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Investigating, Characterizing and Managing Environmentally Impaired Properties Using a Risk-Based Approach

The process by which environmentally impaired properties are investigated, characterized, and eventually cleaned-up (remediated) has many commonalities regardless of whether the effort is driven by a buyer's due diligence before purchase, to support redevelopment of a brownfield property under a state administered voluntary clean-up program, or mandated by a regulatory enforcement program such as the federal Superfund and RCRA/LUST programs and/or a companion state programs. This white paper presents a brief overview of this process.

Site Investigation and Characterization

Investigating a potentially contaminated site starts with knowledge of past or present operations; these define what contaminants are of potential concern, and where they might be found on the site. An initial investigation, referred to as a Phase I Environmental Site Assessment, is often performed to do this (see our white paper on Environmental Due Diligence). Samples are then collected to define the nature and extent of any contamination. A sampling investigation must by properly designed and properly executed to provide useful and defensible results. Proper design should consider the Conceptual Site Model, an idea developed by EPA to define the nature or type of contaminants, where they are most likely to be found on the site (e.g., points of release or source areas), where they have (or potentially will) migrated to, and ultimately how exposure to the contaminant might occur. Sample collection must be performed properly, in accordance with procedures defined by EPA or others to ensure the samples are indeed representative of what is being sampled. The proper analytical methods must be used by the laboratory performing the analysis. Improper sample design and/or improper execution of a sampling plan will yield data of limited or no value - in other words, it can be a tremendous waste of time and money.

A note regarding the presentation of data: the sampling rationale and methodology should be clearly spelled out in the report summarizing the sampling effort. A well thought-out sampling approach and correct methodology may yield excellent data, but if the rationale and methodology are not properly documented, the defensibility of that data may ultimately become compromised. The work product of a consultant will typically contain language restricting its use to the client; but realistically, the results of sampling come under the review and scrutiny of others - regulators, industry representatives, environmental attorneys and other consultants - all the time. If you have paid for a consultant to sample your property that your attempting to sell, another person's property you want to buy, or a property that you are responsible for under a regulatory program, you should receive a report that presents the rationale and methods by which the data was obtained. Again, if the data is not defensible, it represents nothing more than wasted time and money.

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The end goal of any site characterization is to define the extent of contamination; in simplest terms to put an imaginary three-dimensional box around the area of contamination, be it soil, groundwater, sediment, etc. Without adequate characterization of extent, the potential risks posed by any contaminants present at the site cannot be properly assessed. It should be noted that fully defining extent is often a multi-stage process. The sampling plan can incorporate certain field screening techniques and/or collection of "step-out samples" that are held for analysis pending initial results in an attempt to minimize the number of mobilizations; but it is not uncommon that more than one sampling effort will be needed to adequately define extent.

Alternatively, the number and location of samples that undergo laboratory analysis should be carefully planned, with consideration of how any contamination may need to be remediated or otherwise managed. The analysis of samples can be expensive, and the over-collection of samples during the site investigation process can lead to data (albeit of good quality) that are of marginal usefulness in the grand scheme of things.

Evaluating Potential Risk

Today, characterizing and eventually cleaning-up contaminated sites typically relies on the application of risk-based clean-up objectives - contaminant levels that define how “clean is clean” for a particular piece of property. In its infancy, the environmental industry struggled with the question of how clean is clean, as there were few defined clean-up levels for chemical contaminants, particularly in soils. This eventually changed, and now US EPA and most states have developed “look-up tables” of generic objectives for chemical contaminants in various media (e.g., soils, groundwater) applicable to different land use/exposure scenarios (e.g., residential, industrial, construction worker) and different exposure pathways (how a person may become exposed to the contaminant; e.g., soil inhalation, groundwater ingestion). These are variously described as screening levels or preliminary remediation goals/ objectives. They provide an initial starting point for assessing potential risk posed by these contaminants at a given site.

Risk assessment provides a process for developing site-specific clean-up objectives utilizing information on a wide variety of site conditions such as soil types, groundwater flow characteristics, size of the contaminated area, etc. In addition, it also offers the opportunity to document the lack of a migration pathway and/or exposure to receptors. This process will entail calculation of remediation objectives, often utilizing standard risk algorithms. Evaluating risk also often utilizes numerical models to estimate potential contaminant migration.

US EPA has developed a set of generic screening levels for soil, air, groundwater, and drinking water, referred to as Regional Screening Levels (originally, US EPA Regions 3, 6 and 9 each developed separate sets of remediation goals which have subsequently been harmonized into a single set of goals called the

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"Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites.”). The RSL website includes an on-line calculator for use in developing risk-based screening levels; this and the generic RSLs can be found at:

http://www.epa.gov/region9/superfund/prg/

Many states have passed regulations and/or published guidance on the use of risk-based assessment and clean-up, including the initial screening levels or preliminary clean-up goals for contaminants (most often for soil and groundwater), methods for developing site specific clean-up objectives and assessing migration pathways. These clean-up objectives are used to support remediation under the state's voluntary and enforcement-driven clean-up programs. Websites that provide information on risk-based clean-up objectives developed by the following states can be accessed through these web addresses:

Illinois - Tiered Approach to Corrective Action Objectives or TACO:

Overview: http://www.epa.illinois.gov/topics/cleanup-programs/taco/index
Regulations (35 Il Admin Code part 742):
http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx

Indiana - Remediation Closure Guidance (formerly Risk Integrated System of Closure or RISC):

http://www.in.gov/idem/6683.htm

Wisconsin

Overview: http://dnr.wi.gov/topic/Brownfields/Cleanup.html
Regulations: http://docs.legis.wisconsin.gov/code/admin_code/nr/700

Michigan - Cleanup Criteria Requirements for Response Activity (Formerly the Part 201 Generic Cleanup Criteria and Screening Levels):

Overview of site investigation and cleanup:
http://www.michigan.gov/deq/0,4561,7-135-3311_4109---,00.html
Overview of clean-up standards:
http://www.michigan.gov/deq/0,4561,7-135-3311_4109_9846_30022-251790--,00.html

Ohio - Chemical Information Database and Applicable Regulatory Standards (CIDARS):

Guidance: http://www.epa.state.oh.us/derr/rules/guidance.aspx#119153115-risk-assessment

Iowa - Land Recycling Program and Response Action Standards

Overview:
http://www.iowadnr.gov/InsideDNR/RegulatoryLand/ContaminatedSites/LandRecyclingProgramLRP.aspx
Regulations: https://www.legis.iowa.gov/docs/ACO/chapter/567.137.pdf
Standards: https://programs.iowadnr.gov/riskcalc/pages/standards.aspx

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Minnesota - Risk-based Site Evaluation:

Guidance: http://www.pca.state.mn.us/index.php/waste/waste-and-cleanup/cleanup/superfund/risk-based-site-evaluation-process-guidance-documents.html

The risk-based objectives discussed above are focused on human receptors; they are based on exposure of contaminants to people. However, contaminants can pose risk to plant and animal receptors as well, and US EPA and some states have developed guidance for conducting ecological risk assessments and have developed ecological screening levels for water, soil and/or sediment. If contamination affects natural areas such as wetlands, critical habitat for endangered species or similar environments, clean up levels could be "driven" by ecological clean up goals that are more stringent than human health-based ones.

Site Clean-Up and Management

Traditionally, cleaning up a contaminated site entails some form of "active" remediation, including the excavation and off-site disposal of impacted soils (dig-and-haul), and a wide variety of technologies for treating impacted soils and groundwater; these can include techniques that treat the affected media in place (in-situ) or by extracting the affected media and treating "out of the ground" (ex-situ methods). These remediation methods are of course still widely utilized to address contamination that pose potential risk, however, with the increasing use and acceptance of risk based approaches to clean-up beginning in the in the late 1980s and early 1990's, many states began adopting regulations or guidance allowing the use of various environmental controls including engineered barriers, building control technologies and/or institutional controls[1]. Engineered barriers include physical structures that prevent exposure to contaminated media, such as concrete building foundations and asphalt pavement. Building control technologies (BCTs) include vapor barriers and foundation venting designed to prevent vapors from volatile chemicals in underlying soils and groundwater from entering the occupied portions of a building (a phenomenon known as vapor intrusion). Institutional controls are legal devices such as local ordinances that restrict the use of groundwater or deed restrictions on a contaminated site restricting use in some fashion. Institutional controls are also used to ensure that engineered barriers or BCT are maintained and kept in place. These various controls cannot be used on every site and there must be an adequate understanding of the extent of contamination and where the contaminants may migrate before they can be considered. However, using such controls can sometimes eliminate the

[1] The terms "engineered barriers", "building control technologies" and "institutional controls" are used in the State of Illinois' TACO regulations. While they are not unique to the TACO regulations, different terminology may be used by other programs/regulations to identify the same or very similar types of controls.

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need for costly remediation, or at very least allow the clean-up to focus on the most highly contaminated areas of a site.

Also, while there is nothing preventing a private land owner from calling their asphalt parking lot an "engineered barrier", or constructing a building with a BCT, these controls will not be recognized by regulatory agencies as effective control mechanisms unless they have been sanctioned via entering the site into a voluntary clean-up program or addressed in an enforcement program (such as a leaking underground storage tank program), wherein the regulator has the opportunity to review and approve the use of the control. However, the adoption of risk-based clean-up objectives and approaches to site clean-up provide the environmental professional with a much more robust "bag of tools" to custom fit a remedial approach to a given site, often at a significant reduction in cost.

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