



## ITRC PROJECT PROPOSAL

Update the ITRC 2003 "An Introduction to DNAPL Site Characterization" document and expand it to a Technical Regulatory document

### Proposal Contact:

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### Call for Proposals Topical Area

Primary Topic Area: CHAR: Site characterization, sampling, and monitoring

Secondary Topic Areas: CONT: Soil and groundwater contamination

### Problem Statement (why is this project necessary and relevant to ITRC's purpose & mission?)

Dense Non Aqueous Phase Liquids (DNAPLs), particularly chlorinated organics and their co-contaminants, are one of the most widespread and high-risk types of subsurface contamination. Chlorinated organic solvents were produced on an industrial scale beginning in the 1930s. They have been widely used for cleaning and degreasing in a number of industries, including chemical manufacturing, aerospace, semiconductors, electronics, commercial and retail dry cleaning and pest control. The same properties that led to their use in industry also led to their widespread use at Department of Defense (DOD) and Department of Energy (DOE) (predecessor) sites and facilities. By the 1970s, scientists and regulators began to recognize the exposure risk posed by chlorinated organics.

As a result of the widespread use, chlorinated solvent DNAPL and attendant dissolved phase contamination is found at many sites (industrial facilities, military bases, DOE facilities, dry cleaner sites, and grain elevators).. Other DNAPLs such as "coal tar" at manufactured gas facilities are also common throughout industrialized areas of the country. The exact number of DNAPL sites is unknown, but is estimated to be over 10,000, with sites in every state.

The flow and fate of DNAPLs in the subsurface is extremely complicated and affected by many variables. The factors include the physical and chemical properties of the soil or rock matrix and the DNAPL itself, as well as the effect of dissimilar fluids attempting to occupy the same spaces within the subsurface.

In the decades since environmental professionals first became aware of the problems associated with environmental contamination and the role of DNAPLs, they have attempted to characterize the presence, fate, and transport of DNAPLs and the associated subsurface contamination. The standard practice has been to drill numerous monitoring wells in multiple phases of site investigation. This expensive characterization effort has collected data of little practical use or data that can be misleading. Prolonged litigation has resulted at some sites because the characterization methods used did not adequately define the source of the contamination. Once characterization was considered complete, more money was often spent implementing remedial systems that were focused on the wrong areas and had little chance of fully remediating the site or significantly reducing its risk to human health and the environment.

Recent research has discovered that micro and macro heterogeneities in the subsurface matrix and the effects of diffusion into and out of comparatively lower conductivity portions of the aquifer may be major and even dominant factors in the subsurface behavior of DNAPLs and the associated dissolved phase contamination. As a result, researchers and advanced practitioners of site characterization have been modifying and drastically improving site characterization techniques for DNAPL sites. The emerging characterization techniques more accurately characterize the distribution and transport characteristics of

DNAPLs and the associated dissolved phase contamination. This improved characterization allows remediation to be focused on the contamination and to more quickly and effectively protect human health and the environment. These methods also lower costs for remediation because the “remedial” dollars are spent where they will do the most good. In these days of reduced remedial budgets, this can be a significant help to both regulators and problem managers.

In September 2003, the ITRC DNAPL team published the technology overview document: “An Introduction to Characterizing Sites Contaminated with DNAPLs” (<http://www.itrcweb.org/Documents/DNAPLs-4.pdf>.) This document focused on the newly emerging DNAPL characterization methodologies as they were being developed. In the six years since it was published, the emerging characterization science has grown significantly, and the document no longer represents the state of the art of characterization science. The document was also not a technical regulatory document and did not address regulatory issues leaving a vacuum that needs to be addressed as it is not clear how to incorporate these methods into existing processes for many regulators.

These DNAPL site characterization methodologies can also save significant money by allowing remediation to be focused only where the contamination can be best addressed. In these days of reduced remedial budgets, this can be a significant help to both regulators and problem holders. As the site characterization techniques can seem expensive at first glance, a new ITRC Technical Regulatory document on this topic can help explain how using these methods can save large amounts of the available environmental dollars.

Characterization methods and applications data are rapidly changing, and both regulators and private sector practitioners will benefit from a document that captures the current status of technology.”

These and more reasons to develop this document clearly fit the ITRC Purpose:” **To advance innovative environmental decision making**” and it’s Mission to: **“Develop information resources and help break down barriers to the acceptance and use of technically sound innovative solutions to environmental challenges through an active network of diverse professionals.”**

#### **Proposed Scope to Address Problem (what is the approach for this project?)**

The proposed DNAPL Site Characterization team will conduct a comprehensive review of the 2003 ITRC DNAPL site characterization document to determine which sections need to be revised and where to add updated or new material. The team will collect and summarize the fundamental background and the current status of the emerging advances in DNAPL site characterization. The team will develop a DNAPL Site Characterization Technical and Regulatory Document that provides objective guidance on the emerging methods to characterize DNAPL sites that will help regulators improve their knowledge of these techniques when faced with major site characterization decisions and to be more open to advancing their use. The team will also develop an internet based training module or a more innovative training module if appropriate.

Topics that the DNAPL Characterization team will address include:

- The latest conceptual model of DNAPL and its associated dissolved phase contamination.
- The impact of geological and anthropogenic heterogeneities on the distribution and migration of DNAPL and the associated dissolved phase contamination.
- The effect of mobile and immobile pore spaces and diffusion as significant processes affecting contaminant fate and transport.
- The methods to assess geology, DNAPL and associated dissolved phase distribution, and contaminant fate and transport.
- The role of analytical and digital modeling in DNAPL site characterization.
- What managers should consider when reviewing site characterization plans.
- The relative costs of DNAPL site characterization including the effect of improved site characterization on the cost and effectiveness of remediation at DNAPL sites.
- Characterization tools that can be used in the revised characterization methodology.
- Geophysical techniques most appropriate for DNAPL site characterization

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

The primary target will be state and federal regulators, the environmental consulting industry, and problem holders. The products will help the communities and other stakeholders understand DNAPL and related contamination as well as the processes used to best characterize the extent, fate, and transport of contamination at DNAPL sites and how that information can be used to best remediate sites and reduce the risks to human health and the environment.

This proposal fits a number of the State priorities from the 2009 survey: Site Characterization: Sampling, Modeling, Monitoring (14P, 3E); Environmental Impacts from Remediation Technologies (10P, 4E); Groundwater Contamination (9P, 3E); DNAPLs (6P); and Brownfields (5P, 1E)

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

The team will begin work at the 2011 ITRC fall meeting. As per the direction of the Life Cycle Guidance, the team will start by assessing the existing DNAPL characterization document, collecting information on the latest updates in the DNAPL site characterization paradigm, and collecting case studies that clearly demonstrate the methodologies and advantages on the emerging characterization methods. The team will revise the 2003 DNAPL characterization document to bring it up to date and expand the document into a formal ITRC Technical Regulatory document. Case studies will be included as appropriate in an appendix to the Technical Regulatory Document. Upon completion of the draft Technical and Regulatory document, the team will go through the formal ITRC review process. Concurrent with the development of the draft Technical Regulatory document, the team will begin development of Internet Training. If the team determines that there may be an innovative training technique to supplement the Internet Training, the team will consider a proposal to the Board to revise the training methodology.

The final Technical Regulatory document and training should lead to a greater knowledge base for the regulator in the use of up-to-date DNAPL site Characterization techniques. The team will use the Technical Regulatory document to develop an Internet based or other training module as appropriate.

### **Impact (how will this project result in more effective environmental decision making?)**

As discussed above, sites contaminated with DNAPLs continue to be a major environmental issue needing to be addressed by regulators, environmental consultants, academia, and stakeholders. A Technical Regulatory document written by diverse team members will support the development of a widespread network of diverse environmental professionals supporting the ITRC Mission:

**Develop information resources and help break down barriers to the acceptance and use of technically sound innovative solutions to environmental challenges through an active network of diverse professionals**

By bringing forward and publicizing the emerging innovations and improvements in DNAPL site characterization and educating environmental regulators, consultants, and stakeholders, ITRC will impact the entire field of DNAPL site characterization and remediation, while helping regulators, consultants, problem holders, and stakeholders to significantly improve DNAPL characterization. This will help insure that the ever dwindling pool of dollars available for remediation is spent in the most efficient and proactive manner and that human health and the environment are protected.

### **Project Schedule**

- 1) Begin work at 2011 ITRC fall meeting
- 2) Complete review of existing Document by February 2012
- 3) Complete review and summation of emerging characterization techniques including collecting case studies by March 2012
- 4) Complete outline of Tech Reg March 2012
- 5) First Draft completed by July 2012
- 6) Begin development of training July 2012
- 7) Complete final draft Tech Reg October 2012 and submit for review.
- 8) Finalize development of Tech Reg and Training March 1 2013.

## Proposed Personnel

### Potential Team Membership/Needs

**Team Leader:** Naji Akladiss, Maine

Naji Akladiss has significant experience in ITRC. He was the Point of Contact for Maine, a team member on the former ITRC DNAPL team and the Team Leader for the “Bioremediation of DNAPLs” and “Integrated DNAPL Source Zone Strategy” project teams. Naji has consistently demonstrated leadership skills by bringing together a large and very diverse group of regulators, academics, professionals, and stakeholders to put together case studies, overview, resources and Technical Regulatory documents, Internet Based Training and Short Courses all of which have been very well received. Naji was awarded the 2009 ITRC Team Leader of the Year Award at the 2009 fall meeting. Naji has degrees in Chemistry/Engineering, and is a licensed professional engineer with the state of Maine. He works for the State of Maine as a Project manager in the superfund program.

**Co-Team Leader:** Michael B. Smith, Vermont (Starting in 2012 when duties on the ITRC Board of Advisors are complete)

Michael Smith has worked as a geologist and hydrogeologist in both industry and the government spending the last 24 years working for the State of Vermont involved in groundwater protection, remediation, and development of regulations and state policies regarding groundwater. He has focused his work in the field of DNAPL site characterization and remediation. Michael has experience in ITRC as Point of Contact for Vermont, a member of the DNAPL team, and the Bioremediation of DNAPLs and Integrated DNAPL Source Zone Strategy project teams. Michael has also been on the ITRC Board of Advisors since 2005 including the role of Training Liaison to the Board since 2006. Michael has a BS degree in Geology, an MS in Hydrogeology, and an MA in Climatology.

The proposed DNAPL Site Characterization team includes some of North America’s leading academics, researchers, and consultants in this area and the resulting guidance will draw on their collective experiences and skills. The team will also include numerous regulators from a variety of States and from the Federal Government agencies who bring their varying perspectives on this topic, a diversity critical to any characterization technical regulatory document. .

### States interested in participating in this project and why.

California, Florida, Maine, Massachusetts, New Jersey, New York, Vermont, Virginia

DNAPL site contamination is a significant issue in all states with sites ranging from very large industrial sites to small “Mom and Pop” dry cleaners. The funding available for these sites ranges from well funded PRP lead “Superfund” sites, to minimal private funding, to already highly stressed State environmental contingency types of resources. At some sites the Federal Superfund does provide money but this fund is also stressed, and at these fund lead sites, the state may be responsible for O&M that can potentially last for hundreds of years. It is necessary for state regulators to be as up-to-date as possible with the emerging characterization technologies to help insure that the most accurate characterization is conducted to allow regulators to insure remediation is focused where it will do the most good to best protect human health and the environment, and to make most efficient use of the available funding.

### Other organizations that have expressed interest in participating as team members for this project and why.

#### Federal Agencies:

US EPA, US DOD (including AFCEE and the Navy)

Federal agencies that have expressed a need to be involved in this project include both regulators (EPA) and problem holders/stakeholders (DOD, DOE). As problem holders/stakeholders, it is in those federal agencies interests to be both educated in the emerging improvement in DNAPL site characterization and to help insure both federal and state regulators are educated and well versed in this topic. Federal regulators need to be educated in this to be as up to date as possible with the emerging characterization technologies to help insure that the most accurate characterization is conducted to allow regulators to

insure remediation is focused where it will do the most good to best protect human health and the environment, and to make most efficient use of the available funding.

### **Private Environmental Consultants**

Arcadis  
Aquifer Solutions, Inc.  
*Battelle*  
Burns & McDonnell Engineering Co., Inc.  
CDM (Camp, Dresser, & McKee, Inc.)  
Dajak, LLC.  
Fishbeck, Thompson, Carr & Huber

Geosyntec Consultants, Inc.  
GSI Environmental, Inc.  
Geo-Cleanse International, Inc  
JRW Bioremediation, LLC  
Langan Engineering & Environmental Services  
Porewater Solutions  
Tetra Tech, Inc

### **Academia**

Colorado State University, University of New Mexico, Yale University

The team is a forum in which academics can bring their research and network with practitioners from both the private and public sectors.

- The skill mix of Team Members required (e.g., hydrogeology, engineering, risk assessment, etc.) includes hydrogeology, engineering, computer modeling, site characterization, regulatory, geology, chemistry, bioremediation, and chemistry, among other disciplines.
- Sectors of Team Members required: As the DNAPL Site Characterization issue is so common and wide spread, the team needs all of the above sectors involved..

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

Nothing has been identified at this point

### **Related Work**

“The University Consortium for Field Focused Groundwater Contamination Research (formerly the University Consortium Solvents-in-Groundwater Research Program)”

<http://www.solventsconsortium.uwaterloo.ca/>