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Clean and green: Carbon footprint analysis for three MGP site remediation alternatives

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Environmental cleanup of contaminated properties typically consumes large quantities of energy and fossil fuels, and contributes to air pollutant emissions including greenhouse gases. In-situ remedial approaches (i.e. when remediation occurs in the ground rather than aboveground) may involve the input of thermal energy or treatment chemicals to the subsurface to destroy contaminants. Groundwater pump and treat or vacuum extraction systems often require the long-term operation of pumps, compressors, and other treatment equipment, while ex-situ (i.e. aboveground) remedial approaches typically require the use of heavy-duty diesel-powered construction equipment to handle and truck large volumes of material for treatment or disposal off-site.

This consumption of energy and fossil fuels imparts a carbon footprint to all cleanup projects. With an increasing emphasis on the adoption of green remediation strategies, the Environmental Protection Agency (EPA) has encouraged practitioners to establish carbon footprint baselines against which to measure future remedial approaches and to help identify opportunities for improving the carbon footprint of remediation activities. Project stakeholders should evaluate the sustainability/carbon footprint of potential cleanup strategies during the design phase to guide their selection of remediation alternatives. This approach to site cleanup can also positively contribute to the LEED rating for redevelopment/construction projects.

A multi-year remediation project at a former manufactured gas plant (MGP) site provided a major utility client with the ideal opportunity to evaluate emissions of carbon dioxide (CO2) resulting from remedial activities. The selected approach involved excavation of approximately 11,500 tons of coal tar-impacted soil/sediment and treatment of the material at an off-site thermal desorption facility located 75 miles from the site.

Fossil fuel usage inputs were calculated for operation of on-site excavation equipment, dewatering pumps, transportation of excavated material and clean backfill, site personnel transportation, as well as natural gas usage associated with the off-site thermal desorption process. Conversion factors for fossil fuel usage volumes to carbon emission quantities were determined based on review of available published literature. On-site and off-site electrical power usage was also assessed and estimates were made of the carbon emissions associated with power generation.

The selected approach was found to emit 395 lbs. of CO2 per cubic yard (CY) of sediment treated at a cost of $350 dollars per CY treated. The off-site thermal desorption process accounted for 76% of CO2 emissions while trucking of material to the treatment facility accounted for 18% of emissions.

Carbon emissions for two alternative remedial approaches (in-situ chemical oxidation and in-situ thermal desorption) were similarly evaluated along with the associated implementation costs, so that a comparison could be made between the alternatives. Based on the comparison, in-situ chemical

oxidation had the lowest carbon footprint (240 lbs. CO_2 emitted per CY treated). However, it had the highest cost of implementation ($765 - $915 per CY treated) due to the large quantities of chemicals required to treat the viscous material. Chemical manufacture accounted for 78% of estimated emissions for this alternative.

Carbon footprint analysis can be readily performed with accurate tracking of project fuel use, electricity use, material transportation, and personnel transportation during the construction phase. A preliminary analysis can also be performed during the Remedial Alternatives Analysis phase of cleanup projects so that the feasibility of implementing green remedial approaches can be evaluated. Finally, property owners and remedial professionals should consider performing carbon footprint analyses for their remediation projects as well as documenting their findings/results to advance the baseline knowledge of the remediation industry.

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