

Remediation of a Former Chemical Blending Facility Utilizing Multiple Methods Including in situ Chemical Oxidation and Soil Treatment

Anthony Knafla and Lori Vickerman, Equilibrium Environmental Inc.

A complex remediation project was conducted within a municipal boundary. Impacts extended to a depth of 9 m and were comprised of petroleum hydrocarbons and solvents (ketones, alcohols, aldehydes, chlorine substituted). Five techniques were used to optimize remediation efficiencies: Tier 2 guideline development; field mobile screening lab; ex situ chemical oxidation; in situ chemical oxidation; and, a mixed soil/bentonite cutoff wall.

Tier 2 guidelines allowed for the derivation of defensible remediation objectives that were less constrained than Tier 1 guidelines due to site-specific conditions. The mobile GC/PID field screening lab allowed for the segregation of waste into Class 1, Class 2, Treatable Class 1 to Class 2, Treatable Class 2 to reusable backfill, and unimpacted soils. Active in-field waste segregation was determined to be an effective means for optimizing remediation costs. Ex situ chemical oxidation was used to treat a portion of soils from Class 1 to Class 2 (chemistry confirmed by independent laboratory analyses) that resulted in notable landfill cost savings. A similar approach was used to treat a portion of Class 2 soils to below Tier 2 guidelines allowing the material to be used as backfill instead of landfilling.

Impacts also extended beneath a nearby building and excavation was not a suitable technique due to information related to the building structure. In situ chemical oxidation was used to remediate impacts to below Tier 2 guidelines. Remediation was achieved within a six month injection timeframe in clay loam soils and a sand/gravel seam, as a result of the intensive injection grid spacing. Post-injection drilling confirmed Tier 2 guidelines had been met and no subsequent remediation was required.

Impacts extended beyond the property boundary and it was necessary to prevent future re-contamination of the property and unimpacted backfill soils due to contaminant back-migration. A mixed soil/bentonite cutoff wall was constructed that had a tested permeability of <math><10^{-10}</math> m/s. This technique was substantively less expensive than a Waterloo Barrier and provided sufficient protection for the property in order to facilitate a potential property sale.

Due to the presence of 100% LEL vapour concentrations, a comprehensive safety program was developed and maintained to ensure worker and surrounding occupant health protection. This involved the use of custom monitors (fixed and mobile) combined with random SUMA canister sample collection for laboratory confirmation. Concentrations were compared against occupational health and safety limits, with consideration for potential public exposures.

Anthony Knafla

Mr. Knafla is the founder of Equilibrium and has 27 years of experience in the fields of toxicology, risk assessment, modelling, analytical techniques, risk management/ remediation plan development, and remediation innovation. He has provided expert services in public hearings and federal and provincial regulatory agency decision support. Mr. Knafla has innovated and managed the development of several environmental software tools and has extensive experience with software models used in remediation support. He has been responsible for the design and development of remediation strategies for more than 50 sites impacted by petroleum hydrocarbons, metals, salinity, and solvents, including techniques such as steam distillation, reverse osmosis, phytoremediation, enhanced natural attenuation, windmill based soil vapour extraction, thermal oxidation, as well as in situ / ex situ chemical oxidation.