Risk-Based Cleanups at Brownfield Sites

Introduction

Since its inception in 1995, EPA's Brownfields Program has grown into a proven, results-oriented program that changed the way contaminated property is perceived. Properties that once presented serious health and safety threats to the surrounding community and contributed to blight and economic decay are being transformed into community assets with tangible environmental, economic and social benefits. The legacy contamination of urban and suburban properties hails back to the Industrial Revolution and is pervasive across the country. Brownfields and other contaminated properties often are located in environmental justice communities where residents are disproportionately impacted, thus making cleanup and economic development especially critical.

EPA's Brownfields Program is designed to empower states, communities, tribes and other stakeholders by providing grants and technical assistance to assess, clean up, and sustainably reuse brownfields. While these EPA resources often provide critical "seed" money for a project, additional private- and public-sector investment also is needed to successfully remediate and redevelop these properties. These funding sources often include other local, state, and federal government programs as well as property owners, developers, investors, and nonprofit organizations.

There are numerous federal programs that can be leveraged to achieve these goals, but each of these programs is constrained by a unique set of statutory and regulatory requirements that govern how they can be applied. It is important, therefore, that federal agencies work together to identify areas where these programs can be aligned to achieve a common purpose and maximize the use of increasingly scarce federal resources.

Risk-based Brownfield Cleanups

Due to a variety of technical and financial considerations, cleanups rarely result in the removal of all contaminants to pristine conditions. Many brownfields, as well as other contaminated properties, are cleaned up under "risk-based" cleanup programs. Risk-based cleanup methods focus cleanup resources on the reduction of risk and harm prevention, based upon the intended (or restricted) reuse of a property. Risk-based cleanup standards consider the risks that contamination poses to human health and the environment, taking into account the site's anticipated future use (such as residential, recreational, industrial, or commercial), rather than requiring that cleanups meet the standards required for "unrestricted" use. As the term suggests, unrestricted cleanup standards require that any residual contamination remaining on a property be within acceptable health and safety limits without further engineering or institutional controls (discussed below). However, even cleanups that meet standards for residential use, which are generally the most stringent, do not necessarily meet the requirements for unrestricted use. For example, urban fill containing hazardous contaminants is ubiquitous in many cities and towns and may extend dozens of feet below the ground surface. The approved cleanup might involve the removal of the top layer of contaminated soil and replacement with clean fill, with restrictions against excavating below the clean fill layer. The important thing to remember is that restricted and unrestricted cleanups are designed to be safe for the intended use of the property. For restricted use, however, if that use changes additional cleanup might be necessary to ensure protectiveness.

The result of a risk-based cleanup may be that some level or amount of contamination is left on site. In such cases, engineering controls, institutional controls, or land use restrictions may be implemented to reduce human and environmental exposure to any remaining on-site contamination.

Framework for Risk-based Decision Making at Contaminated Sites

Many states use a risk-based decision making process or framework for determining cleanup requirements at contaminated sites. This involves identifying potential hazards, assessing exposure and toxicity, and characterizing the risk to human health and the environment to make an informed decision. While there is no universally defined process to conduct risk-based cleanups at contaminated sites, the following steps are usually implemented under most state programs:

Site Characterization: The first step is to collect information about the environmental conditions at a site and identify potential and existing contamination that might pose a threat to the local community and surrounding area. This can be accomplished via a Phase I and/or Phase II environmental site assessment, which often includes sampling and analysis. Standards for conducting a Phase I and Phase II are established by ASTM International. The ASTM E1517-13 standard for the conduct of Phase I environmental site assessments complies with EPA's All Appropriate Inquiries Rule.

Risk Assessment: Risk assessment is the process of estimating the nature and probability of adverse effects upon human health and the environment due to exposure to contaminated environmental media, now or in the future. An assessment of risk includes both the potential risks posed by the hazardous substances or chemicals found at a property, and the potential for humans and the environment to be exposed to such substances or chemicals. Risk assessment also involves establishing a safe level of risk for human populations potentially exposed to the contamination.

Cleanup Plan and Implementation: Based on the site investigation and risk assessment, a remedy that meets specific cleanup and redevelopment objectives is chosen. The cleanup generally is overseen, and conducted to the satisfaction of, state or federal regulatory authorities. Additionally, since 2013, the effectiveness of cleanup alternatives considered during an EPA-funded project are required to be informed by projected climate change risks.

Where contamination remains on site, engineering controls or institutional controls are usually necessary to limit human exposure, control off-site migration, and ensure that the land remains safe for its intended reuse.

- **Engineering controls** are engineered or constructed physical barriers used to contain or prevent exposure to contamination on a property. Examples include soil caps, sub-surface venting systems, mitigation barriers, or fences.
- **Institutional controls** are legal and administrative tools that include land use restrictions, easements, covenants, zoning restrictions, and posting advisories to increase community awareness of the site conditions. These controls often supplement engineering controls and reduce exposure to contamination by limiting land or resource use and guiding human behavior. Examples of institutional controls include zoning and land use restrictions that prevent certain types of land use at a site, prohibiting the use of heavy machinery at a site, or regulations restricting the use of groundwater.

Subsequent property owners are responsible for ensuring compliance with any land use restrictions, and maintaining any institutional and engineering controls associated with the property. Engineering controls such as asphalt caps and fencing should be inspected on a regular basis to ensure they remain protective of human health and the environment. In instances of long term operations of an active remedial measure, such as a pump and treat system, the property owner may be responsible for submitting monitoring reports to the agency with regulatory oversight on a periodic schedule. Institutional controls often take the form of deed restrictions or easements; property owners must maintain awareness of these restrictions and ensure they transfer to the new owner if the property is sold.

Risk–based Cleanup Success Stories

Roxy Movie Theater – Chanute, Kansas

A new movie theater was built on a 0.42-acre brownfield after a risk-based cleanup was completed on the blighted property in Chanute, Kansas. The site most recently was used as a parking lot. Previous uses also included a gas station, lumber yard, radiator shop, taxi stand, and used car lot. The site was assessed and cleaned up using two EPA Brownfields grants awarded to the Kansas Department of Health and Environment (KDHE). The Phase I environmental site assessment identified on-site and off-site sources of potential contamination. The Phase II assessment included soil and groundwater testing. While the soil and groundwater had petroleum contamination above state levels for residential reuse, the levels of contamination were below the threshold for non-residential uses. In October 2006, Chanute placed institutional controls on the property to prohibit future residential use and limit the use of groundwater, clearing the way for redevelopment. The new Roxy movie theater opened in March 2007.

Station Place – Portland, Oregon

Station Place is a multi-use development built on a 154-acre former rail yard and manufacturing site in Portland, Oregon. The site was cleaned up using a risk-based approach that included excavation and removal of soils along with the use of institutional and engineering controls in various locations to control exposure to residual soil and groundwater contamination. Using a risk-based cleanup approach allowed the site to be cleaned up based on future land use, made the remediation and redevelopment of the large site economically feasible, and resulted in the creation of a much-needed mixed-use development on a former brownfield.

The property was first developed in the 1890s as a rail and switching yard that was used until the 1980s for freight loading and unloading. A manufactured gas plant also operated on the property for about 30 years, starting around1900. The Portland Development Commission (PDC) bought the property in 1987. From 1990 to 2001, the site was the home of the City of Portland's Mounted Horse Patrol facility.

Site investigations were conducted to characterize the nature and extent of contamination in soil and groundwater across the seven lots that comprise the site. A risk assessment evaluated the potential level of risk to human health and the environment. Site contaminants included total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), and metals, with potential worker exposure to soil and groundwater contaminants by direct contact.

The cleanup included excavation and removal of highly concentrated hot spot soils. Engineering controls including soil caps, a vapor barrier, and installation of a venting system at various locations on the site limit exposure to residual contamination. Institutional controls prohibit the consumption or use of groundwater. The use of a risk-based cleanup approach allowed various parts of the site to be cleaned up based on reuse plans, enabled redevelopment work to go forward on parts of the site while the cleanup was ongoing, and resulted in a successful mixed-use development.

Additional Resources

Risk-Based Decision Making and Underground Storage Tanks. EPA Office of Underground Storage Tanks.
https://www.epa.gov/ust/risk-based-decision-making-and-underground-storage-tanks-usts

Toward Improved Risk-Based Decision Making. Science and Decisions: Advancing Risk Assessment. National Research Council 2009.
http://www.ncbi.nlm.nih.gov/books/NBK214634/

Understanding the Role of Institutional Controls at Brownfield Sites. Brownfields Road Map, Brownfields and Land Revitalization Technology Support Center.
https://brownfieldstsc.org/roadmap/spotlight_ic.cfm

Brownfields At-A-Glance: City of Chanute, KS
https://www.epa.gov/sites/production/files/2015-09/documents/chanute_ks_brag.pdf

United States Environmental Protection Agency
Office of Land and Emergency Management (5105T)
EPA 560-F-16-159
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www.epa.gov/brownfields/