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LSPA 2026 Environmental Symposium

Renaissance Framingham Hotel & Conference Center, Framingham, MA

Next-Generation Bioremediation: Plants, Microbes, and Fungi at Work

April 9, 2026, 8:00–9:30 AM, Track 2
1.5 Technical LSP Credits (LSP #1913A) and 0.75 CT LEP Credits (CTLEP-644)
NY PE and NY PG Credits - PENDING

PRESENTATION DESCRIPTION

Advancing Phytoremediation Through Microbial-Assisted Nature-Based Solutions
Kirby Gimson, Remediation Project Manager, Intrinsyx Environmental

Phytoremediation has traditionally been viewed as a supplemental or polishing remedy, but advances in nature-based solutions are changing how plants can be used to manage contaminant mass, flux, and long-term risk at contaminated sites. By pairing plants with carefully selected microbial and fungal partners, phytoremediation systems can now be designed to perform more predictably, last longer, and address a wider range of contaminants than traditional “basic phyto” approaches.

This presentation focuses on how microbial-assisted phytoremediation works in practice and why it matters. We will discuss how endophytic and rhizospheric microorganisms enhance plant performance, reduce phytotoxic stress, and support key remedial processes such as hydraulic control, biodegradation, and natural source zone depletion. These plant–microbe systems can also strengthen enhanced monitored natural attenuation (EMNA) and help manage residual source material under active and post-closure site conditions.

Examples of how these approaches have been applied at project sites will be presented, along with practical design considerations, monitoring strategies, and performance metrics. Attendees will leave with a clear understanding of when microbial-assisted phytoremediation makes sense, how it improves upon conventional phytoremediation, and why nature-based remediation solutions are becoming a defensible and effective tool for long-term site management.

Lab-on-a-Chip Reveals How Fungi Shift Flow and Mobilize Subsurface Oil Contaminants
Sang Hyun Lee, PhD, Assistant Professor, Department of Microbiology, University of Massachusetts Amherst

Filamentous fungi are ubiquitous in porous environments and play critical roles in carbon cycling, nutrient turnover, contaminant degradation, and soil health. Yet despite their

ecological importance, their potential to enhance in situ bioremediation remains underexplored—largely due to a lack of understanding of how fungi interact with fluids and solutes at the pore scale. In this study, we employed lab-on-a-chip microfluidic platforms to uncover the mechanisms by which fungi influence multiphase flow and redistribute contaminants in heterogeneous porous media.

Microfluidic chips made of polydimethylsiloxane (PDMS) were fabricated with dual-porosity architecture to simulate fractured aquifer systems and were saturated with a model hydrocarbon oil to mimic non-aqueous phase liquid (NAPL) contamination. A hydrophilic,

hydrocarbon-degrading strain of Penicillium sp. MLAC-nap12—originally isolated from a coal tar–impacted site—was introduced into the chip, and its interactions with the oil phase were tracked in real time using high-resolution microscopy. We found that fungal colonization in high-permeability flow paths caused localized clogging, which redirected flow toward previously stagnant, low-permeability zones. Moreover, the hydrophilic fungal hyphae penetrated oil-filled pores, physically displacing the trapped oil and mobilizing it into flowing regions.

These findings reveal new mechanisms by which fungi can reshape flow fields and enhance NAPL recovery. This work demonstrates the utility of microfluidic systems in studying microbe–fluid interactions and highlights the translational potential of fungal systems for subsurface bioremediation and enhanced oil recovery. This work was published in *Nature Physics* and featured on the cover of the November 2025 issue.

Time for Questions & Answers will be included at the end of the presentations.