FIU | Applied Research Center
FLORIDA INTERNATIONAL UNIVERSITY

U.S. DEPARTMENT OF ENERGY

ENVIRONMENTAL REMEDIATION SCIENCE & TECHNOLOGY

PROJECT: Environmental Remediation Science & Technology

CLIENT: U.S. Department of Energy
PRINCIPAL INVESTIGATOR: Dr. Leonel Lagos
TASK MANAGERS: Dr. Yelena Katsenovich (Sr. Research Scientist), Dr. Ravi Gudavalli (Research Scientist), Dr. Johnbull Dickson (Sr. Research Scientist)

Description:

FIU-ARC is developing and implementing cutting-edge environmental remediation technologies to remediate contaminated soil and groundwater at the Hanford, SRS, ORR and WIPP sites to support DOE-EM's long-term monitoring strategies. The aim is to reduce the potential for contaminant mobility or toxicity in the surface and subsurface through the development and application of state-of-the-art environmental remediation technologies at DOE sites. The research involves laboratory-scale studies that utilize novel analytical methods, microscopy, and spectroscopy techniques for characterization of various solid and mineral samples.

Remediation Research and Technical Support for the Hanford Site

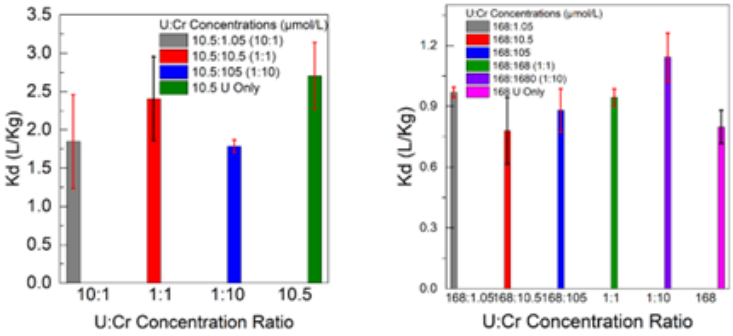
FIU is providing support to the cleanup mission at Hanford Site that is complimentary to ongoing work at Pacific Northwest National Laboratory (PNNL) for a better understanding of the long-term behavior of contaminants in the subsurface, including:

1. *Re-oxidation of Redox Sensitive Contaminants Immobilized by Strong Reductants*

FIU investigated re-oxidation behavior of perched and groundwater contaminants, such as $^{99}Tc(VII)$, in the presence of ^{238}U and NO_3^- that have been initially reduced by strong reductants such as 0.1% and 1% ZVI and SMI in batch experiments under initial anaerobic conditions followed by aerobic conditions.

2. *Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments*

The results of this study can aid in reducing the gap in knowledge of U(VI) fate under a variety of conditions. This fundamental adsorption study of U in the subsurface will help to quantify its long-term mobility and the possibility for monitored natural attenuation (MNA) after active remediation is completed at sites possessing these conditions.



Effect of U:Cr ratio on the adsorption/ K_d values

3. *Experimental Support of Lysimeter Testing*

FIU studied the behavior of borosilicate glass corrosion in grout- contacted solutions and solutions that varied the presence of dissolved cementitious species (Si, Ca, Al, Na, and K) using a combination of single pass flow-through (SPFT, ASTM C1662-18) tests and a static leach test known as the product consistency test (PCT, ASTM C1285-18).

Remediation Research and Technical Support for the Savannah River Site

The study contributes to both our understanding of the interactions of ^{129}I with organic materials and the factors controlling the attenuation of ^{129}I in wetlands, as well as the potential for remediation of U via injection of modified humic materials providing essential data for fulfillment of the permitting requirements and goals for DOE-EM. The potential findings and outcomes of this study will help to address some of the remaining uncertainties to expedite the closure of the site, improve long-term monitoring, and identify potential amendments to

ABOUT

Since 1995, the Applied Research Center at Florida International University has provided critical support to the Department of Energy's Office of Environmental Management mission of accelerated risk reduction and cleanup of the environmental legacy of the nation's nuclear weapons program. ARC's research performed under the DOE-FIU Cooperative Agreement (Contract#DE-EM0005213) can be classified as fundamental/basic, proof of principle, prototyping and laboratory experimentation.

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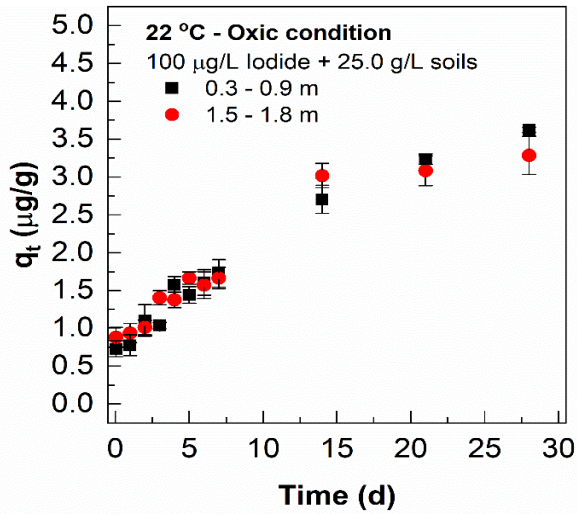
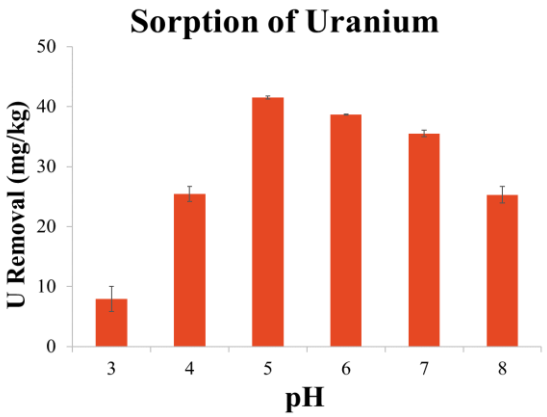
enhance the attenuation of contaminants in the wetlands. This research will also demonstrate if humic substances are viable amendments for in-situ remediation of co-mingled contaminants in an acidic environment and determine conditions for optimal contaminant removal from the aqueous phase.



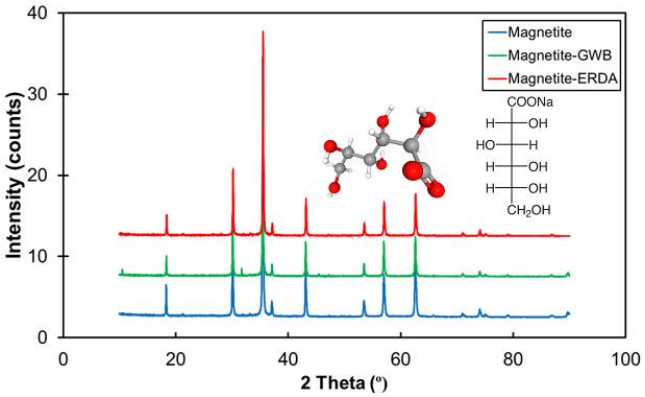
Uptake of iodide by wetland soils under oxic conditions



Effect of pH on uranium sorption onto humate-coated SRS sediment

Remediation Research and Technical Support for WIPP

Experiments supporting the safety underpinnings employed in the performance assessment models provide a better understanding of potential impacts from anticipated degradation or corrosion products. FIU-ARC conducted batch sorption experiments to investigate the impact of ionic strength, brine types and isosaccharinate on the sorption of U, Nd, and Th onto iron oxide mineral (e.g., pyrite). Uranyl (UO_2^{2+}), thorium (Th^{4+}) and neodymium (Nd^{3+}) were employed as stable chemical analogs for plutonium and americium. Experiments utilized a range of ionic strength systems (0.1, 1.0 and 5.0 M), actinide spike concentration (10 - 100 µg/L) and salt solutions (NaCl, $CaCl_2$ and $MgCl_2$), as well as two WIPP-relevant brines: the U.S. Energy Research and Development Administration Well 6 brine (ERDA-6, low Mg) and the generic weep brine (GWB, high Mg).



Impact of organic ligands and magnetite on actinide sorption

Engineered Multi-Layer Amendment Technology for Hg Remediation on Oak Ridge Reservation

FIU-ARC evaluates a suite of select sorbent materials for mercury removal under environmental conditions representative of the EFPC ecosystem. This research evaluates the effectiveness of an engineered treatment technology consisting of multi-layer reactive sorbents/amendments (MRA) contained between two to several geotextile layers (mats) for enhanced removal of mercury and methylmercury from the EFPC ecosystem (soil, ground/surface water and biota). Experiments aid in evaluating the performance characteristics of the MRA technology for design considerations and site-specific deployment.

This technology will aid DOE-EM in meeting its priority mission of reducing mercury concentration to below regulatory targets within EFPC and mitigating contaminant export from demolition of contaminated buildings in the East Tennessee Technology Park (ETTP).

Suite of sorbent media being evaluated for remediation of a mercury-impacted stream