Adaptive, Phased Remediation for PFAS-Impacted Sites: A Practical Pathway

PFAS remediation presents unique challenges due to the sheer number of compounds, their varied environmental behavior and toxicity, analytical limitations, and the high cost of treatment technologies. At many sites, progress stalls because of exhaustive investigations to delineate impacts at part-per-trillion levels, uncertainty around remediation targets, and an evolving regulatory landscape.

These complexities often delay source control—addressing PFAS contamination where concentrations are highest—and divert capital to manage impacts far downgradient, such as point-of-entry treatment at multiple residences, while increasing legal exposure.

To overcome this impasse, the paradigm about PFAS contaminated sites remediation should evolve to fully embrace the concept of holistic site management using phased, adaptive remediation. This approach plans full-site remediation in modular, interconnected phases, adjusting each phase based on monitoring data and regulatory developments. While this model challenges traditional engineering comfort zones, it enables meaningful action sooner, improving efficiency and stakeholder confidence.

This presentation will discuss the main elements to consider for this strategy and showcase its application at a Canadian site, where multidisciplinary teams collaborated to design a four-tier phased solution:

Passive Funnel-and-Gate Permeable Adsorption Barrier (PAB) to intercept the PFAS plume before discharge to surface water.

Targeted PFAS mass reduction in groundwater for source zone mass removal using on-site destructive treatment solutions.

Soil management if required, through in-situ flushing integrated with groundwater source zone mass removal or alternative measures.

Monitored natural retention for residual concentrations.

By leveraging predictive numerical modelling to evaluate the positive impact of the remedial phases, and adaptive design founded on solid monitoring data, this approach accelerates risk reduction and supports a practical pathway for PFAS remediation.

Sara Jamaliniya
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Sara Jamaliniya is an experienced Environmental Scientist at WSP Canada Inc. in Ottawa. She specialises in contaminated site assessment and remediation, with a focus on emerging contaminants such as PFAS. Her expertise includes soil and groundwater investigations, analytical data interpretation, and regulatory compliance. She develops conceptual site models and integrates monitoring data to design adaptive, phased remediation strategies. This approach accelerates risk reduction and ensures flexibility as regulatory frameworks evolve.

Laura Jones
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Laura Jones, M.A.Sc., P.Eng. is an Environmental Engineer with over nineteen years of consulting experience. Laura has managed Phase I and Phase II environmental site assessments for due diligence, Records of Site Condition and using the federal 10-step framework; contaminated site management projects; LNAPL management projects; remedial planning and remediation; and peer review.

Laura has presented case studies on high resolution site characterization techniques (e.g., laser induces fluorescence, membrane interface probe, in situ groundwater sampling) and considerations for PFAS in site investigations at several conferences, external workshops and internal training events. Laura has been the technical lead on several PFAS investigation projects including development of a conceptual site model of PFAS distribution and contaminant transport and a remedial options evaluation at a fractured bedrock RCAF site in southeastern Ontario, and a remedial action plan and design for PFAS remediation (combined soil stabilization and permeable reactive barrier) at an active airport in Northern Ontario.

Laura holds a B.A.Sc. in Environmental Engineering and an M.A.Sc. in Civil Engineering, both from the University of Waterloo. Her masters research focused on on contaminant transport and numerical modelling of in situ chemical oxidation.