BROWNFIELD renewal

Green Remediation: A Holistic Approach

By Ileen Gladstone

Each decision made during the cleanup of contaminated properties has an impact on our natural environment and our future well-being. Environmental professionals make choices throughout the lifecycle of investigation/cleanup projects that affect more than just the removal of contaminants from the ground.

These decisions also affect air emissions, water resources, land and ecosystems, energy requirements, materials consumption and long-term sustainability. Considering the environmental impacts of remedial activities at every stage of the remedial process—in order to maximize the net environmental benefit—is a concept known as "green remediation." Green remediation enables environmental professionals to minimize the environmental and energy "footprints" of all actions taken during the lifecycle of a project, from investigation through clean-up.

The advent of green remediation is paramount given that remediation processes often can adversely affect air quality by emitting particulates during excavation and construction: This would include those particulates produced from burning fossil fuels in vehicles and construction equipment. Wastewater, dewatering effluent, and storm water are often byproducts of remediation, and their discharge can affect surface water quality by introducing toxics, nutrients or solids.

One aspect about green remediation is flexibility: The opportunities to deploy its use exist throughout any remedial process regardless of the selected cleanup remedy. Site investigative techniques, design decisions and the remedial actions should maximize opportunities to reduce consumption of natural resources by reducing waste, conserving energy, and minimizing disturbance of land and ecosystems.

Playing the field (investigation)

It all starts in the field: There are numerous ways to conduct a green field investigation, but it's essential to first identify the potential effects on the range of resources. Green opportunities include minimizing the length of the field program, using less invasive investigative techniques, field screening samples instead of shipping all of them to the laboratory, and performing remote data collection.

These approaches should reduce labor costs, consumption of fossil fuels, vehicle emissions, and the disposal of contaminated personal protective equipment.

Everyone reflexively thinks of the impacts on the property itself during remediation phase, but cleanup activities have impacts well beyond site boundaries. These impacts can be defined through lifecycle assessment. Remedial design should be informed by life-cycle impacts.

A life-cycle assessment considers the effects of the materials and energy consumed to support a site clean-up and consideration of the environmental and energy footprints may lead to less obvious remedies.

Passive mitigation options such as capping, bioremediation, phytoremediation and monitored natural attenuation should all be evaluated as remedial measures. Institutional controls that allow con-

taminants to remain in place are often protective and minimize soil and habitat disturbance, as well as energy use. Emphasis should be placed on reducing green house gas (GHG) emissions with a goal of carbon neutrality. A carbon neutral activity removes as much carbon as it generates (net gain is zero). Remediation approaches can reduce energy consumption and, therefore, GHG emissions. Renewable energies such as solar or wind may augment (or even replace) fossil-fuel based energy and alternative fuels may be used to operate machinery or vehicles.

Ideally, site cleanups and green remediation strategies should take advantage of the earth's water cycle by applying water conservation techniques like stormwater controls and recycling of process water.

Remedial actions

So what action should a environmental stakeholder consider when exploring green remediation? For starters, it can be incorporated into the construction and operation of almost any remedy. Here are a few basic and generally-easy-to-implement recommendations:

- Procure materials locally and select local providers for field operations;
- Conserve diesel fuel consumption by efficiently using right-sized equipment and minimizing idling time;
- Use ultra-low sulfur diesel, alternative fuels or hybrid technologies;
- Reduce dust generation with techniques such as water spraying, covering stockpiled and hauled soils, and revegetating excavated areas as quickly as possible;
- Crush and re-use demolition rubble, such as brick and concrete, on-site, as a substitute for stone or aggregate. Reclaim and reuse asphalt;

One thing's for certain: Green remediation considers the entire scope and life cycle of a remedy. Thus, by considering the multitude of resources used on a project, not only directly but also indirectly, we're now able to make smarter decisions to meet our present goals without sacrificing the ability of future generations to meet theirs.

In short, a win-win proposition.

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