Case Study: Harrison Landfill Brownfield Redevelopment, Camden, New Jersey

Site Overview	The brownfield development area (BDA) consists of eight abandoned sites within a highly urbanized setting along 2 miles of shoreline on the Delaware River. This case study site is an 85-acre former landfill located within the 200-acre BDA in Camden, New Jersey. The unlined landfill operated from 1952 until 1971, when it was closed with vegetative soil cover. A pre-design investigation was performed to delineate the nature and extent of the on-site chlorinated VOC plume. Sustainable remediation best management practices were incorporated at the onset of site characterization and remedial activities to minimize negative impacts to the triple bottom line (TBL) and expedite subsequent redevelopment. The results of the pre-design investigation identified two hot spots within a ten-foot clay layer situated immediately below the waste fill material. These areas of impacted clay appear to be acting as sources of contamination by means of diffusion and desorption to the aquifer below. Interim remedial options (IROs) developed for this site targeted the source material within the clay.
GSR Project Outcome	GSR practices implemented during the pre-design investigation stage included the use of EPA's Triad approach, the use of biofuels (and bio-hydraulic fluids) for heavy equipment, and the use of a local marina to store heavy equipment. A carbon footprint analysis was conducted to determine the reduction in environmental impacts from implementing GSR practices during the characterization stage, compared to a traditional approach: **Environmental Impacts:** - 45% reduction in CO_2 equivalents - 50% reduction in analytical costs and schedule - 40% reduction in field effort - Reduced generation of IDW At the Feasibility Study phase, a carbon footprint analysis and cost benefit analysis were conducted to determine the total CO_2 equivalents and project implementation costs for each proposed interim remedial option (IRO). Due to the localized source area within the clay, *in situ* thermal remediation at the source area combined with *in situ* chemical oxidation for the downgradient plume was determined to have the lowest carbon footprint and cost. A sustainability assessment was conducted for the proposed *in situ* thermal/chem ox IRO to determine impacts to the TBL during the thermal treatment and yearly monitoring events.

Background & Drivers	- Reduce overall carbon footprint through use of GSR practices, IROs, and web-based meetings and electronic deliverables. - Strengthen community institutions and catalyze neighborhood revitalization by expediting complete delineation and not hindering redevelopment activities.
Regulatory Program	New Jersey Department of Environmental Protection Brownfields
Site End Use	Redevelopment plans for this landfill include a state-of-the-art, 132,000-square-foot community center that will feature an atrium-style town plaza, a family service center, indoor and outdoor recreational facilities, an aquatic center, and a child care center, as well as community-enrichment, job training, and antipoverty programs.
Contaminants of Concern and Impacted Media	Chlorobenzene (CB) and dichlorobenzenes (DCBs).
Key Stakeholders in Project	New Jersey Department of Environmental Protection, City of Camden
Cleanup Objectives	- Perform an IRO to address the contamination within the "source area". - Reduce the contaminant mass in an effort to mitigate the potential exposure of contamination to the public and the environment. - Implement an IRO over a short duration with the greatest reduction of contaminant concentrations.
Remediation Strategy	Used Triad approach to expedite the delineation of the source area within the landfill site. The Triad sampling strategy consisted of *in situ* screening of soil and groundwater using the membrane interface probe (MIP), followed by confirmatory sampling via vertical profiles in the soil and groundwater. *In situ* thermal remediation was the IRO chosen to target chlorinated benzene source material within the unsaturated zone and *in situ* chemical oxidation to mitigate the migrating plume.
GSR Strategy/Best Management Practices (BMPs)	- 5-percent biodiesel fuel used to operate all heavy equipment (MIP, Geoprobe® track unit, and support vehicle) - Bio-hydraulic fluids (non-hazardous, high-performance) replaced all petroleum-based hydraulic fluids - TRIAD Approach - *In situ* screening - Direct push technology (DPT) drilling methodology - Waste minimization

GSR Metrics and/or Footprinting Tool(s)	**Environmental Impacts**: A carbon footprint evaluation, using CO_2 equivalents, and a cost benefit analysis of project implementation cost were used to determine TBL impacts during the pre-design investigation stage and IRO alternative assessment. A sustainability assessment was conducted for the proposed IRO using: **Environmental Impacts**: Naval Facilities Engineering Command SiteWise™ environmental footprint analysis tool **Economic Impacts:** Cost-Benefit Analysis of project implementation **Social Impacts:** A socio-economic cost analysis was conducted to identify global monetized damages society endures from the emissions generated (e.g., social cost of carbon) and energy use (e.g., social cost of energy use) for the proposed IRO and O&M (Harclerode 2013).
Lessons Learned [Optional]	
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Relevant Links [Optional]	
References [Optional]	Harclerode M, Lal P, and Miller M. 2013. *Estimating Social Impacts of a Remediation Project Life Cycle With Environmental Footprint Evaluation Tools*. Remediation Journal. Volume 24, Issue 1 Watt M, Burlingame M, Beattie J, Koberle M, and Carlson B. 2010. *Sustainably Expediting Brownfields Redevelopment by Applying Triad Using the Membrane Interface Probe*, Remediation Journal, Volume 20, Issue 4.