Roadside mildly-contaminated soil. Arrows indicate where contamination can be found.
Photo courtesy of Sanborn, Head & Associates, Inc.

Management of Mildly-Contaminated Soil Outside of Landfills

A look at why states are beginning to implement programs, guidance, and regulations for reusing or otherwise managing mildly-contaminated soil without landfill disposal.

What happens when soil contamination does not exceed "the standards," but it is also not "clean"? Soil that contains low levels of contaminants, like heavy metals and polycyclic aromatic hydrocarbons (PAHs) are an emerging concern for states throughout the United States. With landfill capacity diminishing, particularly in the northeast, and disposal costs increasing, the desire to reduce, reuse, and recycle is rising and states are beginning to explore alternatives to managing "mildly-contaminated" soil outside of landfills.

PAHs are a group of chemicals that are formed during the incomplete combustion of organic material like wood, coal, oil, gas, waste, and tobacco. There are over 100 different chemicals that are considered PAHs and it is common for them to occur as a mixture of more than one chemical.[1] PAHs are found throughout the environment in air, water, and soil, and can even occur naturally from forest fires, but can also be contained in manufactured products like asphalt, driveway sealant (coal-tar), and wood preservative (creosote). The U.S. Environmental Protection Agency (EPA) included 16 PAHs on the Priority Pollutant List found in 40 CFR Part 423, Appendix A. This list is comprised of pollutants that are regulated by EPA and could pose a significant potential threat to human health as a result of both their toxicity and potential for human exposure.

It is generally accepted that vehicle emissions and deposition of airborne particulates that contain PAHs along the roadside are a major source of contamination for soil adjacent to roadways.

There are a variety of definitions and terms states use to describe soil with low levels of contaminants, but in broad terms, mildly-contaminated soil has concentrations of contaminants above naturally occurring background concentrations; however, the soil cannot be classified as hazardous waste nor has it been impacted by a specific industrial discharge. Such soil has been contaminated by decades of urban activities, such as filing areas with coal and wood ash, and deposition of automotive and wood/coal burning emissions. In many cases, the soil has been in place for many years; however, when excavated, the soil must be properly managed. This presents a dilemma with respect to contaminated site programs, as the levels of metals and PAHs can exceed stringent risk-based screening levels that prohibit general soil reuse, yet the soil has also existed in the environment for many decades and may not present significantly greater risks than that of "natural" soil.

Where Is Mildly-Contaminated Soil Found?

Mildly-contaminated soil can be found in the environment where anthropogenic (i.e., human) activities have occurred. Sources of mildly-contaminated soil include areas adjacent to roads, construction activities in previously disturbed/urban areas, street sweepings/catch basin sediments, and railroad corridors.

The photo on the opening page of this article illustrates an example of roadside contamination zones.
The extent of PAH contamination in soil adjacent to asphalt pavement (i.e., roadways, driveways, parking lots) has been extensively researched since the 1980s. It is generally accepted that vehicle emissions and deposition of airborne particulates that contain PAHs along the roadside are a major source of contamination for soil adjacent to roadways. Transport of larger particulates from roadways to surrounding soil through stormwater flow or snow removal operations (i.e., mechanical means) in northern climates may also be a source of PAH contamination. The larger particulates that are being transported may contain levels of PAHs from pieces of asphalt, small pieces of tire, motor oil, or coal-tar-based sealants.

In areas that use coal-tar based sealants on parking lots and paved driveways, it is the application on these surfaces that is considered a major source of PAH contamination to the sediments around urban features. The U.S. Geological Survey (USGS) completed extensive research related to the use of these sealants and the associated environmental and health impacts. PAHs are transported from these sealed pavements through stormwater runoff, adhesion to tires or feet, wind, and volatilization. It is important to note that these coal-tar-based sealants were found to be the largest source of PAH contamination in 40 urban lakes researched by the USGS (accounting for 50 percent of all PAH inputs) and the use of these sealants since the 1960s is the primary cause of the trend of increasing PAH concentrations in urban lake sediment.[2,3]

Why Now?

There has been a growing and evolving understanding among industry professionals over the past 20 years that soil in urban areas may contain low levels of contamination. The increasing volume of data from states continues to confirm this understanding and expand the definition and extent of potential mildly-contaminated soil to include new sources, like the areas adjacent to roads. As the potential extent is expanded, so does the potential volume of soil that may require management during construction projects.

Many states have programs and regulations in place to dispose of materials like street sweepings and catch basin cleanout sediment because it has been understood that these materials can contain a variety of contaminants. However, these materials are generated at far smaller volumes than the soil volume that could be generated from a large roadway project. The evolving understanding of the liabilities associated with contractors removing this soil from sites and using it elsewhere is growing at the same time as the understanding of the potential for this soil to be mildly contaminated. States and municipalities must begin to weigh the concerns of environmental degradation and potential health risks with the rising cost of disposing of mildly-contaminated soil in landfills, the limited landfill airspace available, and the benefit of reusing the material to avoid the use of virgin materials.

Who's Leading the Effort?

During 2016, we completed a survey of all 50 states in the country to assess which agencies had guidance, regulations, or programs associated with mildly-contaminated soil, with special attention to soil along roadsides (the survey excluded discussion regarding existing street sweepings/catch basin sediment programs and regulations as these are fairly prevalent throughout the country).

Figure 1 summarizes the findings of our survey wherein 33 states did not acknowledge having guidance for managing mildly-contaminated soil and 17 states had special guidance, programs, or regulations for managing mildly-contaminated soil. Oregon and Wisconsin had specific guidance addressing roadside soil. We found that the states addressing mildly-contaminated soil were motivated by either a large financial loss associated with previous improper disposal of the soil, or by the identified risk associated with potential unrestricted disposal of the soil.

In the northeast, for example, the states of New York, Massachusetts, Vermont, and New Hampshire have started to identify beneficial reuses and alternatives to landfill disposal for mildly-contaminated soil.

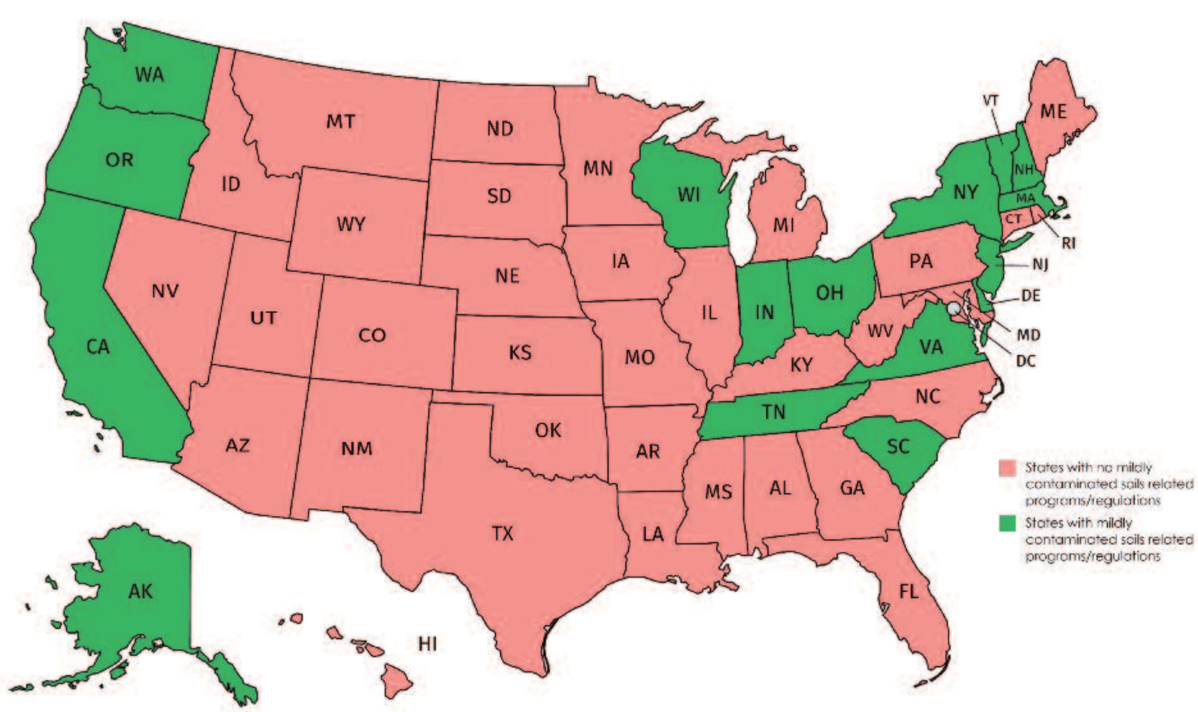

Figure 1. State regulation of mildly-contaminated soil.
Source: Sanborn, Head & Associates, Inc.

In New York, generic beneficial use determinations were developed to allow mildly-contaminated soil to be used as backfill on-site, and for petroleum contaminated soil to be recycled as part of asphalt paving material or (if sufficiently treated) as fill, embankment, or subbase material.

The Massachusetts Similar Soils Guidance/Policy allows for the filling of sites, such as abandoned quarries, with mildly-contaminated soil rather than require landfill disposal.

Vermont completed research to establish background levels of PAHs in soil and allows mildly-contaminated soil to be transferred to other sites so long as the receiving site is not environmentally degraded under the Vermont Policy for Development Soils (Act 52).

While New Hampshire does not have specific regulations to handle mildly-contaminated soil, the New Hampshire Department of Environmental Services is currently working with the New Hampshire Department of Transportation to approve Solid Waste Rule waivers to address soil generated by road-side and right-of-way excavations. These waivers would allow for mildly-contaminated soil to be re-used in the same work area, with stipulations for meeting soil standards and setback requirements.

Should We Be Concerned?

As states begin to find alternatives for managing this mildly-contaminated soil, rather than requiring landfill disposal, the potential health risks and environmental degradation of reusing this soil in place or in similar use areas, should continue to be evaluated. The mobility and transport of contamination in the environment are influenced by a variety of factors, such as environmental conditions (e.g., pH, presence of other chemicals, oxidation-reduction potential, groundwater geochemistry, organic matter content, microorganisms) and the physical and chemical properties of the contaminant itself. Mobility can be defined as the potential for a contaminant to migrate from a source. In the case of PAH soil contamination, mobility is most influenced by the organic carbon content of the soil and the hydrophobic nature of many PAHs.[4,5] Both of these influences relate to the solubility in water, and adsorption and desorption processes for PAHs that dictate the bioavailability and transport of the contaminant in soil. Generally, PAHs tend to stay absorbed to the organic carbon content of the soil and show low potential for leachability from the soil.

Conclusion

Mildly-contaminated soil poses a potential liability for states and municipalities and may often require management once removed from a site. Contaminated soils found along road-sides are a ubiquitous example. States around the country are beginning to implement programs, guidance, and regulations for reusing or otherwise managing mildly-contaminated soil without landfill disposal. The motivations include the high cost associated with disposing large volumes of soil in landfills, limited landfill disposal capacity, and the desire to reuse an otherwise wasted material to avoid the use of virgin materials. Yet, states may be challenged to define what "mildly-contaminated" soil means to them if they do not have established background levels of contaminants, like PAHs, to serve as a benchmark. How "clean" is clean when much of our environment has been impacted by anthropogenic activities? Given the large volumes of mildly-contaminated soils existing throughout the United States, expect states to continue to evolve criteria for when a mildly-contaminated soil requires specific management, as well as acceptable disposal options that avoid landfilling while encouraging reuse. **em**

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