

FEDERAL REMEDIATION TECHNOLOGIES ROUNDTABLE MEETING
Arlington, Virginia
December 11, 2008

ACTION ITEMS..... 2

WELCOME/INTRODUCTION 2

FRTR ADMINISTRATIVE AND BUSINESS ISSUES 2

MEETING OBJECTIVES..... 4

GREEN REMEDIATION TOPIC INTRODUCTIONS 4

Green Remediation: EPA Progress/Updates..... 5

Green Remediation within the U.S. Air Force..... 5

Integrating Green and Sustainable Practices with Navy Restoration Projects..... 6

Incorporation of Sustainability into Environmental Remediation – Army Efforts ... 7

U.S. Department of Energy's Federal Energy Management Program (FEMP)..... 8

Sustainability Is Integrated into NASA Remediation 8

GREEN REMEDIATION PROJECT EXPERIENCES & TOOLS (I)..... 9

Green Remediation: Maximizing the Benefit of Site Cleanups 9

UPDATE: Building Sustainability into the Air Force Remediation Process 10

Sustainable Solutions for Soil and Groundwater Remediation:

Helping the Earth Heal Itself..... 11

Groundwater Remediation and Alternate Energy at NASA White Sands

Test Facility 12

GREEN REMEDIATION PROJECT EXPERIENCES & TOOLS (II)..... 13

NASA Jet Propulsion Laboratory Green Feasibility Evaluation 13

Guidance on Incorporation of Sustainability into the Department of the Army

Environmental Remediation Projects: Practical Aspects of Incorporation

and Application..... 14

Green and Sustainable Remediation: How ITRC Reduces Regulatory

Barriers to the Use of Innovative Environmental Approaches 15

DISCUSSION OF GREEN REMEDIATION ISSUES OF COMMON INTEREST 16

MEETING WRAP-UP/NEXT MEETING AGENDA 17

ATTACHMENTS 17

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

Federal Remediation Technologies Roundtable Meeting **Arlington, Virginia December 11, 2008**

ACTION ITEMS

- ▶ Carol Dona will apprise Roundtable members of any alterations in Web site support that might result from the Corps' change of IT contractor.
- ▶ Members who would like to disseminate information concerning a recently completed research or demonstration project should contact Dan Powell, Mike Adam, or Jean Balent to discuss the potential for developing an online seminar on CLU-IN.
- ▶ News of sites with potential for development of remediation case studies should be forwarded to John Kingscott or Marti Otto.
- ▶ Beth Moore will send contact information for The Energy Conversation to Jessica Burns for dissemination to Roundtable members.
- ▶ The Green Remediation Subgroup will meet, define its purpose, articulate activities it can focus on, and report back to the Roundtable by the end of March.
- ▶ The Navy will take the lead in coordinating the Spring 2009 Roundtable meeting agenda with John Kingscott and Marti Otto.

WELCOME/INTRODUCTION

Jeff Heimerman, Deputy Director of the Technology Innovation and Field Services Division (TIFSD) in the U.S. Environmental Protection Agency's (EPA) Office of Superfund Remediation and Technology Innovation (OSRTI), welcomed the attendees to the 37th meeting of the Federal Remediation Technologies Roundtable (FRTR) and provided a brief overview of the agenda. He introduced Arnold Layne, the new TIFSD Director, who greeted the assembly, noting that the meeting provided an opportunity to continue the Roundtable's good work. He added that the overwhelming majority vote that had made green remediation the focus of the present meeting is evidence of the high level of interest in this topic.

Attendees introduced themselves. Heimerman announced that a representative from each member agency present would be asked to cast a ballot to select a topic for the technical session at the Spring 2009 roundtable, with the results to be announced at the end of the meeting.

FRTR ADMINISTRATIVE AND BUSINESS ISSUES

Erica Becvar, U.S. Air Force Center for Engineering and the Environment (AFCEE), reported that the Air Force's entire Environmental Restoration Program has been centralized in AFCEE. In February 2009, AFCEE also will begin managing the Military Munitions Response Program, and eventually the Compliance Program as well.

William Lodder, U.S. Department of the Interior (DOI), said that he is responsible for the DOI central Hazardous Materials Fund, which is used for remediation of contaminated sites, particularly abandoned mine lands and other sites affected by heavy metals. Given DOI's responsibility for 500 million acres of land within the United States, he is interested in learning more about cost-effective cleanups and the remediation performance metrics used by other agencies.

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

David Morganwalp, U.S. Geological Survey (USGS), announced that the USGS's Toxic Substances Hydrology Program is holding a meeting in conjunction with EPA's Technical Support Project, January 26 through 29, 2009, in San Diego. The sessions will cover the accomplishments, technology transfer, and future priorities for research in the areas of fractured rock aquifers, petroleum contamination, wastewater effluent, landfills, and mixed wastes.

Carol Dona, U.S. Army Corps of Engineers (USACE), said that the Corps has combined two centers of expertise to form the Environmental and Munitions Mandatory Center of Expertise (EM CX). The new CX, part of the U.S. Army Engineering and Support Center, Huntsville, joins the Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Expertise, based in Omaha, Nebraska, and the Huntsville Center's Military Munitions Center of Expertise. Additionally, the Corps is preparing a guidance document on incorporating sustainability into environmental remediation approaches. The Corps has changed its information technology contractor, which has bearing on Corps maintenance of the FRTR Web site. Dona will apprise Roundtable members of any alterations in Web site support that may result from the change in contractor.

Robert Sadorra, Naval Facilities Engineering Command (NAVFAC), said that the Navy has been developing major technology initiatives in remedy optimization and data management. For the latter, NAVFAC has developed the Naval Installation Restoration Information Solution (NIRIS), a central system for maintaining all environmental remediation site data (including geographic information system data), documents, and records. A Web-based tutorial on the development and functions of NIRIS is available on line (www.ert2.org/NIRIS/tool.aspx).

Chuck Reeter, Naval Engineering Service Center (NFESC), has just been promoted to Division Director of NFESC.

Jeff Heimerman mentioned the open solicitation issued in November 2008 by the Strategic Environmental Research and Development Program (SERDP, www.serdp.org/) and said that a Webcast seminar—SERDP Funding Opportunities—had aired on CLU-IN November 20. The Webcast covered the topics being solicited and how to put forward a good proposal. The seminar remains available for viewing in the seminar archive (www.clu-in.org/live/archive.cfm).

Dan Powell (EPA/TIFSD) emphasized EPA's interest in disseminating information concerning technology innovation via its Internet seminars and urged those with recently completed research or demonstration projects to contact him, Mike Adam (EPA/TIFSD), or Jean Balent (EPA/TIFSD) to discuss the potential for developing the information into an online seminar.

John Kingscott (EPA/OSRTI) described an agreement TIFSD has developed with the University of Massachusetts at Amherst to support five national conferences. The focus of the 2008 conference was Triad investigations. The second meeting, the International Conference on the Environmental Implications and Applications of Nanotechnology, will be held June 9-11, 2009 (www.umass.edu/tei/conferences/nanoconference/registration.html). Green remediation is being considered as the focus of the 2010 conference. The conferences to be held in 2011 and 2012 are still open, and TIFSD will be pleased to work with any agency that would like to select a conference topic and serve as co-sponsor. For the next update of the FRTR case study database, 11 sites have been located to date, and Kingscott welcomes news of additional potential case

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

study sites. He added that several dozen sites have been located, at which nanotechnologies are being implemented in remediation. TIFSD has prepared a table that identifies the sites, their contacts, and the technologies used, in addition to a 17-page fact sheet that presents a snapshot of nanotechnology and its current uses in remediation (www.clu-in.org/products/nanozvi/).

MEETING OBJECTIVES

Jeff Heimerman outlined the objectives of the meeting:

- Improve communication and common understanding of green remediation best practices by exploring the boundaries and borders of the topic.
- Share experience and lessons learned in advancing these best practices.
- Outline the key issues and develop shared strategies to address them.
- Identify baseline and benchmark green remediation efforts as a basis for future metrics.
- Develop a charge for future Roundtable green remediation actions.

Heimerman asked if anyone had additional input.

Erica Becvar said that the Sustainable Remediation Forum (SuRF) will be publishing a white paper in the February 2009 issue of Remediation Journal. Some of the topics touched upon as objectives for this meeting are discussed in the paper.

John Kingscott went over the topics on the ballot for the next Roundtable meeting—sediments, data management/decision support tools, optimization, vapor intrusion, and characterization—and solicited suggestions for other topics.

Beth Moore, U.S. Department of Energy (DOE), pointed out the connection between optimization and green remediation with reference to cost reduction, energy efficiency, and carbon footprint reduction and suggested combining them into a Roundtable meeting topic. Carol Dona seconded the suggestion. Moore also suggested a potential resource—The Energy Conversation—for members interested in smart energy use. This joint agency initiative is led by the Department of Defense. The Energy Conversation takes place every few weeks at the L'Enfant Plaza Hotel between 5:30 to 8:30 p.m. as different experts talk about improvements in energy use and/or barriers to improvements in renewable energy. The Conversations can be monitored on line (www.energyconversation.org/), and they remain posted in a resource archive. The Web site allows registration of new members and mentions no limitations on who can join.

Heimerman then introduced Carlos Pachon (EPA/TISFD) and thanked him for serving as the Moderator for the green remediation topic introductions. Pachon is the primary EPA contact for this initiative.

GREEN REMEDIATION TOPIC INTRODUCTIONS

Carlos Pachon introduced six representatives from member agencies assembled to present brief overviews of green remediation initiatives and activities within their respective agencies.

Green Remediation: EPA Progress/Updates

Dan Powell (EPA/TIFSD) discussed the high level of interest in the topic of green remediation within EPA (Attachment A). He emphasized three significant points:

1. Green remediation is relevant to all the environmental impacts of cleanup.
2. Remedies already in place can be evaluated to make them more green and more efficient.
3. Remediation is itself a green practice, but the application of green remediation principles incorporates options in the cleanup that maximize the net environmental benefits.

The drive toward green remediation results from several initiatives: the Energy Policy Act of 2005, the Energy Independence and Security Act of 2007, Executive Order 13423 for reduction of greenhouse gases, and EPA's Strategic Plan. Sustainable revitalization is a holistic approach to the cleanup and revitalization of a property. A broad array of environmental factors and community impacts must be considered during all phases—demolition, waste remediation, design and construction, reuse—to maximize the environmental, social, and economic benefits associated with a cleanup project. Adopting green approaches is a key aspect of sustainable revitalization. Remedies are designed to be protective of human health and the environment; the challenge is to make them as or more protective while being more green.

In April 2008, EPA released the Green Remediation Primer (www.clu-in.org/greenremediation), which provides an introduction to green remediation best practices with examples of how and where they are being used. A green remediation workgroup has been formed within the Superfund Program to develop an overall strategy that will aim the Program toward green remediation. The workgroup is in the process of drafting a strategy document that will go to senior management for review in January 2009, with the goal of having a final strategy in place by June of 2009.

Green Remediation within the U.S. Air Force

Erica Becvar (Attachment B) described how the Air Force's present environmental remediation (ER) programs focus on cost, risk reduction, compliance with existing laws, and other metrics. By incorporating sustainability in the ER program, several new metrics become part of the remediation process, including carbon emissions, energy consumption, worker safety, resource service for land and/or ground water. Sustainability metrics are not new; the Air Force has investigated and promoted sustainable approaches for years.

Some treatment technologies—phytoremediation, recovery of light nonaqueous-phase liquids, passive *in situ* treatment, wetlands, enhanced bioremediation, monitored natural attenuation, and biowalls—although not targeted originally for sustainability, are inherently sustainable and generally are considered green remediation technologies. In addition to sustainable remediation technologies, approaches such as ERP-O (Environmental Restoration Program-Optimization) review, LTMO (long-term monitoring optimization), ground-water modeling, and PBM (performance-based management) have been applied to restoration programs. These approaches optimize existing remediation and monitoring systems, and provide holistic and systematic results-based assessment of restoration programs to expedite site closure.

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

Many Air Force projects are beginning to analyze sustainability factors purposefully and intentionally as part of the selection criteria for new ER systems, as well as for evaluation and optimization of existing systems. For example, a wind turbine has been installed to power ground-water cleanup at the Massachusetts Military Reservation, wind turbines have been installed for on-site power generation at the F.E. Warren Air Force Base (AFB) in Wyoming, and Nellis AFB in Nevada is completely on wind energy. Altus AFB in Oklahoma uses a solar-powered pump for ground-water circulation in a bioreactor and has replaced a pump-and-treat system with a biowall. An *in situ* bioreactor with a solar-powered pump for ground-water circulation was installed at Hickam AB in Hawaii. Solar-powered pumps also were installed at Travis AFB in California in an area where electricity is not readily available for the pump-and-treat system and the *in situ* bioreactor.

Question: Do you have contract language in place that specifies sustainability and/or green remediation practices?

Answer: Not at present. We currently are focusing on policy and optimization to achieve our goals, but we hope to update the contract language eventually.

Comment: Sometimes it is difficult to ascertain what savings result from which practices. Additionally, some of the bills may come to the remedial program manager (RPM) and others to the contractor, so tracking cost reductions and savings might not be a straightforward process.

Integrating Green and Sustainable Practices with Navy Restoration Projects

Tanwir Chaudhry, Naval Facilities Engineering Service Center (NFESC), informed the assembly that NAVFAC is taking essential actions to incorporate the concepts of green and sustainable remediation into the Navy's Environmental Restoration Program (Attachment C). These actions include tasking the NAVFAC workgroup on optimizing remedial actions with assessing the available sustainability evaluation tools, conducting case studies on Navy sites, developing technology transfer items, and providing guidance to the Navy RPMs. Examples of other NAVFAC actions include a pilot project for the use of alternate fuels (biodiesel blend), and a case study for remedy selection that includes sustainability considerations.

In a pilot project at Camp Pendleton, the Navy and Marine Corps partnered with EPA, a cleanup contractor, and equipment suppliers to reduce emissions during a large soil excavation project at a contaminated site. The project employed equipment retrofitted to use biodiesel blends. To select a remedy, the project compared three remedial options to address benzene, toluene, ethylbenzene, and xylenes (BTEX) contamination: air sparging/soil vapor extraction (AS/SVE), a combination of soil excavation and AS/SVE, and a combination of soil excavation and monitored natural attenuation. The demonstration quantified greenhouse gas emissions and energy use for the three options, and also provided qualitative assessment of sustainability factors such as water and land use and collateral risk.

The Navy plans to conduct additional case studies at environmental restoration sites and use the lessons learned from these case studies to develop guidance for Navy RPMs. The Navy also is collaborating with other Defense agencies and interested parties, such as EPA and SuRF, to draw upon their experiences with implementing green and sustainable remediation practices and to share lessons learned.

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

- Question: In the chart that illustrates quantified greenhouse gas emissions and energy use over the project lifetime, is that just for carbon dioxide or are other emissions factored in?
- Answer: Other greenhouse gases were factored in terms of carbon dioxide equivalents.
- Question: Are there numbers for the percentage of overall energy used for remediation and/or water processing at a site? It will vary from site to site, but is this type of information readily available?
- Answer: Relative to energy use base-wide, energy use for remediation projects is quite small. Of course, if the energy used by all the remediation systems across a particular agency could be added up, that would be a significant number.
- Comment: EPA's Office of Program Analysis is working on mapping out the types of energy requirements that can be anticipated at different kinds of sites, such as abandoned mine lands.
- Comment: According to SuRF estimates, remediation accounts for 0.1 percent of the gross national product, which is a small amount relative to all national activity.

Incorporation of Sustainability into Environmental Remediation – Army Efforts

Carol Dona reported that the Army is putting forth significant sustainability efforts in areas such as environmental management systems, green building construction, and demolition waste diversion, as well as limited but growing activity in environmental remediation (Attachment D). For example, a demonstration of wind power at the Nebraska Ordnance Plant in Mead, Nebraska, was conducted in a one-year (2006-2007) pilot study to evaluate cost savings of alternative wind power. Approximately 26 percent of the energy requirement of a ground-water recirculation well installed to treat volatile organic compounds was met by the wind turbine. Multiple organizations participated in the study: EPA, the Army Corps of Engineers, the University of Missouri-Rolla, and Bergy Wind Systems, Inc. This alternative energy source generated 8,422 kWh at an estimated annual savings of \$547. The system could recover total capital costs of \$38,000 in 69 years of operation. Over a 30-year period of operation, 169 tons of greenhouse gases could be eliminated. Army projects always come back to two questions: (1) Is it cost effective? and (2) How much money are we saving?

The Massachusetts Military Reservation (MMR) has 94 contaminated sites and 23 plumes, encompassing both Air Force and Army activities. AFCEE and the Army Environmental Center (AEC) are overseeing the cleanups. Remedies include source removal and pump and treat of 20 million gallons of ground water per day. Changing to high-efficiency pumps has saved more than \$100,000 per year. Remedial process optimization has saved over \$100,000 per year. An energy audit involving motion sensors, programmable thermostats, and more efficient lighting has decreased energy costs by more than \$50,000 per year. Based on the regional power mix, annual power consumption at the MMR ground-water treatment plant produces tons of undesirable emissions. A project is underway to install a \$4.6 million 1.5-MW turbine that will produce approximately 30% of the electricity needed to clean up Air Force plumes. Annual savings are estimated at \$640,000 with a payback period of seven years. Project startup is scheduled for September 2009. The Army estimates that two 600-KW turbines would supply 100% of the electricity needed to clean up two Army plumes at a cost of \$1.8 million per turbine. Annual savings of \$450,000 would pay back the cost of installation in eight years. Project startup is

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

scheduled for December 2009. These systems will tie into public and installation grids (one each). Because of the excellent wind resource at this facility, the state is exploring leasing land on MMR to private investors for up to 30 more wind turbines to power the base and possibly generate revenue.

U.S. Department of Energy's Federal Energy Management Program (FEMP)

Matt Gray (U.S. DOE) explained that energy use by federal entities in the United States is a little more than that of the entire country of Algeria and a little less than that of Austria (Attachment E). The federal government spends 65.4 percent of its energy usage on mobility compared to 26.1 percent in its buildings. As the nation's largest energy consumer—1.6 percent of the Nation's total energy budget at \$17.4 billion in annual energy costs—the federal government has a tremendous opportunity and clear responsibility to lead by example. DOE's Federal Energy Management Program (FEMP) is central to this responsibility. FEMP facilitates the federal government's implementation of sound, cost-effective energy management and investment practices to enhance the nation's energy security and environmental stewardship. FEMP does this by focusing on the needs of its federal customers and delivering an array of products grouped into applied technology services, project transaction services, and decision support services.

The Transformational Energy Action Management (TEAM) Initiative is a plan put forth by DOE to transform the Department's energy, environmental, and transportation management dramatically. The TEAM Initiative aims to meet or exceed the aggressive goals for increasing energy efficiency throughout the Federal government already laid out by President Bush. The Initiative aims for a 30 percent energy intensity reduction by 2015 from the 2003 baseline and a 16 percent water consumption reduction by 2015 from the 2007 baseline. By fundamentally transforming the way DOE manages energy use in its facilities, the TEAM Initiative will leverage every possible public and private resource to improve performance and reduce energy and water costs at DOE facilities over the next few years.

Sustainability Is Integrated into NASA Remediation

David Amidei, National Aeronautics and Space Administration (NASA), spoke in place of Mark Schoppet, NASA Remediation Program Manager, to describe how NASA teamed up with Florida Power and Light (FPL) to explore development of renewable energy projects at Kennedy Space Center (KSC), with help from DOE/FEMP (Attachment F). NASA has provided 100 acres to FPL under Florida's Enhanced Use Lease Authority. FPL plans to design, construct, and operate a 10-megawatt system tied to the FPL Grid. Ten megawatts is enough electrical power to serve roughly 3,000 homes. FPL will provide KSC with a NASA-owned 1-megawatt photovoltaic system as in-kind consideration on a formerly contaminated site. NASA will receive credit for the system under the Energy Policy Act of 2005 and Executive Order 13423. Construction completion is anticipated in 2010.

NASA also is collaborating on green remediation activities in Europe with work on Berlenga Island, which is a unique nature reserve off the coast of Portugal. Environmental problems on the island include raw sewage, generation of electric power by diesel engines, water supply limitations, and fuel spill risks. Systems based on renewable energy—wind and solar power—are being developed to serve water production, wastewater treatment, and domestic power requirements. At the Beja site in Portugal, NASA is assisting in the development of a solar

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

energy system to power a treatment system for a nitrate plume that extends 50 miles through an agriculturally impacted aquifer. The goal is to develop an innovative, integrated, renewable energy system that includes energy storage technologies, as well as management and control software to power ground-water treatment for nitrate removal. NASA is interested in sharing information and lesson learned regarding sustainability metrics for remediation projects.

Question: Is the 1-megawatt system sufficient to meet all the KSC power needs?

Answer: No, but in addition to some essentially free power, the system provides the facility with credit toward its federal energy-saving requirements at no up-front cost to the government.

Comment: As landholders, government agencies have something that private entities want; there must be considerable interest in the private sector about the potential for using the undeveloped land on large government facilities.

GREEN REMEDIATION PROJECT EXPERIENCES & TOOLS (I)

Green Remediation: Maximizing the Benefit of Site Cleanups

Carlos Pachon defined green remediation as "the practice of considering all environmental effects of a cleanup during each phase of the process, and incorporating strategies to maximize net environmental benefit of the cleanup" (Attachment G). The focus is on remedy implementation rather than remedy selection. By planning the project with close attention to air emissions, energy use, materials, water use, and land reuse, negative environmental impacts of the cleanup can be minimized. Implementation of green remediation principles to decrease environmental impacts and increase environmental benefits during site investigation and cleanup can involve the use of innovative technologies, such as passive samplers and solar samplers, as well as approaches as simple as reusing materials and choosing energy-efficient equipment. The drive toward green remediation is influenced by Executive Order 13423, which calls for the federal government to cut energy use, and by EPA's strategic goal for achieving clean air by reducing greenhouse gases.

EPA is working to incorporate green remediation practices across all the cleanup programs. A toolkit of technical and policy enablers is being developed to help people with different constraints and opportunities implement these practices. A contracts toolkit has been developed to help fund-lead RPMs incorporate green remediation in the procurement process. The toolkits provide language and identify incentives to show where people might be able to do more. EPA also is working with the Corps of Engineers to draft an updated Superfund memorandum of agreement that encourages both agencies to advance green remediation. A green remediation certification program is still in the conceptual phase. No documented strategy has been approved as yet, but several green remediation and sustainability initiatives are moving in tandem.

Pachon highlighted three projects where green remediation practices have played a part: the former Ferdula Landfill in Frankfurt, New York, the Operating Industries Landfill in Monterey Park, California, and the former St. Croix Alumina Plant in the Virgin Islands. These sites are listed among 22 profiles and case studies on the Green Remediation Web site (www.clu-in.org/greenremediation).

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

Pachon discussed opportunities to increase sustainability of site cleanups in six core areas: air emissions, water requirements and resources, land and ecosystems, material consumption and waste generation, long-term stewardship, and energy requirements. Green thinking encompasses the impacts of reuse on a site. He pointed out that installing an alternative energy system just for the cleanup may not make sense, but in a larger context, it may make the site more desirable for a beneficial reuse. He recapped several energy and carbon footprint strategies:

- Optimize systems to maximize efficiency and return per unit energy invested.
- Build renewable energy capacity at contaminated sites to power remedies.
- Tap into grid-renewable energy portfolios.
- Leverage carbon sequestration from soil amendment treatment (although currently a policy vacuum exists in this area).

UPDATE: Building Sustainability into the Air Force Remediation Process

Erica Becvar (AFCEE) described a tool AFCEE has been developing to compare various remediation technologies holistically so that remediation professionals can incorporate sustainability concepts into the decision-making process (Attachment H). At present, remediation designs generally are based on cost, risk reduction, and compliance with existing laws and regulations. The Sustainable Remediation Tool (SRT) moves beyond that by incorporating several sustainability criteria, such as carbon dioxide emissions, energy consumption, worker safety, and impacts on ecosystem service for land and/or ground water.

The SRT initiative is sponsored by AFCEE for incorporation of sustainability concepts into remediation projects. The SRT is intended to be used as a planning tool for implementing remediation technologies at new sites, as well as for evaluating and optimizing existing remediation technology systems. Specifically, the SRT allows users to estimate sustainability metrics for soil vapor extraction, excavation, enhanced bioremediation, and pump and treat. Additional technologies will be added at a later date. The tool is based on Microsoft Excel and consists of two tiers. Tier 1 calculations are based on rules of thumb commonly used in the environmental remediation industry. Tier 2 calculations are more detailed and allow the user greater control of the input and output values. The tool consists of the following sections: User Input, Design and Materials and Consumables, and Sustainability Metrics Output. In the Design and Materials and Consumables sections, users can either select default values or input site-specific values.

The output section of the tool currently displays the carbon dioxide emissions, energy use, economic cost, safety/accident risk, and change in resource service for the land and ground water for each technology. The output metrics are presented in both a "right brain" and "left brain" format to allow both intuitive and analytical evaluation by multiple stakeholders. The right brain-style metrics are in natural units specific to each metric (i.e., carbon dioxide emissions are given in tons). The left brain-style metrics are reported in units of dollars. By combining sustainability metrics with the traditional selection criteria in an easy-to-use format, the SRT allows remediation professionals to compare various technologies holistically to maximize the net environmental benefit of cleanup actions. Up to this point, remedial process optimization has been the easiest way to introduce green remediation into projects.

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

- Question: Does the tool address moving material off site to a landfill in terms of sustainability?
- Answer: Is that in the sense that we basically are moving the problem from one site to another? Tier 2 will address questions like that, but Tier 1 does not.
- Question: Has this tool been applied to any actual sites or case histories?
- Answer: Testing of this tool has been ongoing since August 2008 during remedial process optimization reviews. The first big test took place at Massachusetts Military Reservation in November, and information from this test is available. Official beta testing is scheduled for January with the goal of having the four technologies ready for public use in March 2009.
- Question: The model refers to "the value of the resource." What does that mean?
- Answer: Land use controls restrict the potential uses of land, which can decrease its value. Conversely, when industrial land can be turned to residential use, the value of the land as a resource has been increased. Also, soils that are cleaned vs. soils that are excavated and taken away can be assigned different values.
- Comment: This question of terminology suggests that definitions will need to be agreed upon across a wide spectrum of agencies to avoid communication problems when dealing with communities and environmental organizations.
- Response: AFCEE is working with the Interstate Technology and Regulatory Council (ITRC) to help with SRT testing. This testing will involve several state regulators, community stakeholders, and representatives from EPA headquarters and Regions 3 and 9. The testing process is designed to ensure that the tool is understandable, usable, and acceptable by many different parties.
- Comment: The Department of the Interior tends to be the evaluator of damages to natural resources, so it seems desirable for that agency to have some input into any determination of resource values.
- Response: Some of the ITRC team members come from Interior, but we have not dealt with the Department directly.

Sustainable Solutions for Soil and Groundwater Remediation: Helping the Earth Heal Itself
Beth Moore, U.S. Department of Energy (DOE), spoke briefly for Ralph Nichols of the Savannah River National Laboratory, who was unable to attend. The Savannah River National Laboratory (SRNL), located near Aiken, South Carolina, is DOE's Center for Sustainable Soil and Groundwater Solutions (Attachment I).

Moore recommended a paper—First, Do No Harm—by Nichols and Brian Looney, also of SRNL, for its overview of DOE's emerging awareness of the importance of sustainability in the context of dealing with the spatial and temporal variability encountered during remediation of a ground-water contaminant plume. The full text of the paper is available on line (<http://cms.ce.gatech.edu/gwri/uploads/proceedings/2007/7.4.1.pdf>).

The metrics of remediation encompass pounds of contaminants removed, cubic yards of soil excavated, and gallons of ground water treated; however, the metrics of sustainability are quite different. Sustainable goals are more a matter of vision and leadership. They are not driven by cleanup requirements but instead involve the resolution to preserve natural resources, minimize

energy use and gaseous emissions, and recycle materials. Incorporating sustainable goals into remediation will require a paradigm shift.

Comment: Given the need to comply with applicable or relevant and appropriate requirements, otherwise known as ARARs, it seems that changes to regulatory language may be needed to permit the flexibility to achieve sustainable practices in remediation.

Comment: Rather than seeking to make major regulatory shifts, Superfund's green remediation workgroup is considering how the existing regulatory structure can be interpreted to gain more flexibility. Making a larger footprint in the short term to achieve cleanup with an eye toward land revitalization and sustainable future use over the long term might be the most sensible approach at some sites.

Comment: The milieu still involves multiple decision makers—ARARs can extend down to the local level. On the issue of variable energy reduction, great strides are being made in energy storage, which means the intermittent production of wind and solar systems will become less of a limiting factor.

Comment: The McKinsey curve depicts an array of greenhouse gas abatement measures and the marginal costs of implementing those measures. DOE's Office of Energy Efficiency and Renewable Energy is developing estimates along similar lines for DOE-specific uses.

Groundwater Remediation and Alternate Energy at NASA White Sands Test Facility

Holger Fischer (NASA) reported on how the ground-water remediation program at the NASA White Sands Test Facility (WSTF) is incorporating alternative sources of energy (Attachment J). NASA's WSTF conducts simulated mission cycle duty testing to develop full-scale propulsion systems to support space missions and performs cleaning and depot-level refurbishment of flight-critical propulsion system components. Historic operations and practices in the 1960s resulted in contamination of WSTF's ground water with a variety of hazardous compounds, including N-nitrosodimethylamine, dimethylnitramine, tetrachloroethene, trichloroethene, and Freon 11, 21, and 113. The ground-water remediation program calls for capture of the contaminant plume, treatment of contaminants in the mid-plume area, and cleanup of source areas. The goal is to clean up the environment to preexisting conditions. This cleanup liability is estimated at \$350 million, and remediation will involve a staged approach over a period of 60 years.

WSTF plans to implement renewable initiatives by combining new technologies—solar power PV, geothermal heat pumps, wind-generated power, solar-powered thermal systems, hydrogen fuel cells, and hybrid systems—to arrive at the most efficient system(s). The Facility plans to pursue the following goals over the next five years:

- Develop a solar-powered PV farm for providing electrical power to WSTF and sell the surplus power to utility companies.
- Develop 3 megawatts of wind-generated power with a wind farm on top of Quartzite Mountain.
- Utilize geothermal heat pump systems for WSTF's heating and cooling to reduce utility costs.
- Provide renewable energy test beds for supporting future Orion energy requirements.

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

WSTF has studied the application of alternate energy such as wind, solar, and energy storage, to reduce the large energy costs of its remediation efforts. Monitoring of the wind energy on Quartzite Mountain since 2005 has shown that the mountain is a class 4 or class 5 wind site. To construct a wind farm and take advantage of this wind energy, an access road must be built at a cost of \$5 to 6 million. Developers are interested in constructing wind and solar power systems on the WSTF property; specifically, the El Paso Electric Company (EPEC) is interested in a future wind project. A photovoltaic (PV) system has been planned that will provide peak shaving during daylight hours. Incorporated in the roof of a parking structure, the system could be used to charge storage batteries, shade vehicles in the parking lot, and provide plug-ins for privately operated vehicles. With the installation of separate modules based on different technologies, the system also could be used as a PV test bed.

Of the approximately 640 acres of NASA-owned land at WSTF, about 400 acres could be made available for a solar-power generation plant. The plant will be built and operated by the developer, who is responsible for all financing of the design, construction, and operation phases. When the Facility released its request for responses of interest from energy developers in a two-week window of opportunity, it received 14 responses, and expressions of interest are still coming in. WSTF is about to post a Web site that contains information for vendors interested in this opportunity. Finalizing this type of project will be a slow, contract-intensive process.

Question: Who pays for the construction of the road to reach the site?

Answer: It would not be cost effective for the developer to build the road, so the facility is looking for the funding. The original idea was to gain sufficient power to serve the facility's remediation needs, but that was not enough to justify the cost of the road. The vision and potential for power generation has expanded well beyond the initial ideas.

Question: Has the energy-generation potential of the use of exercise equipment within the fitness center been considered?

Answer: It was briefly discussed quite recently.

Comment: Tying small-scale systems into the main power grid can present a complex problem. Practical implementation may involve negotiations with industry experts and lawyers.

GREEN REMEDIATION PROJECT EXPERIENCES & TOOLS (II)

NASA Jet Propulsion Laboratory Green Feasibility Evaluation

Steve Slaten (NASA) summarized the evaluation of sustainable practices associated with construction and operation of a drinking water treatment system for the City of Pasadena, California (Attachment K). This system is part of NASA's overall ground-water cleanup effort under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. Systems are already in place to treat on-site ground water at the Jet Propulsion Laboratory and the area to the east/southeast with a system in place at the Lincoln Avenue Water Company. When operational, the new Monk Hill Treatment System (MHTS) will treat the mid-plume area at the Pasadena-owned Windsor Reservoir. The MHTS is a 7,000 gallon per minute (gpm) drinking water treatment system designed to remove volatile organic compounds (VOCs) and perchlorate from ground water extracted from four production wells.

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

NASA is funding the removal of perchlorate and VOCs from the aquifer and working closely with the City of Pasadena to design and construct this new facility.

Sustainable practices include those supporting the achievement of the goals identified in Executive Order (EO) 13423: Strengthening Federal Environmental, Energy, and Transportation Management (www.whitehouse.gov/news/releases/2007/01/20070124-2.html). Specific areas evaluated for sustainable practices by NASA include energy efficiency, renewable energy, water efficiency, and construction. Incentives were used to encourage the contractor to look voluntarily for opportunities to incorporate green practices. A clause in the Prime Contract made 1 percent of the contract award amount available for incentive payments on efforts that support achievement of the goals of EO 13423. The idea is based on value engineering principles, and anyone at any level can propose a better, greener way to do something and be paid for it.

The project involved some unexpected challenges. It was necessary in some instances to "push back on the status quo," i.e., to persuade the City to set aside conventional or habitual ways of going about things (such as needlessly pumping water uphill in one area) and to consider more effective and less energy-intensive ways to design and operate the system. The tendency of the contractor to over-engineer a system also required oversight; removing a filtration system that was unlikely ever to be needed from the overall system design improved energy usage significantly. The optimization approach and close attention to detail resulted in operational savings of \$50,000 per year and reduced greenhouse gas emissions by 330,000 pounds per year, which is equivalent to the annual greenhouse gas emissions of 27 passenger vehicles.

Question: What contract mechanism is being used?

Answer: Cost-plus, performance-based contracting through Battelle.

Question: Did the city require this approach?

Answer: No, the idea was to do something better and smarter with this project. Although different sources of information and assistance were investigated, the team essentially stumbled its way through the process.

Comment: The Air Force also uses performance-based contracts (PBCs). It is a challenge in a PBC environment to incentivize green remediation/sustainability efforts for the contractors.

Comment: EPA's green remediation workgroup is developing a language package for use in remediation contracts that includes ideas on incentives. EPA will have to train its RPMs to look for and use these ideas.

Guidance on Incorporation of Sustainability into the Department of the Army Environmental Remediation Projects: Practical Aspects of Incorporation and Application

The Army defines sustainability as a strategy that "simultaneously meets current as well as future mission requirements world-wide, safeguards human health, improves quality of life, and enhances the natural environment" (Attachment L). Carol Dona pointed out that from the Army's standpoint, sustainability has to fit within the mission. In its guidance, the Army will try not only to provide standard operating procedures, but also a procedure by which people can document that sustainability has been considered. The strategy is to use or modify structures already familiar to personnel.

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

When a contract has already been negotiated based on outcome and cost, how can sustainability be phased in? And if it is possible, how is it measured? Discussions will have to be held at higher levels to determine whether performance-based contracting is compatible with incorporating sustainability. Another consideration is whether appropriate resources—staff, funds, procedures, and experience with the procedures—are available to make incorporating sustainability feasible in terms of people, budget, schedule, and training. If the resources are in place, the question remains of how to go about it. Where no existing evaluation structure is available, it may be feasible to use a modified environmental management system (EMS) matrix.

Dona reviewed the core element of the guidance, a decision flow-chart for incorporating sustainability into Army environmental cleanup projects throughout the remediation process. The decision flow chart outlines (1) the selection, use, and limitations of contractual mechanisms for incorporating sustainability within the planning process; (2) the modification and use of the EMS scoring system for evaluating sustainability within options and evaluating sustainability with respect to other remedial aspects; (3) and the options of incorporating sustainability into existing remedial criteria (e.g., CERCLA nine criteria, remedial system optimization criteria) or using it as a tenth criterion.

The tools for incorporating sustainability are still in development. The guidance will discuss tools but not develop them. A variety of structures already familiar to Army personnel will be evaluated to assess their suitability as platforms for incorporation of sustainability practices: total project planning (performance-based management), Triad-based investigations, the Remedial Action Cost Engineering and Requirements System (RACER), value engineering studies, remedial process optimization studies, and five-year reviews. Completion of the draft guidance is expected in January 2009. The document then will undergo internal peer and headquarters review with the aim of finalizing it by the end of 2009.

Green and Sustainable Remediation: How ITRC Reduces Regulatory Barriers to the Use of Innovative Environmental Approaches

Anne Willett (ITRC) emphasized that ITRC is the only organization where state regulators, federal regulators, agency representatives, industry, environmental professionals, and educators get together to develop guidance and provide training on innovative environmental technologies (Attachment M). ITRC products, which are used across the United States, are available at no charge through its Web site (www.itrcweb.org/). A program of the Environmental Council of the States (ECOS), ITRC is a public/private coalition working to eliminate barriers to the use of innovative environmental technologies and approaches, so that compliance costs are reduced and cleanup efficacy is maximized. Its development and production of documents and training broaden and deepen technical knowledge and expedite quality regulatory decision making, while helping to protect human health and the environment. With approximately 535 private- and public-sector members from all 50 states and the District of Columbia, ITRC provides a national perspective. The organization achieves its mission through its technical teams, which are composed of representatives from state and federal government, industry, and academia.

In 2009, ITRC is launching a Green and Sustainable Remediation (GSR) Team to focus on educating state environmental regulators and other environmental professionals on how to incorporate sustainability and green technologies appropriately into the cleanup process. Many

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

state environmental agencies are beginning to assess and apply green and sustainable remediation in their regulatory programs; however, there is no nation-wide, practical decision framework on how best to incorporate sustainability and green remediation into a regulated cleanup process. Over a period of three years, ITRC's GSR Team will produce an overview document (year one), a technical /regulatory guidance document (year two), and Internet-based and possibly classroom training (year three) that will provide a consistent approach across the country. This project is aimed at answering the following questions:

- What metrics for assessing sustainability are most useful and have the greatest impact?
- What is a consistent and appropriate way of interpreting the metrics?
- How can we minimize the overall risk to human health and the environment by applying sound GSR practices?
- How can we reduce energy consumption or use alternative sources of energy that will be less harmful to overall environment?
- How do we promote the use and development of GSR technologies?

The guidance and training that ITRC produces can accelerate the proper and practical use of green and sustainable remediation on a national scale, greatly reducing costs and energy input during all phases of the cleanup process.

Question: Who from EPA is on the GSR team?

Answer: To begin with, Carlos Pachon, Ann Marie Hoffman, and possibly staff from the Regions.

Comment: Those who would like to offer funding to support the ITRC Green Remediation Team can contribute by contacting Kirby Biggs, the EPA project officer for the ECOS cooperative agreement with ITRC.

DISCUSSION OF GREEN REMEDIATION ISSUES OF COMMON INTEREST

Carlos Pachon noted that the meeting presentations had indicated several areas of opportunity for FRTR collaboration on green remediation issues. The goal of the discussion session is to identify what the members want to do, what can be realistically achieved, what the FRTR can do more effectively than other groups working on green remediation, the areas in which FRTR should move forward, and the resources to commit to it.

Members submitted the following suggestions:

1. Collect cost and performance case studies about application of green remediation practices.
2. Update the FRTR remediation technology screening matrix and incorporate sustainability.
3. Discuss the incorporation of green remediation and sustainability practices in contract vehicles.
4. Examine barriers to incorporation of green remediation and sustainable practices and forward the conclusions to policy makers.
5. Evaluate the potential of technical impracticability (TI) to serve as a mechanism to promote discussion and acceptance of sustainability.

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

6. Develop a standard process for evaluating tools in this area in addition to guidance on what tools are available and how they can be used.
7. Identify platforms for incorporating sustainability, such as RACER, Triad, and technical project planning.
8. Engage European environmental interests, such as CL:AIRE and NICOLE, to develop a global perspective.
9. Develop common definitions and metrics to promote effective communication and understanding.
10. Establish a green remediation/sustainability subgroup to address these issues.

A general agreement was reached among the member agencies present regarding the need for a green remediation subgroup, which initially will consist of the following volunteers:

U.S. Navy	Chuck Reeter
NASA	Mark Schoppet
U.S. DOE	To be determined
U.S. EPA	Carlos Pachon
USACE	Carol Dona
U.S. Air Force	Erica Becvar (tentative)

This group will meet, define its purpose, articulate activities it can focus on, and report back to the Roundtable by the end of March. The subgroup's progress report will be part of the business update at the Spring 2009 FRTR meeting.

MEETING WRAP-UP/NEXT MEETING AGENDA

Jeff Heimerman recognized Carolyn Perroni (Environmental Management Support, Inc.) for her stalwart support of the FRTR from its earliest days. Perroni, who retires at the end of December, has facilitated every FRTR meeting since the organization's inception.

Balloting for the next FRTR meeting topic indicated green remediation/optimization and data management/decision support systems as the topics of greatest interest to member agencies. A half day will be given to each topic at the Spring 2009 FRTR meeting. The Navy will be the lead agency in developing the agenda and coordinating the meeting with John Kingscott and Marti Otto.

Heimerman thanked everyone for attending, and the meeting was adjourned.

ATTACHMENTS

- A. Green Remediation: EPA Progress/Updates
- B. Green Remediation within the U.S. Air Force
- C. Integrating Green and Sustainable Practices with Navy Restoration Projects
- D. Incorporation of Sustainability into Environmental Remediation – Army Efforts
- E. U.S. Department of Energy's Federal Energy Management Program (FEMP)
- F. Sustainability Is Integrated into NASA Remediation

Federal Remediation Technologies Roundtable Meeting, Arlington, VA, December 11, 2008

- G. Green Remediation: Maximizing the Benefit of Site Cleanups
- H. UPDATE: Building Sustainability into the Air Force Remediation Process
- I. Sustainable Solutions for Soil and Groundwater Remediation: Helping the Earth Heal Itself
- J. Groundwater Remediation and Alternate Energy at NASA White Sands Test Facility
- K. NASA Jet Propulsion Laboratory Green Feasibility Evaluation
- L. Guidance on Incorporation of Sustainability into the Department of the Army
Environmental Remediation Projects: Practical Aspects of Incorporation and Application
- M. Green and Sustainable Remediation: How ITRC Reduces Regulatory Barriers to the Use of Innovative Environmental Approaches