FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE MEETING
Crystal City, Virginia
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WELCOME/OPENING REMARKS

Walt Kovalick, U.S. EPA/TIO, welcomed the attendees and opened the meeting of the Federal Remediation Technologies Roundtable (FRTR) by introducing the other chairpersons for the meeting: Michael Aimone, US Air Force Installations and Logistics Engineering (USAF/ILE), and Al Lowas, US Air Force Base Conversion Agency (AFBCA), and the topic for the meeting: remedial system optimization.

Chairpersons' Remarks

Mr. Aimone cited the recent speech by the Deputy Undersecretary for Defense for Installations regarding the objectives for Defense Department's environmental stewardship mission. The speech concluded by identifying a series of high priority environmental restoration challenges:

- what are the fate and transport characteristics of unexploded ordnance (UXO) constituents?
- what technologies exist that can reduce the number of false positives for UXO detection?
- what detection technologies exist for screening UXO sites?

Mr. Lowas noted that the AFBCA has cleared about half of the Air Force properties designated for conversion, and is beginning to deal with the more challenging properties. Hence, the AFBCA is very interested in optimization as a tool for fulfilling its mission.

ONGOING ROUNDTABLE PROJECTS

Cost and Performance Data Reporting

John Kingscott gave an update on the FRTR cost and performance data collection and reporting subgroup. He noted that 274 studies are completed and 'in the system,' and that the next round of reports are scheduled to be published in the spring of 2002. This is expected to include case studies of at least 43 remediation technologies. Volume 5 in the series of reports, with abstracts of 56 projects reported in the spring of 2001, is now available along with a CD-ROM that includes all of the case studies, as well as other Roundtable products, including a recent version of the remediation technology screening guide.

The Roundtable data were recently used to develop a series of cost curves for selected technologies (including thermal desorption, soil vacuum extraction, pump and treat, and bioventing). Case studies for 39 monitoring and measurement technologies for site characterization also are available at the web site, and 30 additional case studies are scheduled for inclusion in the spring 2002 update.

FRTR Website

Jeff Breckenridge of the US Army Corps of Engineers introduced himself as the new manager of the FRTR website, presented some figures on website usage, and announced the planned revision of the website to be completed in the spring of 2002. The revision will entail updating the information found at the site, revising the site's graphic and navigational functions, and implementing a menu-driven interface to help guide users to the information they need. Since its inception, the website has served as a repository

for FRTR and related documents; the plan is to make the site more interactive to better serve users. Mr. Breckinridge noted that the revision will require input from member-agencies on the accuracy of the information posted on the site, and he also welcomed any ideas and suggestions for the revision from the members.

FRTR DNAPL Initiative

Skip Chamberlain, US DOE, and Jim Cummings, US EPA/TIO, briefed the Roundtable on progress under the FRTR DNAPL Initiative, the effort to design and implement an expedited technology development process for particular remediation problems. The Initiative is engaged in developing a model process based on a set of promising technologies for remediating DNAPLs in the subsurface. Mr. Chamberlain described the ongoing side-by-side demonstration work at Cape Canaveral.

Mr. Cummings noted that one goal of the DNAPL Initiative is to limit the institution of remedies that entail partial source removal, followed by decades of pumping and treating. Instead, sources could be removed aggressively and more completely, saving future operation and maintenance costs. The Initiative seeks to determine whether the present value of those future savings offset the initial cost of removing sources more completely. The ITRC is developing guidance on regulatory and financial incentives for selecting and implementing DNAPL source removal technologies.

Mr. Cummings noted that finding suitable residual plumes at sites that have been sufficiently characterized has been difficult, and described the full-scale project at the Visalia Poleyard site. The protocol developed by the Lawrence Livermore National Laboratory for the project, and the uncertainty about the demonstration results.

TECHNICAL SESSION: REMEDIAL SYSTEM OPTIMIZATION

Overview: Remedial System Optimization in the Federal Government

Major Jeff Cornell, USAF/AFCEE, gave an overview of the state remedial system optimization as carried out by the federal government at its remediation sites. He noted that the common approach to remedial system design under Superfund and other waste cleanup programs is a rush to get a system designed, approved, and operating, with little regard given to planning for system optimization at the design stage. There is usually, if not always, pressure to get a site moving through the remedial process, with attention often then turned quickly to the next site 'on the list.' And once underway, inertia with regard to changes to a remedy often takes over, as changes often entail system evaluation, further site characterization, and other potential drags on keeping the cleanup moving apace. There are also considerable institutional sources of inertia, such as staffing, planning, and budgetary stability, decentralization of program management. Planning for optimization is rarely included is a remedial design, and system performance measurement is rarely a priority once a cleanup is underway. As a result, there have been relatively few opportunities for remedial actions to benefit from optimization, and remedial actions often are neither effective nor efficient.

Maj. Cornell noted that though the above has been the case for most of the history of federal hazardous waste cleanup efforts, change is underway. The various federal agencies with cleanup responsibilities have been devoting more resources to optimization (even if they were starting from a very low point), and there is a strong consensus that optimization promotes efficient risk reduction, provides a large return on investment, and can be seamlessly integrated into existing programs. The barriers to optimization are institutional rather than technical, hence they can be overcome.

Maj. Cornell reviewed the optimization requirement included in the Defense Environmental Restoration Program (DERP) guidance, issued in September 2001. The new DERP requirement states that evaluation of a response action does not end upon implementation, and that continued evaluation shall examine factors that include:

- means for optimizing the overall performance and effectiveness of the remedy;
- means for controlling the operational and maintenance cost of remedies;
- assessing whether remedial action objectives are achieved and whether the treatment system is still needed; and
- determining whether a different remediation goal is needed or whether an alternative technology or approach is more important.

Maj. Cornell closed by proposing the following approach to promoting optimization:

1) Integrate and institutionalize optimization by developing policy instruments and guidance, assembling infrastructure and support for optimization, and developing technologies for tracking performance.
2) Reward optimization through stable funding at program levels, acknowledgment and removal of institutional barriers to optimization, and development of measures of merit.
3) Education and outreach, including working with the ITRC and other senior leaders.

Integration of optimization into the feasibility study (FS) phase is an important step in implementing the proposed approach. While no one wants to hear the words "we need more study," the conceptual site models that have been used in the past to select among alternative remedies will not support the more robust decision-making called for when building optimization into a remedy. The Air Force's Defense Logistics Agency has already seen this work at the FS stage, where planning for the use of diffusion samplers has helped avoid deployment of more expensive pump and treat systems.

Skip Chamberlain noted that stable funding is a significant issue at the program level. The consequence of the perceived threat to, in effect, lose funding by doing business more efficiently has been recognized in other similar initiatives to complete cleanups "smarter, cheaper, and faster."

USACE Optimization Efforts: Remedial System Evaluation (RSE)

Dave Becker, USACE/HTRW Center of Excellence, described the Corps' remediation system evaluation (RSE) process, presented an overview of results of application of the process, and summarized some lessons learned. RSEs are performed for a number of reasons, including fulfillment of CERCLA five-year reviews, identification of ways to reduce O&M costs, verification of achievement of

cleanup goals, and assurance that government-owned equipment is maintained.

The RSE process begins with a review of existing data, followed by interviews with operators and regulators, a site visit by engineering personnel, data analysis, and preparation of a report. RSEs typically cost around $20,000 and take about 45 days to complete. A recent examination of three USACE test sites that underwent RSEs found total potential annual savings per site of $193,000 (~30%) if the findings of the RSE were implemented. Other studies of the RSE process and its benefits for EPA and DoD have yielded similar potential cost savings figures, and have spurred discussions with regulators over the benefits of increased flexibility to go back and evaluate remedies.

In performing RSEs, the Corps has learned that it is best to minimize the impact of the RSE on site staff, and to give them plenty of notice of RSE schedules and activities. The Corps has found that the RSEs often turn up inadequate evaluation of subsurface performance, and that the five-year review process 'as is' is not a particularly effective means of improving remedial system performance.

Pump and Treat Optimization

Kathy Yager, EPA/TIO, gave an update on developments and lessons learned related to optimization of pump and treat systems, including the present collaborative effort between EPA and the Corps of Engineers to evaluate pump and treat optimization at Fund-lead Superfund sites. Ms. Yager noted that while most if not all agencies have expressed interest and support for optimization, few have followed through with implementation, even when EPA offered to fund the remedial system evaluations (at ~$25,000 per RSE), hence the collaboration with the Corps at Fund-lead orphan sites to generate cost and performance data for optimization of pump and treat systems.

The EPA/Corps effort identified 88 candidate sites (67 operational and 21 pre-operational) for the study. Annual O&M costs at these sites total $38 million, with annual O&M costs exceeding $1 million at 13 of the sites. The median operating cost is $350,000/year. Carbon adsorption and air stripping are by far the most prevalent treatment processes.

RSEs were completed at 20 of the sites, with results reported for 16 of these so far. At these 16 sites, potential cost savings total $3.2 million/year after an upfront capital expenditure of $3.8 million. Most savings are associated with above ground treatment costs. The study also found significant improvements in protectiveness, and yielded six lessons learned:

- Capture zones not adequately evaluated.

- RPM's and Regions have little incentive to reduce costs.
- O&M reports do not have enough interpretation, and often are not read.
- RPMs are not receiving adequate assistance with technical issues and/or cost control.
- Over-design based on maximum RI concentrations, initial monitoring requirements, and/or relationship to earlier source-removal actions.
- Contracts are sometimes inefficient and overly constraining, "Value Engineering" is not a cure-all.

In FY02, EPA expects to followup on the RSEs completed in FY01 and conduct up to 15 more, adding mining and monitored natural attenuation sites for study. EPA also plans to extend the list of candidates to PRP-lead sites, and establish protocols for doing so. EPA also is preparing the following documents during FY02:

- Ground water P&T operating guide (Elements of Effective P&T Operation)
- Capture zone analysis guide
- Ground water P&T optimization fact sheet
- LTRA transfer fact sheet
- Ground water P&T contracting approaches
- Ground water remediation data management and performance evaluation tools
- Ground water remediation exit strategy fact sheet

US Army Program

Ira May, U.S. Army Environmental Center (USAEC), gave an overview of USAEC's effort to to encourage the use of optimization and other strategies to remediate groundwater contamination more efficiently and effectively at federal facilities owned by the Army. The Army has installed major pump and treat systems at 38 installations, and has plans to install 50 more. The Army presently spends $60 million annually just to operate the existing systems. He noted as an aside that the "lifespan" of a pump and treat system is always 30 years: it is 30 years today; and it will be 30 years ten years from today, and ten years after that, and so on.

Mr. May noted that there are few if any incentives for using optimization as a tool to reduce costs at these sites. The conventional bean-counting approach to groundwater cleanup sites has served as an effective barrier to the implementation of optimization, since that implementation will siphon off money needed for system evaluation. He noted that mathematical optimization and management optimization are two different things, and that USAEC is working to bring these two approaches together into an overall strategy for improving groundwater cleanup based on the following premises:

- Source control is the highest priority, including shifting the focus away from stopping plumes at boundaries to attacking the pollution problem at it root.
- Risk reduction is more important than plume control.
- Only plumes that exhibit an imminent risk should be contained.
- Goals and objectives for pump and treat systems should be quantifiable.
- Incentives and mechanisms for optimization are needed.
- Alternatives to pump and treat as a presumptive remedy are needed, especially innovative approaches and monitored natural attenuation where it is the best alternative.
- There should be an independent review of all high-cost pump and treat systems.
- Exit strategies are an integral part of the remedy.
- Cost avoidance is the general guideline for developing the elements of the strategy.

Mr. May noted that the Vicksburg Waterways Experiment Station (WES) has developed a groundwater modeling system that is available to other agencies. The system provides a single database to house all site data, site characterization tools, predictive numerical models, visualization tools, and optimization tools for developing treatment designs.

Mr. May concluded by reviewing USAEC's planned activities, including the development of a groundwater strategy for the Army, study of monitored natural attenuation as an approach to UXO and energetics remediation, and improvements in the Environmental Restoration Information System (ERIS) its data management system.

US Navy Program

Doug Zillmer, U.S. Navy/NFESC, reviewed the activities of the Navy for the promoting optimization as part of its environmental cleanup mission. He described the working group formed in 1998 to develop guidance for optimization of monitoring systems, and added that, similar to the experience of other agencies, it is easy to get 'buy-in' to the idea of optimization as a standard practice. Actual implementation of the practice, on the other hand, has been elusive.

The Navy is particularly interested in optimization of soil vacuum extraction, bioslurping, and pump and treat systems. A study of the state of the practice found such systems at many Navy installations are experiencing low removal rates, high costs, uncertainty with regard to plume containment, and overdesign of systems. To rectify these problems, the Navy is working to:

- educate regulators, RPMs, and contractors on the benefits of system optimization;
- identify further opportunities for optimization;
- integrate optimization as a routine part of each step in the remediation process, including planning and budgeting;
- include cost and performance data collection and reporting as a task assigned to Navy cleanup contractors;
- including flexibility in RODs and decision documents such that optimization improvements in a remedy can be implemented without re-opening decisions.

US Air Force Optimization Partnerships

Presentations on four US Air Force partnerships for remedial process optimization implementation were interspersed throughout the technical session.

Overview of Remedial Process Optimization Implementation/AFCEE

Javier Santillan, U.S. Air Force/AFCEE, gave an overview of the Air Force's remedial process optimization implementation effort currently led by AFCEE and being executed by the Air Force Base Conversion Agency (AFBCA), the Defense Logistics Agency (DLA), and the Pacific Air Forces Command (PACAF). The effort is an offshoot of AFCEE's long-term monitoring optimization work that began in 1995, which added remedial action optimization in 1996, leading to the creation of the current joint remedial process optimization work, created by DUSD(ES) with AFCEE in the lead. One result of the effort is the Remedial Process Optimization Handbook, authored by AFCEE and DLA and published in June 2001 (see www.afcee.brooks.af.mil/er/rpo.htm).

Remedial process optimization is defined as an iterative/systematic planning approach for evaluating existing and proposed remediation processes with the goal of improving overall risk control effectiveness, reducing site cleanup time and costs, and providing timely feedback to decision-makers. A remedial process strategy:

- examines whether conceptual site models, cleanup goals, and data quality objectives are adequate to support smart decisions;
- determines whether remedial design/action is likely to meet cleanup goals;
- verifies the existence of formal decision rules that (as needed) update cleanup goals, technology selection, performance evaluation, and exit strategies;
- performs technical optimization of both remedial action operations and long-term monitoring activities;
- verifies that appropriate QA/QC is being implemented (usually by examining DQOs);

- streamlines and standardizes data management;
- creates incentives that promote accelerated closure without compromising risk reduction; and
- assesses the human health and environmental risk of the remedial action.

Remedial process optimization is conducted in three phases. Phase I is a scoping visit and installation-wide program review performed by a support contractor, in-house staff, or service center. Phase II is a detailed assessment of a specific process or system, performed by third party technical experts. Phase III implementation is performed by contractors. Mr. Santillan reviewed some lessons learned from each Phase. Phase I and II activities have identified many challenges for site managers that seek to optimize their processes, including conceptual site models, plume tracking, effective and efficient operation (including monitoring), technology selection optimization, decision rule implementation, cleanup goals, access to electronic data, and cost and schedule-to-complete tracking. Challenges to Phase III implementation include assembling a remedial process optimization team (including contractor support), obtaining remedial process optimization work plan approval from stakeholders, improving data visualization for stakeholder briefings, and promoting upper management participation at installation visits to ensure support from installation staff and prompt access to installation data.

In closing, Mr. Santillan reviewed some planned activities for FY02. AFBCA will implement a regional remedial process optimization approach covering six AFBCA installations in California, and is looking to promote the involvement of ITRC in the process. The Air Force will have remedial process optimization activities underway at seven installations under three or four major commands, and DLA has Phase II or III work underway at five installations.

Remedial Process Optimization Implementation/AFBCA

Mario Ierardi, USAF/AFBCA, gave a presentation on the Air Force Base Conversion program's commitment to long-term management as reflected in the new DERP guidance outlined by Maj. Cornell. The AFBCA's mission has shifted from cleanup and transfer of properties to include long-term responsibilities at sites that will require more extensive remedial work before they are ready to be transferred. Until recently, sites that could be transferred in the short-term were given priority.

Mr. Ierardi noted that nearly all long-term management is not "programmed" but is a part of the federal agency responsibilities nonetheless. The national long-term management effort would benefit from the development of policy and guidance. The five-year review process, and protectiveness statements in particular,

could use some "tightening" that national policy on long-term management could provide. Mr. Ierardi added that the U.S. Department of Energy has taken the lead among federal agencies for the development of long-term management standards[1], and that other federal agencies use DOE's work as a starting point.

Mr,. Ierardi recommended that feasibility studies should consider long-term management issues in evaluating remedial alternatives, and decision documents should include cleanup objectives, conceptual models and performance review schedules. Residual contamination from removal actions should be better documented. Finally, information systems that will facilitate future decision-making, including records management strategies for long-term management, are needed. He noted that regulators should be involved in the process of meeting these needs, including working with organizations like the ITRC. Federal agencies should be partnering on long-term management efforts to avoid duplication of effort, leveraging the existing DOE work, and integrating the results into their cleanup and property transfer programs, including issuance of guidance on the national level and development of individual site closeout plans.

Remedial Process Optimization Implementation/DLA

Lt. Col. Daniel Welch gave a presentation on remedial process optimization at Defense Logistics Agency (DLA) installations, focusing on lessons learned as optimization has been implemented. DLA is implementing optimization to meet both CERCLA and RCRA requirements for periodic reviews of remedial systems and the DERP guidance. For DLA, optimization is a means of stretching budget dollars, accelerating risk control/reduction and its site closure schedule, and maintaining and improving project quality. DLA expects to see an 84% return on the budget dollars devoted to optimization, with a projected lifecycle return of $28 million (over 32 years) on the initial investment of $1.07 million in FY00. The same amount invested in FY01 is expected to return 64% per annum, and in FY02, DLA will invest $650,000.

Col. Welch reviewed some of DLA's experiences at pump and treat sites, and identified some opportunities and lessons learned. Plume data may be available but may not be up to date. Decision rules that establish conditions which trigger an alternate remedy or optimization of the existing remedial approach are rarely implemented. Similarly, decision rules are often needed to establish monitoring well management (including conditions for

[1]See comments of Gerald Boyd, US DOE, at the December 2000 FRTR meeting.

decommissioning), conditions for the review and revision of cleanup goals, and the review and revision of sampling protocols. Conceptual site models are often deficient (either out of date or based on inadequate data).

In conclusion, Col. Welch noted that implementation of remedial process optimization at DLA installations has been highly successful, as measured in cost avoidance numbers. The effort to ensure that regulators and other stakeholders are involved upfront in the process has resulted in support of DLA's program to implement optimization. He noted that data visualization tools that illustrate scientific and engineering findings are essential to working with stakeholders. Finally, through optimization, DLA has been able to maintain risk control while accelerating site closure and transfer schedules.

Remedial Process Optimization Implementation/PACAF

Mark Ingoglia gave a presentation on the experiences of the Pacific Air Forces Command (PACAF) in implementing remedial process optimization, particularly the experience at Eielson Air Force Base and other sites in Alaska. He noted that optimization offers significant potential cost savings, since many of PACAF's sites involve long-term bioventing and/or natural attenuation remedies. Optimization also provides post-decision quality checks and opportunities for enhanced technical exchanges as the process gets their RPMs together with experts and has created an informal RPM referral network for addressing specific concerns. In FY01, PACAF offered remedial process optimization as a peer review waiver alternative, and is now seeking other opportunities to implement the process.
At Eielson AFB, the long-term monitoring plan's sampling schedule was optimized in 1999 in a manner that maintained protectiveness, met project data quality objectives, and reduced annual sampling costs by $196,000. Also, a phase I and II assessment under the optimization initiative provided supporting data for the closure of three soil contamination sites and eliminated the need to build and operate a soil vapor extraction system, with resulting savings in excess of $1 million. Mr. Ingoglia also reviewed optimization efforts at the King Salmon Airport site and Elmendorf AFB.

Mr. Ingoglia closed by noting that RPMs are restoration "generalists," and, as such, can benefit greatly from training on concepts of optimization. Hence, the premium PACAF places on getting experts onsite to work with RPMs on optimization, especially since management and monitoring of remedial systems (rather than design and implementation) has become the mainstay of most RPM's work.

Simulation Models for Optimization

Michael Peralta, U.S. Air Force, gave an overview of how simulation models can be used for designing optimization strategies. Simulation models for optimization are designed by considering four elements of the user's "problem:"

- decision variables;
- State variables;
- the objective function (what is the user trying to achieve or avoid?); and
- bounds and constraints.

Simulation models are most effective in performing discrete tasks like selecting final well locations from a list of candidates. Mr. Peralta noted that simulation models are most effective when employed early in the process and when there is flexibility in the user problem. Situations that are relatively constrained do not benefit as much from modeling. He closed by presenting a case study/success story of a simulation model funded by the Environmental Security Technology Certification Program (ESTCP) at the Umatilla site.

NEXT STEPS

During the meeting, representatives of the member-agencies were asked to vote on a preferred technical topic for the Spring 2002 FRTR meeting. Sediments received the most votes, and it was agreed that a special presentation on the work of the ITRC would be placed on the agenda.

The meeting adjourned.

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