FIU | Applied Research Center
FLORIDA INTERNATIONAL UNIVERSITY

U.S. DEPARTMENT OF ENERGY

ENVIRONMENT & ENERGY / ENVIRONMENTAL REMEDIATION

PROJECT: Environmental Remediation Science & Technology: *Remediation Research and Technical Support for Savannah River Site*

CLIENT: U.S. Department of Energy
LOCATION: Savannah River Site, Aiken, SC
PRINCIPAL INVESTIGATOR: Dr. Leonel Lagos
TASK MANAGER: Dr. Ravi Gudavalli

Description:

FIU's Applied Research Center (ARC) is supporting the U.S. Department of Energy's Savannah River Site (SRS) in remediating uranium in F/H area seepage basins.

The F/H Area seepage basins received approximately 1.8 billion gallons of acidic (pH 3.2-5.5) waste solutions contaminated with radionuclides and dissolved metals. The acidic nature of the basin waste solutions caused the mobilization of metals and radionuclides, resulting in contaminated groundwater plumes. The major constituents of concern are uranium (U), iodine (I), and technetium (Tc). The pump-and-treat system designed and built in 1997 became less effective prompting research for new remediation alternatives.

This project investigates (i) if a low cost humic substance can be used as an amendment to facilitate U adsorption to control its mobility in acidic groundwater; and (ii) environmental factors controlling the attenuation and release of iodine in the wetland sediments at Savannah River Site.

Objectives:

- Understand sorption of U using soil amended with humic substances and evaluate the effect of time, initial concentration, and pH on U sequestration.
- Investigate the natural attenuation and effect of geochemical factors on the sorption and release of Iodine in the wetlands.
- Investigate if the organoclays and granular activated carbon can help to reduce the elevated concentration of iodine species in the SRS F-Area wetlands.

Benefits:

- Evaluates whether humic substance amendment is an effective remediation technique to control U mobility in acidic groundwater.
- Provides insight on the sorption of humic acid onto SRS sediments and its effectiveness on uranium mobility in the subsurface, which will help to determine approaches to deploy humate technology under varying site conditions.
- Provides information on speciation and mobility of iodine, and determines how to control its elevated concentration in SRS wetlands.
- Improves the understanding of the effect of environmental factors on the adsorption and release of iodine species.
- Evaluates if organoclays and/or granular activated charcoal are feasible amendments for the in-situ remediation of iodine species in the SRS wetland environments.

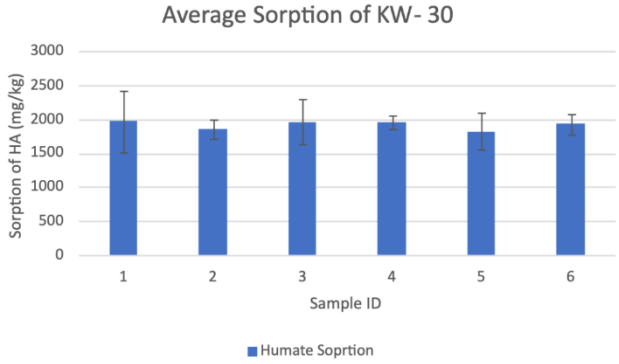

Fig 1. The average sorption of humic acid (KW-30).

Accomplishments:

- Quantified the kinetics of U removal by SRS sediments and sorption capacity of U onto SRS sediments with/without humate amendment.
- Investigated the effect of pH on interaction of uranium with humate-coated SRS soil.

ABOUT

Since 1995, the Applied Research Center (ARC) at Florida International University (FIU) has provided critical support to the Department of Energy's Office of Environmental Management (DOE-EM) mission of accelerated risk reduction and cleanup of the environmental legacy of the nation's nuclear weapons program. ARC's applied research is performed under the DOE-FIU Cooperative Agreement (under Contract # DE-EM0005213) and provides technical support to DOE EM in the area of environmental remediation and STEM workforce development and training.

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- Investigated the effect of KW-30 (Humate Material) on the co-contaminant (Uranium, Iodine and Strontium) removal
- Completed the characterization of organoclays MRM and PM-199 using scanning electron microscopy coupled with energy dispersive X-ray spectroscopy (SEM-EDS).
- Conducted batch experiments on the influences of environmental factors on the attenuation and release of Iodine from SRS wetland soils.

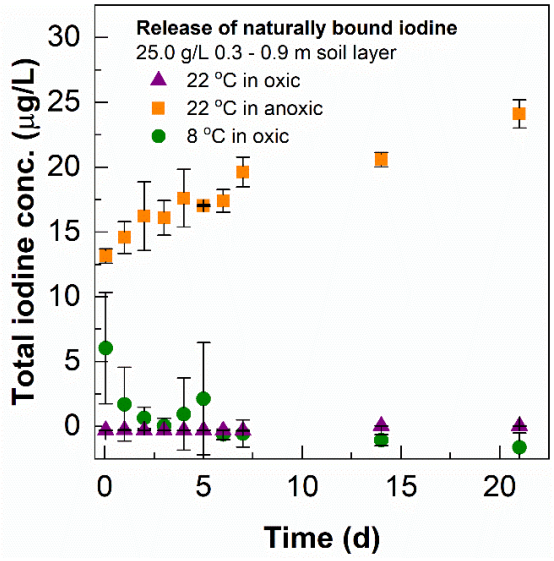

Fig 2. Release of naturally bound iodine from 0.3 - 0.9 m soil layer at 22 °C oxic, anoxic, and 8 °C oxic conditions.

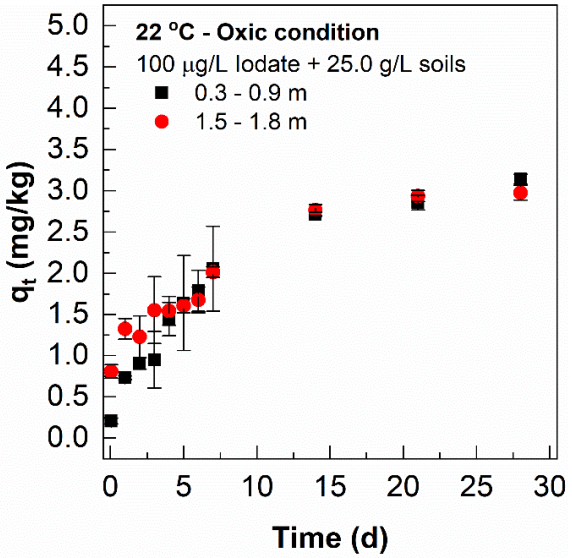

Fig 3. Uptake of iodate by wetland soils in oxic conditions.

Publications and Presentations:

- Pham, P., et al. (2023) "Remediation of Iodine-129 at Savannah River Site's Wetland by Organoclays Amendment" *WM Conference Proceedings.*
- Pham, P., et al. (2023) "Characterization of Savannah River Site's Wetland Soils at Different Depth Intervals" *WM Conference Proceedings.*
- Pham, P., et al. (2022) "Removal of Iodine-129 by Organoclays MRM and PM-199" *WM Conference Proceedings.*
- Gudavalli, R., et al. (2021) "Low Cost Humate as an Amendment for Uranium Remediation" *WM Conference Proceedings.*
- Gudavalli, R., et al. (2020) "Impact of Free Radicals on the Fate of Tc, I, and U in Wetlands at the Savannah River Site" *WM Conference Proceedings*.
- Gudavalli, R., et al. (2020) "Study of an Unrefined Humate Solution as a Possible Attenuation-based Remedy for Uranium Contamination in Acidic Groundwater" *WM Conference Proceedings*.
- Gudavalli, R., et al. (2019) "Investigating the Effect of Sorbed Humic Acid on the Mobility of Uranium" *WM Conference Proceedings*.
- Delarosa, k., et al. (2019) "Effect of Minerals on the Removal of Uranium (VI) in the Presence of Humic Acid and Colloidal Silica" *WM Conference Proceedings.*
- Gonzalez-Raymat, H., *et al.* (2018) "Unrefined humic substances as a potential low-cost amendment for the management of acidic groundwater contamination", *Journal of Environmental Management,* 212, P 210-218.
- Gudavalli, R., *et al.* (2018, 2016) "Synergetic Interactions between Uranium, Humic Acid, Silica Colloids and SRS Sediments at Variable pH", *WM Conference Proceedings.*