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Green Remediation

By Ileen Gladstone, P.E, LSP, LEED AP, GEI Consultants, Inc.

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 which affect more than the removal of contaminants from the ground. They also affect air emissions, water resources, land and ecosystems, energy requirements, materials consumption and long-term sustainability. Considering environmental impacts of remedial activities at every stage of the remedial process to maximize the net environmental benefit is known as Green Remediation. It enables environmental professionals to minimize the environmental and energy "footprints" of all actions taken during a the lifecycle of a project, from investigation through clean-up.

Remediation can adversely affect air quality by emitting particulates during excavation and construction. Secondary particulates, which can be formed from sulphur and nitrous oxide emissions and direct greenhouse gas (GHG) emissions, such as carbon dioxide and methane, are produced from burning fossil fuels in vehicles and construction equipment. Wastewater, dewatering effluent, and storm water are often byproducts of remediation. Their discharge can affect surface water quality by introducing toxics, nutrients or solids. Remediation manipulates the landscape during excavation or capping and often disturbs or reduces diverse ecosystems. Remediation is typically a consumptive process.

Opportunities for Green Remediation 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.

Site Investigation

There are numerous ways to conduct a "Green" field investigation, but it is 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

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What's News

Editorial

No Action Alternative?

By Jerry Zak, GEI Consultants, Inc.

Most regulatory agencies responsible for site remediation have a funded mandate to ensure that responsible parties remove or mitigate subsurface contamination so that human and ecological risks are minimized. This also applies to impacts that do not currently pose a risk, but could do so in the future. The same agencies typically require that responsible parties conduct an evaluation of remedial alternatives beforehand, including a "no-action" alternative. The no action alternative is rarely chosen because it's difficult to demonstrate that doing nothing is a "good" choice. However, climate change could affect the way we interpret "no action".

In 2008 James Hansen, Director of the NASA's Goddard Institute for Space Studies, and his colleagues reported[i] that the average concentration of carbon dioxide (CO_2) in the atmosphere is 385 parts per million (ppm). They also reported that a maximum CO_2 concentration of 350 ppm is required unless we are willing to accept significant changes in the ways of life for all organisms on earth. Significant changes have already occurred. They are most apparent in glaciers, where ice is melting at measurable and accelerating rates. Other effects include rising sea level, shifts and/or reductions in forest cover, and increased severity of weather conditions and local climates. According to Hansen and others, the only way to slow or reverse the trend is to reduce the rate and volume of greenhouse gas emissions. Most sources indicate that any and all safe methods to do so should be immediately applied. In other words, all options should be on the table.

One of the options should be "no action" for certain contaminated sites. The no action choice would be based on an evaluation of the climate change risk (emissions due to clean up) versus the human and ecological risk of no action. If the traditionally chosen remediation is construction equipment and thermal treatment heavy (lots of energy used and lots of CO_2 emitted), but there is little human or ecological risk of doing nothing, "no action" could be one of the tools to reduce emissions.

There are serious logistical, legal, political, economic, and administrative shortcomings that would need to be addressed. For example, responsible parties are often pro-active about clean-ups because they want to eliminate or reduce current and long-term liabilities. These parties would not choose a no action alternative unless they are released from future liability. This is just one the complicated hurdles.

Based on compelling evidence and reports like that from Hansen, if we really want to reduce green house gas emissions, a debate over the value and meaning of no action is in order.

i. Open Atmos. Sci. J. (2008), vol. 2, pp. 217-231

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Newsbriefs

Development in SC

An old bus barn lot in Columbia, SC will begin its transformation next month as SCANA Corp. begins clean up of the contamination leftover from an era of coal gas lit city streets. The property has great potential for mixed-use development. "It's right next to the river, right next to the state museum" said Fred Delk, director of the Columbia Development Corp. SCANA waited until this November to begin removing the soil because cold weather will help to lessen the smell that the removal will cause, project manager Bob Apple said. *The State, 10/22/2009.*

Pelham Plaza

NYSDEC Commissioner Pete Grannis congratulated the team for their work cleaning up Pelham Plaza site to productive use. He said, "We have made the comprehensive and expeditious cleanup of MGP-related sites a priority for DEC. As a result, today Pelham Plaza has been transformed from a polluted site to an asset. That's good news for the environment, public health and the local economy." *News from New York State Department of Environmental Conservation. 9/16/2009.*

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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.

Collecting soil samples with direct-push drilling rigs rather than traditional rigs has multiple benefits. The production rates are typically better than traditional auger rigs. They avoid the use of drilling fluids and generate substantially less Investigation Derived Waste (IDW) that requires off-site disposal, often as a hazardous waste. In addition, direct-push rigs frequently cause less site disturbance.

The use of remote sensing methods such as geophysical techniques may narrow the breadth of invasive investigations, such as test pit excavation. This may also reduce the number of trips made to the site for data colllection.

Maximizing the use of on-site field testing techniques can minimize the number of samples submitted for laboratory analysis. This reduces the packing, preservation and transport of samples to the laboratory and the energy and labor associated with the analysis.

Decontamination of field equipment using steam or non-phosphate detergents instead of potentially toxic cleaning fluids is preferred. However, it is important to select appropriate equipment, to avoid the presence of oversized equipment consuming more fuel than is necessary.

Remedial Design

Cleanup activities have impacts well beyond the site boundaries. These impacts can be defined through life-cycle 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. For example, in-situ stabilization requires Portland cement. Manufacturing cement is an energy intensive process that may occur hundreds of miles away. As such, there is energy consumption and emissions at the point of manufacture; there is consumption and emissions in transporting the cement to the site.

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 be evaluated as remedial measures. Institutional controls that allow contaminants 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. Typical treatment systems such as pump and treat, dual-phase extraction, soil vapor extraction and air sparging are energy intensive. If these systems are recommended, the designers should optimize the energy efficiency of treatment equipment and buildings. Insulating equipment and housing may improve performance. 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.

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. Caps can be designed using porous materials that maximize infiltration and minimize stormwater runoff (without allowing leaching of the underlying waste). Treated process water and effluents can sometimes be recharged to the groundwater, rather than discharged to surface waters.

Remedial Actions

Green Remediation can be incorporated into the construction and operation of almost any remedy. Project specifications and product procurement can incorporate green requirements. 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.

Consideration of the environmental and energy footprints may lead to less obvious remedies.

Green Remediation (from pg 3)

Green Remediation considers the entire scope and life cycle of a remedy. By considering the multitude of resources used on a project, not only directly, but also indirectly, we are able to make smarter decisions to meet our present goals without sacrificing the ability of future generations to meet theirs.

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Coal Tar History

As a follow on to news reported in the Winter 2006 and Spring 2007 issue, this month, Austin, Texas Mayor, Lee Leffingwell, said he will go to the U.S. Conference of Mayors next year to seek support for a nationwide ban on coal tar sealants. As a councilmember, Leffingwell introduced legislation to make **Austin the first city in the nation to ban coal tar.** Two other cities, Washington, D.C., and Madison, Wisc., have since banned coal tar. "As the sponsor of the 2006 effort to ban the use and sale of coal tar sealants in Austin, I believe it is an effort that should be reviewed nationwide," Leffingwell said. "EPA has advised me that its scientific studies and requests for public comment regarding human health assessment on these carcinogens are about to get under way," U.S. Representative Lloyd Doggett said. "Hopefully, this overdue work will provide the basis for national action that follows Austin's lead." *Oak Hill Gazette. 10/7/2009.*

Speak Up

Monitored Natural Attenuation of Manufactured Gas Plant Tar Mono- and Polycyclic Aromatic Hydrocarbons in Ground Water: A 14-Year Field Study

Authors: Neuhauser, Edward F.; Ripp, John A.; Azzolina, Nicholas A.; Madsen, Eugene L.; Mauro, David M.; Taylor, Terry

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Abstract: Site 24 was the subject of a 14-year (5110-day) study of a ground water plume created by the disposal of manufactured gas plant (MGP) tar into a shallow sandy aquifer approximately 25 years prior to the study. The ground water plume in 1988 extended from a well-defined source area to a distance of approximately 400 m down gradient. A system of monitoring wells was installed along six transects that ran perpendicular to the longitudinal axis of the plume centerline. The MGP tar source was removed from the site in 1991 and a 14-year ground water monitored natural attenuation (MNA) study commenced. The program measured the dissolved mono- and polycyclic aromatic hydrocarbons (MAHs and PAHs) periodically over time, which decreased significantly over the 14-year period. Naphthalene decreased to less than 99% of the original dissolved mass, with mass degradation rates of 0.30 per year (half-life 2.3 years). Bulk attenuation rate constants for plume centerline concentrations over time ranged from 0.33 ± 0.09 per year (half-life 2.3 ± 0.8 years) for toluene and 0.45 ± 0.06 per year (half-life 1.6 ± 0.2 years) for naphthalene. The hydrogeologic setting at Site 24, having a sandy aquifer, shallow water table, clay confining layer, and aerobic conditions, was ideal for demonstrating MNA. However, these results demonstrate that MNA is a viable remedial strategy for ground water at sites impacted by MAHs and PAHs after the original source is removed, stabilized, or contained.

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