid to the influence of hydrogen, produced radiolytically and by corrosion of the steel container vessel, on the corrosion rate.

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