Soil Amendments for Remediation, Revitalization, and Reuse Tools: Fact Sheet

In August 2006, the U.S. EPA Office of Superfund Remediation and Technology Innovation brought together 18 federal and local government, academic, and private sector experts to answer questions about using soil amendments in remediating, revitalizing, and reusing contaminated lands. Two new tools to encourage and assist site cleanup managers to use soil amendments for remediation, revitalization, and reuse of their sites resulted from this collaboration. ***The Use of Soil Amendments for Remediation, Revitalization, and Reuse*** is a white paper that describes soil amendments, the advantages of using them, the types of environmental problems and contaminants they can address, the types of sites where they can be used, and regulatory and other issues related to using them. It focuses on the use of amendments on sites dominated by inorganic contaminants, although they also can be used to address volatile and semivolatile organic contaminants that have left sites barren of vegetation. ***Soil Remediation, Revitalization, and Reuse: Technical Performance Measures*** is an Internet-based tool that helps users determine whether soil amendments are functioning as designed to reduce risks to human health and the environment.

Soil amendments are residual materials from other processes and include municipal biosolids, manures, litters, sugar beet lime, wood ash, coal combustion products, log yard waste, neutralizing lime products, compost, and traditional agricultural fertilizers.

The Use of Soil Amendments for Remediation, Revitalization, and Reuse

provides information to assist regulators, consultants, site owners, neighbors, and other stakeholders in understanding the principles of soil amendment application for remediating and revegetating contaminated sites and to encourage widespread use of this alternative to revitalize and reuse contaminated land. It focuses on amendments that are generally residuals from other processes and have beneficial properties when added to soil (see box at lower left). When applied properly, soil amendments reduce exposure by eliminating exposure pathways and immobilizing contaminants to limit their bioavailability. The addition of amendments restores soil quality by balancing pH and organic matter, increasing water holding capacity, re-establishing microbial communities, and alleviating compaction.

Ellengowan Mine Site, Mahanoy Township, PA

View or download a copy of ***The Use of Soil Amendments for Remediation, Revitalization, and Reuse*** (EPA 540-R-07-013) at www.clu-in.org/ 542R07013

Each major section of the document contains a quick-reference table that summarizes the text to follow. For example, Table 1 lists the types of bioavailability and phytoavailability problems (e.g., toxicity) and poor soil health and ecosystem function problems (e.g., high or low pH) addressed by soil amendments and provides information on exposure pathways, how various amendments interact with contaminants, and the potential solutions for each problem. Table 2, lists the types of sites where soil amendments can be used. This includes hard-rock and coal mining, smelting and refining, and construction and mixed waste sites, and the table provides information on potential solutions for each site type. Table 3 lists the types of soil amendments currently available, the advantages and disadvantaged of each, and the cost, public acceptance, and availability issues that can impact when and where each is used. The table also provides links to sources and further information about each type of amendment. Table 4 lists transportation, storage, and equipment needs that may impact decisions to use soil amendments. The quick-reference tables can be used independently by readers, depending on the focus at their particular sites. In combination, however, the tables and text provide readers with a thorough overview of how, when, and where to use soil amendments as well as information on planning and implementing site revegetation efforts, regulatory requirements and authorities that may pertain to the use of soil amendments to remediate and revitalize sites, and the environmental, human health, economic, and other advantages of soil amendments.

West Page Swamp, Bunker Hill Superfund Site, Kellogg, ID

Soil Remediation, Revitalization, and Reuse: Technical Performance Measures

is built on a searchable database containing a variety of potentially applicable technical performance measures (TPMs) and provide site managers with the flexibility to design the most appropriate testing for their sites while providing consistency and comparability between sites.

Access *Soil Remediation, Revitalization, and Reuse: Technical Performance Measures* at www.clu-in.org/products/tpm.

The database includes a list of "core" TPMs chosen for their availability, reasonable cost, and level of standardization. The core TPMs are:

- Laboratory animal bioassay (ASTM 1976-07)
- Laboratory plant bioassay (ASTM 1963-02)
- Percent vegetative cover
- pH
- Plant nutrients
- Plant tissue residue (field)
- Pore water or in vitro extraction
- Salinity/sodicity
- Synthetic precipitation leaching procedure (SPLP)

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The core TPMs evaluate the toxicity, bioavailability, and/or mobility of the contaminants present as well as assist in determining if remediation is protective of human health and the environment. The database also includes supplemental TPMs that could be useful and/or important depending on site-specific conditions.

The intended users of the TPM database and search engine are site project managers and their technical support teams.

The range of TPM options in the database currently focuses on metals, and the list is not exhaustive. The matrix is intended to be a "living" document, and users are encouraged to suggest other appropriate tests that should be included through the "Comment" feature on this site. Over time, the database also may be expanded to include other types of contaminants.

There are protocols established for many aspects of TPMs and specific QA/QC requirements are associated with these protocols (e.g., QA/QC requirements for chemical determination and toxicity testing). These protocols use a combination of reference (background) and control samples to validate results and ensure that they meet project needs. For more specific information on data quality objectives, see EPA's "Guidance on Systematic Planning using the Data Quality Objectives Process (QA/G-4; EPA/240/B-06/001)" and the other general guidance to help users ensure the quality and usefulness of their environmental data at http://www.epa.gov/QUALITY/qa_docs.html.

When should this database and search engine be used?

The TPM website is designed for use in evaluating the performance of soil amendments used for remediation, revitalization, and reuse of sites for nonresidential purposes. However, it also can be used during the evaluation and selection of remedial alternatives. For example, the database and search engine can be used to assess bench- and pilot-scale tests of a range of soil amendments being considered for potential use at a site; evaluate the performance of any *in situ* technology that leaves contaminants in place; or ensure that soil quality is appropriate for a revitalization and reuse scenario.

Aerial, Ellengowan Mine Site, Mahanoy Township, PA

Consideration of this database and search engine in the development of the remedial investigation (RI) and feasibility study (FS) and any site-specific treatability studies can result in significant cost and time savings to the site. Some of the TPMs used at the end of the cleanup process are the same tests that are used to evaluate the nature and extent of contamination and the risks posed by the site during the RI. Such consistency in test usage can provide data for comparative analysis and an early indication of the benefits from remediation by soil amendment. Therefore, the careful selection of specific tests can (1) reduce analytical costs while increasing the number of samples analyzed, (2) establish a solid database for pre-/post remediation comparisons, and (3) provide a more thorough characterization of the site.

How Can One Use the TPM Search Engine?

When you access the TPM website, click on the "TPM Search" button on the left of the page to determine the specific test methods appropriate for your particular case. The search process is iterative and based on three primary criteria: your project goal, the exposure pathway, and the performance measurement to be used. Once you select a goal from a pull-down menu (Box A), the pull-down menus for boxes B (exposure pathway) and C (performance measurement), in turn, provide you with options that are appropriate based on the criteria selected from menus in the previous boxes. Search results provide information about each method that matches the criteria, including whether the method is a "core" TPM, comments on issues to consider when using the method, and references for additional information. When search results indicate that multiple TPMs are appropriate for your site, the methods are interchangeable as long as the same test is used consistently at the site to ensure that data will be comparable. In some cases, however, site-specific conditions (e.g., a particular soil constituent's tolerance limit) could further limit the list of TPMs shown through the search.

Once you have completed your search and have a list of specific TPMs, click on each TPM listed to access information to support a comparative analysis of the selected method. This includes 1) whether the method is a core TPM, 2) availability of the method, 3) cost magnitude, and 4) degree of standardization, plus "Comments" and "More Information," if appropriate, to provide additional relevant details and references that resulted from the critical review of each method. The Search procedure should be completed for each goal, if there are multiple goals for the site. You also have the option to view a TPM Overview Table that presents all TPMs available through the search engine, along with the comparative analysis, comments, and other information about each.

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