

FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE MEETING
Arlington, Virginia
December 7, 2000

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FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE MEETING
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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 (Roundtable) by noting that the Roundtable had entered its second decade and reviewing the agenda for the day. He then introduced the chairman for the meeting, Gerald Boyd of the U.S. Department of Energy.

Chairman=s Remarks

Mr. Boyd stressed the importance of long-term monitoring (LTM), the technical subject for this meeting, to the Energy Department=s environmental management, restoration, and stewardship effort. He noted that many of DOE=s goals and objectives established at the beginning of the 1990s were not met, and may not be feasible given what DOE and other federal agencies now know about environmental management. For example, DOE now knows that it can not wait for remediation technology development to >catch up= with current program needs. The past assumption that new technologies would come along to solve some of their more difficult environmental cleanup challenges has come up against the need to speed progress at restoration sites. This has caused DOE to shift its strategy toward safety, risk reduction, stabilization, and containment. DOE is now more heavily engaged in on-site storage in large waste cells.

In revising their strategy, DOE sought input from the National Academy of Sciences (NAS) to answer some questions regarding long-term monitoring. In response, NAS said DOE should work from the following assumptions in forming a new containment strategy:

- < Engineered barriers are prone to failure.
- < Initial subsurface characterization will probably be proven wrong.
- < DOE=s internal management structures require revision.

On the final point, NAS made several recommendations:

- < DOE should develop corrective action plans to deal with barrier failures.
- < DOE should develop a stakeholder process for decision-making at its sites.
- < DOE should step up its research efforts.

DOE has drafted a strategic plan for long-term stewardship that is under review. Also, DOE has completed a programmatic environmental impact statement that is undergoing public comment. Dr. Kovalick added that a recent report issued by the National Research Council on groundwater cleanup reached many of the same conclusions and made recommendations similar to those in the NAS study.

UPDATE ON ROUNDTABLE POLICY AND OPERATIONS

Cost and Performance Report Status/Website/Feeding the Technology Pipeline

John Kingscott, U.S. EPA/TIO, gave an update on the status of the Cost and Performance Case Studies issued by the member-agencies. At the June 2000 Roundtable meeting, Mr. Kingscott reported that 78 new case studies had raised the total number to 218. The fourth volume of abstracts was published, and all the case studies were published on CD-ROM. Thirty-nine new reports covering site characterization and

monitoring were added in November 2000. Mr. Kingscott noted that while the latter may not conform strictly to the cost and performance data reporting guidelines, the information is still valuable to site project managers and other decision-makers.

Forty-eight additional remediation case studies should be completed by the next Roundtable meeting. State projects, including numerous dry cleaner sites remediated under state programs, also may be added in the future.

Johnnie Shockley, U.S. Army Corps of Engineers, said the Army has funds to update the Remediation Technology Screening Matrix and wants to reconvene the Roundtable workgroup for that publication. She also noted that the Defense Department has instituted a workgroup on perchlorate that includes a subcommittee on technologies. The Roundtable website now includes a link to a webpage maintained by the perchlorate workgroup. Similarly, there is now a link to a multi-agency workgroup on diffusion samplers.

Dan Powell, U.S. EPA/TIO, led a discussion on opportunities presented by the Small Business Innovative Research (SBIR) program for feeding the technology pipeline. Mr. Boyd reminded the member-agencies that SBIR can fill some of their environmental technology research needs, and any savings can be re-directed toward other research priorities. Mr. Powell noted that using SBIR money to fund Phase III demonstrations can be more time- and cost-effective than going through the full procurement process.

Skip Chamberlain, U.S. DOE, said DOE engineers are developing a detailed environmental engineering cost analysis system for pricing entire remediation projects, rather than just cost per unit remediated. The system uses a work breakdown structure similar to the structure used by the Roundtable for pricing technologies. DOE plans to make the new engineering work breakdown structure compatible with the technology structure.

DNAPL Maturation Strategy Update

Skip Chamberlain and Jim Cummings, U.S. EPA/TIO, gave an update on the Roundtable's DNAPL technology maturation strategy, particularly on a December 6 meeting held by member-agencies. Mr. Chamberlain reported that the side-by-side demonstration of technologies for treating DNAPLs in the subsurface continues. The results of the six-phase heating demonstration did not match expectations for a number of possible reasons (not enough time, erroneous estimates of TCE concentrations, mineralization of contaminant, migration of contamination through aquitard).

Mr. Cummings reviewed the focus areas of the overall strategy (technology demonstration and deployment, research and development, technology transfer, and policy development) and summarized trends in *in situ* thermal technology applications. He noted that private developers are doing more than governmental entities on the steam enhanced extraction front. There has been some progress on policy development in the area of residual plumes. The federal agencies developing the technology maturation strategy has been working with the Western Governors' Association's Interstate Technology and Regulatory Cooperation (ITRC) workgroup, particularly regarding true costs of containment and federal/state regulatory expectations.

Next steps in implementing the strategy include creating an online database of *in situ* thermal projects and compiling residual plume behavior data. Mr. Cummings said studies are underway to examine whether reproduction of oil-eating microorganisms is stimulated when the subsurface is heated, which would increase the efficacy of the technologies. Preliminary results indicate that this is the case, but further study is needed. The Strategic Environmental Research and Development Program (SERDP) has issued

two FY2002 procurement announcements related to DNAPL source removal aimed at increasing the predictive capability for source zones. The Environmental Security Technology Certification Program (ESTCP) is engaged in work to improve characterization of DNAPL sites. Mr. Boyd stressed the need to establish a project feedback mechanism and to finalize an overall strategic plan.

Fractured Rock Workshop Results

Rich Steimle, U.S. EPA/TIO, reported results from the recent fractured rock workshop sponsored by EPA, DOE, and the Ontario Ministry for the Environment. The workshop sought to document the state-of-the-practice for remediating fractured rock sites. Other sponsoring participants included the U.S. Geological Survey, the State of New York, private entities, and the National Ground Water Association. About 50% of workshop attendees were regulators (representing about 40 states and other U.S. and Canadian government agencies) and 50% were project and other technical personnel. Mr. Steimle noted that information on two dozen technologies implemented at 27 fractured rock sites is available at the Clu-In website <www.clu-in.org>. A report from the workshop will be prepared in time for the Fractured Rock 2001 conference in Toronto. ???DATE???

LONG-TERM MONITORING AND SYSTEMS OPTIMIZATION: PLANS AND PROJECTS

USAF Efforts

Mario Iarardi, U.S. Air Force, briefed the Roundtable on the Air Force=s LTM optimization efforts under the Base Realignment and Closure (BRAC) program. He noted that BRAC=s principal goal is to get sites to >closure,= but closure and cleanup often are two different things. The Air Force has identified optimization of systems performance as one of the BRAC program=s four key challenges. (The others are improved awareness, technology application, and technology transfer). Mr. Iarardi said the Air Force recognizes the importance of documenting LTM system performance in meeting the optimization challenge.

U.S. EPA Superfund Reform Initiative, Pump and Treat Optimization at Fund-lead Sites

Kathy Yager, U.S. EPA/TIO, briefed the Roundtable on the Superfund reform initiative aimed at optimizing pump-and-treat systems at Superfund-lead sites, where EPA has the technical and enforcement lead. She noted that 89% of remedies at groundwater sites are Apump-and-treat only.@ Often, in the drive to get to construction completion as soon as possible at these sites, remedial projects will not include a full pump-and-treat optimization analysis. The initiative aims to address this problem by creating a streamlined process for designing optimized systems at the outset of treatment, rather than during the maintenance and operation period.

Recommendations under the reform initiative focus on effectiveness, cost reduction, technological improvement, and site closeout. A study of four groundwater sites where optimization was implemented prior to construction completion yielded life-cycle savings estimates of \$9.5 to \$19 million (aggregated). Ms. Yager noted that most cost savings are achieved through optimization of Aabove-ground@ work.

U.S. DOE Long-Term Stewardship and Vadose Zone Roadmaps

Gerald Boyd and Skip Chamberlain reviewed DOE=s long-term stewardship priorities. DOE has a relatively small number of sites (144) that range in size from very small to some of the largest in the U.S., such as the Hanford Reservation. Of these, 109 will require some degree of LTM, including 103 that will

remain active while environmental stewardship issues are being addressed. DOE has not yet developed cost estimates for LTM at these sites, but costs are expected to be high. Mr. Boyd noted that active stewardship at DOE sites has been on the rise for the last ten years but is expected to explode in the next five years, by the end of which 80% of the DOE complex will be in active stewardship.

To deal with this change, DOE has created an Office of Long-Term Stewardship which sets environmental priorities and plans their implementation for the sites within the complex. Given the nature of contamination at sites within the complex, Long-term stewardship sometimes translates into several centuries for some sites. Long-term stewardship planning seeks to deal with the following contingencies and circumstances:

- < barrier failure
- < institutional controls that will lapse or fail in the long run
- < adequacy of information technology and system durability
- < management structures (including issues such as whether the U.S. government will endure)

Given the size and complexity of the environmental stewardship challenges facing DOE, the agency has begun to focus on creating national, interagency science and technology roadmaps to help guide future decision-making. Skip Chamberlain provided one example: a vadose zone science and technology roadmap to guide such decision-making for the next 25 years. Dr. Kovalick noted that the approach translates beyond radionuclides cleanup to other LTM issues, which should be of interest to the other member-agencies. Johnnie Shockley added that it is important to link the roadmaps to overall agency missions. Mr. Boyd said the best they can do is plan for dealing with issues in the future. Whether the plans are implemented is another matter. He noted that an agency charged specifically with addressing LTM issues (e.g., a Department of the Steward) does not exist. This was noted in the NAS study as an area of concern.

DoD Research Requests

Cathy Vogel, SERDP, updated ongoing and prospective LTM projects that are receiving or will receive funding under SERDP. Ongoing projects include:

- < radon-222 as a natural tracer
- < portable equipment for monitoring explosives
- < demonstrations of analytical techniques for monitoring natural attenuation
- < demonstration of monitoring wells installed with direct push technologies

Planned projects that will receive funding include:

- < direct push chemical sensors for detecting DNAPL and other organic contaminants
- < demonstration of a water solute flux measuring device

The SERDP solicitation for FY2002 will include alternative technologies for LTM.

LONG-TERM MONITORING GUIDANCE DOCUMENTS

U.S. Navy Long-Term Monitoring Guidance Document

Doug Zillmer, U.S. Navy, gave a presentation on the Navy's guide for optimal groundwater monitoring during long-term remediation. Mr. Zillmer outlined the elements of a groundwater monitoring plan contemplated by the guide, which includes:

- < goals
- < an exit plan, including decision criteria
- < methods
- < annual evaluation

Within the plan, methods should aim to minimize the number of monitoring points and sampling frequency keep the parameters simple, employ efficient methods such as low-flow sampling that minimize investigation-derived waste, and streamline data evaluation and reporting

In a pilot case study at NAS Brunswick, where monitoring was leading to the generation of redundant, predictable data, the Navy revamped the monitoring program using a data quality objectives (DQO) process, which allowed them to reduce the number of wells to be monitored and the frequency of monitoring, fill data gaps, and issue reports on CD-ROM. The Navy found that the process allowed them to generate better data at about half the cost. The workgroup charged with developing the guidance maintains a website where further information is available:

<erb.nfesc.navy.mil/support/work_grp/raoltm/main.htm>

In response to a question regarding incentives for optimization, Mr. Zillmer said the NAS Brunswick project team took it upon themselves to optimize their monitoring plan. The lack of incentives or rewards for implementing optimization was identified as a significant barrier.

American Society of Civil Engineers Monograph on Long-Term Monitoring

Barbara Minsker, University of Illinois, briefed the Roundtable on the American Society of Civil Engineers (ASCE) pending monograph on LTM and the work of ASCE's task committee on the state of the art in LTM design. The monograph covers physical design aspects of LTM systems (sampling strategies and optimization, data quality and management) and summarizes methods and case studies. It does not evaluate types of sensors or measurements.

The optimization process begins by defining quantitative monitoring objectives, decision parameters, and physical, regulatory, and social constraints. The monitoring design should minimize objectives while meeting constraints. The ASCE committee working on the monograph expects to complete the monograph in 2001 and is seeking participants. Anyone interested should contact Ms. Minsker or visit their website <web.ead.anl.gov/asce> for more information.

Multi-Agency - Diffusion Sampler Protocol

Javier Santillan, Air Force Center for Environmental Excellence (AFCEE), reviewed the multi-agency protocol for diffusion samplers (*Guidance Document For Use of Polyethylene-based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells*, August 2000), which is intended to reduce sampling costs and IDW volumes. The protocol is a joint effort of several federal agencies and the ITRC workgroup, and is available via the ITRC website <itrcweb.org>. A workgroup meeting was scheduled for December 8, 2000, at which several issues would be resolved prior to finalization of the protocol.

The protocol has been pilot-tested at six Defense Department sites. Each has seen significant cost-per-sample reductions and considerable cost avoidance. Mr. Santillan stressed that these samplers can be used only for collecting non-oxygen bearing VOC samples (*i.e.*, VOCs with very high solubility).

LONG-TERM MONITORING TOOLS

AFCEE Decision Support Software for Long-Term Monitoring (MAROS)

Julia Aziz, AFCEE, gave an overview of AFCEE's Monitoring and Remediation Optimization System (MAROS) LTM decision support software, which is designed to achieve the LTM goals of reducing the number of monitoring wells and sampling frequency. Knowledge of the plume trend based on lines of evidence is the key to achieving these goals, and MAROS provides a first-cut blueprint of plume trends and issues and presents that information in a one-page report to guide decision-making. Information on MAROS, including downloadable versions, is available online at <www.gsi-net.com>.

Results of Long-Term Monitoring Optimization at NAS Ft. Worth Using Statistics and Geostatistics

Ted Lillys, HydroGeologic, Inc., gave an overview of LTM optimization that used statistics and geostatistics at NAS Ft. Worth Joint Reserve Base (formerly Carswell AFB). Mr. Lillys noted that geostatistics are not new, but their application to LTM optimization is relatively recent. TCE is the principal contaminant of concern at the site, where 12 wells are being used to for pump-and-treat, and more than 260 monitoring wells are in operation.

The objective of the optimization project was to maintain data quality objectives while minimizing monitoring costs. The optimization method involved subjecting sample data and other knowledge of the site to geostatistical estimation (kriging) to identify possible redundant sampling locations. Results were compared to DQOs toward achieving optimization. When optimization work was completed, cost savings for one year of operation reached \$85,969 as the number of monitoring samples collected dropped from 193 to 72.

AFCEE Field Evaluation Results of In Situ TCE Sensors

Roger Schlicht, General Atomics, briefed the Roundtable on the results of field evaluation of *in situ* TCE sensors undertaken by AFCEE. The sensors evaluated include a surface acoustic wave sensor, a metal oxide semiconductor, and a deep UV spectrometer. He noted that while fully loaded costs have dropped to about \$65 per sample in the last few years, the evaluation results showed that those costs could be halved in the near future as new sensors are deployed and field methods are implemented. AFCEE also has evaluated the E-SMART system for accessing *in situ* sensor data online.

U.S. DOE Long-Term Stewardship Fernald Workshop Results

Scott McMullin, U.S. DOE, briefed the Roundtable on the results of DOE's workshop on long-term stewardship issues at the Fernald complex, which is projected for closure in 2006. The workshop focused on post-closure stewardship. Immediate needs at Fernald include:

- < cap and cover monitoring
- < leachate quality monitoring
- < leachate flow monitoring
- < meteorological monitoring

- < passive leachate treatment
- < data acquisition, storage, and public availability

DOE has designated the Fernald complex as a test bed for all new technology applications, which will be open to other agencies. The technical approach to the test bed facility includes a core technical team, an independent advisory group to oversee operations, technology screening, solicitation, and implementation. A workshop on the test bed facility is scheduled for March 2001 as part of the complex's annual review.

Mr. McMullin stressed the changes and challenges facing the complex as it transitions from an active, controlled site to a less controlled, monitored site. Should the focus after 2006 be on contaminant migration or material performance? Engineered materials or systems equilibrium? Mr. Boyd reiterated that this is why DOE and other large site owners facing LTM challenges need long-term roadmaps to begin to deal with these issues.

NEXT STEPS

In between some of the technical presentations, the Roundtable members proposed and discussed technical and policy subjects for the next Roundtable meeting. Topic areas identified included:

- < perchlorate remediation
- < bioavailability
- < site characterization and monitoring
- < unexploded ordnance
- < *in situ* sensors
- < sediments
- < fractured rock

The Roundtable settled on perchlorate as the technical topic for the next meeting, which will be chaired by NASA. The meeting adjourned.

Federal Remediation Technologies Roundtable Meeting, Arlington, Virginia, December 7, 2000

**ATTENDEES
FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE
December 7, 2000**

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