

Oct 9th, 4:00 PM - 5:00 PM

Reactive Iron Mineral Coatings in Redox Transition Zones and Their Impact on Natural Attenuation

Lisa Axe

New Jersey Institute of Technology

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The Doctoral Program in Environmental Management and
MSU Sustainability Seminar Series Present:

Reactive iron mineral coatings in redox transition zones and their impact on natural attenuation

WHEN: October 9, 4:00 pm WHERE: CELS 120 lecture hall

Lisa Axe

New Jersey Institute of Technology



Lisa Axe is a Professor and Chair of the Otto H. York Department of Chemical and Materials Engineering at NJIT. She has a joint appointment with the Department of Civil and Environmental Engineering at NJIT. Dr. Axe received her Ph.D. in Environmental Engineering from Illinois Institute of Technology (IIT) in 1995. She also has a MChE Master of Chemical Engineering and MS in Environmental Engineering from IIT. Her BS is in Geoscience with an option in Geochemistry from Purdue University. Dr. Axe's research is in chemical and physical processes in environmental systems. Much of her group's efforts have been in understanding interfacial processes and their impact on contaminant attenuation. Her group uses a suite of complementary analyses to study surface chemistry and contaminant behavior. Dr. Axe has been funded by Chemours, National Science Foundation, SUEZ North America, U.S. Army, NJ Department of Transportation, and NY State Department of Transportation. She was a recipient of the DuPont Young Professor Grant to study adsorption competition mechanisms. She currently serves on the Chemours Science Advisory Board for the Chambers Works Site as well as a NJDEP Science Advisory Board. She has published over 60 peer reviewed publications.

Reactive Fe mineral coatings play an important role in contaminant attenuation in redox transition zones at sites with subsurface contamination. An anaerobic 60 foot core was collected from the Chambers Works Site in Deepwater, NJ. Working in a glovebox, two-inch subsamples were used to evaluate redox transition zones using bulk composition, redox potential, pH, VOCs in the headspace, as well as abundant bacteria. A number of redox transition zones were identified and further studied with a suite of complementary analyses to characterize the surface chemistry. Analyses have included sequential extraction (phases and speciation), x-ray diffraction (mineralogy), x-ray fluorescence (composition), field-emission scanning electron microscopy (surface morphology down to the nm scale) with energy dispersive analysis (surface composition), and bench-scale experiments. Results reveal a clear trend in reactive iron (II)/(III) mineral coatings throughout transition zones. Reactive iron mineral coatings reveal iron (II) minerals pyrite, mackinawite, pyrrhotite, and siderite in a transition zone running through an aquitard. Ferrihydrite, goethite, and lepidocrocite were dominant iron (III) minerals in a transition zone that was observed in an aquifer, while pyrite, greigite and gypsum were the most abundant mineral coating in an upper aquitard transition zone. Overall, the most significant reactive mineral coatings were observed in redox transition zones located in aquitards where there is $\text{Fe}^{2+}/\text{Fe}^{3+}$ cycling. Ongoing studies are focused on abiotic degradation pathways for halogenated solvents present in the system.

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