# Fiscally Conscious DNAPL Remediation
# Legacy Liability to Managed Closure

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**Background/Objectives.** A former chemical plant stored, repackaged, and (re)distributed chemicals, including but not limited to: hydrogen peroxide, methylisobutyl carbinol (MIBC), tetrachloroethene (PCE), acetone, ethanol, and diesel fuel. Based on the site's geology, a phased approach utilizing combined remedies was selected as the preferred remedial option: Trap & Treat® BOS 100® was installed as a permeable reactive barrier (PRB) off-site to capture dissolved impacts leaving the facility, and shallow soil mixing with activated persulfate was used to mitigate unsaturated soil impacts adjacent to source media. Additionally, Trap & Treat® CAT 100 was used to mitigate saturated soil source mass and groundwater impacts.

**Approach/Activities.** High-density quantitative soil and groundwater sampling was conducted in 2011 and 2012 to refine the existing Conceptual Site Model (CSM). High density soil and groundwater sampling verified vertical and horizontal distribution of contaminant mass on and off-site, significant unsaturated mass confirmed a sustained NAPL source for a dissolved solute plume downgradient further off-site. A Phased approach utilizing combined remedies was selected as the remedial option for the facility; interim corrective action was completed in 2013 and 2014 and included 1) an off-site in-situ permeable reactive barrier utilizing Trap & Treat® BOS 100® to capture dissolved impacts leaving the facility and 2) shallow soil mixing activated persulfate to mitigate unsaturated soil impacts adjacent to source media. Pilot-Scale Phase 1 was conducted in December 2016 utilized Trap & Treat® CAT 100 to evaluate effectiveness with mitigating saturated source mass soil and groundwater impacts. Full Scale Phase 2 completed in September 2018 included additional off-site source and dissolved-phase treatment utilizing Trap & Treat® CAT 100. Full Scale Phase 3 and Phase 4 were completed in September 2019 and September 2020 respectively) included CAT 100 injections in the source area. The final Full-Scale Phase 5 was completed in September 2021 included CAT 100 injections in the remaining on-site source areas.

**Results/Lessons Learned.** The presentation will discuss the development of the CSM over time, highlight the remedial action as a site-specific case study example including characterizing and injecting remediation products into tighter lithologies, and the financially responsible phased approach deployed at this site over multiple fiscal years. Lessons learned and relevant data to be presented will include the benefits of high-density indiscriminate soil and groundwater sampling for quantitative analysis in the laboratory and improvements to the BOS 100® platform to mitigate source-level DNAPL mass on-site. Long term performance monitoring will demonstrate CVOCs reductions in comparison with abiotically and biologically generated degradation byproducts and microbial biomass and metagenomic sequencing analysis, supporting the decision to issue a managed closure status for the facility in the 4$^{th}$ Quarter of 2022.