North Dakota Water Resources Research Institute (NDWRRI) Seminar

Laboratory- and Field-scale Evaluation of In Situ PFAS Immobilization Using Activated Carbon Barriers

Dr. Anh Pham, University of Waterloo

Date and Time: Mon. 10/27/2025

3:30 - 4:30 PM (CDT)

Via Zoom, Meeting ID: 995 0056 5246 Passcode: 920171

https://ndsu.zoom.us/s/99500565246

Abstract:

The use of Aqueous Film-Forming Foams (AFFFs) in firefighter training has created sites where soil and groundwater are highly contaminated with per- and polyfluoroalkyl substances (PFAS) and other related contaminants. The presence of PFAS at many of these sites poses a direct threat to groundwater and surface water resources. As such, there is an urgent need for technologies that can contain PFAS to mitigate their risks. In recent years, in-situ adsorption barriers have emerged as a promising technology for reducing PFAS transport in the subsurface. These barriers are created by injecting a suspension of powdered activated carbon (PAC) or colloidal activated carbon (CAC) into the subsurface, creating an adsorption zone that removes PFAS from groundwater and substantially reduces their downgradient transport. Compared with conventional ex-situ treatment approaches—such as pump-and-treat systems employing granular activated carbon (GAC) or ion exchange (IX) resins—in situ immobilization has the potential to be more cost-effective by reducing both energy demand and remediation-derived waste. However, the breakthrough of PFAS is expected to eventually occur once the adsorption sites in the barrier become saturated. Thus, a critical question remains: for how long can in situ barriers reduce PFAS flux, i.e., the remedy's longevity? This presentation will discuss the results of laboratory experiments designed to elucidate the fundamental processes that govern the sorption of PFAS on PAC and CAC, and develop a reactive transport model capable of predicting the retention and breakthrough of PFAS in AC barriers. The presentation will also discuss a field experiment that is being conducted at a former firefighter training area within the Naval Air Station, Jacksonville, Florida, to assess the retention of PFAS under more complex geochemical and flow conditions, and to benchmark the performance of the reactive transport model. The presentation will conclude by considering current data gaps in predicting barrier longevity and future research needs, including strategies for managing PFAS fluxes from the adsorption barrier near the end of the barrier's useful life.

Speaker biography:

Dr. Anh Pham is an Associate Professor in the Department of Civil and Environmental Engineering, University of Waterloo, Canada. He obtained a B.S. degree in Chemical Engineering from Hanoi University of Technology in 2005 and M.S. and PhD degrees in Civil and Environmental Engineering from the University of California, Berkeley in 2012. Prof. Pham's research interests include soil and groundwater remediation, passive sampling, electrochemical water treatment technologies, and advanced oxidation processes. His current research focuses on PFAS in groundwater, soil, surface water, wastewater, and biosolids.