PFAS Stabilization: Comprehensive Bench Scale Evaluation of Amendments, Dosage, and Binders

Korene Torney, SLR Consulting Ltd

Due to the persistence of per- and polyfluoroalkyl substances (PFAS) in the environment and the changing regulatory framework, remediation of PFAS contaminated sites is complex and challenging. Soil stabilization and solidification are generally effective remedial approaches to managing PFAS contamination in soil. However, it remains a challenge to select optimal amendments and dosing to cost-effectively achieve desired outcomes. Although bench-scale tests have been performed for a variety of soil amendments, there were gaps in the available data due to test limitations. To this end, a bench scale study was conducted on behalf of the Department of National Defence (DND) to provide a more comprehensive, comparative review of amendment efficacy by evaluating a combination of stabilizers and binders.

The study was conducted to help inform remediation planning at a DND site with aqueous film forming foam (AFFF)-impacted soil. Bench scale testing was conducted on soil collected from the site. The study included three stabilizers (proprietary and generic) at four dose percentages (0.2 %, 0.5%, 1%, and 2.0 % dry weight) either with or without binder for a total of 26 mixes including control samples. The study was designed to report a four-point (plus unamended reference) dose response relationship for each mix and be consistent with the minimum testing regime for similar peer-reviewed published studies. The testing regime included compaction, hydraulic conductivity testing, geotechnical analyses, USEPA Leaching Environmental Assessment Framework (LEAF) 1314 and 1315, low-level liquid chromatography mass spectrometry (LLLCMS), total oxidizable precursor assay (TOPA), and Synthetic Precipitation Leaching Procedure (SPLP) for comparison to LEAF methods. This study is one of the most comprehensive studies of PFAS amendments and testing methodologies to date.

The results informed the following testing objectives: 1) relative performance of proprietary and non-proprietary amendments at varying does; 2) dosage/quantity of amendment required to meet site-specific remediation targets; 3) effectiveness of binders to enhance stabilization performance; and 4) comparison of leaching methods. Additionally, the geotechnical and hydraulic conductivity data was used to interpret leaching results and was also assessed for potential field-scale quality control, and TOPA data was assessed to determine amendment activity with respect to precursors.

Study results provide a significant contribution to the PFAS soil amendment efficacy literature that can assist practitioners in decision-making with respect to amendments, leaching/analytical approaches and implications, and field implementation. Use of amendments to mitigate PFAS contamination represents a sustainable option that reduces soil landfilling and minimizes transportation related emissions. With the reported dose response relationships and other available literature, practitioners may avoid or reduce project specific bench scale studies which would represent a significant cost savings.

Korene Torney

Korene Torney, P.Geo, PMP, SLR Consulting (Canada) Ltd., Senior Project Manager. BCEIA Vice President and Board Member. Ms. Torney is a senior scientist and project manager with over 25 years' experience driving successful contaminated sites projects in BC. She combines contaminated sites expertise and project management techniques to deliver projects for private industry, developers, first nations, and all levels of government (municipal, regional, provincial and federal). She has delivered projects with values ranging from $5K to $30M through all stages of project design, feasibility, and implementation including all levels of investigation, data gap analysis, remediation, and risk assessment. Her technical experience spans a wide range contaminant sources including manufactured gas (coal tar), military, railyards, fire training, septage/wastewater treatment, fueling facilities, wood treatment, metal fabricators, and landfills. Ms. Torney's regional government experience provides a unique 'client' perspective that optimizes project delivery through strategic planning, options analysis, project risk assessment, procurement expertise, stakeholder liaison and a detailed understanding of BCs regulations. Since 2020, Korene has managed and supported multiple PFAS investigations and remediation projects in British Columbia. In this capacity, Korene and SLR's team designed and implemented the largest PFAS stabilization/amendment project in North America in 2021.