Development of Performance Specifications for Solidification/Stabilization (SS-1)

EXECUTIVE SUMMARY

The ITRC Solidification/Stabilization (S/S) Team was formed in 2009 to develop the technical and regulatory guidance needed to support the use of S/S technologies for the on-site treatment of contaminated soil, sediment, sludge, and waste (i.e., contaminated material). S/S remedies are designed to reduce the flux of contamination that leaches from a contaminant source to within acceptable parameters set forth in a site-specific remediation goal.

Abundant literature describes the S/S process and test methods for design and implementation. However, guidance on applicable contaminants, effectiveness, comprehensive performance specifications, and long-term performance is not widely available. Because these issues have long been a concern of regulators and site owners, the lack of readily available guidance represents a regulatory barrier with respect to the use of S/S technologies. Of particular concern is the assessment of contaminant leaching to the environment and the relationship of leaching test results to the performance of the remedy over time.

S/S technology may be applicable for a wide range of contaminants. To determine site- and contaminant-specific potential effectiveness of S/S technology, performance specifications should be used to ensure protectiveness of the remedy. Performance specifications refer to the collection of performance-related parameters, tests, and criteria used to develop an S/S treatment recipe that meets performance goals (i.e., the design targets that describe a treated material that will meet specific site remediation goals). These specifications have two purposes: (a) to guide the evaluation of the ability of the treated material to meet remediation goals and (b) to establish a minimal set of properties for evaluation during field operations to verify consistency with materials characterized in the laboratory.

As an illustration of performance specifications, leachability may be considered a primary performance parameter used to assess the ability of a material to retain a specific set of site contaminants of concern. Several different performance tests have been used to measure leachability of S/S materials, including both recognized and draft U.S. Environmental Protection Agency methods. The resultant eluate concentrations represent performance measurements describing the leachability of the S/S material. These performance measurements are typically compared to a set of predefined concentrations or action levels used as performance criteria to determine whether the solid material will leach beyond acceptable limits.

A key part of the S/S process is the role of treatability studies in providing site-specific information to evaluate the technology and to develop process design parameters and scale up for full-scale implementation. Treatability testing typically involves characterizing the untreated contaminated material and evaluating the technology performance under different operating conditions. Testing may include both bench-scale and pilot testing, although full-scale pilot testing may be considered during startup of field implementation. Once treatability testing is completed, a plan for treating the full extent of the contaminated material in the implementation phase is based on those testing results.

During implementation, achievement of material performance goals is documented through quality control testing for both compliance with material performance specifications and consistency through construction. Once a remedy has been implemented and safeguards are put in place, long-term stewardship programs are typically used to verify the remedy continues to meet material performance goals and therefore remains effective and protective of human health and the environment.

Long-term stewardship of a completed S/S remedy may include monitoring of environmental media in contact with and potentially affected by the remedy, monitoring of institutional controls, monitoring and maintenance of engineering controls, financial assurances, and periodic review(s) by the controlling environmental agency. Because the most common impact from a treated mass is to groundwater, the key long-term stewardship component is typically groundwater monitoring programs. Groundwater modeling is a valuable method for assisting in the design and evaluation of a groundwater monitoring program. An S/S remedy should be considered successful if it meets material performance goals designed to meet site groundwater cleanup criteria at established points of compliance and groundwater monitoring data show that the cleanup criteria have been met.