

# FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE MEETING

Arlington, Virginia

December 11, 1996

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**FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE MEETING**  
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**INTRODUCTION**

Roundtable Chairman **Dr. Walter W. Kovalick, Jr.**, Director of EPA's Technology Innovation Office (TIO), welcomed all participants. Roundtable agencies represented included:

Tennessee Valley Authority	U.S. Navy
U.S. Department of Defense	U.S. Army
U.S. Department of Energy	U.S. Environmental Protection Agency
U.S. Air Force	National Aeronautical and Space Administration

A complete list of participants is attached to this summary (see Attachment 1).

Dr. Kovalick opened the meeting by reviewing the agenda and giving attendees a preview of the events planned for the meeting. He drew attention to the ground water research proposal solicitation in the briefing package and the publication entitled *Completed North American Innovative Remediation Technology Demonstration Projects*, a directory of some 250 completed demonstration projects. Dr. Kovalick noted that there are a number of ground water technology reports available from the Ground Water Remediation Technologies Analysis Center (GWRTAC) and let attendees know that they could sign up to receive copies. Dr. Kovalick said TIO has been involved in a number of public-private partnerships for technology development, including the Remediation Technology Development Forum, which is sponsoring a meeting on phytoremediation in Fort Worth, Texas, on December 18-19. An announcement for the meeting was included in the briefing package. He encouraged anyone interested to consider attending the meeting.

Donna Kuroda, U. S. Army Corps of Engineers, said the Corps has posted a number of documents related to cost and performance data reporting on its WebSite and has issued engineering pamphlets on its cost and performance data reporting guide specification. These documents may be obtained by going through the Roundtable WebSite (<http://www.frtr.gov>). Dr. Kovalick thanked everyone for attending this meeting and introduced the first speaker.

**TECHNOLOGY DEMONSTRATION AND VALIDATION**

*Overview of Current Cleanup Technology Demonstration/Validation Activities*

**Wayne Sisk**, U.S. Army Environmental Center, provided an overview of nine examples of projects that constitute USAEC's current cleanup technology demonstration and validation program (see Attachment 2). The first project is a biofiltration system for treating TCE-contaminated air streams that uses a filter column packed with microorganisms. The system is designed and operated by the Tennessee Valley Authority (TVA). The next project uses constructed wetlands for phytoremediation of ground water contaminated with explosives. USAEC has constructed two lagoons using a gravel bed system as part of the project. The lagoons have been thriving as habitat to the point where USAEC introduced bass into the system to control the population of frogs and tadpoles which were consuming the plants needed for phytoremediation.

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The next project is a bioslurry system for treatment of explosive-contaminated soil being conducted by the Argonne National Laboratory at a site in Joliet, Illinois. The site has significant safety problems since up to 90% of contamination by volume is in the top few inches of soil. The project has concentrated on stabilizing the area and acclimating the organisms. The project has resulted in 99.6% removal of TNT using native organism cultures. The substrate used is molasses.

The next project drew special attention from the Roundtable. It is a multiple technology demonstration to treat explosive-contaminated soil planned for the Milan Army Ammunition Plant that will also treat soil transported from Joliet. A solicitation for participants will appear in the *Commerce Business Daily* in December or January. The project seeks technologies that have completed laboratory-scale demonstrations with reported results to do field demonstrations with support from USAEC. The solicitation will operate in a manner similar to the Program Research and Development Announcements (PRDAs) issued by the Department of Energy, with USAEC will pick up any costs of the demonstration aside from the direct costs of the demonstration itself.

The next project is a joint small arms range remediation demonstration for treating spent ammunition at firing ranges. The demonstration is related to Base Realignment and Closure (BRAC) activities. Contamination at these sites is mostly lead, with some copper and cadmium in earth berms. The technology demonstrated uses a physical/chemical extraction process for removal through acid leaching in smear zones. The next project will demonstrate phytoremediation of lead-contaminated soil and will examine the entire process, including the relative performance of different chelators. TVA will do the work, and is in the process of selecting a site. The site will probably be near a university to take advantage of its analytical capabilities and labor force. The next project is a hot gas decontamination system, which is a transportable thermal unit with an afterburner chamber and stacked discharge for treating contaminants associated with explosives production.

The final two projects involve peroxone treatment of explosives in ground water and *in situ* electrokinetic treatment of metals in soil. Peroxone treatment is a new technology meant to enhance granular activated carbon (GAC) systems and overcome the secondary waste stream problems associated with GAC. Peroxone uses a mix of hydrogen peroxide and ozone to oxidize TNT to produce 1,3,5-trinitrobenzene. Electrokinetics is an older technology. The project aims to evaluate the cost and performance of the technique at a port site.

***Update on Cost and Performance Subgroup Activities/Ongoing Efforts***

**John Kingscott**, U.S. EPA/TIO and chairman of the Roundtable Subgroup on Cost and Performance Data, briefed the attendees on activities of the Subgroup on two issues: the status of new case studies that could be joined together in a second round of cost and performance case studies; and possible revision of the cost and performance data reporting guidelines.

Mr. Kingscott polled the member-agencies to determine whether there are enough new case studies to issue another round. He said there are 16 available from EPA and DOE since the last round (10 from the DOE Green Book series and 6 from full-scale completed remediation projects via EPA). He said he expected that the Army and Navy had enough to get the total up over 20. He mentioned that the Subgroup had hoped to have around 100 by March 1996, and they still expect to get up to around that number soon. Dr. Kovalick mentioned that the services had changed contracting mechanisms recently and that this has led to some delays in reporting for case studies. Hopefully in 1997 the number of case

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studies from the services will increase, especially since all projects are now required to report cost and performance data. Dr. Kovalick said the number of EPA projects should increase because EPA will expand the types of projects that report data to include demonstrations.

Mr. Kingscott moved on to the second issue and asked whether the time was right to revise the cost and performance data reporting guidelines. The Roundtable members generally felt that they should. Mr. Kingscott said electronic information reporting could be built into the revised guidelines. Mr. Kingscott also said the revision should address whether the existing guidelines would cover the demonstration projects slated for inclusion. He recommended that the Subgroup have the existing guidelines reviewed by the EPA Engineering Forum and similar groups in other member-agencies. Dr. Kovalick asked whether the member-agencies would be willing to devote staff time to revising the guidelines. Robert Nash said NFESC wants to move forward and add in new technologies. The other member-agencies indicated a willingness to support the effort.

Johnette Shockley, USACE, said the problem with cost data is that the standards include too many non-process-specific factors that render the numbers difficult to compare. The revised guidelines should get to the "core" costs that can be compared. Bob Furlong, USAF, agreed, but said that this is the sort of issue the Workgroup should address. Mr. Kingscott said he heard the members say that a revision is appropriate and that a meeting of the Subgroup would be convened before the next Roundtable meeting, with a report from that meeting to be on the next Roundtable meeting agenda.

***Demonstration of Dynamic Underground Stripping at Tennessee Valley Authority (TVA) Sites***

**Dr. Harold Speidel**, Tennessee Valley Authority, described recent remediation technology development activities of the TVA as well as their support of a demonstration of dynamic underground stripping (see Attachment 3). Dr. Speidel said there has been significant scrutiny of TVA in recent congresses and there will be fundamental changes in the near future. For example, his section, the Environmental Research Center (ERC), will become self-sufficient by the year 2000. ERC's federal budget has already been reduced from \$20 million to \$15 million; by the year 2000, federal funding will be zero. TVA plans to cover the shortfalls through partnerships with private firms.

Dr. Speidel distributed a list of abstracts for nine current or pending technology demonstration projects sponsored by TVA. Several of these are biofilter projects. One bioremediation project, sponsored by TVA, the Oak Ridge National Laboratory, and the University of Tennessee, is receiving heavy scrutiny. It is a technology for treating PCBs at electrical substations that involves both soil irrigation using a naturally-occurring aerobic microorganism and an anaerobic bioreactor that uses an engineered microorganism developed at the University of Tennessee. This is the first instance where an engineered organism has been demonstrated. Dr. Speidel also noted a biomass conversion project that involves acid hydrolysis of cellulose material to produce ethanol.

The dynamic underground stripping technology was developed in partnership with the Lawrence Livermore National Laboratory (LLNL) and the University of California-Berkeley. The technology was developed to remove gasoline from soil at LLNL. The technology can be used to treat deep spills and in areas which can not be excavated. In response to a question, Dr. Speidel said the project team was interested in reporting cost and performance data for the project.

***Current Status and Future Directions of the EPA SITE Program***

**Joan Colson**, U.S. EPA/ORD/National Risk Management Research Laboratory, gave an update on activities of EPA's Superfund Innovative Technology Evaluation program (SITE). She said she was speaking in place of Annette Gatchette of the SITE program, who was unavailable.

The SITE program is undergoing a "paradigm shift" and becoming a program based on market-demand rather than technology-supply. Under the old approach, the SITE program would select candidate technologies for participation and then find a site to host a demonstration. Under the new approach, the program will identify sites in need of innovative technological solutions and then solicit technologies to meet those needs. EPA will serve as a liaison between owner/buyers and developer/sellers, rather than working nearly exclusively with developers as was done in the past. Under the envisioned program, site owners in need of innovative technologies will come to the SITE program, which will help select technologies and assist in the peer review process. EPA will fund the sampling and QA plans, with the costs of disposal, permitting, *etc.*, held by the site owner. Performance verification and reporting will be the same as under the old SITE program. Publications will cover technologies in a generic fashion rather than by "brand name" as in the past.

Ms. Colson explained that the program shift occurred to correspond to ORD's risk-based approach to program priorities which addresses needs first, rather than capabilities. Also, the SITE program faces budget reductions to the point where it will not be able to fund all qualified (*i.e.*, promising) candidate technology demonstrations. Ms. Colson said cost-effective technologies are more likely to be selected under the new program. The Emerging Technology area of the SITE program will be phased out. Planning for the new program will be completed in January.

Ted Zagrobelny, NAVFAC, asked where developers with technologies that would have qualified for the Emerging Technologies program could go in the future. Dr. Kovalick said the disappearance of that program means there will be a potential \$150,000 over two years that will no longer be available for developers. He said he refers inquiries from developers to the Small Business Innovative Research program (SBIR) if the developer is small enough, and to other PRDA-type programs. This was why he was particularly interested in the multiple technology demonstration project discussed by Wayne Sisk earlier. Program thinking at EPA Headquarters has shifted toward verification and other end-of-the-pipeline activities. Start-up technologies that will feed the verification programs may be left behind. Ms. Colson said the circumstance is partially a result of ORD's risk-based approach and budget cuts throughout the program.

In response to a question on how sites are identified, Ms. Colson said they believe the SITE program is well-known enough such that they expect to see sufficient expressed by site owners. Back on the subject of emerging technologies, Dr. Kovalick said that working capital to support new technologies is available but scarce, and that, if they cared to, the Roundtable member-agencies could look into picking up the slack beyond the SBIR program and the other efforts already identified, such as the Army Environmental Center's multiple technology demonstration.

## TECHNOLOGY INFORMATION PRODUCTS: CURRENT AND PLANNED

### *Overview of the Final Report of the Federal Facilities Environmental Restoration Dialogue Committee*

**Deborah Tremblay**, U.S. EPA/Federal Facilities Restoration and Reuse Office, reviewed the final report of the Federal Facilities Environmental Restoration Dialogue Committee, issued in April 1996 (see Attachment 4). The Committee is chaired by EPA and chartered under the Federal Advisory Committee Act (FACA). There are fifty members representing a broad range of perspectives on federal facility cleanup. Ms. Tremblay concentrated on the consensus principles reached by the Committee members:

- The federal government is obliged to cleanup federal facilities.
- There is a sustained commitment to environmental cleanup.
- Environmental justice is an important goal of the cleanup effort.
- Treatment of federal facilities and private sites should be consistent.
- Cleanup contracting should use mechanisms that specify, measure, and reward desired outcomes rather than simply reimbursing contractors for an end product
- Fiscal management should be flexible.
- Interdependent decision-making roles and responsibilities should be recognized and the decision-making process should ensure that all roles are preserved and balanced.
- Negotiated cleanup agreements are important for setting priorities at a site and balancing stakeholder roles and responsibilities.
- Human health, environmental risk, and other factors play important roles in federal facility cleanup decisions.
- Pollution prevention and control activities are important.
- Future land use determinations should play an important role in cleanup decisions.
- Studies should play an important role in the cleanup process.
- There should be a systematic approach to decision-making and priority setting.
- Stakeholder involvement should be achieved at federal facilities.

Anyone interested in obtaining a copy of the Committee report should contact Michelle Morris of EPA by telephone (202-260-9924) or email ([morris.michelle@epamail.epa.gov](mailto:morris.michelle@epamail.epa.gov)).

The Committee's reliance on milestones for federal facilities cleanup can be used to promote the use of remediation technologies through strict adherence to those milestones, which apply pressure to utilize technologies to meet milestones while dealing with engineering risks.

### *Status Report on the Environmental Restoration Technology Initiative: Achieving a Common Goal*

**Mary McCune**, U.S. DOE, gave an update on DOE's implementation of performance-based contracting for site cleanups to meet the Department's technology implementation goal of applying the right technology at the right time at the right site (see Attachment 5). Ms. McCune said DOE's project managers are documenting cost and performance data following a procedure modeled on the Roundtable's guidelines. Reports are available in two forms: Office of Science and Technology (EM-50) Greenbooks documenting pilot-plant demonstrations and Office of Environmental Restoration (EM-40) cost and performance reports documenting full-scale demonstration and implementation.

Ms. McCune showed an example of a preferred alternatives matrix (PAM) that DOE uses to link problem sets to available technologies and analyze the commercial state-of-the-practice as it relates to the problem sets. Problem sets are defined for each of four focus areas and are developed by a unique combination of media and contaminants. The four focus areas are Characterization and Monitoring; Remediation; Waste Processing; and Decommissioning. The Characterization and Monitoring focus area is matrixed with each of the other focus areas. The present PAM analysis focuses on remediation, which now comprises forty problem sets of different combinations of media and contaminants. The PAMs rank commercially available technologies on the basis of performance, cost, and risk using four categories of technological alternatives (preferred, probable, potential, and possible) and three categories to define the state of commercial practice for each problem set:

- 1) green: there are more than one preferred or probable alternative for the problem set;
- 2) yellow: there is only one preferred or probable alternative or more than one potential or possible alternative for the problem set; and
- 3) red: there is one potential or possible alternative or any alternatives are unlikely or not applicable for the problem set.

Ms. McCune showed a number of graphic representations of the way EM-40 cuts the data to evaluate the state of commercial practice and the opportunities for and barriers to technology development that will feed EM-40's research and development decision-making. For example, Ms. McCune showed a PAM that indicates that DNAPLs in ground water constitute a "red" type of problem.

In response to a question, Ms. McCune said EM-40 is still working on criteria for developing lists or menus of technologies written into RODs under the performance-based contracting strategy that will allow market forces to select the technologies from the menu for the remedy. Ms. McCune was asked whether DOE is working with EPA on the approach, since EPA seems fixed on selecting least-risk remedies regardless of cost. She said EM-40 recognizes this will require some effort, especially at older sites. She said EPA has indicated that it does not see why the approach can not work, but DOE is still assuming some negotiation will be required. Dr. Kovalick said there are contingencies built into many existing RODs, and said the multiple alternatives approach should operate in a similar fashion.

Diane Lynne, U.S. EPA/FFRRO, said her office is designing a "flexibility" pilot project that will tie a performance-based approach to ROD contingencies. She said FFRRO is working on identifying sites for the pilot and the presentation indicated that there may be sites within the DOE complex that could participate. Scott Edwards also offered DoD's assistance in finding sites for the FFRRO pilot. Lt. Col. Selstrom said performance-based RODs have the advantages of inviting innovative technologies to the table and distributing risks on all parties rather than creating an adversarial relationship between regulators and the other stakeholders.

### ***Update/Plans for the 3rd Edition of the FRTR Remediation Technology Screening Matrix and Reference Guide***

**Ed Engbert**, U.S. Army Environmental Center, gave a presentation on USAEC's plans to update the Remediation Technology Screening Matrix and Reference Guide with a third edition (see Attachment 6). There was a working meeting on December 10, 1996, at which a commitment to issuing a new edition was reached. The working group is also committed to working with the Roundtable to find ways to make the next version available through the Roundtable's WebSite. An electronic version of

the second edition of the Matrix is available, and the next and subsequent versions will be designed specifically for Web access, rather than as a paper edition. The next edition will include additional technologies, updated technology descriptions, and updated cost and performance sections.

Mr. Engbert said USAEC has a contract and budget for the revision, but it is looking for additional support from other Roundtable member-agencies. Dr. Kovalick said getting dollars pitched into projects like this is sometimes like herding cats, while encouraging the member-agencies to ante up if they were so inclined. He noted that a relative dearth of funding creates a challenge that can keep a task focused and maintain interest. Regarding the question of electronic versus paper editions, Dr. Kovalick said the best is often the enemy of the good.

***Implementing Innovative Site Characterization Technology: Navy/EPA Technology Matrix***

**Todd Margrave**, Naval Facilities Engineering Command, gave an update on the joint Navy/EPA project to develop a matrix for site characterization technologies similar to the above matrix for remediation technologies (see Attachment 7). Mr. Margrave said the purpose of the matrix project is to produce a basic screening tool designed for use by regulators, potentially responsible parties (PRPs), entry-level remedial project managers (RPMs), and the general public that provides an overview of options for innovative field analytical technologies to address site assessment, investigation, and monitoring of man-made contaminants. The matrix is not meant to serve as a decision tool, only as a guide to available technologies that will screen some technologies. The matrix will be organized into sections covering location, collection, and sample preparation and analysis technologies and limited to technologies at the full and pilot-scale level of development.

Mr. Margrave described the factors that drove the decision to develop the matrix. There is pressure to characterize sites faster and cheaper that could be relieved if field analysis techniques were used more often. The principal barriers to wider utilization are regulatory acceptance and technology transfer: the matrix project aims to overcome both of these barriers. Like the remediation technology matrix, the characterization technology matrix will include a reference guide providing material in support of the matrix ratings.

Mr. Edwards asked whether the project considered including long-term monitoring at older sites, rather than focusing only on characterizing new sites. Mr. Zagrobelny said he thought subsequent editions of the matrix will expand the base of technologies in the future. Similarly, "intellectual management" tools such as modeling programs are beyond the scope of the project, at least for time being, but may be worked into future editions.

Dr. Kovalick said EPA's motivation for sponsoring the project was to try to get the consulting engineer community to shift away from its current site characterization practice of digging a lot of holes and sending the samples off to a laboratory, a practice that is time-consuming and expensive. The need is for quicker field analytical techniques, especially in Brownfield situations where cities lacking expertise are hiring consulting engineers. With the matrix, the cities will have a tool to help them guide their consultants. Mr. Margrave concluded by reviewing the timetable for issuing the matrix. A revised list of technologies to be included will be finalized in December 1996 to be reviewed by a panel of experts in January 1997. A draft matrix and reference guide will be completed in March 1997, with the final version distributed in May 1997.

**STATUS OF FEDERAL REMEDIATION TECHNOLOGY ROUNDTABLE PUBLICATIONS**

***Roundtable Publications - Recent Releases***

**Naomie Smith**, U.S. EPA/TIO, announced that copies of the Roundtable publication *Accessing the Federal Government: Site Remediation Technology Programs and Initiatives* had been printed thanks to Scott Edwards and DoD. Each member-agency should have received two copies. 2500 copies had been sent to the National Center for Environmental Publications and Information (NCEPI) in Cincinnati.

**DNAPLS AND REACTIVE WALL BARRIERS**

***Technology Developments for DNAPLs: Overview from the Ground-Water Remediation Technologies Analysis Center***

**Walt Kovalick** gave a report on the status of technology developments for treating dense non-aqueous phase liquids (DNAPLs) as assessed by the Ground-Water Remediation Technologies Analysis Center (GWRTAC). GWRTAC reports that ground water remedies have been selected at 603 sites. 93% of those call for pump-and-treat alone, 1% call for *in situ* remedies, and 5% combine pump-and-treat with *in situ* remedies. GWRTAC has identified six abiotic *in situ* technologies for treating ground water:

- |                        |                        |
|------------------------|------------------------|
| thermal enhancement    | fracturing             |
| surfactant enhancement | co-solvent enhancement |
| treatment walls        | electrokinetics        |

As of March 1995, there were 92 projects to implement the above technologies, of which 23 were treatment walls. Today, there are over 100 treatment wall projects in some stage of implementation. Most of these systems treat halogenated organics. Dr. Kovalick said the increase indicates that people with money to spend on developing these remedies are spending it on treatment walls. Anyone interested in keeping up with developments in this area can contact GWRTAC through its WebSite. Dr. Kovalick noted that in two months GWRTAC will have Oracle on-line in support of its WebSite for user-driven searches of their data.

***Somersworth Barrier Walls and Superfund Risk Sharing/Interstate Technology and Regulatory Cooperation Work Group***

**Jim Cummings**, U.S. EPA/TIO, reported on progress made at the Somersworth Landfill Site and the EPA pilot project on Superfund risk sharing. Liability for any failure of a technology is usually placed entirely on the developer or promoter of the technology. These parties are often unable to assume the risk, hence innovative technologies are often unused for reasons that have nothing to do with performance capabilities. The risk sharing initiative is designed to spread the risk of innovative technology failures, with EPA assuming 50% of the cost of any failures. The pilot project involves installation of a passive barrier wall to treat a TCE plume. The backup remedy is a cap. The barrier wall was selected over a cap because the wall is cheaper and a cap would have a potentially adverse effect on a downgradient wetland.

Mr. Cummings also reviewed the activities of the Interstate Technology and Regulatory Cooperation Work Group (ITRC) and its effort to de-balkanize acceptance of innovative technologies by state regulators through partnerships with the Remediation Technology Development Forum (RTDF), the Environmental Security Technology Certification Program (ESTCP), and the Rapid Commercialization Initiative (RCI). For example, ITRC has been working through the RCI with RTDF's Action Teams on permeable walls, *in situ* bioremediation, and the Lasagna™ technology to promote state acceptance of technologies in these areas. Cooperation on permeable walls has been the lead effort in the ITRC/federal program partnerships. ESTCP has been involved with ITRC's Metals-Soils Work Group, which will attend a small arms range remediation visitor's day at Ft. Polk, Louisiana, and with ITRC's work groups on plasma torch and low-temperature thermal desorption technologies.

The objectives for linking ITRC activities to federal partnerships for technology development are to increase regulator familiarity with new technologies, identify regulatory requirements early in the development process, and to increase consistency and reciprocity of acceptance across states. Ted Zagrobelny asked whether there was any relationship between ITRC and the Environmental Council of the States (ECOS). Mr. Cummings said there is a constellation of organizations including ITRC, ECOS, and the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) that are working in the area of technology development and affecting each other. Dr. Kovalick said ITRC is still working on how to cast its work in a way that will get the attention of ECOS. Mr. Edwards said the risk sharing pilot may accomplish this objective. Dr. Kovalick said it is difficult to get on the ECOS agenda with a topic as narrow as state regulatory acceptance of remediation technologies.

### ***U.S. Department of Energy Barrier Walls Projects/Upcoming Conferences***

**Skip Chamberlain**, U.S. DOE, gave a presentation on U.S. DOE's barrier wall projects for treating radiological and mixed waste (see Attachment 8). He opened his presentation by announcing an upcoming meeting on the use of barrier walls to treat radiological and mixed waste. This meeting is a follow-up to a meeting held in Baltimore last August. That meeting resulted in a proceedings document including case studies that serves as a textbook on the state-of-the-technology for barrier walls. The publication is available via the DOE WebSite (<http://www.doe.gov>).

Mr. Chamberlain said there are two types of reactive barrier walls: trenches and funnel/gate systems. DOE has scheduled demonstrations for treating metals and radiological contaminants at Oak Ridge and Rocky Flats. Other candidates for demonstrations include Savannah River and the ARCO site in Butte, Montana. Site characterization is a big issue at these sites, especially Rocky Flats, where DOE will install a ground-water collection system down to 15' as part of the demonstration. In addition, DOE will construct a 1000' wall to treat chrome contamination using chemical reduction at depths down to 50' at the Hanford Reservation.

Jim Cummings asked whether some states see what DOE is doing as merely concentrating contaminants that will then be left in the ground. Mr. Chamberlain said the issue is addressed as part of negotiations for cleanup of land belonging to the Nez Perce tribe at Hanford. DOE will remove the treatment wall when the cleanup is completed in that situation. Joan Colson mentioned that the SITE program will sponsor a treatment wall demonstration at Rocky Flats in support DOE's efforts. Bob Furlong asked whether the contracts for the treatment wall project at Rocky Flats will be performance-based. Mr. Chamberlain said upper management within DOE's environmental restoration program

favors the technology, but other remedies are being considered. DOE expects the proposed barrier wall to become part of the remedy for Rocky Flats.

***Clean Sites Public-Private Partnership: Reactive Wall Partnership at Massachusetts Military Reservation***

**Richard Waesche**, Clean Sites, Inc., described the reactive wall partnership at the Massachusetts Military Reservation (MMR) that serves as a pilot project testing a model for selecting innovative technology remedies through a stakeholder process that ensures acceptance of the remedy by regulators and the public prior to implementation (see Attachments 9 and 10). Mr. Waesche noted the principal technical issue for such projects is no longer whether the reactive technology will work (in this case, iron filings to treat chlorinated organics), but rather the best method of emplacement. Contamination at the site is 80 to 120 feet down. The alternative to a reactive wall would have been a pump-and-treat system expected to operate for 30 years. The other main objective of the MMR pilot is to generate cost and performance data for a “typical” reactive wall project.

Techniques considered for emplacement included a slurry wall, a driven/vibrated mandrel, deep soil mixing, and hydrofracturing. Wall design alternatives include a continuous permeable reactive wall and a funnel/gate system. The reactive media considered were iron and a combination of iron and nickel. The iron-nickel combination reduces the half-life of PCE reduction time from 30 to 3 minutes and reduces the required column width to one-tenth that of iron alone. However, the media selected was iron alone for cost reasons. The relative emplacement costs estimated for a 400' wall were:

slurry wall	\$2.0m	deep soil mixing	\$2.5m
driven/vibrated mandrel	\$1.9m	hydrofracturing	\$1.3m

The initial emplacement method considered was a hanging funnel and gate configuration using driven sheetpile funnels. However, the drivability test was unsuccessful as they were unable to penetrate to required depths of 150 feet. Funnel and gate systems were rejected as being too expensive if sheetpiles could not be driven. The decision was made to go ahead with hydrofracturing and emplacement of a continuous wall to treat the contaminant source. The next steps for the demonstration are to complete site characterization, verify that iron slurry can be emplaced using hydrofracturing, and to develop a fracture verification method.

In response to a question on how the remedy will deal with the contaminated plume at the site, Mr. Waesche said this project deals with the source. Once demonstrated successfully, he expects they will scale-up to deal with the plume; however, this will require extensive site characterization and plans for doing so are not yet in the works. He noted that concentrations of contaminants in the plume are relatively low but above MCLs.

**ELECTRONIC INFORMATION/EXPERT SYSTEM/TECHNOLOGY SELECTION MODELS**

***Demonstration of the Federal Remediation Technologies Roundtable Information WebSite***

**Johnnie Shockley**, U.S. Army Corps of Engineers, gave an update on information available on the Roundtable’s WebSite (<http://www.frtr.gov>). The presentation included a demonstration of the WebSite. She said there are many changes and updates occurring at the present time, the Corps has

been responding to calls from member-agencies to establish links and include information. The remediation technology matrix is now on-line: Ms. Shockley demonstrated how users can move through the matrix to obtain specific reference data. A statistical program will be added to track usage and aim resources toward the areas that generate the most interest.

Dr. Kovalick asked whether the cost and performance data case studies were available on the WebSite. Ms. Shockley said they were not yet available but the abstracts should be available in a few weeks. EPA's case studies are available on the CLU-IN WebSite. Ms. Shockley reminded the member-agencies that each is responsible for maintaining its information on the WebSite. The Corps is only serving as a host for the system. Ms. Shockley is the contact for updating the links and information on the system.

### ***Demonstration of the Historical Cost Analysis System***

**Jim Peterson**, U.S. Army Corps of Engineers, gave a demonstration of the Historical Cost Analysis System (HCAS), an on-line data base of 60 remedial action projects undertaken by different federal agencies. The information in the data base is the same as the information reported under the Roundtable's cost and performance reporting guidelines. HCAS is being re-programmed for a Windows-based interface. The new HCAS will also incorporate the Corps' work breakdown structure and be linked to other cost estimating systems developed by the other service branches. The new version of HCAS is scheduled for delivery in June 1997. The Corps is seeking input from the Roundtable and its member-agencies, especially on compatibility issues.

Dr. Kovalick asked what the Corps had to offer in return for input from the member-agencies. Mr. Peterson said HCAS provides a reality check for cost comparisons and estimating and the system can be adapted to allow other agencies to enter and track their own project data from award to completion. HCAS is free to other member-agencies.

### ***Petroleum Environmental Research Forum (PERF): How to Access the PERF Bulletin Board***

**Paul Becker**, Exxon Research Engineering Corporation, provided the Roundtable with background information on the Petroleum Environmental Research Forum and some of its current research projects, including research in the areas of natural attenuation, biological barriers, and bioremediation treatment walls (see Attachment 11). He moved on to a demonstration of PERF's WebSite and bulletin board (<http://perf.vs.com>). Since PERF is a cooperative research forum rather than a formal research organization, it has no staff to coordinate efforts among the participants for a particular research project. The WebSite and bulletin board serve as valuable communication links for participants.

Dr. Kovalick asked whether research results were still owned by the research project participants as proprietary information and whether PERF was still controlling "freeriders." Mr. Becker said the members are free to publish results provided they give the other project participants 30 days notice. He noted that PERF allows different types of participation and that the groups trade in few secrets, though the biological barriers group feels their results are proprietary. The "results" available on the WebSite are usually descriptions of research subjects rather than the results of the research. Dr. Kovalick said listing references for WebSite users would be very helpful whenever possible.

[For a more detailed description of PERF and its research structure, see the presentation by John Wilkinson in the minutes of the June 1995 Roundtable meeting.]

***U.S. Department of Energy Remedial Action Assessment System (RAAS) and Electronic Encyclopedia of Remedial Action Options (ReOpt)***

**Larry Bagaasen**, Pacific Northwest Laboratory, gave presentations on DOE's Remedial Action Assessment System (RAAS) and Electronic Encyclopedia of Remedial Action Options (ReOpt) (see Attachment 12). These are two of several software tools that are available to help guide remedial action decision-makers. Mr. Bagaasen identified other complementary tools such as EPA's Vendor Information System on Innovative Treatment Technologies (VISITT) and the Air Force's Remedial Action Cost Engineering and Requirements System (RACER, see below).

RAAS is a comprehensive integrated environmental analysis method designed to support a wide range of environmental restoration decision-making. Mr. Bagaasen reviewed the RAAS analysis framework that leads to development of restoration alternatives for comparison. The analysis framework is built on the interactions of:

- a site conceptual model;
- human health effects;
- contaminant transport;
- technology selection and performance; and
- restoration alternative effects.

Components of the analysis framework can be mixed and matched to suit a user's needs.

Mr. Bagaasen also presented a brief demonstration of the ReOpt system, which provides application information in 13 categories for 107 technologies. Records can be searched by function, media, or contaminant.

Todd Margrave asked Mr. Bagaasen to explain the differences between RAAS and RACER. Mr. Bagaasen said RACER is a cost estimation tool that is used after decisions have been made on the technology to be used and the approach for the remedy. RAAS is used earlier in the process to get an idea of what technologies are available, how long the action may take, and other more general issues. Dr. Kovalick asked how RAAS is updated to keep up with innovations. Mr. Bagaasen said RAAS can accept additional modules. He said his group works on anticipating innovative technology developments. Also, the system is very flexible and will operate with a wide variety of parameters and defaults. Parameters can be substituted to test how a technology may perform (*e.g.*, a user can substitute changes in  $K_d$  values that correspond to site contaminants). Dr. Kovalick said RAAS users must be fairly sophisticated, and impressed upon Mr. Bagaasen the need to keep defaults updated. Mr. Margrave agreed that RAAS is a tool for site managers with some experience. ReOpt, on the other hand, can be used by managers with less experience. A two-day RAAS training course is offered for about \$750.

***Air Force Remedial Action Cost Engineering and Requirements System (RACER)***

**Bob Furlong**, U.S. Air Force, gave a presentation on the Air Force's Remedial Action Cost Engineering and Requirements System (RACER) (see Attachment 13). RACER is a parametric environmental cost estimating system to aid in planning and execution of site cleanups that allows users to estimate costs with limited or detailed site information. RACER allows users to estimate multiple treatment trains to find the most cost effective solution. Parametric methods for cost estimating use cost models based on generic engineering solutions derived from historic project information, government laboratories, vendors, contractors, and engineering analysis. Solutions can be tailored to reflect project conditions and requirements. RACER can be used to estimate costs for all phases of remediation. Many of the elements are user-defined and all defaults can be modified.

In response to an earlier discussion, Mr. Furlong said emerging technology cost data generated under programs sponsored by the Strategic Environmental Research and Development Program (SERDP) are being captured using the RACER model. Other related projects and benefits include EPA's Tank RACER system (see below) and the development of treatment train templates and site assessment models. A two-day RACER training class is available to government employees and contractors. DoD employees should contact Scott Ammon at Wright-Patterson Air Force Base (513-255-5654, ext. 3566). Others should contact Tom Ove at Tyndall Air Force Base (904-283-6186).

***U.S. EPA Office of Underground Storage Tanks (OUST), Tank Remedial Action Cost Engineering and Requirements System (Tank RACER)***

**Steve McNeely**, U.S. EPA/OUST, gave an overview of the use of the Tank RACER system to support risk-based corrective actions undertaken by states at underground storage tank sites (see Attachment 14). Tank RACER is used to generate two types of numbers: budgetary/programming estimates; and state reimbursement fund validation. Mr. McNeely noted that, while RACER deals with large sites, Tank RACER deals with small sites.

Version 2.0 of Tank RACER is being developed based on the needs of the Tank RACER user community. Key development items identified include:

- development of a labor rate data base, user costs files, account codes for contractor/subcontractor designation, and agency templates;
- modification of general conditions, overhead and profit models, and user-defined estimates and models; and
- development of a Tank RACER program for network installation and other interface improvements.

RACER and Tank RACER are now available as a package. The two may be split apart in the future but will remain compatible.

**WRAP-UP**

The members briefly reviewed the action items from the meeting:

- Scott Edwards will provide addresses for the mailing of a flyer announcing the latest Roundtable publications.

**Federal Remediation Technologies Roundtable Meeting, Arlington, Virginia, December 11, 1996**

The Cost and Performance Data subgroup has a mandate to produce another round of case studies and ensure that the existing case studies are available on the Roundtable WebSite. Scott Edwards will move DoD's case studies over from the DENIX system. EPA's studies will be linked. Dr. Kovalick set February 1, 1997, as the deadline for placing the existing case studies on the Roundtable page.

The agenda for the next Roundtable meeting will include time for an evaluation and assessment of the number of case studies that can be issued for the next round.

Dr. Kovalick recommended that the chair for future Roundtable meetings rotate. TIO will continue to provide contractor support. Dr. Kovalick asked whether there were any other agenda items for the next meeting. Mr. Edwards said there is a need for the Roundtable to demonstrate how and when their activities will affect cleanups. The value of technology demonstrations and verifications to the cleanup programs of the member-agencies should be made more clear to the agencies for support of the Roundtable to continue. Dr. Kovalick agreed, noting that President Clinton has set a goal of 900 cleanup completions by the year 2000. That means 490 are to be finished in the next three years and that means the agencies have a lot of work to do and they will need new and better ways to do it. Todd Margrave suggested that the member-agencies bear in mind that the prime customers for innovative technologies are project managers in the field.

Bob Furlong said cost and performance reporting issues and discussions should be tied into HCAS to evaluate how the systems run in parallel and whether they obtain enough information and transfer the information effectively. Dr. Kovalick agreed, noting that EPA had a policy directive that states that all treatability study results are to be submitted to EPA's laboratory in Cincinnati; however, only about 60 reports have been submitted out of the hundreds of studies completed. Data reporting requirements are often ignored because there is no benefit to the people in the field charged with reporting, nor is there any penalty. Johnnie Shockley said she sees the same effect in the Corps' construction districts.

Dr. Kovalick mentioned that TIO is finishing its national study of the remediation technology marketplace, to which many of the member-agencies made contributions. He said TIO expects to release the study in January 1997. He also mentioned that the five-year project to study and report on international technology development issues (supported by EPA and the Air Force) under the auspices of the NATO/CCMS is in its closing stages, and that there will be a final meeting under the project at the Colorado School of Mines on March 17-21, 1997. He encouraged the member-agencies to attend, where they will be able to see presentations on 40 major technology development projects from around the world. Information on the program is available on the CLU-IN WebSite (<http://clu-in.com>).

The meeting adjourned.

**LIST OF ATTACHMENTS**

- Attachment 1: Attendees
- Attachment 2: Current Cleanup Technology Demonstration/Validation Activities of the U.S. Army Environmental Center
- Attachment 3: TVA Current or Pending Technology Demonstrations
- Attachment 4: Consensus Principles and Recommendations of the Federal Facilities Environmental Restoration Dialogue Committee
- Attachment 5: DOE Environmental Restoration Technology Initiatives: Achieving a Common Goal
- Attachment 6: Update Plans for the FRTR Remediation Technology Screening Matrix and Reference Guide
- Attachment 7: Site Characterization Technology Screening Matrix and Reference Guide Update
- Attachment 8: DOE EM-50's Reactive Barrier Program for Metal/Rad Mixed Waste
- Attachment 9: Clean Sites Public Private Partnership: Reactive Wall Partnership at Massachusetts Military Reservation
- Attachment 10: "A Nickel-Cadmium Wall Against Contaminated Groundwater"  
*Environmental Science And Technology* vol. 30 no. 12 1996
- Attachment 11: Petroleum Environmental Research Forum (PERF) Home Page
- Attachment 12: Remedial Action Assessment System (RAAS)
- Attachment 13: Remedial Action Cost Engineering and Requirements System (RACER)
- Attachment 14: Tank Remedial Action Cost Engineering and Requirements System (TANK RACER)

## ATTACHMENT 1

### Attendees

#### FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE

December 11, 1996

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