The "Outside-In" Approach: A New Paradigm for Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) Site Investigation, Risk Assessment and Risk Management

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Background/Objectives. As a result of their stain-resistant properties and chemical durability, PFAS have been used in many products from waterproofing agents in leather and fabric, detergents, fast food wrappers, and most notably as foams in fire suppressants and deluge systems. As a result of their widespread presence, they have entered the food chain and contaminated vast groundwater areas. PFAS are suspected to cause cancer and tumors, weaken the immune system, and affect fetal development. Despite the paucity of regulatory drivers, investigation and remediation of PFAS is underway in many countries to protect human health and the environment, as well as to avoid future litigation costs and damage to public relations. The standard RI/FS approach is to identify the source, delineate transport pathways and identify receptors using an inside-out approach. For PFAS, heightened public concern, unique physical and chemical properties that make PFAS highly mobile and persistent, and a poor track record of risk communication have forced a new paradigm wherein potential receptors and risk mitigation are prioritized before sources are fully characterized, i.e. an "outside-in approach." This presentation provides evidence that the "outside-in" risk-based approach is better suited for managing PFAS than the traditional RI/FS framework.

Approach/Activities. At several sites, parties have taken an "outside-in" approach whereby potentially affected areas are screened for at-risk receptors, sampled, and assessed for risk. Then, the beginning and intermediate portions of the conceptual site model (CSM), such as sources, transport mechanisms, and complete exposure pathways are filled in. This approach helps to rapidly communicate risks to human health and the environment (or lack thereof) to regulators and members of the general public.

"Outside-in" Human Health Risk Assessments uses a combination of promulgated health-based standards and guidelines and site-specific concentrations of dietary items (e.g., eggs, fish, vegetables) to calculate risks from PFOS, PFOA, and PFHxS.

"Outside-in" Ecological Risk Assessments rely on a patchwork of scarce but growing body of screening benchmarks protective of direct contact and food chain exposures, supplemented with site-specific tissue testing to develop bioconcentration factors, bioaccumulation factors, and biomagnification factors to refine risk estimates.

Results/Lessons Learned. Using the "outside-in" approach, we have been able to rapidly demonstrate where there are negligible risks to human and ecological health from PFAS and identify priority areas for immediate risk management, allowing the client to rapidly satisfy public concerns and focus future efforts on source control.