

P.12 Technical Evaluation of Remediation Technologies for Plutonium-Contaminated Soils

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Abstract

The Nevada Test Site possesses widespread soil contamination caused by deposition of plutonium and other radionuclides from defense related nuclear test operations. Clean up efforts are ongoing using conventional remediation techniques. However, the U.S. Department of Energy desires to obtain technologies that can further reduce risks, reduce clean up costs, and reduce the volume of contaminated soil that remains.

The CETL and teaming partner WPI will assist the NTS in evaluating, developing and demonstrating technologies which have the potential of reducing risks and clean-up cost. The NTS Technology Assessment project will consist of comprehensive technology evaluations, performance assessments, and information management and dissemination. The ultimate goal of the NTS project will be to develop a roadmap for finding improved solutions for the NTS soils.

The primary components of the NTS Technology Assessment will be as follows:

- Provide a summary of geological and geochemical characteristics of NTS soils, including description of extent and distribution of contaminants.
- Provide a description of the interaction between contaminants and soil particles.
- Provide an independent review of applicable, physical, chemical and biological treatment approaches.
- Catalogue technology profiles and available data.

- Provide a roadmap for deploying a technology or combination of technologies, which can assist NTS cleanup efforts, including a description of barriers and applied research needs.
- Establish a database and web site for exchanging information about radiologically contaminated soils among researchers and technology developers.

We will begin by gaining an understanding of the NTS contaminant problem and then conduct a baseline evaluation of physical, chemical and biological processes that have potential application. We will conduct an extensive literature search of both U.S. and international sources. We will categorize processes into each of the three categories, rank based on predefined success criteria and provide a discussion of barriers which must be overcome to implement. This baseline effort will provide researchers and technology vendors with information necessary to focus additional development efforts. The WPI will provide guidance on deploying technologies at NTS or other sites.

It is uncertain at this point if additional bench and/or pilot scale studies will be needed for this study. If they are, to aid in unbiased assessment of vendor technologies, the CETL is available to perform bench-scale testing and/or to assist vendors in their testing. In addition, the comparison from vendor to vendor would be enhanced if the testing were performed at a single facility. The CETL also has the ability to work with the plutonium-contaminated soils rather than surrogate materials.

The end result of these investigations and studies will be a report that discusses the NTS soil contamination problem, including the interaction between contaminants and soil particles. Technology profiles will be completed for relevant and promising physical, chemical and biological treatment processes. The proposed project will provide the NTS with clean-up strategies. It will also assist researchers in focusing on the barriers that need to be overcome to achieve full-scale implementation.

Our technical approach, which includes operation of a central database, interactive web site and performance assessment tasks, will yield value not only to NTS but any site contaminated with radionuclides. Based on the vast quantities of contaminated soils that exist and billions of dollars required to implement long-term solutions, we believe this project represents an excellent investment.

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<p>Steve L Hoeffner (shoeffn@clemsonedu, 864-646-2413, ext. 264) Clemson Environmental Technologies Laboratory Clemson University (CU) 100 Technology Drive Anderson, SC 29625</p> <p>Jim Navratil (nav@clemsonedu, 864-656-1004) Environmental Engineering & Science Clemson University PO Box 340919 Clemson, SC 29634-0919</p> <p>Richard Smalley (Richard_Smalley@ak.wpi.org, 803-652-8020, ext. 36) Waste Policy Institute (WPI) Savannah River Research Campus 227 Gateway Drive, Suite 223 Aiken, SC 29803</p>	<ol style="list-style-type: none"> 1) Perceived risk of success due to lack of engineering or scaleup data. 2) Lack of integration between technology evaluations, treatability testing and selection of record of decision. 3) Lack of sufficient performance data. 4) Inconclusive cost/benefits analyses <p>Low levels of plutonium contamination are distributed somewhat uniformly throughout the NTS soils and, as a result, it is difficult to obtain volume reductions above 70%.</p> <p>We will address these concerns and others in our evaluations</p>	<p style="text-align: center;">Project Description</p> <p>The primary components of the NTS Technology Assessment will be as follows:</p> <ol style="list-style-type: none"> 1) Provide a summary of geological and geochemical characteristics of NTS soils, including description of extent and distribution of contaminants. 2) Provide a description of the interaction between contaminants and soil particles. 3) Provide an independent review of applicable physical, chemical and biological treatment approaches. 4) Catalogue technology profiles and available data. 5) Provide a roadmap for deploying a technology or combination of technologies which can assist NTS cleanup efforts, including a description of barriers and applied research needs. 6) Establish a on-line database and web site for exchanging information about radiologically contaminated soils among researchers and technology developers. <p>We will begin by gaining an understanding of the Nevada Test Site contaminant problem and then conduct a baseline evaluation of physical, chemical and biological processes that have potential application. We will conduct an extensive literature search of both U.S. and international sources. We will categorize processes into each of the three categories, rank based on predefined success criteria and provide a discussion of barriers which must be overcome to implement. This baseline effort will provide researchers and technology vendors with information necessary to focus additional development efforts. The WPI will provide guidance on deploying technologies at NTS or other sites.</p>	<p>Clemson University proposes to evaluate physical, biological and chemical processes that have possible application to NTS soil decontamination. Our technology assessment plan will include the following sub-tasks:</p> <ol style="list-style-type: none"> 1) A description of the NTS soil contamination problem including a description of contaminant distribution, soil characteristics and adhesion/absorption characteristics of contaminants on soil particles. 2) An evaluation of physical, chemical and biological processes that have potential to remediate NTS soils. 3) Ranking of technologies based on technical merit, potential experience and implementability. 4) An engineering evaluation of technologies to determine scale-up potential and cost effectiveness. 5) Identification of secondary waste treatment needs for full-scale implementation. 6) Identification of barriers and research needed to overcome technology limitations. 7) Preparation of a comprehensive final report that will provide a road map for developing and demonstrating an optimal treatment approach. 8) Development of an on-line database of technologies evaluated for future reference by the Nevada Test Site and other radiologically contaminated sites. <p>To aid in unbiased assessment of vendor technologies the Clemson University is available to perform bench-scale testing and/or to assist vendors in their testing. In addition, the comparison from vendor to vendor would be enhanced if the testing is performed at a single facility. Clemson University also has the ability to work with the plutonium-contaminated soils rather than surrogate materials. It would be better to perform bench-scale testing on the actual contaminated soils rather than soils spiked with surrogates.</p>	<p style="text-align: center;">Results</p> <p>A report will be prepared that discusses the NTS soil contamination problem, including the interaction between contaminants and soil particles. Technology profiles will be completed for relevant and promising physical, chemical and biological treatment processes. The proposed project will provide the Nevada Test Site with clean-up strategies. It will also assist researchers in focusing on the barriers that need to be overcome to achieve full-scale implementation.</p>
<p style="text-align: center;">Introduction</p> <p>The Nevada Test Site (NTS) possesses widespread soil contamination caused by deposition of plutonium and other radionuclides from defense related nuclear test operations. Clean up efforts are ongoing using conventional remediation techniques. However, the U.S. Department of Energy desires to obtain technologies that can further reduce risks, reduce clean up costs, and reduce the volume of contaminated soil that remains.</p> <p>A considerable amount of technology development and demonstration work has been carried out on radiological soil decontamination. However, application of improved technologies and commercialization has enjoyed limited success because of the following factors:</p>	<p style="text-align: center;">Objectives</p> <ol style="list-style-type: none"> 1) Provide an up-to-date evaluation of treatment technologies 2) Determine which companies can work with radioactive soils 3) Determine the maturity of available technologies 4) Summarize available cost and cost/benefit analyses 5) Develop an on-line database for future reference 6) Determine where data are lacking and attempt to fill the gaps 			
	<p style="text-align: center;">Approach</p> <p>Clemson University and teaming partner WPI will assist the NTS in evaluating, developing and demonstrating technologies which have the potential of reducing risks and clean-up cost.</p> <p>The NTS Technology Assessment project will consist of</p> <ol style="list-style-type: none"> 1) comprehensive technology evaluations, 2) performance assessments, and 3) information management and dissemination. <p>The ultimate goal of the NTS project will be to develop a roadmap for finding improved solutions for the NTS soils.</p>			

