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In Situ Stabilization/Solidification as a Sustainable Alternative for the Remediation of Heavy Hydrocarbon Sites

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Background/Objectives. In situ stabilization/solidification (ISS) is an established remediation technology used to treat contaminated materials by mixing soils in situ with a binder (e.g., cementitious/pozzolanic reagents) to achieve immobilization of contaminants through solidification and stabilization processes. ISS is an effective method for difficult to treat sites contaminated with heavy hydrocarbons (e.g., polynuclear aromatic hydrocarbons), non-aqueous phase liquid (NAPL), volatile organic compounds, and metals. ISS can also complement other remedial approaches by treating recalcitrant source areas (e.g., NAPL) and augmenting conditions for application of other in situ approaches (e.g., bioremediation).

Because ISS is completed in situ, less volatiles are released during implementation to construction workers and the surrounding community compared to traditional excavation and off-site disposal (excavation) of contaminated soils. In addition, the material is treated in place, reducing typical remedial excavation requirements: dewatering, transportation and off-site disposal. To quantify the benefits of implementing ISS as a green and sustainable alternative to excavation for the remediation of heavy hydrocarbon sites and a complement to other in situ approaches, a life cycle assessment (LCA) was conducted for a manufactured gas plant (MGP) site cleanup in South Central Florida.

Approach/Activities. The LCA used two tools to quantify the sustainable benefits of ISS: 1) a basic cost analysis; and 2) the USEPA's Methodology for Understanding and Reducing a Project's Environmental Footprint (Methodology). The basic cost analysis compared the actual cost of implementation for ISS at the Site and the estimated cost of implementation for excavation based on engineering judgement and previous project experience. The Methodology involved identifying and quantifying green remediation (GR) metrics for ISS and excavation implementation, then subsequently converting each of these metrics into a CO_2 footprint for comparative analysis. The GR metrics considered include materials, waste, water, energy, air, and land consumption. The GR metrics were calculated based on the type of equipment and materials, in addition to site-specific parameters used for the actual ISS implementation and the theoretical excavation implementation based on previous project experience. Recommendations will be presented from the assessment of GR metrics for ISS implementation to reduce the cost and overall environmental footprint of future ISS implementations.

Results/Lessons Learned. This presentation will provide a summary of ISS as a sustainable remedial alternative for heavy hydrocarbon sites. Additionally, the presentation will discuss the results of the LCA for both ISS and excavation implementations, comparison of ISS and excavation based on environmental footprint results, and recommendations to reduce cost and overall environmental footprint of future ISS implementations based on assessment of GR metrics.