You're not alone! Understandably, the issue is a major concern for many in industry. How do you know if you need to cleanup your site? Does cleanup always entail the use of complex and expensive technologies? How do you know which cleanup option is most cost-effective for your needs? Because every site is unique, these are valid and complex questions that often don't have simple answers.

At Mayotte Design and Engineering, PC we make it our business to understand the technical and regulatory issues that affect the selection of cleanup strategies for contaminated facilities. Our scientists and engineers have the experience and training to develop cleanup strategies that are:

- Compatible with applicable laws and regulations.
- Cost-effective for the unique conditions at each facility.
- Minimally intrusive or disruptive to daily business operations.

In the following paragraphs, we provide general information regarding common remedial strategies for commercial and industrial facilities dealing with environmental contamination. Our goal is to help minimize confusion over the variety of cleanup options available to facility owners. It is important to emphasize that every site presents a unique set of challenges. Therefore, it is advisable to have a general understanding of the limitations associated with the common cleanup options available today. This understanding can help you to determine the option that best addresses your situation. In the past, too many facility owners made the mistake of assuming that a strategy that worked at one site could work at all sites, with the consequences often being excessive cleanup costs and lengthy interruptions to business.

Introduction

To begin our discussion, it's helpful to make a distinction between "passive" and "active" remediation strategies.

Passive remediation strategies entail addressing environmental contamination problems through periodic monitoring of the impacts and, possibly, establishment of legal controls to restrict access to the contaminated soil or groundwater.

Conversely, active remediation strategies involve the use of specific engineered technologies to treat or remove contaminated soil and/or groundwater.

These distinctions are brought into clearer focus in the following paragraphs.

Passive Remediation

Management Options

A major point that must be emphasized in any discussion of cleanup options for facilities is that one must not assume that it is necessary to invest in expensive and intrusive technologies to remediate environmental problems. Most environmental laws in effect today reflect the current understanding of natural processes that control the movement and chemical stability of solvents (like perchloroethylene and xylenes) in soil and groundwater. For sites deemed to possess the appropriate conditions, these laws permit leaving solvent contamination in the ground provided that a management strategy is implemented that requires periodic monitoring of the movement of the contamination, and imposes restrictions on access to and use of the impacted soil and groundwater. For example, at some sites, measurement of the solvent levels in groundwater may reveal that the movement of the contamination under and away from the site is balanced by natural chemical or biological processes that serve to dilute or destroy the contamination. At such sites, cleanup may be achieved through a plan for monitoring to verify that the original assumptions regarding contaminant attenuation remain valid. However, the laws often require that if contamination is left "in-place", a facility owner must ensure that legal prohibitions are imposed in deeds for properties that overlay the contamination. This is done to ensure that current and future landowners are restricted from coming in contact with or making use of the impacted soil and groundwater. Cleanup strategies of this sort are often referred to as risk-based management and "Monitored Natural Attenuation" strategies.

Environmental Drilling

Air Sparging/Soil Vapor Extraction Off-Gas Treatment

Active Remediation

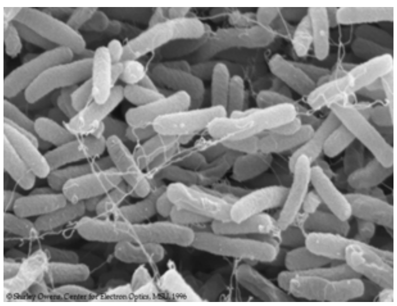
Air Sparging and Soil Vapor Extraction

The chemical properties of dry-cleaning solvents cause them to vaporize, or evaporate, relatively easily when in contact with air. Air sparging (AS) and soil vapor extraction (SVE) technologies are soil and groundwater treatment processes that exploit this tendency for vaporization. Air sparging involves the pumping of clean air into the ground so that the air can contact soil and groundwater that has been contaminated with dry cleaning solutions, thereby promoting the evaporation of the solvents. Soil vapor extraction is a process in which air is moved through the ground by suction. Consequently, the vapors from dry cleaning solutions can be drawn toward suction points and collected for treatment. Collected vapors are often treated using a sorbent media or by processes similar to the catalytic conversion of automobile exhaust.

Air sparging and soil vapor extraction systems are routinely used together, with sparging being the primary mechanism for causing solvent vaporization and soil vapor extraction being necessary to collect the solvent vapors for subsequent treatment.

Bioremediation

Soils contain microorganisms. Certain soil microorganisms are capable of metabolizing (chemically breaking-down) dry-cleaning solvents that are dissolved in groundwater or soil moisture. Bioremediation technologies are designed to enhance the growth and metabolic activity of these microorganisms, thereby accelerating the remediation of soil and groundwater contaminated with dry-cleaning solvents. Typically, the enhancements are accomplished through adding a key nutrient or food source to the affected soil and groundwater. However, to know what type or amount of nutrient to add is no trivial matter. This knowledge is only gained by examining samples of site soils and groundwater to determine the microbiology and chemistry that is unique to each site.



Bacterial Cells

Phytoremediation

Phytoremediation is the use of plants specifically for the purpose of treating certain contaminants in soil, groundwater, and other environmental media. A variety of plant species have the capacity to degrade (break-down), accumulate (soak-up), dissipate (soak-up and vaporize), or immobilize environmental contaminants, including organic compounds like gasoline, oils and solvents, and metals like arsenic, chromium and lead. Plants may even be used to control the movement of groundwater at some sites. Proper use of phytoremediation as a remedial tool requires careful planning and selection of plant types to ensure growth and compatibility with climate and soil conditions and effectiveness with the target contaminants.

Compressor and Manifold for an Air Sparging System

In-Situ Oxidation

In-situ oxidation is the use of chemical oxidants like ozone, permanganate, and hydrogen peroxide, to break-down contaminants. This technology is most effective on organic compounds such as gasoline and other petroleum-based products. Oxidants are delivered to contaminated soils and groundwater through subsurface injection. The oxidants are non-discriminating. Once introduced into contaminated media the oxidants react with all forms of oxidizable material. It is important to understand how much non-contaminant material may be oxidizable at a site in order to estimate the effectiveness of this technology.

In-Situ Thermal Treatment

In-situ thermal treatment is, as the name implies the application of heat energy to soil and groundwater to desorb, break down, or vaporize organic contaminants like petroleum products, solvents and dielectric fluids. Typically, electrical power is used as to introduce thermal energy to the subsurface. Because treatment is accomplished by heat conduction instead of the delivery or movement of fluids, in-situ thermal treatment may be used within a wide variety of soil types, including silts and clays. Conversely, the nature of the technology precludes its use on soil or groundwater beneath or in proximity to structures.

Groundwater Pump-and-Treat

In the past, site remediation was routinely accomplished by pumping contaminated groundwater to the surface for treatment. Although a variety of options exist for treating contaminated groundwater at the ground surface, the technologies that have been most commonly employed include either passing the water through a sorbent medium, like granular carbon particles, or through an air stripping tower, which would serve to vaporize contaminants like dry-cleaning solvents.

Direct-Push Drilling Rig

Experience has now shown that, although pumping groundwater to the surface for treatment may be a viable option under some circumstances, it has been used with limited practical effectiveness at most sites. In general, this is because solvents in groundwater tend to stick to soil particles. Therefore, extremely large volumes of water must often be extracted from the ground to remove just a small quantity of solvent contamination.

Groundwater extraction and injection delivery system

Soil Excavation/Disposal

At many sites, a practical means for treating soil contaminated with dry-cleaning solvents is to excavate the impacted soils for disposal in a licensed waste management facility. In fact, for sites with relatively small volumes of impacted soil, this option may be the quickest and easiest way to address the problem. However, it must be emphasized that soil excavation will not address groundwater contamination. Consequently, this option is best suited for sites where groundwater contamination is not a significant issue.

Soil Excavation/Treatment

Often excavated soils may be treated on-site and, once treated, returned to the excavation. In recent years, on-site treatment processes like thermal desorption have been used with success to cleanup solvent-contaminated soils. Thermal desorption entails heating the soil in a rotating kiln. The elevated temperature of the soil promotes vaporization of the solvent material. The solvent vapors are collected and processed through off-gas treatment equipment such as granular carbon. The solvent-saturated carbon is then disposed in a licensed waste management facility, while the treated soil is returned to the on-site excavations.

On-site treatment of soils can be quick and effective. However, the use of on-site treatment equipment requires considerable space and can often be disruptive to daily operations at small facilities.

Air-stripping towers for groundwater treatment

Conclusion

Be aware that for any cleanup technology to be successful, it is essential to work with experienced scientists and engineers to select, design and implement a cost-effective strategy to meet the needs of your facility.

MD&E specializes in applying hydrodynamic, chemical and biological expertise to bring about cost effective environmental management solutions for industry. Services offered by MD&E include:

Industrial Wastewater Management & Treatment Solutions
•
Waste Minimization and Material-Loss Prevention Solutions
•
Management & Remediation Strategies for Environmental Impacts
•
Quantitative Evaluation of the Fate & Transport of Pollutants
•
Environmental, Health & Safety Compliance Services
•
Litigation Support and Expert Witness Testimony
•
Due Diligence Services for Property Transactions
•
Support of Corporate Acquisitions and Divestitures
•
Brownfield Redevelopment Assistance

MD&E

Civil & Environmental Engineering

2407 Boston Boulevard
Lansing, Michigan 48910
Phone: 517-367-2674
Fax: 517-374-6228
Cell No: 517-388-2623
E-Mail: mayottet@comcast.net
Web: mayottedesign.com