Quantifying Sustainability Metrics for an Innovative Groundwater Cleanup Employing a Passive Biobarrier and Pond Wetlands at the Aberdeen Proving Grounds New O-Fields Site

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Background/Objectives. In this study, we developed, evaluated, designed, and implemented an innovative cleanup strategy, to address migration of soluble metals/solvents/chemical warfare materiel (CWM) product degradation at a 14-acre highly-contaminated CERCLA site, reducing Army's liability and long-term monitoring (LTM) cost by at least 50 percent compared to other Feasibility Study action alternatives considering wetland and pond habitat destruction, sediment and soil excavation/removal, and offsite disposal. The site was formerly used as an open burning/dump site for CWM, munitions and explosives of concern (MEC), and lab wastes. Contaminants of concern (COCs) in the sediment, surface water, and groundwater include: 8 chlorinated volatiles, 3 metals, 3 nerve agent degradation products, white phosphorus, and highly hazardous mixed CWM considered principal threat waste. After 8 years, performance monitoring data indicate that all COCs are below remedial goals in surface water and 85% of COCs are below conservative temporary remedial goals in groundwater. New goals that account for COC breakdown in a nearby pond and marsh are currently under Army and EPA consideration; and once adopted, the site will transition from active remediation by injection to passive remediation, resulting in decreased LTM for the Army.

Approach/Activities. Although not a part of the initial performance work statement, we designed and implemented a green and sustainable remediation (GSR) approach to realize substantial savings on carbon footprint and other green metrics by implementing: 1) landfill capping (rather than excavating and offsite disposal); 2) reuse of existing soil piles as subgrade for the landfill cover; 3) in situ bio-barrier treatment for groundwater contaminants consisting of chlorinated solvents, petroleum aromatics and metals; and 4) pond preservation as a wetland treatment buffer zone (employing recycled chitin as an electron donor for biological reactions) for impacted groundwater to surface water transmission. To quantify tangible sustainability metrics, Sitewise™ was utilized to compare activity and material options for several Feasibility Study alternatives, including the innovative cleanup described above. Metrics calculated with SiteWise™ included energy consumption (British Thermal Units), greenhouse gases emitted (metric tons carbon dioxide equivalent), criteria air pollutants emitted (nitrogen oxide, sulfur oxide, and particulate matter in metric tons), water impacts (gallons), and worker safety (accidental injury and death).

Results/Lessons Learned. The findings of the sustainability evaluation include the following. First, the combined remedy we promoted offers substantially less carbon footprint (greater than 50% reduction in greenhouse gas emissions over the life cycle of cleanup) relative to other Feasibility Study alternatives. Second, though the total energy utilized for the remedy is comparable to the excavation/offsite disposal and pond filling option, site impacts and safety risk were greatly reduced. Third, the remedy cost for the sustainable solution was 20 times less than the excavation/offsite disposal and pond filling option (i.e., $2 million versus $40 million). In summary, by working cooperatively with the state regulatory agency, APG was able to implement an innovative response to achieve a level of protection equal to or greater than strict Applicable or Relevant and Appropriate Requirements compliance, and achieved sustainability goals while remaining cost effective considering the complex nature and impacted condition of

the site. This project was also cited by the Army as a successful demonstration of sustainable remediation in Army Environmental Command newsletter.