# Coupling of Nuclear Waste Form Corrosion and Radionuclide Transport in Presence of Relevant Repository Sediments

**PI**: Nathalie Wall – Washington State University

**Collaborators**: James Neeway – Pacific Northwest National Laboratory

Nikolla Qafoku – Pacific Northwest National Laboratory

Joseph Ryan – Pacific Northwest National Laboratory

**Program**: Used Nuclear Fuel Disposition

**ABSTRACT**

Assessments of waste form and disposal options start with the degradation of the waste forms and consequent mobilization of radionuclides. Long-term static tests, single-pass flow-through tests, and the pressurized unsaturated flow test are often employed to study the durability of potential waste forms and to help create models that predict their durability throughout the lifespan of the disposal site. These tests involve the corrosion of the material in the presence of various leachants with different experimental designs yielding desired information about the behavior of the material. *Though these tests have proved instrumental in elucidating various mechanisms responsible for material corrosion, the chemical environment to which the material is subject is often not representative of a potential radioactive waste repository where factors such as pH and leachant composition will be controlled by the near-field environment*. Near-field materials include, but are not limited to, the original engineered barriers, their resulting corrosion products, backfill materials, and the natural host rock. For an accurate performance assessment of a nuclear waste repository, realistic waste corrosion experimental data ought to be modeled to allow for a better understanding of waste form corrosion mechanisms and the effect of immediate geochemical environment on these mechanisms. Additionally, the migration of radionuclides in the resulting chemical environment during and after waste form corrosion must be quantified and mechanisms responsible for migrations understood. The *goal* of this research is to understand the mechanisms responsible for waste form corrosion in the presence of relevant repository sediments to allow for accurate radionuclide migration quantifications. The *rationale* for this work is that a better understanding of waste form corrosion in relevant systems will enable increased reliance on waste form performance in repository environments and potentially decrease the need for expensive engineered barriers. *Our specific objectives are to*: **A)** Quantify waste form corrosion and radionuclide release rates measured in static conditions (batch experiments), in the presence of relevant sediments, **B)** Quantify waste form corrosion and radionuclide release rates in dynamic conditions (hydraulically saturated and unsaturated column experiments), in the presence of relevant sediments, and **C)** Model geochemical phenomena occurring during waste form corrosion and radionuclide release, in the presence of relevant sediments.