# 2014 ITRC PROJECT PROPOSAL

## Transition Assessment and Projecting Remediation Performance

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**Proposals Topical Area**

**Primary Topic Areas:**

CONT (Soil, Groundwater - flow and/or contaminant fate and transport modeling)

LONG (Long Term Stewardship – managing long term stewardship of contaminates sites, optimization strategies)

**Proposal Summary**

**Problem Statement**:

- The ITRC's Integrated DNAPL Site Strategy (IDSS) technical/regulatory guidance is a landmark document that, among other things, stresses the importance of developing realistic Functional Objectives for management of DNAPL (and formerly) DNAPL sites.
- To enhance the use of the IDSS, users need to be able to reliably predict the performance of remediation technologies to ensure their Functional Objectives are SMART (Specific, Measureable, Attainable, Relevant, and Time bound).
- Unfortunately, there is no formal process to help Site Managers find, process, and apply the extensive collection of existing resources (empirical performance databases, remediation rules of thumb, new computer models, and expert knowledge) to predict remediation performance for an IDSS.

- In a related development, the National Research Council (NRC) has recently advanced an important new concept about managing contaminated groundwater sites called a Transition Assessment. Despite years of effort and considerable investment, many sites "will require long-term management that could extend for decades or longer." They discuss the need for developments that can aid in "transition from active remediation to more passive strategies and provide more cost-effective and protective long-term management of complex sites," including conducting formal Transition Assessments. This concept, which is an intrinsic part of the ITRC's IDSS framework, has now been validated by a key U.S. scientific body, the National Research Council.
- We propose to develop a focused system to deliver key knowledge to site managers and guide them so they can incorporate detailed, robust, and reliable remediation performance predictions into their IDSS. While guiding remediation and treatment trains, this system can also serve as the cornerstone for performing the "Transition Assessments" recently advocated by the National Research Council (NRC).

**Specific Barriers to be addressed:**

- As described in Section 4 of the IDSS guidance, predicting remediation performance is now performed using some mixture of three different methods: 1) personal knowledge about remediation; 2) expert knowledge from technology experts; and 3) empirical (historical) databases of remediation performance. Section 4 of the IDSS provides a broad overview of the information and data related to remediation performance that were available at the time the guidance was developed (2010-2011). Section 5 provides a brief summary of existing models, but notes the paucity of source remediation models that can be used to predict remediation performance.
- Different methods are applied at different sites, leading to inconsistent results and expectations regarding remediation performance technologies.
- Inaccurate methods to estimate remediation performance for different technologies can lead to a poor "technology selection" step when an IDSS is being developed.
- Unrealistic expectations about a particular technology, either too pessimistic or too optimistic, can skew the technology selection step and lead to frustration on part of site stakeholders.
- The Transition Assessment, while now explicitly identified as a key step in the site lifecycle by the NRC, does not have a formal methodology or guidance on how to perform this key step. With this, the Transition Assessment will be applied in an inconsistent, ad hoc manner that will retard its adoption by the groundwater remediation community.

**Approach/General Process of the Project:**

Existing methods to predict remediation performance will be assembled for evaluation, comment, and where appropriate, inclusion in the document. These will likely fall into the several key categories, described below.

- **Empirical databases** of remediation performance will be assembled that show the change in key site metrics (for example, average source concentration, maximum source concentration, source mass, mass discharge) that have occurred at actual remediation projects. Key resources include past technology-specific Environmental Security Technology Certification Program (ESTCP) projects for thermal remediation and chemical oxidation, a current ESTCP project scheduled for completion in 2012 (*"Development of an Expanded, High-Reliability Cost and Performance Database for In-Situ Remediation Technologies"* ESTCP Project No. ER-201120), literature studies, vendor-supplied databases, large-scale on-line remediation databases such as California's Geotracker Database. Figure 1 shows an example of a database now being developed as part of ESTCP Project 201120.

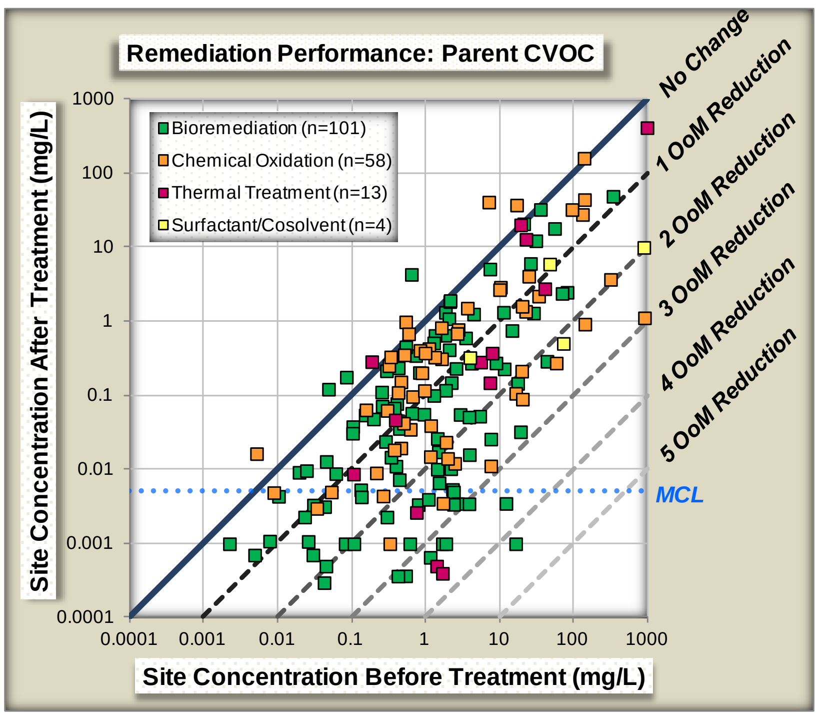


Figure 1. Average source zone concentrations in groundwater before and after source remediation projects at 176 chlorinated solvent sites. The diagonal lines represent reduction in concentration as Orders of Magnitude (OoM). Different symbols represent four different remediation technologies. Note some sites have *average* source zone concentration below the MCL but still have individual wells that exceed MCLs. Work is underway now to correlate the observed remediation performance more closely to hydrogeologic, contaminant, and key design characteristics. Source: ESTCP Project 201120 (GSI Environmental).

- **Source zone remediation computer models**, such as the U.S. EPA's REMChlor model. Models of this type can provide useful, planning level information on the likely response of a source zone and plume to a given remediation project. The strengths and limitations of each particular model will be presented in detail. The evaluation of model uncertainty will be an important focus of our proposed approach; models such as Probabilistic REMChlor (P-REMChlor) will be evaluated in detail.
- The **expert judgment** of the Team will be mined to provide a "heuristic" view of remediation performance. Using simple polling and consensus-building techniques from the field of Decision Support Systems, the Team will provide users of the Guidance with its expert knowledge as it relates to remediation performance.

Once these methods are compiled, the Team will develop a framework to instruct and guide members of the groundwater remediation community on how to use the best possible lines of evidence to predict remediation performance. The framework will be technology-specific (covering at a minimum thermal, chemical oxidation, chemical reduction, bioremediation, physical removal, and combined techniques). In addition, site-specific hydrogeologic factors will play a key role in the framework (covering both a number of specific unconsolidated and fractured rock settings). The pre-remediation geochemical condition of the site (more aerobic or more anaerobic) may also play a part in the framework.

The remediation performance framework will then be extended to a critical step in a site's lifecycle: the Transition Assessment. As described by the NRC in their 2012 publication, the key to the Transition Assessment is determining when continued active remediation (either by an existing technology, or switching to another technology as part of a treatment train) will have cost effective, beneficial effects on the long-term management of the site. The Team will take the existing tools and develop a focused, specific methodology for performing a Transition Assessment a site.

Technologies that can be used to manage a site using more passive techniques will be reviewed in detail. These will likely include, but are not limited to, monitored natural attenuation, enhanced attenuation, physical containment, hydraulic containment, and hydraulic modification. The strengths and limitations of each technology will be presented in detail.

The regulatory and institutional implications of a post-Transition, passive management approach will be developed and discussed.

Existing technical and regulatory guidance that address the "Transition Assessment" concept will be reviewed and summarized. Key documents include the San Francisco Regional Water Quality Control Board's Assessment Tool for Closure of Low-Threat Chlorinated Solvent Sites" and the Air Force's Low Risk Site Closure Manual.

Once the Technology/Regulatory Guidance document is complete, a detailed web-based training program will be developed. The key elements of the document will be presented at technical conferences in the US and abroad.

## General Schedule

We anticipate a 2-year schedule to complete this Technology/Regulatory Guidance document. A multiple-year internet training program will be implemented after the document is published.

## Proposed Personnel

The general composition of the proposed team will resemble that the previous IDSS and existing DNAPL Site Characterization team, with a broad representation of State Regulatory professionals, environmental consultants, technology vendors, US EPA personnel, and academics.

Team Leader: To be Identified
Members: To be identified. We do not see an issue getting more than five states, industry or federal partners to join the team.

## Summary of Deliverables

Key deliverables will be:

1) Technology/Regulatory Guidance document in both conventional pdf and hyperlinked form;
2) Internet Training program.

## Targeted Users

The targeted users will include

- Environmental consultants
- Site owners/managers
- State and federal regulators and technology specialists