FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE MEETING
Arlington, Virginia
May 25, 2005

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ACTION ITEMS

- EMS will make electronic copies of the presentations available to the participants as soon as possible after the meeting.
- EMS will send a copy of the draft FRTR fact sheet summarizing selected Remediation Technology Assessment Reports to all participants for review. Comments are to be submitted to Martha Otto (EPA/OSRTI) by June 10.
- Beth Moore (DOE/EM) will identify a contact for characterization research at the Department of Homeland Security.

WELCOME/OPENING REMARKS

Walt Kovalick (U.S. EPA/OSRTI) welcomed the attendees and opened the 30th meeting of the Federal Remediation Technologies Roundtable (FRTR) and provided an overview of the agenda. Participants introduced themselves. Kovalick noted that the Roundtable is celebrating its 15th anniversary. He said that FRTR has achieved much during its existence by never resting on its laurels; instead, FRTR has constantly sought to re-invent itself and expand efforts to serve its purpose. The group's joint efforts and accomplishments are built on shared interests, rather than any statutory basis.

In introducing the meeting's technical topic of performance-based contracting, Kovalick expressed his appreciation to the American Consulting Engineers Council (ACEC) in supporting the meeting with speakers willing to share their experiences. ACEC input allowed the program to address performance-based contracting from both the program and project perspectives. He said that these speakers will give participants the opportunity to learn how contractors respond to performance-based contracting requirements.

PROJECT UPDATES

Status Report: Technology Cost and Performance Activities

John Kingscott (EPA/OSRTI) updated Roundtable members on the status of the FRTR Technology Cost and Performance case study database (www.frtr.gov/costperf.htm) and its companion products. His presentation covered activities since the December 2004 meeting (see Attachment A). Ten years have passed since the publication of the first compilation of remedial treatment cost and performance case studies, during which time the areas of interest have expanded. The focus areas now encompass remediation, site characterization and monitoring, long-term monitoring and optimization (LTMO), and performance assessment. The annual abstracts volume is in preparation, but an updated compilation will not be issued on CD-ROM this year because the capacity of a single disc to contain the case studies has been reached. New material consists of 13 treatment technology case studies, 10 site characterization and monitoring case studies, 9 remediation technology assessment reports, and 13 new LTMO case studies. Kingscott reported that the website statistics show brisk traffic, indicating a high level of interest in the case studies; 100,000 users visited the site over the months of February, March, and April in 2005.

Kingscott also briefly discussed the fact sheets in the program package, particularly the draft "Summary of Selected Reports," which was developed to identify remediation technology assessment reports that reflect experience with innovative technologies gained through extensive field work. The fact sheet highlights 12 reports that may be particularly useful to project managers:

- *Cost and Performance Report: Multi-Site Air Sparging* (Navy, 2005)
- *In Situ Thermal Treatment of Chlorinated Solvents: Fundamentals and Field Applications* (EPA, March 2004)
- *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater, Second Edition* (ITRC, 2005)
- *Capstone Report on the Application, Monitoring, and Performance of Permeable Reactive Barriers for Ground-Water Remediation: Volume I and II* (EPA, 2003)
- *Permeable Reactive Barriers: Lessons Learned/New Directions* (ITRC, 2005)
- *Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents* (ESTCP, Air Force, Navy, and Army, 2004)
- *Strategies for Monitoring the Performance of DNAPL Source Zone Remedies* (ITRC, 2004)
- *Evaluation of Subsurface Engineered Barriers at Waste Sites* (EPA, 1998)
- *Technical Protocol for Implementing Intrinsic Remediation with Long-Term Monitoring for Natural Attenuation of Fuel Contamination Dissolved in Groundwater* (AFCEE, 1999)
- *How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites: A Guide for Corrective Action Plan Reviewers* (EPA, May 2004 update)
- *Multi-Phase Extraction* (USACE, June 1999)
- *Engineering and Design: Soil Vapor Extraction and Bioventing* (Army Corps, 2002)

Kingscott requested that the draft fact sheet be reviewed and comments sent to Marti Otto (EPA/OSRTI, 703-603-8853, otto.martha@epa.gov). He also asked that the list of agency points of contact be examined and any changes reported.

A Summary of Results: NRC Source Zone Report

Dr. John Fountain (North Carolina State University) discussed the development of a recent publication, *Contaminants in the Subsurface: Source Zone Assessment and Remediation* (2004), by the National Research Council's Committee on Source Removal (see Attachment B). The 372-page report is available in hard copy and on line (books.nap.edu/catalog/11146.html).

This effort is the most recent of a handful of reports that refer back to a statement issued by the National Research Council in 1994: "... there is almost universal concern among groups with diverse interests in groundwater contamination … that the nation may be wasting large amounts of money on ineffective remediation efforts." The current report and the other studies have attempted to update this conclusion in regard to source zones.

The report was written to provide general guidance to those who ask: “When should source zone remediation be attempted? What can it be expected to accomplish? What technology should be used?” The report proposes elements of a protocol for accomplishing source remediation that should enable project managers to decide whether and how to pursue source remediation at their sites.

The committee based its work on analysis of peer-reviewed material that described actual applications of source remediation technologies. The conceptual framework of the report provided a basis for systematic discussions by considering the interrelation of remediation objectives, hydrogeologic settings, and remediation technologies. Fountain pointed out that all 17 members of the committee had to sign off on the report before it could be published.

The first few chapters of the report essentially review background information for source zones, source zone characterization in various hydrogeologic settings, and objectives for source remediation. Considerable attention is given to the topic of coping with uncertainties during source characterization. The committee noticed that, at many sites affected by dense nonaqueous-phase liquid (DNAPL), site characterization as described in the literature was inadequate to support the remediation strategies and success metrics chosen. This is not to say that the technologies used were not appropriate, but that there was no evidence of sufficient basis for their selection. Additionally, at most sites where source zone remediation was attempted, characterization was insufficient to evaluate performance in terms of remaining mass; there were not enough data to conclude what had been accomplished.

The same problem was evident with regard to remediation objectives. To determine if source zone remediation is appropriate at a site, one must be able to determine if the objectives can be accomplished. In the majority of cases examined, however, the objective was not stated in advance. As a result, the question could not be answered. Fountain stressed the importance of not only stating a specific objective, but also having a metric (a quantity that can be measured) to evaluate achievement of the objective. Some objectives, e.g., "protect human health," do not have appropriate direct metrics, and reducing a contaminant to a concentration specified in the regulations (e.g., MCLs) is often substituted as an objective. The NRC group found that inappropriate metrics were commonly reported in source zone remediation projects. For example, the amount of mass removed might be measured, but that information did not provide a measure relevant to the stated goal of protection of human health, and the reviewers could not determine whether the project might or might not have been successful.

A clear distinction between functional and absolute objectives is needed to evaluate cleanup options. The distinction is important because functional objectives (e.g., reduce concentration in a well to MCL) may have some flexibility, whereas absolute ones (e.g., protect human health) do not. For example, if it is not feasible to lower a concentration to attain an MCL (and if regulators have not made MCL attainment an absolute requirement), the requirement to protect human health might be met by providing water from another source.

The report contains a 26-page table designed for high-order screening of remediation alternatives to identify the likely effectiveness of a technology in different hydrologic settings. Once the site has been thoroughly characterized and the remediation objectives determined, the table indicates which technologies have a greater or lesser likelihood of meeting those objectives in that particular setting. At that point, a site-specific evaluation, or feasibility study, will provide further information on which to base a decision. If all the technologies show a low potential for meeting the objective, it might be time to reevaluate the objective.

The literature shows that several source remediation technologies have been demonstrated to achieve substantial mass removal, and a number have demonstrated concentration reductions. Fountain also touched on the topic of using changes in mass flux as a metric. Theoretical, modeling, and laboratory

data suggest that partial mass removal can affect local concentration and downgradient mass flux; however, mass flux is difficult to measure effectively and few cases of effective measurement in the field have been documented. This lack does not necessarily indicate that measurement of mass flux is an ineffective metric; it simply has been extremely difficult to measure it effectively so far. The data are not there yet.

Thermal treatments have shown some good results at removing source contaminants from low-permeability media, but most of the other technologies were less applicable in that setting. The ability of DNAPL to penetrate clays, sediments, and other low-permeability layers is an area that continues to elude the perfect understanding of the scientific community. With regard to karst terranes, the committee concluded from the literature survey that available source remediation technologies are unlikely to work in such complex settings. Several source zone treatment technologies show enough promise to warrant further investigation. Future work should attempt to determine the full range of conditions under which these technologies can be successfully applied and to better understand how mass removal via these technologies affects water quality.

In Fountain's opinion, there are some good reasons for source zone remediation. The effort can reduce mass flux and maximize the likelihood that natural attenuation will work, and it also can remove as much contamination as is practical, thereby doing all that is possible to restore the environment and reducing the time it takes to do it. In order to determine when source zone remediation is worthwhile, we need to know three things: (1) what is the objective, (2) what can really be accomplished, and (3) how much will it cost?

Question: Was peer-reviewed literature the only material considered? Or were case studies or “gray” literature considered?
Answer: Although the committee members are aware of the “gray” literature, only peer-reviewed material was used for this study. Following the basic rules of science, if the material has not been published and peer-reviewed, we can't consider it proven .

Question: Are you cognizant of the work on mass flux sponsored by DoD?
Answer: If it had not appeared in the peer-reviewed literature by the time our study concluded about six months ago, we did not consider it.

Question: What source zone contaminants were considered?
Answer: We were most concerned with chlorinated solvents and explosives residues. We were not looking at LNAPLs. Any examination of the vadose zone was excluded from our charge. There was no emphasis on metals and no attention paid to radionuclides.

Comment: It sounds as though we need to know everything about a site before we start cleaning it up.
Response: There is a need for better, well-documented field testing and sampling, but information needs vary with the site and the circumstances. For example, if the intention is to contain the contamination within barriers, you simply need to know how far the barriers should extend. You don't need to know the details of contaminant distribution within the containment area. If you are doing an injection technique of some kind, you need to know, with some certainty, where the pathways are that will deliver the agent to the source zone.

Report on Triad Partners Workshop, March 17, 2005

Linda Fiedler (EPA/OSRTI) explained that Triad is a methodology for managing decision uncertainty. The name stands for the three components of a methodology involving systematic planning, dynamic work strategies, and real-time measurement technologies (see Attachment C). Fiedler said that Triad is a way to go about collecting the data needed to determine the extent of contamination, what metrics to use, and what remedy to select. Some of the Triad components have been around for many years under different names, but the concept as a whole may be contrary to many of the processes and procedures currently in place for cleanup programs, which can be linear in practice—very different from the dynamic and flexible approach supported by real-time data gathering under Triad. The main advantage of the Triad methodology is that it provides greater certainty on the areal and vertical extent of contamination.

The Triad program has been in place for about five years, and interest in it is high. There were many more applicants for advanced Triad training held in March than could be accommodated. As an adjunct to the March training, a Triad Partners planning meeting brought together about 40 people—policy makers and practitioners from EPA, DoD, DOE, the states, and the private sector. The objective was to identify and prioritize what issues need to be resolved to further Triad implementation and to outline a strategic plan to address these issues over the next five years. One of the main meeting outcomes was the identification of key focus areas. These areas include regulatory issues, education and training, technology and science, marketing and outreach, administrative and institutional issues, and leadership and coordination. Fiedler highlighted one of the main goals identified within each area:

1. Regulatory Issues—Overcome perceived and real regulatory barriers. One way to define this problem more precisely is to document issues that come up with regulators at sites where Triad is being used.

2. Education and Training—Develop a curriculum, training materials, the most appropriate training mechanism, and a forum.

3. Technology and Science—Foster acceptance of new technologies and new application of existing technologies. This challenge indicates a need to get the word out on what the technologies used in Triad can do.

4. Marketing and Outreach—Create a clear, unified message. Some of the meeting attendees reported finding that different groups have different perceptions of what Triad is and what it can do for them.

5. Administrative and Institutional Issues—Identify and overcome institutional barriers and limitations in procurement, programming resources (time, money, staff), and policy/guidance. For example, contracting officers are sometimes suspicious of the dynamic approach because they perceive it as unstructured.

6. Leadership and Coordination—Develop and define an organizational backbone. The program is moving toward a Triad Community of Practice (CoP) that allows people from all sorts of organizations to work together in sharing experiences and helping each other spread information on

the program. But how should this community be led? By a formal or an informal group? Should the group have decision-making authority?

The Triad Partners Workshop produced the following overall recommendations:

- Use Focus Area subgroups as the tool to finalize and initially implement a strategy.
- Define a charter for coordination and leadership ASAP.
- Place high priority on
  - developing a mechanism for tracking and disseminating the status of Focus Area actions and
  - assuring communications between those responsible for each Focus Area.
- Consider providing training to the membership focused on interpersonal skills and building social capital.
- Make sure the purposes of any future planning workshops are made clear to potential participants.

The Triad group's plans for the future call for the preparation of a policy memo from OSRTI (and possibly other programs) to show upper management support, implementation of Triad at Superfund sites in all EPA Regions to disseminate the message and mentor staff, and development of a more comprehensive training program. A Triad Strategy will be developed within EPA and within the CoP.

Question: If OSRTI signs off on a policy memo, does it apply to EPA's Federal Facilities Restoration and Reuse Office (FFRRO)?

Answer: Kovalick responded that Triad pilots are currently under way at approximately 40 sites (voluntary use at mostly brownfields sites). Successful application of the approach in the pilots may illuminate ways that Triad could be insinuated into activities such as the PA/SI and RI/FS in the Regions. The approach is being implemented already at several Air Force facilities.

Update on Joint FRTR Initiatives

Walt Kovalick reminded those assembled that an FRTR joint project by definition involves at least three different agencies working together to achieve an end. He then discussed recent developments in three FRTR initiatives: the Decision Support Tools Matrix, the Long-Term Monitoring Optimization Seminar, and a planned workshop on nanotechnology for site remediation (see Attachment D).

The Decision Support Tools Matrix has been developed to help front-line remediation project managers across the different agencies recognize and choose appropriate tools for their projects. The Matrix developers have selected 20 software tools and evaluated each one's function, purpose, limitations, ease of use, and suitability for different areas of project decision-making. The wide field of possible products to evaluate was narrowed by limiting the tools considered by the following criteria: the software is freely available to the public, rather than sold commercially; it is not so complicated that it can be used only by a technical expert; and the decision support, or default output, is predictive from input. The developers are producing the Matrix and a final report, as well as providing case studies that illustrate the use of SADA/FIELDS, VSP, Scribe, Bioscreen, and the Johnson & Ettinger model. The matrix has been mounted temporarily on CLU-IN for testing, and final comments are solicited from FRTR members and tool developers. The due date for submission of final comments to Michael Adam (EPA/OSRTI, 703-603-9915, adam.michael@epa.gov) is June 10.

Richard Mach (U.S. Navy/NAVFAC) recommended that the Matrix be titled "Decision Support Software Tools'" to differentiate these tools from other types of tools found in broad definitions of decision support products. Kovalick agreed that a title change would indicate an important distinction to potential users of the resource.

The Long-Term Monitoring Optimization (LTMO) Seminar held in Sacramento on March 30-31, 2005, was a joint effort involving the State of California, U.S. Army Corps of Engineers (USACE), Army, Navy, Air Force, and EPA's Region 9 and Technology Innovation and Field Services Division (TIFSD). The seminar provided state and federal regulators with information about new quantitative methods of LTMO and included hands-on training in the use of some of these methods. Long-term monitoring is expensive, and the interest in the Seminar was so great that there was standing room only on the first day for the lectures on LTMO benefits and techniques. On the second day, 35 participants received advanced hands-on training. Participation in advanced training was limited by the computer space available, and training venues are needed that will allow computer access to a greater number of people. Kovalick urged the attendees to report back if they can provide free access within their own agencies to a facility with meeting space and 30-plus workstations in one room that could be used for LTMO training.

Feedback for the seminar was overwhelmingly positive, with many requests for the training to be conducted again, and EPA is considering additional deliveries in other parts of the country. The *Roadmap to Long-Term Monitoring Optimization* (EPA 542-R-05-003), which has been developed by EPA and USACE and on which the core Seminar presentations are based, will soon be available. The contact for additional information on LTMO is Kathy Yager (EPA/OSRTI, 617-918-8362, yager.kathleen@epa.gov).

A workshop on nanotechnology for site remediation is being planned for October 20-21, 2005, in Washington, DC. EPA's Office of Research and Development is working with other agencies to develop a program for 75 to 100 invited practitioners and researchers to explore the state of the science. The meeting also will give the attendees an opportunity to network and, in light of shrinking research funding, discuss partnerships for future research solicitations. Marti Otto (EPA/OSRTI, 703-603-8853, otto.martha@epa.gov) is the EPA contact for the workshop.

NEXT MEETING TOPICS

Walt Kovalick presented the attendees with five options from which to select the topic of the next Roundtable meeting:

(1) Measurement and treatment of emerging contaminants
(2) Sediments characterization and cleanup
(3) Sensor technologies (other than nanotechnologies)
(4) Innovative approaches to small site closure
(5) DNAPL cleanup case studies

By a show of hands, the attendees selected Option 3: Sensor technologies (other than nanotechnologies) as the technical topic of the next meeting in November or December. The members were urged to send

in suggestions for speakers who could present new developments in the monitoring and measurement of soil and water.

Beth Moore (U.S. DOE/EM) volunteered that portions of the characterization research program formerly supported by DOE had been picked up by the Department of Homeland Security. Kovalick asked if she had a contact for the characterization work within that agency, and she promised to locate a contact and get back to him with the information.

PROGRAM PERSPECTIVES ON PERFORMANCE-BASED MANAGEMENT/CONTRACTING IMPACTING INNOVATIVE TECHNOLOGY USE

Performance-Based Management (PBM): Tool for Compliance and Restoration Programs

Erica Becvar (U.S. Air Force/AFCEE) presented an overview of the history and applicability of performance-based management (PBM) from an AFCEE perspective (see Attachment E). PBM is an approach for managing environmental cleanup projects that involves communication with stakeholders, systematic planning, and an understanding of site conditions and planned uses to reach an economical site closure by focusing on goals and results achieved. As implemented by an expert team in clear and constant communication, PBM involves the following components:

- A defined problem, land use, and objectives
- An updated conceptual site model by Triad
- An established land use and risk management strategy
- An established ARAR analysis strategy
- Documented decision logic to promote clear communication among team members
- A defined exit strategy
- A contracting strategy
- Process optimization

Becvar said that it is important to understand that PBM is not a checklist of process steps to be followed but instead is comparable to a philosophy whereby contracted work is performed with minimal focus on government process and maximum focus on results. PBM can be used with a variety of contract types, and performance-based contracting (PBC) is a subset of PBM.

PBM requires a different mind-set from conventional project management, because the focus shifts from steps completed to results attained. PBM is a continuous process in which the status of the project is evaluated throughout its life-cycle. The approach relies on streamlined characterization techniques, promotes establishing a realistic exit strategy, and implements process optimization. It also promotes use of innovative contracting.

Becvar emphasized the importance of defining an exit strategy. This process helps determine how performance will be measured by selecting metrics that can be used to prove that project goals have been achieved. The exit strategy may be modified by characterization findings and regulatory changes. She provided examples of sites where PBM has been successfully implemented, pointing out that PBM implementation represents a change in the way business is done and requires support from upper

management, contracting, and the installations, as well as good coordination with regulators. Most importantly, PBM requires up-front time commitment and active participation from all team members.

Performance-Based Contracting for Environmental Cleanup

Janet Kim (U.S. Army/AEC) pointed out that PBC (formerly known as Guaranteed Fixed Price Remediation, or GFPR) is a contracting mechanism that requires the contractor to achieve specific remediation objectives, for a fixed price, based on a detailed scope of work (see Attachment F). The contractor can buy insurance to cover additional costs that may occur if the cleanup expenditures exceed the contract award. All cleanups do not require insurance. In the late 1990s, the Army began using PBC for environmental cleanups via GFPR contracts in pilots at both BRAC and active installations. Under PBC, the contractor is expected to achieve one or more performance objectives at each site, such as demonstrating that the remedy is operating and performing successfully, putting the remedy in place with a successful subsequent 5-year review, or achieving a "no further action" assessment from the regulators.

Kim stressed the importance of defining objectives clearly without being too prescriptive. Simply stating the desired end state leaves room for innovation in achieving it. The use of incentives or environmental insurance (though not necessarily on all contracts) can enhance performance. For example, groundwater sites are good candidates for environmental insurance. The Army has not aggressively pursued the use of incentives across the board—there is a large learning curve within the agency. Leadership buy-in is essential for successful PBC implementation. Use of it has increased in the last few years, and the Army is aiming to make PBC 50 percent of its total Installation Restoration Program (IRP) in 2005, perhaps as high as 70 percent by 2007. The BRAC program also has made good progress in implementing PBC, while the Formerly Used Defense Sites (FUDS) program is adopting to it more slowly.

Kim cited innovative technologies implemented in PBC cleanups at seven Army installations. She remarked that having an insurance provider can encourage the contractor to use innovative technologies as a means to meet the schedule and lower costs, because the insurance company is there to back up the additional cost if faster cleanup at lower cost does not result from the application of innovative technology.

A draft guidance manual is currently in development. USAEC will post the final version to the PBC website (aec.army.mil/usaec/cleanup/pbc00.html), and Kim offered to let FRTR know when it becomes available.

Question: How will you handle performance-based contracting for investigations, since they have inherent high levels of uncertainty? Are investigations included in your goal of using PBC 70 percent of the time in the IRP?

Answer: The 70 percent refers to program dollars, not to the amount of work. We do not want sites going into the process prematurely, because we do not want to pay a premium for dealing with a high level of uncertainty. We certainly do not intend to lump every effort into the PBC program.

Question: Is long-term monitoring included under PBC?

Answer: Only until the period of performance ends.

Performance-Based Management: Interstate Technology Regulatory Council (ITRC) Experience

Thomas O'Neill (New Jersey DEP and ITRC) described the role the ITRC plays in gaining regulatory acceptance for new solutions to environmental problems (see Attachment G). ITRC is a state-led, national coalition of regulators, public stakeholders, and representatives from EPA, DOE, DoD, the Environmental Council of States (ECOS), industry, academia, and several regional state organizations. This coalition works to speed the implementation of new environmental technologies and improve state permitting processes. ITRC's day-to-day work is accomplished through a series of topic-specific project teams. Each team must have representatives from at least five states and tries to have a representative from each group in the coalition.

O'Neill explained that the PBM model illustrates the elements that you should expect to see contained in a proposal or contract. It also shows what you should expect to have to do if you become involved in such a project. States are interested in PBM as a means to control costs that will inevitably rise on long-term projects. For example, the Higgins Farm Superfund Site project in New Jersey costs $1.5 million to operate each year. Under Superfund, New Jersey currently presently pays half of the cost; eventually, the site will be turned over to the state and the state will have to assume responsibility for all costs. Even private-party cleanups tap state resources, so a PBM proposal may be well-received where a cost advantage is apparent. At present, there is little state awareness of PBM issues, and it is the role of the ITRC to help the states become familiar with the approach.

O'Neill said that bureaucratic and procedural inertia will affect state implementation of PBM. For example, it is difficult to change from working with turnaround time expectations expressed in years to turnaround expected in weeks. Additionally, with PBC there is emphasis on risk-based cleanups, which some states use and some do not.

A white paper on performance-based remediation contracts from the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Base Closure Focus Group, "A Guide To Performance-Based Environmental Remediation," was presented at the November 2004 Current Issues Symposium in Charleston, SC. It is available as a Microsoft Word file at the ASTSWMO website (http://www.astswmo.org/Publications/Revbkshlf.htm#Federal Facilities).

ITRC intends to issue five fact sheets in 2005 on the following topics: (1) performance-based management, (2) life-cycle cost analysis, (3) above ground treatment technology, (4) data visualization, and (5) ARAR analysis. An Internet training component will also be developed to tie in to the fact sheets.

The ITRC issued a guidance document in September 2004, *Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation* (RPO-1, available at www.itrcweb.org/gd_RPO.asp). The document provides practical information and guidance on how to systematically evaluate and manage uncertainty associated with the remediation process. O'Neill said that remediation process optimization (RPO) is a "snapshot" effort; it is done periodically rather than on a continuing basis. He emphasized that periodic optimization is important both because it can save

money and because circumstances (such as the future intended use of a site or the availability of new technologies) change. Internet training for RPO should be available in 2006.

Question: Are there DoD agencies working with ITRC other than AFCEE?
Answer: Yes, the Navy and the Army Corps of Engineers.

Federal Remediation Technologies Roundtable Performance-Based Contracting

Renee Wynn (EPA/FFRRO) said that EPA supports the use of PBC at federal facilities (see Attachment H). A successful PBC approach, however, is contingent upon the following factors:

- The regulators understand the PBC concept and participate in the development of the statement of work.
- The roles and responsibilities of the parties involved are understood and supported.
- Knowledgeable project managers are available.
- Performance measures are agreed to by the involved parties, all of whom have sufficient resources to perform to the level agreed upon.

Wynn said that it is important for the involved parties to understand that PBC does not replace good project management, allow cleanup requirements to be disregarded, or mean that a change to enforceable agreements is automatically required. With resources getting tighter, the key to success is clear communication. Communication must be flexible and agile, and terminology must be precisely defined so each person understands what the other is saying. Communications must be clear enough to allow each party to answer the following complex questions: What do I need? When do I need it? How do I know it's good when I get it?

Question: DOE has participated in the One Cleanup Program approach, which has tried to optimize the regulatory framework for RCRA in conjunction with CERCLA. Do you have a perspective to offer on progress being made there and how that might pertain to performance-based contracting?
Answer: The One Cleanup workgroup—made up of EPA, many other federal agencies, and some states—is still working on the RCRA/CERCLA integration.

Navy's Program Perspectives on Performance-Based Contracting

Robert Sadorra (U.S. Navy/NAVFAC) discussed the history of the Navy's involvement with PBC (see Attachment I). PBC allows the Navy to specify work for a contractor in terms of what it wants the outcome to be and places responsibility on (transfers risk to) the contractor for determining how to produce the desired outcome. This gives the contractor more freedom to consider innovative approaches.

The Navy has worked to increase contracting opportunities for small businesses, from 9 percent of contract funding in 2001 to 40 percent in 2004, with 45 percent projected for 2005 and 2006. It has also expanded fixed-price work from 32 percent in 2001 to 55 percent in 2004, with future increases planned. The Navy tries to integrate PBC throughout the entire acquisition strategy; PBC techniques can be implemented at any stage in the cleanup process. The level of PBC implementation can vary depending on uncertainty, balanced against efficiency, in a situational analysis of risk versus reward.

NAVFAC has been using PBC techniques since 1999. In October 2004, NAVFAC issued specific PBC guidelines that 1) explain the elements of the method, 2) call for its increased use, 3) address PBC eligibility (applies to non-Brooks Bill work only), 4) designate responsibilities and level of approval, and 5) establish reporting requirements. PBC has been used for environmental work at Charleston Naval Station (SC), Naval Air Station Whiting Field (FL), Naval Submarine Base Kings Bay (GA), Naval Communications Station Stockton (CA), Mare Island Naval Shipyard (CA), and in other remediation contracts Navy-wide. The Navy also uses a Performance Environmental Restoration Multiple Award Contract (PERMAC) to combine design and construction under a fixed price contract.

DOE Perspectives on Performance-Based Contracting: Impacting Innovative Technology Use

Lawrence Bailey (DOE/EM) said that DOE's environmental management program encompasses over 60 installations in 22 states (see Attachment J). The cleanup program involves decontamination and decommissioning of nuclear facilities, groundwater and soil remediation, and the stabilization and disposal of nuclear waste. DOE expects to spend $80 to 90 billion on cleanup ($10 -$15 billion on soil and groundwater remediation) between 2005 and 2035. Some 222 groundwater plumes have been identified, with 302 remedies either confirmed or proposed. More than one remedy may be deployed to clean up a plume, especially when monitored natural attenuation (MNA) plays a part. MNA is being applied to 95 of the plumes. Pump-and-treat is in place in a similar number of cases; however, pump-and-treat often is put in place as a hydraulic containment mechanism to prevent contaminant migration until an effective remedy becomes available. The primary contaminants are metals, DNAPLs, and radionuclides. This mixture of contaminants is what makes DOE's cleanup effort challenging.

The DOE cleanup program is driven by applicable state and federal regulations and concerns for public health and safety. Remediation decisions are affected by determinations of property end use, cleanup standards versus technology capability, and the emergence of new technologies. Bailey commented that the budget for technology research and development has decreased significantly and is largely consolidated at Hanford (both Richland and the Office of River Protection), Idaho National laboratory, and the Savannah River Site. Investment in technology development and deployment is linked to corporate performance measures, performance management plans, site end use, and site baselines.

DOE has moved aggressively within the past year toward implementing performance measures, e.g., ROD approval or cleanup levels met, in its contracts. Some Indefinite Delivery Indefinite Quantity (IDIQ) contracts have been awarded to give site managers a mechanism to accomplish work expeditiously. The goal is to award cost-plus incentive-fee contracts.

In 2003, DOE signed a cost-plus incentive-fee contract (3-year base period with 1-year options) at a site. That contract identifies a target number of sites and a maximum number of sites. Progress payments are broken out in the fee structure and assigned to each site. Incentive fees are not awarded until the fee condition has been met. At another major site, a similar type of contract breaks the fee down by groundwater challenges and by soil challenges. DOE plans outreach to capture information concerning incentive fee results, positives and negatives associated with the management of risk and uncertainty, and the general level of satisfaction with the various contracting approaches.

Question: How do you budget for a 3-year base contract with 1-year increments in cleaning up multiple sites?
Answer: With multi-year funding. With our cost-plus contracts, we specify the sites that will merit an fee. The fees are not applied to just any site.

Question: When you obligate the work for the delivery order, are you obligating the fee as well, and it just sits there until it is awarded? Do you not have to de-obligate it at some point?
Answer: We do not award the incentive fee until it has been earned.

PERFORMANCE-BASED CONTRACTING CASE STUDIES

South Carolina's UST Program: Pay-for-Performance Contracting

Thomas O'Neill described pay-for-performance contracting in South Carolina's underground storage tank (UST) program (see Attachment K). South Carolina spends $12-$15 million each year on risk-based cleanups of leaking USTs. The pay-for-performance contracts are applicable to all petroleum releases requiring active corrective action, which involves remediation of free product, remediation of soil and/or groundwater, and, sometimes, replacement of impacted receptors (e.g., water supply well, utility). In 1997, South Carolina began to bid out all corrective actions under pay-for-performance practices. The state does the contracting and the contractor proposes and controls the cleanup schedule, technology used, and cost. Payment is based on documented cleanup progress. The award price is the low bid, and it is a firm fixed-price unless the South Carolina Department of Health and Environmental Conservation agrees that the site assessment contained major errors or omissions, a new release occurs, or the initial concentrations have dramatically increased.

The state has seen pay-for-performance contracting produce many immediate benefits, such as completion times below estimates, greatly reduced costs for time and materials, simplification of budget planning, and no equipment problems (because that is the contractor's responsibility). The program also benefits the contractor by providing quicker payment—time between submission of the invoice upon completion and payment averages only two days. The state estimates that its total savings between 1997 and 2004 amounted to $75,341,783.

Because so much of the remediation process is the responsibility of the contractor, the state and the owner must supervise the process sufficiently to ensure that the contractor does not take short cuts with materials or technology, the entire plume is addressed, and the contractor does not stop before goals are met.

Arctic Surplus Salvage Yard Response Complete Report

Erica Becvar described the performance-based elements used in the cleanup of the Defense Logistics Agency's Arctic Surplus Salvage Yard in Alaska (see Attachment L). The AFCEE-developed Performance-Based Environmental Restoration Management Assessment (PERMA) was used for the first time at this site.

The Arctic Surplus Salvage Yard was listed on National Priorities List in 1990. It contained an estimated 8,500 cubic yards of PBC- and lead-contaminated soils, a little less than 10 cubic yards of pesticide- and dioxin-contaminated soils, over 45,000 cubic yards of scrap materials, numerous waste drums and transformers, 5,000 cubic yards of tires, 83 trailers, and more than 400 pressurized gas cylinders. An old military landfill was also present. The ROD selected solvent extraction for PCB-contaminated soils and stabilization for lead-contaminated soils, with costs estimated at $34 to 38 million over a period of 3 to 4 years for the remedial action (not including costs for handling unexploded ordinance discovered later). A PERMA conducted at the site in June 2002 produced a recommendation for stabilization and on-site placement of PCB- and lead-contaminated soils; an RPO assessment indicated that the remedial action could be completed in less than two years for an estimated $3.6 million. Treatability studies were conducted later in 2002 to demonstrate the viability of the proposed stabilization process.

A firm fixed-price task order at a negotiated cost of $3.45 million was awarded in March 2003 for stabilization and solidification of the contaminated soils, placement of up to 8,500 cubic yards of soils in an on-site landfill, and five years of O&M. Field work began in May, the explanation of significant differences (ESD) was completed in June, and 10,000 cubic yards of soil had been stabilized and placed in the landfill by August 2003. Construction of a multilayer cap over the landfill was completed in October and agreements were reached with site owners regarding institutional controls. About 100 cubic yards of PCB hot spots and 10 cubic yards of PCB/dioxin soils were excavated for off-site disposal, and disposal was completed in December 2003. The entire remedial action was completed in seven months (versus the original estimate of 3 to 4 years) with no cost increases for additional soil stabilization or off-site disposal.

Expended munitions (EM) materials (including 19 live primers) were discovered at the site in September 2002. A small amount of slightly radioactive waste was discovered during demilitarization (DEMIL) operations, and the material was cleared from the site. The UXO and radiological waste were remediated for $5.8 million on an accelerated schedule. The EM DEMIL was completed early in 2004 and verified by a geophysical survey.

PERMA implementation resulted in a protective remedy with minimal adverse impact to human health and the environment at cost savings of $30 million (approximately 90 percent of original estimates) and the long-term monitoring strategy was optimized. One hundred percent of the site was returned to beneficial use, and delisting from the NPL is expected by September 2005. The Alaska Department of

Environmental Conservation considers Arctic Surplus a model to follow for teamwork, communication, real-time response, and regulatory involvement in environmental cleanup. This model is presently being followed at Galena AFB and King Salmon AFB, AK.

Question: Did you do an ESD for PCBs?
Answer: No, we had good communication with the regulators. The ROD did have to be amended for the UXO and radiological waste.

Question: How did you dispose of the expended munitions?
Answer: Eilson AFB handled the treatment and landfill disposal of the expended munitions at no charge to the project.

Question: The remedy was solvent extraction for PCB soils and stabilization for lead soils. Were the PCB soils stabilized after solvent extraction?
Answer: The remedy used trisodium phosphate to stabilize the PCBs and lead at the same time.

Question: Did the contractor assume the risk for re-doing the remedy if the first one failed?
Answer: Treatability studies minimized the risk to the contractor.

Application of Innovative Technologies in Performance-Based Contracting

Erhardt Werth (ARCADIS) presented three examples of cleanups for the Army where performance-based contracting provided the flexibility for the contractor to apply innovative technologies (see Attachment M). He remarked that the real challenge in remediation is not so much the selection of an effective treatment technology as it is the effective delivery of the treatment agent.

At Fort Leavenworth, KS, a pilot test of enhanced reductive dechlorination (ERD) was used on a tetrachloroethylene (PCE) plume in loess and till. ERD involved injecting molasses and whey into the treatment area. The project focused on total (sorbed and soluble) contaminant mass removal over the course of one year. The plume isocontours show noticeable post-pilot shrinkage. The applications reduced PCE significantly in the treatment area with complete degradation to ethene, and ERD with MNA was proposed as the final remedy for the site.

At Graces Quarters in Aberdeen Proving Grounds, MD, abiotic dechlorination was used to address the presence of 1,1,2,2-tetrachloroethane (TeCa) and carbon tetrachloride. TeCa releases chloroform, which is toxic to microorganisms and derails biodegradation processes. ARCADIS had to find a way around the problem via a non-biological approach. First, the TeCa was eliminated chemically using titanium-driven vitamin B-12 reduction, and subsequent biological activity resumed the dechlorination process. The abiotic process is contact-driven, and the cycling of groundwater and agent through circulation wells provided the necessary contact. Vitamin B-12 applications are expensive at $500 per can. The course of treatment required one can per well per month in six wells over a 6-month period.

At the Milan Army Ammunition Plant, a composting facility was developed to degrade explosives (TNT, RDX, and tetryl) in soils. The contaminated soil was mixed with organic carbon and bulking agents and constructed in windrows. The windrows were periodically tilled. The target treatment level was reached 20 days after construction of the windrows. The treated soil was then re-used on site.

Composting can create an issue of materials handling because bulking makes more solid waste at the end of the process. The contract gave 10 years to complete the remedy. Payments were based on the volumes of soil cleaned to a stated level.

Question: When was the work done with vitamin B-12?
Answer: About 10 years ago. It was tested in circulation wells.

Question: Have you looked at other means for substrate distribution?
Answer: We are always looking for improvements, but so far haven't found any.

Performance-Based Contracting: CH2M HILL Case Studies

James Kovalcik (CH2MHill) discussed work performed for the Navy and DOE that illustrates three different approaches to performance-based contracting (see Attachment N).

At Charleston Naval Complex (CNC) under a $28.8 million fixed-price, insured environmental contract, the company was charged with responsibility for site investigations, remedial planning, remedial action to close RCRA and UST sites, regulatory approvals and release of a RCRA permit, property transfer documentation, O&M of remedial systems for 20 years, and liability for newly discovered sites. The contract also included a "no differing site conditions" clause. The Navy costs were capped and the liabilities covered with a 20-year "Environmental Liability and Stop Loss" insurance policy. The property is cleaned and is being transferred. Almost all the remedies have been implemented except for a few awaiting approval by the regulators, and only one site remains where a remedy has yet to be submitted.

CH2MHill was shielded from certain liabilities by contract exclusions for unexploded ordnance and wastes associated with the nuclear propulsion program (Insurance coverage can sometime be found for UXO, but not for radiological wastes.), biological and chemical warfare agents, sediments below mean low tide, and changes to the reuse plan. Virtually no change orders were issued for work at the CNC site. Kovalcik said that CH2MHill learned some valuable lessons from this project, including:

- A project of this scope requires a totally integrated design/build remediation and insurance team.
- There was a considerable learning curve for insurance issues and dealing with performance standard metrics.
- Integrating regulators into the process early is invaluable.
- It is important to develop a centralized group (a 'tiger team') to manage this type of project.

At Mare Island Naval Shipyard, the site closure process was delaying development, though both the Navy and the stakeholders were eager for the Navy to divest itself of the property. Under an insured, fixed-price contract for BRAC Early Transfer, CH2MHill accepted responsibility for closure of more than 550 sites. Simultaneous negotiations between the Navy, the City of Vallejo, the developer (Lennar), and CH2MHill to agree upon and document revised responsibilities revealed the extraordinary amount of time it could take to iron out who had what responsibilities and the conditions attached to them. The company also found that on a 150-year-old industrial base, unknowns can exceed expectations.

At the Rocky Flats Environmental Technology Site, the company accepted DOE's challenge to reduce costs and accelerate closure while maintaining an exemplary safety program at a site with extraordinary contamination problems. This project is uninsured PBC work. The contract contains cost and schedule incentives. CH2MHill and DOE share savings or overruns on a 30/70 split. When costs are over budget, the contractor bears the burden; when costs are under budget, the contractor earns more incentive fee the less the government must spend. Under the schedule incentive, the earlier the project is completed, the more incentive fee the contractor earns.

The site contains over 14 tons of plutonium, 50,000 containers of wastes, 170 areas of contaminated soil, plus groundwater and surface water contamination. The scope of work encompasses operation of the site as caretaker, environmental remediation and site closure, nuclear material handling and waste disposal, property transfer, and community and regulatory affairs. Work at this site has shown that the target-cost-incentive-fee approach aligns client and contractor goals to expedite cleanup and land transfer. Partnered solutions allow more client control than guaranteed fixed-price contracting (GFPC). PBC can work at large, complex sites, whereas the higher degree of uncertainty would weigh against a GFPC approach. It also avoids the cost of insurance. DOE is using this contract approach at three other sites.

Question: Is your target fee a percent of the base contract?
Answer: Yes, that's the way it was originally established, but it becomes a lump sum. It's in the 10 percent range.

Question: If you come in on schedule, do you get zero additional fee?
Answer: There is a specific fee for schedule, and another fee for cost. The total amount of fee was determined in advance.

Question: Do you use value engineering as a tool to assess the uncertainty when your company agrees to the structure of what will be undertaken? At Rocky Flats, the uncertainty was enormous. How do you translate that level of uncertainty into an effective business model?
Answer: Determining the solution or remedy that's most likely to work is what drives it. Then we take a hard look at a lot of tough questions: What is the risk if the remedy does not work? What if the regulators do not approve it the way we expect? What are the chances that available technologies will change? What if there is much more contamination than expected? What if the contamination is of a different nature than it is supposed to be? We carefully identify those risks and then decide how we will manage them. We assign a cost to the uncertainties, assign a risk management strategy to them, and determine how much of the risk we are going to share with an insurance company. We usually ask for 45-60 days to respond with a bid because of the weight of these deliberations.

Question: How much of your cost model incorporated input from the public, the well-educated stakeholders in the communities surrounding Rocky Flats?
Answer: A significant portion of the bid involved staff dedicated to working with the community and stakeholders. We gave the risk of negative outcomes from the community careful consideration.

Pay-for-Performance Contracting Using Integrated Treatment Approach

Robert Steele (Environmental Remediation and Financial Services, LLC) reported his company's experiences with PBC as a vendor of a specialized cleanup products (see Attachment O).

PBC makes sense when you want flexibility but need to avoid budget overruns, and the goal becomes very clear when incentives are tied to defined remedial endpoints. This approach does require a high degree of alertness, though, because it is best to make adjustments at the first hint of difficulty or conditions not being as expected. Close communication with the regulators is essential to avoid delays. In Steele's experience, contracts can be paid on a milestone basis. The initial milestones are linked to completed tasks, and the remaining milestones are paid when specific cleanup goals are achieved. The payments are proportional to contaminant reduction between 50 and 90 percent. Contract modifications are not expected for treatment of defined areas and specified contaminants of concern, but are for new releases or constituents.

Steele's company uses a remediation strategy involving (1) dynamic decision making to direct remediation technologies, (2) treatment directed at depth-specific subsurface horizons, and (3) technology substitutions built into the remediation approach. Treatments are targeted by defining treatment horizons using Triad real-time data collection methods. The company then uses its product, ConductivPlanz K (an injection point system that can perform the work of multiple wells from a single 2-inch surface interface) to increase subsurface permeability. Treatment processes are integrated and adjusted/changed as needed. Steele said that having a reliable delivery method is essential to his company's undertaking a PBC project with a reasonable level of confidence.

Question: How deep can your technology be used?
Answer: Usually to about 100 feet, though we can work at greater depth if needed.

Question: Do you work in fractured bedrock?
Answer: We have used the technology to create pockets to collect DNAPL in the subsurface to facilitate its recovery.

Question: Going back to your origin in chemical oxidation, you found that, as you injected, concentrations increased, because you were liberating sorbed material. How do you work that into your fee structure in a performance-based contract? When you are given the characterization data, how do you balance the assumptions of mass concentration against sorbed concentration?
Answer: We have to assume a certain number of treatments, and we will switch to different chemistry when necessary. We try to get through the adsorbed phase as quickly as possible. The need having to switch reagents on an increased frequency is built into the model. We always assume that the mass is greater than estimated, and the characterization is less than perfect. We also assume that unrecognized pockets of contamination are present. For example, at a site affected by mixed petroleum and solvent waste, we found much more mass present than expected. We increased the number of applications and switched reagents whenever we started getting indications that any given reagent was not being effective. We built into the model that we would make these substitutions, and we made them early in the process so money would not be spent on ineffective measures.

Question: What percentage of the projects you encounter have a good conceptual site model? Thirty percent? Less than 10 percent? Are we in a truly disastrous state on DNAPL characterization?

Answer: I'll give you an example. For a site where investigations had been ongoing for 15 years, I was given the site data and four days to produce a bid. The site had two source areas—a one-acre and a half-acre zone of contamination. The owner wanted a fixed-price cleanup. The characterization work was sorely lacking. That is typical of what we see.

Question: So it's a disaster?

Answer: I think the characterization process has evolved a lot and it continues to move ahead with initiatives like Triad. But in industry, we have not educated ourselves enough yet in terms of the data that we need to obtain to do remediation. You would be surprised at how many times I have been told that a client wants a chemical and biological solution for a property where the geochemistry has not been characterized. Those data simply have not been collected. Instead of characterizing the site over and over again using the same approach, it would be more cost-effective to assess it from another angle, such as from a biological standpoint.

Question: What is your experience with source treatment and the amount of source that could or should be removed before you can use your system?

Answer: We are usually treating a source, the area to which a source has migrated. We usually deal with a high-concentration mass, not a miles-long plume. I am working now for a private client on a chlorinated solvent site where pump-and-treat has been going on for 20 years at a cost of $30 million. DNAPL is still there, so we are using ConductivPlanz K to enhance the permeability of the subsurface for better extraction. We are looking for an inoculum that is site-specific. We have looked at the geochemistry to come up with specific conditioners for the site and plan to use a combination of enhanced extraction and biostimulation with the conditioners, followed by inoculum injection. The treatment is being customized for that specific source area.

NEXT MEETING AGENDA AND WRAP-UP

Walt Kovalick thanked attendees and speakers for their participation. He urged all participants to consider ideas for presentations on innovations in non-nanotechnology monitoring and detection systems for the fall meeting.

The meeting adjourned.

Attachments

A. Status Report: Technology Cost and Performance Activities
B. A Summary of Results: NRC Source Zone Report
C. Report on Triad Partners Workshop, March 17, 2005
D. Update on Joint FRTR Initiatives
E. Performance-Based Management (PBM): Tool for Compliance and Restoration Programs
F. Performance-Based Contracting for Environmental Cleanup
G. Performance-Based Management: the Interstate Technology Regulatory Council Experience
H. Federal Remediation Technologies Roundtable Performance-Based Contracting
I. Navy's Program Perspectives on Performance-Based Contracting
J. DOE Perspectives on Performance-Based Contracting: Impacting Innovative Technology Use
K. South Carolina's UST Program: Pay-for-Performance Contracting
L. Arctic Surplus Salvage Yard Response Complete Report
M. Application of Innovative Technologies in Performance-Based Contracting
N. Performance-Based Contracting: CH2M HILL Case Studies
O. Pay-for-Performance Contracting Using Integrated Treatment Approach