# 2014 ITRC PROJECT PROPOSAL
## Remediation Projects Only

## Geostatistics for Remediation Optimization

### PROPOSAL DATE

**June 19, 2013**

### Proposal Contact

Ning-Wu Chang, Cal/EPA DTSC, 5796 Corporate Avenue, Cypress, CA 90630, nchang@dtsc.ca.gov, 714-484-5485

### Proposals Topical Area

**CHAR** **Site characterization, sampling, and monitoring:** *Technologies and approaches for site characterization, soil and groundwater sampling, and contaminant monitoring; Includes geophysical techniques, long term monitoring tools, and optimization tools and approaches.*

**CONT** **Soil, groundwater, and sediments contamination:** *Technologies and/or approaches for modeling, treatment, and remediation of contaminated soil, groundwater and sediments. Proposals are sought in the following areas:*

- *Groundwater flow and/or contaminant fate and transport modeling*
- *Large, dilute plumes*
- *Emerging contaminants*
- *Characterization and remediation in fractured rock*
- *Characterization and remediation of vadose zones*

**LONG** **Long term stewardship and land use controls:** *Systems and approaches for implementing, monitoring, tracking, and managing long term stewardship of contaminated sites, including engineered and institutional controls, as well as optimization strategies.*

### Proposal Summary

**Problem statement**

To explain, educate and train state regulators and other practitioners in understanding and using geostatistical approaches in remediation optimization, specifically in long-term stewardship of groundwater remedial system performance and monitoring.

**Specific technical, knowledge, and/or regulatory barriers will be addressed through the completion of the project.**

For complex groundwater cleanup sites, it is challenging to determine how to optimize the remedial system performance and monitoring. Without proper tools, decision makers may be reluctant to proceed with decisions to optimize or to justify final close-out of the site.

There is also reticence to rely on statistics to assist in these decisions, even though application of geostatistical approaches is one tool that can help project managers make effective choices based on proper evaluation and interpretation of data (including geology and hydrogeologic characteristics) gathered at complex groundwater cleanup sites.

Geostatistical approaches for groundwater monitoring optimization typically involve the use of spatial and temporal statistics to systematically estimate correlations and redundancy between sampling locations and events, as well as identify areas and/or periods of high statistical uncertainty in a groundwater monitoring network over time. Typical examples include: 1) flagging wells that are statistically redundant to the network so that they can be eliminated from routine monitoring; 2) optimizing sampling frequencies so that there is little correlation between sampling events and a maximally cost-effective sampling scheme; and 3) locating areas of high uncertainty where new wells should be added.

While optimization using geostatistical approaches offers significant benefits, without a proper understanding of the fundamentals of geostatistical approaches, mis-use or mis-interpretation may occur. Thus, a guidance document will benefit project managers in understanding and implementing geostatistical approaches for evaluation of optimization opportunities in groundwater remediation performance and monitoring, and assist project managers making better management decisions based on geostatistical evaluation.

## Approach for the project

US EPA recently (September 2012) issued a *National Strategy to Expand Superfund Optimization Practices from Site Assessment to Site Completion* to expand and formalize optimization practices as an operating business model, and to apply optimization concepts throughout all phases of a remediation project. In addition, the DOE, USACE, AFCEC and NAVFAC have developed optimization strategies. For complex groundwater cleanup sites, optimization under long-term stewardship of groundwater remedial system performance and monitoring becomes very challenging. The National Academy recently (November 2012) published a report *Alternatives for Managing the Nation's Complex Contaminated Groundwater Sites* which discusses the challenges of managing and remediating complex groundwater cleanup sites. Optimization approaches will contribute to improved remediation and monitoring.

In additional to chemicals of concern, site geology, geochemistry, and hydrogeologic conditions affect decisions about how to conduct optimization. A simple deterministic decision flow chart may not adequately account for complex site conditions, and may not help the user to make a proper decision about how to optimize. Instead, a geostatistical approach can be utilized as one of the tools to evaluate and interpret how optimization can be achieved in long-term groundwater remediation performance and monitoring. ITRC has already developed a series of Tech Reg documents for better remediation practices (e.g. RPO, SC&M, PBEM, RRM, GSR). The new guidance using geostatistics for remediation optimization will provide a supplemental tool and approach for optimization that will support the previous ITRC Tech Reg documents. In addition, the new guidance will extend the groundwater statistical analyses presented in the Groundwater Statistics and Monitoring Compliance (GSMC) Tech Reg which is due to be published fall of 2013.

The new guidance will help state regulators and project managers to understand how to use geostatistical approaches in reviewing and conducting groundwater remediation performance and monitoring optimization, and to make better decisions to achieve final site completion. The new guidance, like the GSMC document, is envisioned to be a resource for project managers and other practitioners who are not statistics experts, with information provided in an easy-to-use and searchable format. The guidance is also envisioned to include tools and metrics for effective optimization; to provide the information in levels of details so the document can be read at a summary level and also users can drill down into the details for specific site applications; to include interactive case study demonstrations with cloud computing using tools available from the public domain and, to be useable without extensive training. In order to accomplish this, the following step-wise process is proposed:

- Conduct a state survey on what level of detail states need to understand and conduct geostatistical approaches in remedial optimization.
- Develop a guidance on basic geostatistical techniques and methods, how to apply geostatistics in remedial optimization and make better decisions in long-term stewardship.
- Compile application information on available geostatistical and data management tools.
- Develop a user-friendly, interactive web-based document to guide user on how geostatistical approaches can be used in remedial optimization. In conjunction with the internet-based training noted below, the Tech Reg will support project managers and all the practitioners in the use of geostatistical approaches.
- Develop an internet-based training for effective optimization using geostatistical approaches.

**Project Schedule** –

Team Formation - January 2014

State Survey – June-October 2014

Tech Reg Development - April 2014 thru December 2015

Draft for review – March 2016

IBT development – April - October 2016

TechReg release - October 2016

First IBT public offering - November-December 2016

## Proposed Personnel

Team Leaders: Ning-Wu Chang, Cal/EPA DTSC
Harold Templin, Indiana Department of Environmental Management

Federal Agencies:

Phil Hunter, AFCEC, San Antonio, TX, 210-536-7237, Philip.Hunter@af.mil
Dave Becker, USACE, Omaha, NE, 402-697-2613, dave.j.becker@usace.army.mil
Kirby Biggs, USEPA, Alexandria, VA, 703-299-3438, biggs.kirby@epa.gov
Kirk Cameron, MacStat Consulting, Colorado Springs, CO, kcmacstat@qwest.net

**Potential Team Membership/Needs**

- State and federal regulators with the responsibility of managing groundwater remediation or monitoring projects and who need to use geostatistical approaches for optimization

- CA, NJ, IN, DE, KY, UT, WA, ME, FL, OK, do have an interest in implementing the guidance document
- DOE, DOD, US EPA, consulting companies, IAP members and members from academia.
- Skill mix of Team Members required: geologists, engineers, statisticians, risk assessors, and groundwater modelers.
- Sectors of Team Members required: state, federal, regulated community, public, and consultants

**Proposed In-Kind/Direct Project Funding**

None

## Summary of Deliverables (primary project product(s))

State Survey of Interests

Web-based Tech Reg document, including interactive case study demonstrations with cloud computing using tools available from the public domain

Internet-based training

## Targeted Users (who will use products generated by this project?)

Primary targeted users are the state regulators who will be reviewing and making decisions on optimization opportunities

Secondary users are the federal regulators, federal agencies, regulated public, consultants and contractors who will be identifying optimization opportunities and performing optimization evaluation.