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U.S. Department of Energy, Office of Integration and Disposition

TIE QUARTERLY

Technical Information Exchange: "Sharing Experience, Expertise, and Lessons Learned."

DOE Welcomes TIE to Augusta

Mary McCune, U.S. Department of Energy (DOE), Office of Integration and Disposition (EM 20) and lead for the Technical Information Exchange (TIE) Workshop, welcomed all those present at the Twelfth TIE Workshop. She specifically thanked the Savannah River Operations Office for hosting the Workshop, and the speakers, session chairs, and staff who worked very hard to make the workshop possible.

Mary expressed her satisfaction with the new expanded vision for TIE, which she introduced last year. TIE will continue to share lessons learned, experience, and expertise in all business areas of Environmental Management (EM).

Charles Hansen, Office Deputy Manager at Savannah River Operations Office

Mary is also responsible for DOE's Lessons Learned Program. Lessons Learned and TIE are intended to unite peers from across the DOE complex that are facing similar challenges, so all can benefit from other's successes and failures.

As a reminder, Mary asked participants to provide their feedback on the workshop by completing the survey included in the registration handout package. In particular, she requested input on tangible benefits resulting from the exchange of information. This type of input is essential in order to receive continued DOE support for TIE. She also asked participants to provide evidence of their lessons learned to TIE staff, or by stopping in at the Lessons Learned booth, before leaving Augusta or soon after their return home.

Charles Hansen, Savannah River Operations Office, also welcomed participants to this year's TIE Work-

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TIE Continues its Trail to Albuquerque!

The Technical Information Exchange (TIE) Workshop has literally been "around the block" once, visiting sites and laboratories in the DOE complex. Last year the workshop returned to Augusta, Georgia and the Savannah River Site to begin "round two." Judging from the feedback, it was a huge success - and is chronicled for you in this TIE Quarterly.

While "knee deep" in planning for the Savannah River workshop, Sandia National Laboratories expressed their interest in hosting the 2001 TIE Workshop. Why not! You see, Sandia hosted the second workshop in April 1992. Unquestionably, this was an easy decision to make - and we welcome Sandia and Albuquerque, New Mexico to host the 13th TIE Workshop, scheduled for November 13-15.

A "Call for Papers" for the upcoming workshop is included in this TIE Quarterly. The topics have been selected by TIE

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From the Desk of Patty Bubar!

This fall I attended a TIE Workshop for the first time and I must say - I was very impressed! I now have a better understanding of why the workshop has enjoyed consistent success over the years and why it continues to receive "excellent marks." The workshop was well attended and session topics were both timely and diversified, addressing a wide range of site related cleanup and decommissioning activities and a number of difficult complex-wide problems. I was also impressed by the number of formal meetings and numerous informal discussions that took place before, during, and after the workshop, taking full advantage of the opportunity for peers from across the complex share their thoughts and get to know one another firsthand. Taken together, TIE truly is a forum for sharing experience, expertise, and "lessons learned."

Attending the workshop also provided me with renewed and valuable insight into problems facing project staff in the field. In addition, I received several suggestions for contributions Headquarters can make to help resolve these problems.

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Field Area Technology Representatives (FATR), after carefully considering survey results and suggestions from the last workshop. The FATR team is made up of individuals representing DOE sites who volunteer their time and resources to both plan the TIE Workshop and contribute to the TIE Quarterly. They play an integral and important role in the development program and the success of TIE.

And, guess what!! Lawrence Livermore National Laboratories, host for the 3rd TIE Workshop, is laying the groundwork for hosting the 2002 workshop! Let's welcome their offer and look toward the future. "Round two" is definitely off to a good start!

The Sheraton Augusta offered an informal atmosphere during the TIE 2000 Workshop

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In an effort to maintain this type of dialogue, I have tasked the Technical Program Integration team (EM-22) to formalize communication mechanisms, that capture issues requiring Headquarters attention and assistance. This, I believe, will help Headquarters focus more resources on the right issues.

Finally, one cannot help but observe the spirited discussions that re-establish lines of communications between colleagues and engender new and exciting professional relationships. This is what I see as the ultimate success of the workshops - if we can walk away having established new relationships with colleagues that help us to be more successful, what more can we ask for?

I look forward to the 2001 Workshop in Albuquerque, New Mexico, and the continuing TIE tradition of opening new doors and improving communication between the field, Headquarters, and those actually performing the work. If we do just that, it will be a success. Hope to see you in Albuquerque!

Patty Bubar
Associate Deputy Assistant Secretary
Office of Integration and Disposition, EM-20

Inside the TIE Quarterly

Session I - Tanks Panel Session

Session Introduction

Tom Gutmann, Session Chair, introduced his session by briefly discussing some of the immense problems DOE faces with tank wastes. These wastes are a huge problem, as there are hundreds of thousands of tanks located at DOE sites. For high-level sites, there are 282 tanks containing more than 790 curies that have to be addressed. A very concerted effort will be required to address these problems.

Evaluation of a Foster Wheeler Environmental Corporation Stabilization Process to Enhance Treated Radioactive Sludge Leach Resistance

Roger Spence discussed the application of a Foster Wheeler Environmental Corporation (FWENC) stabilization process on surrogate and actual sludge samples, designed to enhance radioactive sludge leach resistance characteristics. Sludge samples from two ORNL storage tanks farms (W23 and MVST), along with two sludge surrogates, were treated using the FWENC stabilization process. The approach allows waste consolidation by removing free water and immobilization of RCRA contaminants using additives. The tests were conducted to evaluate the process for immobilizing Oak Ridge tank wastes in the Melton Valley Storage Tanks. This evaluation included both immediate and longer-term leach testing to ensure treated tank waste forms retain hazardous metals and meet RCRA Toxicity Characteristics Leaching Procedure (TCLP) limits.

Results presented were collected for DOE as independent assurance of the FWENC process viability for compliance with Waste Acceptance Criteria and storage needs prior to shipping of final waste forms. Data from water accumulation affinity and TCLP performance tests for both stabilized surrogates and actual sludges were presented. Stabilized wastes were also subjected to freeze/thaw thermal cycling, long-term storage under conditions simulating East Tennessee's ambient weather, and radiation durability testing. These latter tests were designed to determine sustainability of TCLP performance and free water accumulation, which are important considerations for transport and storage of final waste forms.

Spence concluded the presentation by stating the FWENC process stabilized both surrogate sludges, but failed to stabilize the rinse from the more representative surrogate. The FWENC process stabilized W23 tank sludge to RCRA standards, but failed to stabilize mercury in the MVST tank sludge. The process did not meet underground storage tanks (UST) limits for either surrogates or actual tank wastes.

For more information, contact Roger Spence, Oak Ridge National Laboratory at (865)574-6782 or spencer@ornl.gov.

Good friends or new friends - TIE gives participants every opportunity to share their stories

In Situ Plasma Remediation of Underground Storage Tanks

Louis Cicero discussed to potential for using plasma arc technology for in situ remediation of USTs. According to Circeo, plasma technology can make a real contribution for in situ cleanup and closure of USTs. Plasma arc technology is an emerging technology which uses high power levels of electricity (100 kW to 10 MW) to create plasma, a form of artificial lightning, with temperatures exceeding 7000 degrees Celsius. The development of a stable, efficient, and cost-effective heating source over three times hotter than conventional fossil fuels has opened the door to a wide-range of thermal remediation applications previously not possible.

Cicero stated that the very high temperatures and energy densities associated with plasma technology have fully demonstrated its potential to remediate many waste materials in an environmentally safe and cost-effective manner. Materials vitrified with plasma arc torches have readily passed all standard leach-

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ing tests. Plasma arc technology is ideally suited for waste treatment, as hazardous and toxic compounds are broken down to elemental constituents, while organic materials are either pyrolized or volatilized, they may be converted to fuel gases and they are amenable to conventional off-gas treatment. Residual materials containing heavy metals are immobilized in a rock-like vitrified mass.

In situ plasma remediation of underground storage tanks could be conducted as follows: using a plasma torch, the interior of a storage tank and its contents could be brought up to essentially any temperature short of melting/collapsing the tank. Thus, a plasma torch could be operated inside a UST until required temperatures and residence times are achieved to remediate the specific contaminants resident in the tank The contaminants in the UST would either volatilize or vitrify. If solid contaminants are present in the UST to a considerable depth, the plasma torch could be operated in a grid of prepared boreholes within the contaminated material in order to remediate the contaminants through the in situ plasma vitrification process. A standard offgas treatment system would collect and treat the gaseous effluent from the underground storage tank.

Circeo concluding by stating that plasma technology has much potential for the in situ remediation of USTs, and could yield fundamental improvements in effective treatment, reduced cleanup time, reduced costs, and improved worker safety. Circeo felt that plasma technology is a simple and straightforward process that should be evaluated further.

Several of the questions following Circeo's presentation concerned safety issues involved with remediating USTs. Gutmann, concluded that although plasma technology is an interesting potential application for some tanks, it is probably not appropriate for remediating high level waste tanks.

For more information, contact Louis Circeo, Georgia Institute of Technology, at (404)894-2070 or lou.circeo@gtri.gatech.edu.

In-Line Monitoring of Slurry Transport Properties

The Department of Energy has millions of gallons of radioactive sludge and supernatant wastes stored in underground storage tanks. These wastes need to be retrieved, transferred to treatment facilities, and processed to a final and stable waste form. Sludges are typically suspended into the supernatants by some mechanical method, such as single-point sluicing or using an in-tank mixer pump, to create slurries that can be transferred through pipelines.

Because the slurries are radioactive, it is critical that they are transferred without plugging the pipeline. The risk of plugging can be reduced by determining the transport properties prior to beginning a transfer and continuously monitoring those properties during the transfer. Properties that may need to be monitored include density, suspended solids concentration, particle size distribution, and viscosity. The baseline technology for monitoring these properties is sampling and analysis, which is time-consuming, exposes the sampling and analytical personnel to radiation, and raises questions concerning the representativeness of the samples. In-line monitoring, the alternative technology, analyzes the slurry as it flows through the pipeline. The results are available in seconds and the pipeline can be monitored remotely and continuously.

Tom Hylton discussed in-line monitoring testing conducted at the Gunite and Associated Tanks (GAAT) Remediation Project at Oak Ridge National Laboratory (ORNL). The project objective was to test, demonstrate, and evaluate various types of slurry monitoring instrumentation to determine the most accurate and reliable instruments. Testing was conducted on both nonradioactive and radioactive slurries. Twelve instruments were evaluated (nine in a pipeline, three in a mixing tank), and included both prototype and commercially-available instruments.

An Endress + Hauser Promass 63M Coriolis meter was used to continuously monitor the density of the slurries and also to indirectly determine the suspended solids concentration. A Lasentec M600P instrument, which operates on the principle of a focused beam reflectance measurement, was used for monitoring the particle size distribution.

Hylton summarized the testing performed and the results. The Endress + Hauser Promass 63M Coriolis meter and the Lasentec M600P performed well and were officially deployed by GAAT. A prototype ultrasonic instrument was found to be sensitive to entrained air in the slurries. The Dual Coriolis Meter System was devised to simultaneously measure the density of the slurry and the carrier fluid, and was tested at the Wastewater Triad Project (WTP) at ORNL. Results showed the dual Coriolis meter setup was able to measure the concentration of suspended solids in real time, although the concentration measured by the meter was slightly higher than that measured by the laboratory. This project yielded three different technical reports.

For more information, contact Tom Hylton, Oak Ridge National Laboratory, at (865)576-2225 or hyltontd@ornl.gov.

Alternative HEPA Filter Media

Alternative filtration media are needed for high-level wastes, because existing High Efficiency Particulate (HEPA) filters have major problems - including operating at elevated temperatures and susceptibility to fires, low filter strength due to wetting, air leakage, and reduced performance with aging.

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The ideal high-level waste (HLW) HEPA filter is a low cost unit that can be cleaned in situ with high efficiency. It improves the safety of the operation, consists of structurally strong media (i.e. resistant to flushing), and may be returned to an operational mode immediately after a cleaning cycle. The ideal filter has a long life (preferably 15+ years) and generates no secondary waste stream during the cleaning process.

Duane Adamson discussed alternative HEPA filtration media for HLW applications. Sintered metal and ceramic monolith filters were tested as in situ, regenerable HEPA filters for HLW tank applications. The filters were subjected to a hostile environment to simulate conditions that challenge HLW tank ventilation systems. Studies found both filter media were insensitive to high humidity or moisture conditions. The filters regenerated to approximately clean filter status, even after numerous particulate loading and in situ cleaning cycles. Both filters have passed the DOP efficiency test with a 99.97% or greater retention efficiency.

The Defense Nuclear Facility Safety Board Technical Report entitled, "HEPA filters Used in the Department of Energy's Hazardous Facilities" found that conventional glass fiber HEPA filters are structurally weak and easily damaged. This innovative approach of the alternative HEPA filter media may be a significant improvement upon the shortfalls of conventional disposable HEPA filters.

Duane Adamson, Westinghouse Savannah River Company, discusses alternative HEPA filtration media for HLW applications

Specifications for both sintered metal and ceramic filters were presented, including filter dimensions, thicknesses, and surface area. The HEPA test apparatus was discussed, and an overview of the testing process was presented. Test conditions included simulated HLW salt, simulated HLW sludge, and South Carolina road dust (dry). The filters were cleaned in situ after 20% decrease in flow with dilute nitric acid, and rinsed with water. The filters were plugged and cleaned in situ many times, and returned to essentially a clean filter status after each cycle. The filters continued to operate safely, and performed well in high humidity environments. The biggest problem was soluble cesium; sludge was the hardest material to remove from the filters.

Filter efficiency is a very important parameter, and filters used for HLW must have a greater than 99.97% efficiency. The filter efficiency was tested at ATI in Baltimore, Maryland, and the sintered metal filter tested at 99.9995 efficiency, while the ceramic filter tested at 99.995 efficiency. Although these alternative filters have smaller surface areas than conventional HEPA filters, they show great potential for waste tank applications.

Full scale testing of the filter elements was the conducted at the Oak Ridge FTF. A full-scale cold demonstration was conducted at Savannah River Site, and a full scale hot demonstration was conducted on the HLW Tank.

In summary, these alternative filters show significant advantages over conventional HEPA filters. They minimize the risk of catastrophic failures, which can be extremely costly. They also reduce waste disposal costs, are fire and temperature resistant, can be rapidly regenerated if they become plugged, are not damaged by water, and allow analysis of the particulate waste streams.

Future challenges for this technology include gaining acceptance for the filters, and meeting regulatory issues. Currently, the ceramic filter is the only approved filter by regulators. Adamson is working with ASME to obtain approval for the sintered metal filters.

For more information, contact Duane Adamson, Westinghouse Savannah River Company, at (803)725-5307 or duane.adamson@srs.gov.

Savannah River Site Developed Remote Tank Technologies and Tools

Steven Tibrea presented an overview of the Savannah River Site-Developed Remote Tank Technologies and Tools. The Savannah River Technology Center (SRTC) provides operational support of various Savannah River Site processes. A number of special devices have been developed and fielded to aid in the operation, inspection, characterization, and closure of radioactive containing waste tanks and process transfer lines.

Tibrea's presentation provided an excellent overview of the devices developed or being built by SRTC to support waste tank operations. These technologies and tools included visual inspection systems, special tools, samplers, and crawlers. They are used to assist in closure of waste tanks and transfer pipe lines.

Visual inspection systems typically include camera technologies incorporated into a variety of gizmos. Special tools are developed with primary development objectives of minimum cost and rapid deployment time. These tools are often job-specific and in response to obstructions and/or debris in tanks and pipes containing high level waste. A wide variety of samplers were discussed, varying from dry to wet sampling applications. SRTC has developed samplers for everything from solids to sludges to liquids to floating organisms. They are often developed for very challenging environments, yet have

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to be compatible for the sample requirements of the various analytical laboratories.

Finally, Tibrea discussed Crawlers. There are two primary types of crawlers; annulus inspection crawlers and hydro laser crawlers. Annulus inspection crawlers are designed to allow entrance into the 8" annulus of high level waste tanks. Hydro laser crawlers use water blasting to move or loosen material in the bottom of tanks.

Gutmann ended the presentation by briefly discussing aspects of the Savannah River Technology Center, and the support they provide throughout the DOE complex.

For more information, contact Steven Tibrea, Westinghouse Savannah River Company, at (803)725-3210 or steven.tibrea@srs.gov.

Raman Spectroscopy Determination of Corrosion Species in High-Level Wastes

David Hobbs discussed using Raman Spectroscopy to measure corrosion species of high-level waste (HLW) tanks. SRS has 49 active tanks containing high-level wastes in which corrosion must be monitored. There are two predominant type of corrosion in these carbon steel tanks; stress corrosion and pitting corrosion. Corrosion is limited by controlling the liquid phase chemistry of key in-tank species, including nitrate, nitrite, and hydroxide.

Current practices to characterize the corrosion species involve collecting liquid-phase samples from the tank contents, transporting the samples to an analytical laboratory, and performing two different analytical methods to determine the concentrations of the key corrosion species. This practice is expensive, time-consuming, and results in radiation exposure to personnel.

The Raman spectroscopic method utilizes fiber optics to apply monochromatic light to the high-level wastes, and allows remote sensing of the waste's properties, with better detection levels. Hobbs presented results from an evaluation of this Raman spectroscopic method for the in-tank determination of nitrate, nitrite, and hydroxide. The method, which is being developed in combination with an electrochemical noise technique for use in HLW tank, was tested on radioactive samples from the two SRS tank farms.

Hobbs described the Raman spectroscopic method in detail and presented testing results. Testing was conducted on decontaminated supernatant liquid from tank wastes and on filtered and unfiltered samples of actual tank wastes.

Testing demonstrated the system is feasible for measuring key corrosion species in radioactive wastes but, due to the sensitivity of the method to entrained solids, it was found the samples had to be filtered to ensure accurate results. The testing showed no radiation damage to the fiber optic elements, the probe, or the system. Test results showed excellent agreement between the Raman spectroscopy results and samples analyzed using standard analytical methods. Results were not so good for remote applications. Ongoing project activities include improved calibration and data analysis, and in-tank probe development. Filters are also being evaluating to reduce fouling and reduce pressure drop.

For more information, contact David Hobbs, Westinghouse Savannah River Company, at (803)725-4704 or david.hobbs@srs.gov.

GIS Forms User Groups

As a follow-on to the Geographical Information Systems (GIS) technical session held at the workshop, several GIS professionals from various Department of Energy (DOE) sites held a day-long meeting on November 16th. The purpose was to discuss the following topics:

- information of an ad hoc DOE GIS User's group,
- GIS programs at the various DOE sites,
- Long-Term Stewardship and how GIS will play a role in this critical program,
- technical issues regarding ArcInfo-8 deployment,
- use of SDE software,
- internet technologies, and
- metadata.

It was a very fruitful meeting. Ground work was laid for the ad hoc DOE GIS User's group. Denise Bleakly, Sandia National Laboratories (SNL), and Jim Bollinger, Savannah River Site (SRS), agreed to be group coordinators, and have developed an e-mail contact list. They will be sending an e-mail news letter to group members in late February. This ad hoc group would like to meet in conjunction with the next TIE Workshop, as a follow-on to the anticipated GIS technical session.

Long Term Stewardship was discussed. Randy Lee, Idaho National Engineering and Environmental Laboratory (INEEL), and Denise Bleakly outlined proposals for using GIS for Long- Term Stewardship, and gave an overview of proposed Fiscal Year 2001 activities.

The meeting continued with discussions about each DOE site's GIS efforts. SNL, INEEL, SRS, Argonne National Laboratory, Remote Sensing Lab, Nevada Test Site, and DOE Headquarters were represented. Each site has a GIS system set up and in use, but each site has taken a slightly different approach on how to deploy GIS to end users. We learned from each other the “pros” and “cons” of each GIS deployment method.

Participants also learned of each other's trials and tribulations with the latest upgrades of the GIS software we use – ESRI's ArcInfo™. Each site is approaching upgrades differently, based on their site's GIS configuration and customer base. This was a great opportunity to share “what works” and “what doesn't” information. Everyone agreed it was very important to keep in touch with one another as we learn to navigate the new software.

The relationships built and the lessons learned from this day long meeting certainly helped Bleakly when she returned to her site – Sandia. She also looks forward to a continued dialog with her counterparts at other sites across the DOE complex.

For more information, contact Denise Bleakly, SNL at (505)284-2535 or drbleak@sandia.gov.

Session II - Using Risk for Remedial Decisions Panel Session

Jerry Nelsen, DOE Savannah River, welcomed the audience to this session and reminded the group of the purpose for TIE - it is a venue for sharing ideas and experiences associated with environmental restoration and waste management work. "Risk" is a term of the time and can be a tool for managing decision making. Hence, the interest in arranging this session. Nelsen also welcomed a delegation from Argentina who were attending TIE. To facilitate their understanding of the papers in this session, the conference arranged for simultaneous translation into Spanish.

Human Health Risks of Heat Stress Encountered During Remediation Activities

During 1984 - 1996, 56 OSHA reports of heat stroke were filed. These incidents resulted in 54 fatalities. Heat stress can develop into heat stroke and during remediation activities, particularly activities requiring personal protective equipment (PPE) featuring a water vapor barrier, heat stress is an ever present danger. This presentation discussed the precautions taken to prevent and monitor heat stress during remediation of a classified waste site at Sandia National Laboratories (SNL) in Albuquerque, New Mexico. First, workers were trained to recognize the signs of heat stress (i.e., cramps, exhaustion), reviewed the process for determining work/rest schedules, and encouraged to be an active participant in protecting their health. Implementation of Integrated Safety Management required that there be a daily health and safety briefing - where workers could candidly discuss their job assignments and provide information to reduce job risks. This was found to be extremely important.

Body core temperature was monitored and medical examinations were used to develop the workers' schedule; if preliminary signs of heat stress were noted (e.g., weight loss), the work level was reduced and rest level increased. Measures taken to reduce the potential for heat stress included: the use of evaporative coolers; use of light cotton clothing; use of a personal ice cooling system (PICS); and temporary structures that could provide cooled space without direct sun exposure. Workers preferred PPE that permitted them maximum mobility and a PICS was most appreciated by sedentary workers. SNL found that water must be readily available and workers encouraged to rest and drink water whenever they felt it necessary. Worker empowerment was the key to successfully reducing heat stress.

For more information, please contact Wayne McKenna, Sandia National Laboratories, at (505)284-4145 or wsmcken@sandia.gov.

Successful Risk-Based Decision Making at Fort Campbell-A Model for Success

While it is generally accepted that cost-effective remedial actions can be achieved through objective, risk-based decision making processes, it is often thought that placing such a methodology in place is too time consuming and expensive to achieve in practice. AIMTech has shown that technically defensible and regulatorily compliant risk-based decision making can be achieved economically and can offer a practical solution for facility-scale remediation projects. AIMTech utilized ASTM's RBCA-Style methodology to evaluate remedial actions at Fort Campbell, a DoD facility.

A multidisciplinary team from AIMTech, Oak Ridge National Laboratory (ORNL), and the University of Tennessee developed a risk assessment strategy (RAS) that incorporated the views of all regulators and stakeholders and the latest risk information available from the Risk Assessment Information System developed by ORNL. The initial investment of time and money required to arrive at an acceptable RAS was extensive but, once accepted by all stakeholders, the screening of solid waste management units across the site proceeded smoothly. RAS eliminated many redundancies, reduced the need for site-specific regulatory negotiations, provided consis-

Tess Rottario, AIMTech, speaks of solutions for facility-scale remediation projects while the interpreter for TIE's Argentines guest delivers her message

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tent technical quality, decreased the turn around time for document preparation, and expedited decision-making using previously agreed upon action levels.

Money saved through the implementation of the risk-based decision making system and the elimination of redundancies actually permitted the funding of special toxicity studies to close a data gap that emerged during the risk evaluation! RAS produced an administrative record of the risk evaluation process, a transferable strategy to other facilities within the regulatory region, and was easily integrated within facility operations. Currently RAS is available on CD; in the future it will be "on-line" for easiest access by users.

For more information, contact Dennis Miller, AIMTech, Lockheed Martin Energy Systems, Inc., at (865) 241-9590 or 42d@y12.doe.gov.

Evaluation of Foodweb Modeling at INEEL

The Idaho National Engineering and Environmental Laboratory (INEEL) occupies ~890 square miles above a large aquifer. It is a cool desert ecosystem characterized by shrub-steppe vegetative communities. Since 1957, the central portion of INEEL has been maintained as a grazing exclusion area. Ungrazed sagebrush steppe is an endangered ecosystem and in 1975 DOE established INEEL as a National Environmental Research Park. It is the second largest of seven such parks and is one of two containing sagebrush-steppe ecosystems.

Foodweb modeling was conducted at INEEL to support the site-wide ecological assessment. Default values for environmental contaminants are available from standard literature sources but site specific information is preferable. In 1997 environmental samples (e.g., sagebrush, deer mice, grasshoppers, cottontails, crested wheatgrass, and beetles) were collected on- and off-site and subjected to laboratory analysis to establish a baseline for local conditions. Inadequate detection limits for elements in soil resulted in some difficulty in evaluating uptake factors. In 2000, archived soils samples were analyzed for a set of specific elements using analytical methods with appropriate detection limits. A preliminary evaluation of the data permitted the following tentative conclusions:

- Predicted transfer (literature values) of contaminants from soil to vegetation using default parameters was generally over conservative.
- Predicted transfer (literature values) from soil to tissue was generally under conservative.

The lessons learned from this study were that site specific information is important to adequately evaluate risk to ecological receptors, and that transfer factors can be strongly species dependent. Additionally, whereas the measurement of contamination in vegetation is normally most useful for ecological risk estimation, this year, when fires were common at DOE sites in the West, such measurements provided useful data for evaluating inhalation pathways from burning sagebrush for both animals and humans.

For more information, contact Robin Lee VanHorn, INEEL, at (208)526-8531 or wolfie@srv.net.

Extemporaneous remarks by Argentinian delegation:

Since a scheduled paper was withdrawn and time was available, the visitors from Argentina were asked to describe some of their environmental remediation/waste management problems. They began by stating that since Argentina has only two nuclear reactors, one in Buenos Aires and the other, a CANDU reactor, in the Cordova province, their nuclear waste problem was small compared with ours. Argentina is working with DOE on several projects and has to be concerned with nuclear reactor D&D in the future. They have some environmental problems related to uranium mining that will require remediation. Currently they utilize resins to purify water before releasing it into the environment and need techniques for treating spent resins.

Evaluating the Behavior of Chlorinated Hydrocarbon Plumes in Ground Water Using Plume Population Studies

This study attempts to mine information from subsurface contamination data regularly collected in characterization and remediation efforts, to better understand how chlorinated hydrocarbons behave in the subsurface. Such information would be very useful for the selection of remediation methods (e.g., natural attenuation, bioremediation, dynamic underground stripping, etc.) and to compare the results of natural attenuation against active remediation, such as "pump and treat."

In the first phase of this work, completed last year, 65 sites around the country with differing hydrogeologies were investigated. Plume length (with the edges determined by contaminant concentration) were compared with mean ground water velocity and maximum concentration. Sites were classified according to the probability of reductive dehalogenation, based on the presence or absence of dehalogenation reaction products (e.g., cis-1,2-DCE, vinyl chloride) and geochemical indicators (xylenes, alkalinity, manganese). The second phase of the study is focusing on information obtainable from individual wells at a site. Trichloroethylene (TCE) measurements taken from 533 wells at 41 sites over a four to twelve year period have been analyzed. In 50% of the cases, no trend is discernible and in 36% of the cases the concentration has declined whereas, in 14% of the cases, the concentration has increased. Differences in the tendencies for declining concentrations versus increasing concentrations were noted for compounds thought to be most susceptible to degradation processes. Principal compo-

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nent analysis has been applied to contaminant data sets in order to date plumes and a linear relationship between the first principal component and plume age has been observed.

The authors hope to develop a set of data access tools to query VOC databases and make those available to off-site users. The tools will be available for beta-testing on a CD ROM in early 2001; they will eventually be available on the web.

For more information, contact Walt W. McNab, Lawrence Livermore National Laboratory, at (925)422-0061 or mcnab1@llnl.gov.

Successful Risk-Based Alternative Studies for the High-Level Waste and Facility Disposition EIS at INEEL

Whenever waste management or environmental remediation actions are taken at a site that is isolated from the public, the total "risk" from site hazards may temporarily increase due to facility accidents, transportation accidents, and increased worker and public exposure to radioactive and chemically hazardous materials. The quantitative representation of these risks over the life cycle of proposed alternatives under NEPA is referred to as "implementation risk."

This presentation discussed an application of implementation risk methods during a NEPA process to the evaluation of treatment alternatives to immobilize liquid waste and solid high-level waste (HLW) stored at INEEL and render it "road ready" for transport to a National geologic repository. Risk based alternative studies using implementation risk assessment (IRA) were used intermittently throughout the preliminary draft, draft, and final EIS processes to screen potential alternatives, validate and support decision making processes, help identify an environmentally preferred alternative, and provide a mechanism to address concerns on the part of NEPA stakeholders.

IRA considered additional health risks to the public and involved workers that could result from facility accidents, transportation activities, air emissions, and ground water releases. It evaluated implementation risks over the life cycle for which the alternatives were implemented - 35 years for "action" alternatives that fully addressed immobilization and removal of wastes, 10,000 years for alternatives such as "no-action" that did not address the immobilization of wastes. Ecological risks were not explicitly considered, since alternatives posing higher health risks could also be assumed to pose a higher potential for ecological damage. IRA supported the DOE selection for the preferred alternative (Direct Vitrification) as also being an environmentally preferable alternative. The implementation risk from all "action" alternatives was dominated by worker risk.

For more information, contact Alfred Unione, Enercon Services, Inc., at (208)528-2831 or aunione@earthlink.net.

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shop. He congratulated sponsors for expanding the scope, and thanked all those who worked hard to facilitate the workshop. Hanson stressed the importance of TIE and how beneficial it is to improving EM performance. The TIE and EM Lessons Learned programs are key contributors to DOE's deployment of innovative approaches for achieving cost and schedule efficiencies. He also stated that the Savannah River Site (SRS) is one of the leaders across the DOE Complex in the deployment of innovative approaches.

Patty Bubar, Associate Deputy Assistant Secretary, EM-20, announced during her opening address that the Office of Integration and Disposition is the new home for the TIE Program. She reminded participants that the very first workshop was hosted by SRS, in Augusta, and took place during November of 1991. Each workshop continues to be hosted by a DOE site, with the focus on DOE and contractor field personnel – those actually doing the work. Historically TIE has been a forum for presenting results from the field, sharing insights about "what works" and "what doesn't" and why, and discussing the practical experience and expertise gained in the process.

Bubar told workshop participants that because TIE focuses on working-level personnel presenting the latest information from the field, it provides the opportunity to react to late-breaking issues. She was also aware that TIE attendees returning to their home sites with new avenues to pursue in addressing site-specific problems in not an unusual occurrence.

Bubar stressed that new innovative methods for performing work more efficiently must be found if DOE is to succeed in achieving projected site closures by 2006. This is also true for dealing with the inventory of legacy wastes and materials. The TIE Program vision is that the workshop will continue to be the premier opportunity for field personnel – those actually responsible for moving waste or soil and for evaluating competing technologies to decide which will be applied to a specific problem – to come together freely to share information and, in the process, garner new ideas and potential answers to their own challenges.

Bubar encouraged open communications and information sharing, and, most of importantly, using this new insight! Clearly, the TIE and Lessons Learned programs' objectives are the same - to promote information exchange and to enhance EM progress.

Bubar emphasized that both TIE and Lessons Learned provide opportunities to improve performance, which is so important to being able to achieve EM's mission. The Lessons Learned Program exists so anyone in the DOE system can, when faced with new problems, go to the web page (www.em.doe.gov/lessons) and check to see if others have experienced identical

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Session III - Sampling Panel Session

Well Redundancy Assessment with Geoscience and Geostatistics

Cary Tuckfield, Westinghouse Savannah River Companh, discussed the application of the "4 Rs," Relevancy, Redundancy, Reliability, and Regulatory, for their groundwater sampling management plan. After reviewing all monitoring well data, they perform a relevancy analysis among all wells in their network. Then they apply a geoscience and geostatistics approach to determine if some of the wells in the network supply redundant information.

Cary Tuckfield, WSRC, describes the "4Rs" for ground water sampling management plan at SRS

At the well head of active monitor wells they deploy their Purge Water Management System (PWMS). This is a closed loop system which permits reinjection of the well purge water following sampling.

SRS has been working closely with regulators and has achieved approval of this approach. They estimate annual savings of $385K from the well redundancy deployment, by reducing 21 wells from the normal monitor sampling regime and removing 20 analytes from routine analysis.

For more information, contact Cary Tuckfield, Westinghouse Savannah River Company, at (803)725-8215 or cary.tuckfield@srs.gov.

Using Cone Penetrometer Technologies to Characterize Radiological Waste Sites

Wes Bratton, Applied Research Associates, Inc., described the investigation at the Nevada Test Site (NTS) using a cone penetrometer consisting of standard cone penetrometer technology sensors, a gamma spectroscopy module, and a soil gas sampling module. Over 100 penetrations were made at the NTS to identify areas where higher gamma emitting activity was present. This method nearly eliminates the generation of waste, so it keeps costs to a minimum. The technology was also used at the Hanford facility near the S-Tank Farm.

For more information, contact Wes Bratton at (509) 942-1841 or by e-mail at: wbratton@ara.com.

Cost-Effective Sampling Using the EasyPump® at LLNL

The use of the EasyPump® at Lawrence Livermore National Laboratory (LLNL) was demonstrated by Robert Bainer. The EasyPump® is an innovative and efficient sampling process that does not produce purge water, does produce results equivalent to micro purging, reduces the sampling time, and can be used for specific depth sampling. Recent collaborations between the Savannah River Site (SRS) and LLNL have led to each site testing and using sampling techniques developed at the other's site. When purge water is necessary to satisfy regulations, then PWMS units developed at SRS can be used; when it is necessary only to obtain a relevant water sample, then the EasyPump® is a simpler and more cost effective technique.

For more information, contact Robert Bainer, LLNL, at (505)422-4635 or bainer1@llnl.gov.

Characterization of Under Building Contamination at RFETS using Horizontal Drilling and Real Time Monitoring

Annette Primrose, Rocky Flats Environmental Technology Site (RFETS), reported on the use of horizontal directional drilling and real time monitoring techniques to sample under old and contaminated building slabs. The "hammer rig" drilling technology minimized generation of hazardous waste, and RFETS teamed with scientists at Sandia National Laboratories (SNL) to use the real time monitoring system developed at SNL to characterize the contamination under building slabs.

For more information, contact Annette Primrose, RFETS, at (303)966-4385 or annette.primrose@rfets.gov.

Session IV - Recycle/Reuse Panel Session

On July 13, 2000, the Secretary of Energy, Bill Richardson, challenged the Department's manager's "to think creatively, and come up with incentives to promote internal reuse and recycling." While at first blush, the July 13th Secretarial memo may seem to threaten the long-term growth and viability of the radioactive metal, materials, and equipment marketplace, in fact it has done much to advance this cause. During this TIE session, the growth of the internal equipment and materials reuse market over the past few years was fully explored by Lee Bishop, DOE, from the National Center of Excellence for Metals Recycle (NMR). NMR has become a complex-wide broker for the cost effective and safe recycle and reuse of excess contaminated materials and equipment. Bishop shared with the audience a number of success stories, and also explained the proven methodology NMR has used to evaluate opportunities for maximizing pollution prevention (P2) related recycle/reuse initiatives. This methodology helps sites minimize the disposal of materials and equipment that indeed still have associated value. The NMR proven methodology was shared with the audience, and a number of related applications and lessons-learned were also shared with the assembled group.

Les Bishop, DOE-Oak Ridge, shares NMR success stories with workshop participants

TIE provids informal settings for informal meetings outside of the workshop sessions

Doug Maynor, DOE, and Dick Govers, The Chamberlain Group, representing the Ohio Operations Office, provided a unique success story that Ohio has achieved by fully enacting the noted NMR methodology. During this past CY 2000, the Ohio Mound Site was able to define a reuse path for a large quantity of tritium contaminated equipment that had already been budgeted for disposal. Working with NMR, Maynor, Govers and many others at the Mound Site and at the Ohio Field Office, were able to save $1.4 Million, and shave 22 days off a critical Mound project milestone schedule, by defining a "bartered service agreement" with NSSI, a commerical licensed firm from Houston Texas. As the story goes, one man's garbage is another man's treasure. In this case, the Mound equipment would be reused in its contaminated form at NSSI, as part of a tritium recapture and purification process plant they were building in support of the production of medical targets used in the FDA approval process. In turn, NSSI agreed to clean-up several large tritium contaminated mercury laden pumps at the Mound Site, thereby helping to accelerate the overall project schedule.

This was truly a session that exemplified fiscal advantages of applying P2 - lessons learned thinking in complex environmental remediation projects, that at first appear to offer little hope for equipment reuse. The cooperation across several sites helped to make the application of the NMR methodolgy at the Mound Site possible.

For more information, contact Dr. Michael Gresalfi, Oak Ridge National Laboratory at (301)916-0509 or i32@ornl.gov, or Lee Bishop, DOE Oak Ridge Operations Office, at (865)241-6199 or bishopml@oro.doe.gov.

Session V - Enhanced Performance Through Collaboration Between the Pollution Prevention and the Office of Science and Technology

Early in the year (2000), the Savannah River Operations Office (SR) made a proposal to Environmental Management (EM) at Headquarters to integrate the site pollution prevention (P2) and technology development programs in order provide greater effectiveness and operating efficiency. The proposed integration would be designed to enhance deployment of new technologies, especially where they would result in waste or energy reductions, or reduce cleanup schedules and project costs.

In August, after discussions between the field and Headquarters staff, the Office of Science and Technology (EM-50) and the Office of Integration and Disposition (EM-20) sent a joint memorandum to the managers of the Ohio Field Office and SR, supporting the proposal and requesting both sites to conduct pilot integration efforts in Fiscal Year 2001. Both offices have been pioneers in the integration of these two programs, but have distinctly different approaches to achieving results. The sites were encouraged to continue their integration efforts and, at the same time, advise other Operations and Field Offices on the mechanics of the process.

Presentations were made during this session by project managers from the Ohio Field Office, the Savannah River Site, and from the Hanford site – a leader in performing cost benefit analyses associated with technology deployments.

Combining Technology and P2 for Cost Savings at Multiple Sites

Doug Maynor, Ohio Field Office, presented an overview of their Cost Savings Group and provided examples of their successes. This group was formed specifically to evaluate ways the five Ohio sites can work together for joint cost savings, to generate and receive cost saving ideas or technical issues, and to recommend solutions. It was noted that waste management, waste processing, and disposal represent about 40% of the budget for Ohio closure sites.

The Group has developed the following cost savings categories:

- treating and disposing of mixed wastes,
- removing and disposing of concrete structures,
- packaging and transporting radioactive and mixed wastes,
- processing soils and sludges,
- reusing surplus Government equipment, and
- characterization of piping, soil, and similar materials.

Doug then used some examples to illustrate the potential for this approach. The Group evaluated the new Environmental Protection Agency's megarule for direct disposal of PCB (Polychloronated Biphenyl) contminated radioactive waste, for a potential saving of $4M. In the area of equipment reuse, the group was instrumental in bringing a surplus concrete crusher located at the Hanford site to Mound for an estimated $700K savings. They also identified glove boxes and HEPA filters that could be used at the Waste Isolation Pilot Plant (WIPP) for a net savings of $500K, and tritium processing equipment that could be used by NSSI for a potential savings of $1.4M.

In the technology deployment area, the Group, assisted by the TechCon Program, was instrumental in performing a Value Engineering study for characterizing entombed hot cell remnants at the "Old Cave" facility at the Mound site. That study resulted in an Accelerated Site Technology Deployment (ASTD) project being implemented, which has the potential for saving nine months in the Old Cave project schedule.

For more information, contact Doug Maynor, Mamisburg Area Office, at (937)865-4402 or doug.maynor@ohio.doe.gov.

P2 / TD Integration

David Griffith, Westinghouse Savannah River Company, discussed specific examples of innovative technologies implemented at the Savannah River Site (SRS) which have prevented waste, improved operations, and generated cost savings. He also outlined anticipated benefits to be accrued from the integrated Pollution Prevention (P2) – Technology Development (TD) pilot project.

David discussed an innovative polyurea spray coating system that is a key part of an aggressive campaign to recover radiological contaminated areas, where surface conditions make it impractical to decontaminate. A high pressure, high temperature sprayer mixes and applies a resin and isocyanate to create a long-life polyurea coating, which encapsulates the surface and fixes contaminates. This system replaces paint coating systems, which typically have much shorter life and require constant mainte-

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nance and surveillance. SRS savings are estimated to be about $8M per year from reduced radioactive waste generation, laundry avoidance, and productivity improvements. It also supports ALARA hazard reduction goals.

He also discussed development of the purge water management system, a closed loop system for obtaining monitoring well ground water samples. Well water drawn to purge the system prior to obtaining a representative sample is temporarily stored in a tank containing an expandable bladder, thus preventing the water from reaching the atmosphere. After the sample is drawn, the purge water is returned to the well. This system avoids containerization, transportation, and treatment of the purge water normally associated with well sampling procedures. Current costs for collection and treatment of this waste water average about $400K per year for the approximately 400 wells at SRS. This new technology is proving to be cost effective.

David then discussed efficiencies accruing from combining the P2 and TD programs. These include common reporting and measurement systems, joint participation of the two programs, integration of P2 opportunity assessments and the technology needs process, and integrated promotions. The pilot program is expected to improve cost effectiveness, increase identification of both P2 accomplishments and technology deployments, promote better communications, and provide increased management awareness of Field performance.

For more information, contact David Griffith at (803)208-6006 or david.griffith@srs.gov.

Susan Hoyt, Massie Chair point of contact, gives Pete Castle, BBWI, a quick overview of DOE-EM's Chair of Excellence Program

Hanford Benefit Analysis for Technical Deployments

Jim Hanson, Richland Operations Office (DOE-RL), briefly discussed the importance RL places on incorporating Science and Technology (S&T) into Hanford environmental remediation and waste management projects. He stressed that S&T planning must be integrated directly into, and become an integral part of, site projects. RL provides contractor incentives in the form of performance measures emphasizing S&T.

A simplistic model of the their technology deployment strategy is:

- Projects identify S&T needs
- "Challenge" site baseline activities
- Identify technology insertion points
- Develop S&T plans
- Develop and apply a benefit methodology
- Demonstrate and deploy technologies – reduce overall cleanup costs

Jim then very briefly talked about their benefit analysis. This analysis is important in order to clearly demonstrate the contribution that science and technology makes toward Environmental Management's (EM's) cleanup mission. A key element of the benefit analysis is to identify the technology insertion point in the overall project planning process. This is the point in the project where new technology is implemented and cost and schedule comparisons of the new technology relative to the baseline technologies begin to be tracked.

Hanford has built upon the Pollution Prevention Return on Investment (ROI) model as the foundation for their S&T benefit analysis. Their experience with cost data is briefly as follows:

- Cost benefit analysis was initiated in Fiscal Year 1997 (FY 1997).
- The Office of Science and Technology (OST) cost methodology, issued in December 1997, was challenging.
- In FY 2000, a prototype of the Pollution Prevention model was implemented.
- OST has decided to pilot the Hanford benefit analysis in FY 2001.

Jim concluded by stating that a simplified approach to benefit analysis is achievable. The Pollution Prevention ROI cost model provides credibility to this process. He also feels implementation of the EM pilot for benefit analysis should be viewed as an opportunity to enhance the existing Hanford model.

For more information, contact Jim Hanson at (509)372-4503 or james_p_hanson@rl.gov.

Session VI - SFCA in the 21st Century: Identifying Opportunities for Partnership and Progress

The panel session was convened around the central theme of the Subsurface Contaminants Focus Area's (SCFA's) future mission and vision for addressing subsurface contamination at DOE sites across the complex. Panelists addressed the integration of SCFA with other programs to address site needs, future challenges, and success in terms of technology deployments, technical assistance, cost savings, and risk reductions.

The Changing Nature of Innovative Technology Required to Meet Site Needs

Early remediation efforts at DOE sites focused on source term removal of contaminant plumes that posed the greatest threat to human health and the environment due to high concentrations and mobility of pollutants. In later stages of the remediation program, the larger-volume distal portions of plumes containing low concentrations of relatively immobile contaminants are being addressed. Conventional remediation techniques such as excavation, off site disposal or pump and treat systems may not be cost-effective for these situations. Innovative remediation technologies that liberate previously immobile contaminants or stabilize contaminants to permanently leave them in place present elements of risk that may not be considered acceptable to stakeholders. Possible responses to this challenge include more widespread use of advanced numerical simulation techniques, comparative risk assessment, and science-based conceptual models for interactions between contaminants and geomedia.

For more information, contact Malcolm Siegel/ Sandia National Laboratories at (505)844-5426 or msiegel@sandia.gov.

The Changing Nature of Site Needs

As more projects approach decision milestones for cleanup, a significant reduction of time available to develop technologies is resulting in increased emphasis on use of existing technology. Impending site closures in 2006, near-term project deadlines, increased attention required by stakeholders, shrinking budgets available for cleanup, and technical resource limitations present challenges to sites. In addition, the shift of more projects into operational stages is resulting in new challenges to solve associated problems. Many of the simple projects have been completed and remaining projects are more complex, requiring increased reliance upon resources external to the organization. Technical assistance, provided through a cooperative effort of SCFA's Lead Lab, ITRD, and TechCon, can help sites reduce cost, minimize risk, and improve compliance with cleanup schedules.

For more information, contact Dale Pflug/ Argonne National Laboratories at (630)252-6682 or dpflug@anl.gov.

John Lehr, DOE-HQ, addresses participants in the open discussion period during the SFCA session

Meeting Future Needs through Technical Assistance

During the last several years, DOE sites expressed both a need for technology-based solutions and technical assistance in identifying appropriate solutions to the end-user community's concerns. SCFA responded to this need by implementing a Lead Laboratory concept, a virtual organization including representatives from eleven DOE Labs and Bechtel. In FY00, the SCFA Lead Lab completed thirty-nine technical assistance efforts across the DOE complex. Seventy-nine additional efforts are scheduled for

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Session VII - ASTD: Building Partnership for Success Panel Session

Janna Unterzuber, SAIC, session co-chair for ASTD Panel Session

Deploying In-Situ Gamma Spectrometry at Fernald to Delineate Radionuclide-Contaminated Soils During Remediation

Chris Sutton, Fernald Environmental Management Project (FEMP), reported on their use of in-situ gamma spectrometry to delineate soils contaminated with U-238, Th-232, and Ra-226 during a soils remediation project. The technology was successfully demonstrated as an Accelerated Site Technology Demonstration (ASTD) project, to provide near real-time characterization results. This technology has now become an integral part of the daily soil characterization efforts and has allowed Fernald to achieve a stringent schedule for remediation. Primary successes were; cost savings from the use of this method of in-situ characterization, results superior to those that could be obtained using conventional methods, and the integration of real-time characterization technology into this large excavation program. An issue that still needs work; the achievement of broader and more complete regulatory acceptance of the methods.

For more information, contact Robert Janke, FEMP, at (513)648-3124 or rob.janke@fernald.gov.

In-Situ Measurement Techniques for Characterization of the Brookhaven Graphite Research Reactor

Paul Kalb, Brookhaven National Laboratory (BNL), characterized the Brookhaven Graphite Research Reactor (BGRR) facility, which is currently undergoing decontamination and decommissioning (D&D). Brookhaven used in-situ measurement techniques to quantify the type and extent of radiological contamination during D&D of the reactor facility. This process resulted in near real-time data, fewer samples required, and lower dose exposure to personnel. Several additional innovative technologies have been proven effective during this project and, as a result of this success, have been adopted into the BNL baseline for future use.

For more information and specific details, contact Paul Kalb, BNL at (631)344-7644 or kalb@bnl.gov.

Remediation of LLNL Plume Source Areas by Electroosmosis

Using Electroosmosis (EO) techniques to remove Trichloroethylene (TCE) in fine grained sediments at a Lawrence Livermore National Laboratory (LLNL) field deployment site was described by Walt McNab. EO is a process entailing the movement of pore water under the influence of an electric field, resulting in significantly speeding up of the removal of contaminants from fine-grained material. This movement is a result of the positively charged ions (that form on the negatively charged clay surface) to the negatively charged electrode with viscous drag pulling the remaining pore water in the same direction. Bench tests and field tests have confirmed movement of the TCE to the cathode. This process can be useful at a remediation site where fine-grained sediments harbor high concentrations of contaminants or Non-Aqueous Phase Liquids. McNab reported on the optimization of operations of the EO system for greatest process efficiency.

For additional information, contact Walt McNab, LLNL, at (925)422-0061 or mcnab1@llnl.gov.

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Old Cave Characterization Alternatives at the Miamisburg Environmental Management Project

Michael Krstich, Environmental Management Solutions, discussed the immediate need for advanced techniques to provide both physical and radiological characterization of entombed remains of a 1950's hot cell, through the walls and floor of the concrete entombment, for the Miamisburg Environmental Management Project (MEMP) project known as the Old Cave. ASTD funds are being used to secure expert technical support, to select the best available technologies, and to deploy innovative technologies that have been successful in similar situations.

The Ohio Operations Office will utilize effective technologies demonstrated on the Old Cave project at multiple Ohio Closure Sites, since all sites have contaminates and buried objects under concrete and in buried lines.

For more information and specific details, contact Michael Krstich, EMS at (513)697-6682 or mak@fuse.net.

Pollution Prevention at SRS through Purge Water Management and Aqueous Waste Management

Cary Tuckfield, Westinghouse Savannah River Company, reported on the development and use of their tankless Purge Water Management System (PWMS). This system involves the temporary storage of the well purge water within the well casing during the sampling event, instead of in an above-ground tank. A flow-through packer is installed in the well just above the screened zone of the casing. To sample, the packer is inflated and water is circulated in a closed loop system from below the packer, through the sampling station, and back into the well above the packer. After purging and sampling, the packer is deflated - allowing the purge water to drain back into the aquifer. This system was initially tested in 1994 and is currently installed at 28 wells in SRS and two at LLNL.

Cary also reported on the Aqueous Waste Software Application (AWSA) system, which combines a relational data base with a statistical algorithm to recommend monitoring wells which require containerization of investigation derived waste.

For more information on these systems, contact Cary Tuckfield, Westinghouse Savannah River Company, at (803)725-8215 or cary.tuckfield@srs.gov.

Operation of an In-Well Air Stripping System at BNL

Vincent Racaniello, Brookhaven National Laboratory (BNL), discussed the successful implementation of an in-well air stripping technology designed to address a ground water plume contaminated with volatile organic compounds that has migrated beyond site boundaries. The system employs a closed loop air treatment system and a centrally located control system in conjunction with the in-well stripping technology.

After overcoming several technical barriers, the system has been in operation since September 1999. BNL is now planning to deploy this technology at five other off-site locations.

For more information, contact Vincent Racaniello, BNL at (631)344-5436 or vjr@bnl.gov.

Luncheon Keynote Address

Les Germany, Waste Area Group (WAG) Manager with the Department of Energy's (DOE's) Savannah River Operations Office, introduced the luncheon keynote speaker, Camilla Warren, Chief of the DOE Remedial Section in the U.S. Environmental Protection Agency's (EPA's) Region 4. Warren has managed oversight of DOE CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) cleanup activities in the Region for the past eight years. Prior to that, she managed Superfund and RCRA (Resource Conservation and Recovery Act) programs in eight Southeastern States. DOE sites currently under her purview include Savannah River, Paducah, and Oak Ridge.

Germany also informed us that Warren is an ardent champion for deploying innovative technologies in CERCLA cleanup projects, and works equally hard on community issues. She was instrumental in developing a Memorandum of Understanding (MOU) with DOE and the State of South Carolina Department of Health and Environmental Control for technology deployment, which has led to numerous deployments of new technology at the Savannah Rive Site. Warren's support has also led to similar successes and Paducah and Oak Ridge.

Warren's background includes degrees in Environmental Systems Engineering and Forest Hydrology.

Warren is keenly aware of the magnitude of environmental cleanup challenges we face, and the very limited resources available to accomplish them. With these issues in mind, she is an ardent champion of technology development and deployment as a means of making the best possible use of the resources that are available. This is consistent with her goals for expediting cleanup of all sites which pose risk to the safety and health of both workers and the public.

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Session VIII - Cost Engineering Panel Session

The Cost Engineering session included presentations and recommendations from Department of Energy (DOE) Headquarters, Field Offices, and other Federal Agencies on collecting and compiling cost data, and estimating cost of emerging technologies. The session also included discussions on issues and challenges associated with collecting environmental and innovative technology costs within the Environmental Management (EM) program. Finally, the session covered current policies and efforts being developed to capture innovative technology costs and the use of value engineering to deploy new technologies.

Issues and Recommendations for Collecting Cost Savings Information

Milton Gorden, ATL International, Inc., presented findings and recommendations identified by the Technology Advisory Group (TAG), lead by Lawnie Taylor, DOE-Headqurters, regarding issues associated with the collection of innovative technology cost data. The issues identified are:

- uncertainty associated with reporting savings,
- identification of a point of reference to compare cost savings against,
- availability of cost data,
- Field Office incentives for reporting cost savings, and report format,
- intermixed technology cost savings data with other savings, making technology cost savings identification difficult, and
- providing enough time for Field Offices to submit savings information.

Some of the specific actions being taken by TAG include: 1) use of ranges to report uncertainty and 2) implementation of the Return on Investment (ROI) method. The ROI format is also being recommended for reporting savings data. Additionally, the Savannah River Site and the U.S. Navy have lists of baseline technologies that may be used as a reference to compare cost savings against. There are also several databases and cost information resources available that may be used to obtain data on innovative technologies.

Incentives for Field Offices to report cost savings information include: recognition - for both the site and the personnel implementing innovative technologies and documenting the associated cost savings, certificates or awards, and/or the possibility of monetary rewards. Regarding the issue of intermixed costs, allowing sites to report technology cost savings as a percentage of the total cost savings may be helpful. Finally, DOE-Headquarters proposes an action which will allow sites to test reporting systems and improve guidance for the cost savings information format.

Additional questions or comments may be directed to Lawnie Taylor, DOE-HQ, at (301)903-8119 or lawnie.taylor@em.doe.gov, or to Milton Gorden, ATL at (301)515-6781 or mgorden@atlintl.com.

Status of the Environmental Cost Analysis System

Jake Appetta, National Energy Technology Center, gave an overview of the Environmental Cost Analysis System (ECAS). ECAS is a web based system being developed to store and retrieve costs for completed EM life-cycle projects, using an Environmental Cost Element Structure (ECES). Uses of ECAS include: the development of benchmarks for environmental costs, as a tool that will assist DOE better understand parameters that impact EM project costs, and as a means to distribute EM cost data. ECAS is currently being developed for DOE use, but can be expanded to include other agencies or organizations. It is approximately 80% complete, and is scheduled to receive project information in the Spring of 2001. ECAS is now available on the Internet for testing at: http://ecas.netl.doe.gov. The user ID and Password for accessing the system is ACE.

For more information, contact Jake Appetta, National Energy Tech Center at (412)386-4762 or appetta@netl.doe.gov.

Project Definition Rating Index for Environmental Projects

Dave Pepson, EM Office of Project Management (EM-6), discussed the Project Definition Rating Index (PDRI). PDRI is a management tool developed by the Construction Industry Institute (CII) to increase the likelihood of project success. CII includes members from Bechtel, Exxon, Dupont, MK Ferguson, and other international companies. For EM, the CII PDRI was used as a model but modified for environmental projects. EM PDRI rating elements cover cost; schedule; scope; management, planning, and control; and external factors such as stakeholders and regulators.

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There are approximately 60-77 project rating elements included in PDRI, and the maximum project score is 1,000. The actual number of project rating elements and scores varies depending on project type and project phases. Also, each rating element carries different weight or importance value. Element scores range from 1 to 5, with 5 being the best. Each element score is then multiplied by an element weighting factor and the final numbers are summed to get the total score.

EM-6 has established target scores for each project planning phase and critical decision point. A memo from Carolyn Huntoon directs sites to use PDRI for implementing technologies that have been demonstrated.

For more information, contact Dave Pepson, DOE-HQ at (301)903-7432 or david.pepson@em.doe.gov.

U.S. Navy Systems/Tools for Technology Identification and Cost Estimates

Robert Nash, U.S. Navy, gave a briefing on the systems and tools they use to identify technologies and to develop cost estimates. These include;

- NORM (short for "Normalized Data") system,
- Remedial Technology Evaluation Tool (RTET), and
- Integrated Data Evaluation and Analysis Library (IDEAL).

NORM is the Navy's automated corporate environmental information system developed to ensure consistency across the program, integrate existing information systems, eliminate redundancy in input for common data elements, and ensure proper backup to support the budget. NORM was developed to eliminate data calls - it provides a single source of environmental data and has information on project scope, costs, schedule, risk, impacts, and points of contacts.

RTET contains the Navy's technology short list. This is a list of preferred technologies organized by media and contaminant, and contains description of each technology. The short list contains new and emerging technologies. RTET, when completed, will be available on the Internet.

IDEAL System is an Excel™ based parametric system that can be used to develop cost numbers for both conventional and innovative technologies. IDEAL was developed using RACER (Remedial Action Cost Engineering and Requirements) models and cost data for similar technologies and equipment. It allows users to input parameters such as contaminant, contaminant media type, waste volume, and other higher level parameters and get a cost output based on cost curves. IDEAL outputs are high level results that may be used for budget estimates.

For more information, please contact Robert Nash, U.S. Navy at (805)982-5070 or nashra@nfesc.navy.mil.

Hanford Benefit Analysis for Technology Deployment

Jim Hanson, DOE Richland, and Terry Walton, Flour Hanford, discussed the reporting of cost savings at the Hanford, Richland Washington, site and the benefit analysis method used for innovative technology deployment. Keys to success are: determination of important decision points that will reduce cost, and incorporation of Science and Technology planning within a project. Additionally, the Richland Operations Office provides incentives for identifying Science and Technology needs, identifying technology insertion points, developing the Science and Technology plan, and demonstrating and deploying the technology to save money. Since 1997, the program has identified ninety-seven technology deployment needs and has identified and documented the associated new technology benefits.

The cost/benefit analysis Hanford is using is built on the Return on Investment (ROI) method initiated in the Pollution Prevention program in 1997. Cost/benefit analyses are being performed to measure research and technology effectiveness, and to aid in technology deployment decisions. Advantages of the Hanford cost/benefit method include: limited need for detailed data, ease of use, and acceptance by management and Congress. Included as part of the benefit analysis are factsheets on the technology, the benefit analysis form, and back-up data supporting the analysis. The ROI model was implemented in FY 2000, and the Office of Science and Technology decided to pilot this analysis at Hanford in FY 2001.

For more information, please contact Jim Hanson, DOE-RL at (509)372-4503 or james_p_hanson@rl.gov.

Environmental Cost Element Structure (ECES) Update

Bryan Skokan, DOE-EM, provided a brief update on the Environmental Cost Element Structure (ECES). ECES is a hierarchical list of elements that may be required to accomplish environmental projects. It evolved from the Hazardous, Toxic, and Radioactive Waste Work Breakdown Structure developed to improve cost management among Federal Agencies. Because of changes in regulations, changes in performing environmental management work, and introduction of new technologies, the participating agencies agreed to update ECES annually. The latest version of ECES includes the addition of new environmental technologies and elements, inclusion of more detailed or lower level activities and cost items, modification of units of measure, updated transportation and disposal tasks, and changes to the formatting of the document.

More information on ECES and its supporting documents are available for downloading at http://www.em.doe.gov/aceteam, or contact Bryan Skokan, DOE-EM at (301)903-7612 or brian.skokan@em.doe.gov.

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Latest EPA and Federal Remediation Technology Roundtable Information on Technology Costs

Kelly Madalinski, Environmental Protection Agency (EPA), shared information on Federal Remediation Technology Roundtable (FRTR) initiatives and current efforts. The FRTR is made up of representatives from Federal agencies involved in remediation of hazardous waste sites, with the purpose of sharing information and exploring cooperative efforts of mutual benefit.

One FRTR product is the Case Study Report. These reports are based on public or government projects and document both technology performance and cost, using a standardized and consistent format. The latest revisions to the report format have concentrated on the cost section. Seventy-eight reports were submitted this year, and there are 218 total reports to date. These reports are now available on CD, and are free to the public. Case studies are also available on the web at: http://www.frtr.gov.

Kin Chao, Legin Group, and Bryan Skokan, DOE-HQ, go over details after setting up the "ACE" Team Exibit. Skokan also chaired the Cost Engineering session.

Future FRTR activities include continuing development of case study reports, to add new technologies to the collection, and performing EPA cost analyses with the project data. These activities will include collecting total treatment train direct costs, normalizing the cost data, and performing trend and similar analyses.

FRTR is also continuing to update EPA Remedial Action Reports by expanding closeout procedure guides. EPA Remedial Action Reports contain comprehensive performance and cost data on remedial projects.

For more questions or information, please Kelly Madalinski, EPA at (703)603-9901 or madalinshki.kelly@epa.gov.

Remedial Action Cost Estimating and Requirements System Technical Developments

John Claypool, Talisman Partners, discussed the RACER system and the latest RACER 2001 updates. RACER is Windows based parametric environmental cost estimating software, initially developed by the Air Force. It can provide capital, operations, and maintenance cost estimates needed for restoration projects at the accuracy needed for budget estimates or for alternative cost comparisons. Although RACER was initially developed for the Air Force, EPA, DOE, Corps of Engineers, Navy, and commercial industry use the software.

The current version of RACER includes estimating models for emerging technologies such as phytoremediation, in-situ vitrification, enhanced soil vapor extraction, and others. RACER 2001 will include the updated ECHOS 2001 database, enhanced reporting capabilities, and the ability to access Monitoring Technologies in Studies Phase. Additionally, some new technologies will be updated, such as passive water treatment, permeable barriers, bioventing, and others, in the 2001 version.

For more information, contact John Claypool at (303) 771-3103 or jclaypool@talpart.com.

Using Value Engineering to Deploy Innovative Technologies

Doug Maynor, Ohio Field Office (OH), discussed the introduction of Value Engineering (VE) methods into the Office of Science and Technology (OST) program and the training of program personnel. The concept was to expose OST technical experts to specific problems and opportunities in an intensive week long VE Study. The studies, led by a Certified VE Specialist approved by the Society of American Values Engineers, followed the standard six-step job plan required to meet the definition of a formal VE Study.

To date, eleven formal studies have been conducted in OH with at least one study occurring at each of the five OH (Ashtabula, Columbus, Fernald, Miamisburg, and West Valley) sites. The eleven studies have produced both long and short term improvements to cost and schedule baselines. Additionally, the studies served as a check on the technical baseline and, in some cases, have led to complete project revisions using innovative technologies. The latest Ohio VE effort resulted in generating a successful proposal for the Accelerated Site Technology Deployment (ASTD) Program, and a reduction in the project schedule. ASTD funding was awarded in May 2000 and is already being used to implement the VE recommendations.

For more information, contact Douglas Maynor, DOE-OH at (937)865-3986 or doug.maynor@ohio.doe.gov.

Session IX - Vadose Zone Panel Session

The DOE Complex-Wide Vadose Zone Science and Technology Roadmap

The Idaho National Engineering and Environmental Laboratory (INEEL) was charged by the Department of Energy (DOE) Office of Environmental Management to lead the development of a complex-wide vadose zone science and technology roadmap for the characterization, monitoring, and simulation of the fate and transport of contamination in the vadose zone.

It is a formidable task to characterize and model such contamination and quantify the fate and transport of those contaminants in complex hydrogeologic systems. Increasing the understanding of vadose zone contaminant fate and transport through better science, characterization, modeling, and correct technology application is critical for continued operation and cleanup, and for final disposition of DOE facilities.

INEEL is developing and using numerical models to evaluate contaminant presence, fate, and transport in saturated and unsaturated zones that are creditable and mirror real situations so that project managers, regulators, and stakeholders can have confidence in the output. Preliminary roadmap work has been completed and INEEL is currently in the implementation phase of the project. Additional vadose zone science and technology roadmap information can be found on the Internet at http://vadosezone.inel.gov/.

For more information, contact Daniel Stephens, Daniel P. Stephens and Associates, at (505)822-9400 or danstephens@dbstephens.com.

Vadose Zone Science and Technology Solutions: "The Book"

The Department of Energy (DOE) Office of Science and Technology (EM-50) sponsored research and writing of the book "Vadose Zone Science and Technology Solutions." This book is a resource to help people with diverse backgrounds understand first, what the vadose zone is and second, how vapors and liquids, including contaminants, migrate in this zone so remedial programs can be established that effectively address vadose zone contamination. A consortium of experts from DOE, DOE laboratories, other Federal agencies, universities, and industry provided input and helped write the book.

The book is divided into five major topics: 1) introduction of vadose zone concepts, 2) characterization and monitoring of the vadose zone, 3) understanding and modeling vadose zone systems, 4) solving vadose zone problems, and 5) identifying scientific challenges and opportunities. The book also contains actual case studies that illustrate scientific concepts and potential problems, including both success and failures.

For more information, contact Brian B. Looney, Savannah River Technology Center, at (803)725-3692 or brian02.looney@srs.gov.

Vadose Zone Contaminant Migration Software

The Vadose Zone Contaminant Migration Software which has been developed and deployed at the Savannah River Site (SRS) since May 26, 1999 has been well received and has produced good results. It uses well-accepted principals, practices, and assumptions. The software is used more as a screening tool than as a final remedy tool. The model evolved from actual on-site work and projects, not from research, and is consistent with U.S. Environmental Protection Agency (EPA) and local regulator requirements.

The technology is mandatory for all facility investigation, remedial investigation, and baseline risk assessment documentation and vadose zone contaminant migration analyses performed either by SRS or its subcontractors. It was also used in the radioactive seepage basin "Plug-in Record of Decision." The program evaluates "if", "when", and "how much" contaminants from a waste unit will migrate to the ground water.

In summary, utilization of the software has been successful because it saves time and money. Geochemical inputs are preloaded in the software, it is simple to use, and the results are easily understood. Multiple (about 200) contaminants are run simultaneously. This technology also saves money because it doesn't require extensive technical inputs in order for it to work. The program calculates less restrictive, but still protective, cleanup levels. It operates in Microsoft Excel 97 and simulates site-specific conditions almost anywhere in the world.

For more information, contact Gregory G. Rucker, SRS Environmental Restoration Division, at (803)952-6683 or gregory.rucker@srs.gov.

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Evolution of the Savannah River Site Vadose Zone Monitoring System Program

Vadose zone monitoring is required at the Savannah River Site (SRS) to ensure ground water resources are being protected. Unfortunately, traditional ground water monitoring is not feasible due to existing contaminant plumes that have migrated underneath low-level radioactive disposal units. SRS developed and deployed the Vadose Zone Monitoring System (VZMS) in early 1999 to provide data and information about the possible downward flux of water and contaminants, primarily tritium. The system monitors areas beneath and around shallow disposal trenches to validate performance assessments (PAs) and to assess impacts of the disposal units on the Drinking Water Standards. VZMS consists of monitoring sensors installed in clusters at four depths in each of three boreholes. In addition, there are three access wells for neutron probe monitoring that provide water content information and four angled wells underneath the centerline of the trench that provide soil water samples for contaminant concentration.

Phase II of VZMS, deployed in 2000, incorporated lessons learned from Phase I. The monitoring system has an improved design with enhanced features to reduce redundant monitoring of soil parameters, develop long-term monitoring strategies, and establish pre-operational monitoring to obtain baseline data. The design is also based on two-dimensional steady state modeling that determines spatial arrangement of the vadose zone wells. A new technology known as the "Vapor Well-Cold Wringer Tritium Gas Sampling System" was also deployed. This technology involves the collection of soil-gas from discrete vadose zone points followed by condensation, collection, and analysis. The soil-gas samples are saturated with water containing tritium concentrations that are representative of soil-water tritium concentrations due to diffusive processes. This technology offers advantages over the baseline by enabling a "larger zone of influence" to be accessed.

In summary, the VZMS was reported to be one of the few operating systems in the country successfully monitoring contaminant migration through the ground. The system provides an early-warning monitoring system, protects ground water resources, reduces costs, validates PAs, and identifies the source and pathway of contaminant migration.

For more information, contact Heather Holmes-Burns, BNFL-Savannah River Company, at (803)952-3725 or heather.holmes@srs.gov.

Cost-Effective Method of Determining Shallow Radionuclide Activities

This presentation focused on a waste pit at the Hanford Site that was characterized using a small-diameter geophysical logging approach - resulting in a significant cost saving. The small-diameter geophysical logging system uses a Geoprobe® to push 44.5 to 57.2 mm (1.75 to 2.25 inch) outside diameter rods to a depth of up to 10 meters (33 feet). A passive gamma-ray scintillation detector is then lowered down the inside of the rods and spectral gamma data are collected at regular intervals.

The system was deployed at a waste site which had been identified as pervasively contaminated. The original remedial approach was to "muck and truck" the waste. Through spectral analysis of the data, it was determined that the very near surface area had abnormally high concentrations of naturally occurring potassium, uranium, and thorium, but contained minimal to undetectable activities of man-made radionuclides. Thoroughly characterizing the waste site with the small-diameter geophysical logging system resulted in decreasing the estimated volume of contamination by nearly 150,000 cubic meters.

This work was performed at a significantly lower cost than conventional near-surface characterization techniques (e.g., test pits or boring technologies). The estimated cost avoidance of not excavating, transporting, and disposing the uncontaminated soil at this one waste site is $7 to $12 M.

Use of this small-diameter geophysical logging system provides a cost-effective method to access and evaluate subsurface radionuclide activities. The system could be used to characterize any area that has unconsolidated sediments.

For more information, contact John April, Bechtel Hanford, Inc., at (509)372-9632 or jgapril@bhi-erc.com.

Fissures in Yucca Dry Lake Bed, Nevada Test Site, U.S.A.,

This presentation focused on enhanced permeability and preferential vertical flow through the vadose zone via fissure development. In arid areas, such as at the Nevada Test Site (NTS), fissure development and flow can be more easily observed and studied than in more humid regions. Seismic activity, draping of sedimentary material over basement rock features, changes in stratigraphy, and horizontal ground water flow are controlling factors in fissure development.

Fissures in the Yucca Dry Lake Bed at NTS typically start as cracks at depth, migrate upwards, and intercept the land surface. Increased horizontal tensile strain, or horizontal stretching due to sedimentary or volcanic rocks draped over basement

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features, is a probable cause for crack initiation. Subsequent rainstorms wash sand grains into the crack, which begins an erosional stage of fissure (gully) development. The original crack is usually less than a centimeter in width and can be hundreds of meters deep and thousands of meters long. The subsequent erosional filling in of the crack with sand eventually leaves a surface fissure with a width and depth of roughly one to three meters.

For more information, contact Donald C. Helm, Morgan State University, at (443)885-3183 or helm@eng.morgan.edu.

Development and Implementation of a High Rate Logging System at Hanford Tank Farms

In 1995, the Department of Energy Grand Junction Office (DOE-GJO) began using a high-resolution spectral gamma logging system (SGLS) in existing monitoring boreholes in the vicinity of the Hanford single shell tanks, to characterize gamma-emitting contaminants in the vadose zone. SGLS uses a cryogenically cooled detector that can detect gamma-emitting radionuclides such as Cesium-137 at levels as low as 0.1 pCi/g. During logging operations, many intervals were encountered in which the gamma flux was so high that the SGLS became "saturated," with system dead times approaching 100%. No usable spectra were obtained when this occurred because of pulse pileup and elevated background. Within these intervals, concentrations were found to exceed several thousand pCi/g.

In order to investigate contamination levels within these intervals, DOE-GJO designed and deployed a high rate logging system (HRLS). HRLS presented a number of unique challenges. For example, the detector had to utilize readily available technology, function within the existing logging system, and be calibrated using standards intended for environmental measurements. Shields were provided to extend the upper range of the detector, and corrections had to be derived for the shielding, as well as for dead time and casing. The detector was deployed in 1999 and was used to collect data in intervals where the SGLS had been saturated. Radionuclide concentrations as high as 108 pCi/g were successfully measured.

HRLS has been successfully developed and deployed at Hanford to investigate intervals that had "swamped" SGLS. Although HRLS was only used in limited intervals, the bulk of the subsurface contamination was characterized. When combined with SGLS data, HRLS data provide a basis to estimate subsurface contaminant inventory. In addition, HRLS data agree with preliminary laboratory data.

For more information, contact R.G. McCain, Grand Junction Office, at (509)946-3623 or rickmccain@aol.com.

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or related problems. The Lessons Learned Program is so much more than just a database! It is another useful tool for exchanging ideas and information from site-to-site and contractor-to-contractor.

Cynthia Anderson, DOE-SR, Environmental Restoration Division, gave a very brief overview of the SRS Environmental Restoration Program (ER). To date, SRS has identified 516 major ER waste sites, which encompass a combined area of about 500 acres and include 11 instances of ground water contamination. Of these, 261 sites (340 acres) have been remediated or are in remedial design. Eight ground water treatment systems are in operation and have processed about 4 billion gallons of water. SRS is a leader in the deployment of innovative technologies, including 33 in Fiscal Year 2000 (FY 2000). SRS attributes cumulative cost savings of $58.8 million from technology deployments from FY 1996 through FY 2000.

Anderson highlighted the SRS ground water strategy, an area where innovative technologies have been very successfully deployed. First phase of the strategy is to aggressively attack source areas with technologies such as grouting, capping, pump and treat, soil vapor extraction, dynamic underground stripping, and vegetative covers. The next phase is to remediate the primary ground water plume, using technologies such as in-situ chemical oxidation, horizontal wells, bioremediation, and recirculation wells. Natural attenuation and passive remediation technologies such as phytoremediation, bioremediation, and geosiphons can then be used at the distal and/or dilute portions of the plume. A well-planned monitoring well program, using state of the art technologies such as long term remote monitoring, ensures cleanup progress and protection against further ground water contamination.

Anderson stated that early, open, and continual regulatory and stakeholder interactions are essential for having a successful remediation program. Benefits resulting from these interactions include enhancing the public's perception of innovative technology deployments as being "environmentally friendly."

In closing, Anderson outlined future technology opportunities:

- innovative technologies to support natural remediation,
- long-term monitoring technologies,
- phytoremediation for attenuation of volatile organic compounds, metals, and radionuclides,
- non-invasive characterization and treatment technologies for DNAPLs (Dense Non-Aqueous Phase Liquids),
- in-situ treatment technologies, and
- long-term covers for humid environments.

Session X - Project Management Panel Session

The "Phoenix" Project Management System

Lawrence Livermore National Laboratory (LLNL) has developed an activity-based costing model called the Phoenix Project Management System that uses a work breakdown structure combined with an engineering cost element structure to assist in the following:

- development of baselines,
- historical records maintenance,
- tracking year-to-year progress, and
- serving as a performance management tool for project managers.

Phoenix cost data is derived from historical cost or are based on best commercial and management practices. The coupling of engineering and geo-technical data with the Phoenix system has allowed for comprehensive and defendable budget projections. This allows Phoenix to be used to calculate defendable life cycle cost scenarios and to examine cost benefits of proposed cleanups. The cost, scope, and schedule for each project are used by LLNL project managers and validated by DOE Oakland to address numerous HQ questions and requests. Phoenix is an interactive database that is not site-specific and can be used on multiple computer platforms.

For more information, contact Dick Woodward, LLNL, at (925)422-1885 or woodward5@llnl.gov

Experiences and Strategies for using DOE Technical Assistance Resources

Technical assistance has played an increasingly important role with Environmental Restoration project teams across the DOE complex in identifying commercial technology alternatives at a time when stakeholders are questioning DOE's direction. Three major components of DOE technical assistance include ITRD (Innovative Treatment Remediation Demonstration Program), TechCon (Technology Connection Program), and Subcon (Subsurface Contaminants) Lead Laboratory, the Savannah River Site.

ITRD was established in 1993 to evaluate technology alternatives and to conduct demonstrations to obtain beneficial performance data required for deployment decisions. Techcon was established in 1992 to support the location and understanding of commercial environmental technology alternatives. The Subcon Lead Laboratory Technical Assistance program was established in 1999 to provide rapid response to project specific requests for best available technology and National laboratory expertise from across the DOE complex.

These three technical assistance resources provide an integrated approach to environmental technical assistance requests from across the DOE complex. Expected and anticipated outcomes from utilizing this integrated technical assistance process are: changes to baselines, increased access to best available technical resources, reduced lead time to deploy technologies, and increased integration of technology "pieces".

For more information, contact Dale Pflug, Argonne National Laboratory, at (630)252-6682 or dpflug@anl.gov.

Guaranteed Remediation: An Innovative Approach to Environmental Cleanup and Site Closure

Guaranteed remediation is a complex, innovative approach to environmental clean-up that guarantees, at a fixed price, regulatory-approved site closure. The comprehensive approach, combining environmental insurance, financial guidelines, and advanced technologies, can reduce clean-up costs by 50%. Remediation is accomplished via a fixed price contract which covers known and unknown contamination with no change orders.

To begin, candidate sites are evaluated for their applicability of the guaranteed clean-up approach. After site selection, the clean-up approach and cost estimates are agreed upon. The fixed price is deposited into an interest-bearing escrow account and payments are made to the subcontractor upon achieving performance milestones.

This innovative approach has been successfully deployed at commercial and industrial sites with documented 10% to 50% savings. The benefits of guaranteed remediation include lower clean-up costs, guaranteed regulatory closure, increased efficiency through comprehensive coordination of all environmental activities, successful implementation of innovative technologies, liability buffer to the customer, and multiple year funding.

For more information, contact Mark Nickelson, Advanced Infrastructure Management Technologies (AIMTech), at (865)241-9236 or xv7@y12.doe.gov .

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Session XI - Stewardship: Policy and Program Perspectives Panel Session

The Office of Long-Term Stewardship

As specified in the settlement of a lawsuit brought against DOE, the agency was asked to investigate long-term stewardship for sites that it will not fully remediate. The study was to address national and crosscutting institutional and programmatic issues (e.g., hazards, property and information management, environmental and socioeconomic issues, sustainability) and follow the CEQ/DOE NEPA process for public involvement, but the study itself would not be considered a NEPA document.

Scoping workshops were held in Tennessee, Nevada, Ohio, and Idaho and a public hearing was held in Washington DC on November 30, 2000. The final study will be released after a public comment period. It will not determine policies but will provide support for the policy development process. Parallel to this activity, the FY2000 National Defense Authorization Act requires preparation of a Long-Term Stewardship Report which identifies sites or portions of sites where environmental restoration, waste management, and facility stabilization will conclude by 2006, and residual hazards will not permit unrestricted land use. This report, which will probably be delivered to Congress in the Spring of 2001, will include sufficient detail to understand the cost, scope, and schedule of the necessary management and stewardship activities.

The presenter, Steven Livingstone, described other tasks his office is engaged in: construction of a database of sites with past involvement in nuclear weapons related activities (by January 2001); development of a strategic plan for Long-Term Stewardship (LTS); development of a DOE policy for LTS at sites with non-EM missions; publication of a National Academy of Science study on buried transuranic (TRU) wastes; administration of a $6.25M Citizen Monitoring & Technical Assessment Fund created in response to the PEIS (Preliminary Environmental Impact Statement) lawsuit; and maintenance of an LTS web page (http://lts.apps.em.doe.gov).

For more information, contact Steven Livingstone, DOE Office of Long-Term Stewardship at (202)586-9874 or steven.livingstone@em.doe.gov.

The Draft Long-Term Stewardship Study

The Long-Term Stewardship (LTS) study was required by 1998 PEIS (Preliminary Environmental Impact Statement) Lawsuit Settlement Agreement.

Michael Barainca, U.S. DOE at Headquarters listens to positive results from his Stewardship session

Robert Hegner, ICF Consulting, discussed key challenges identified in the draft study (comments are in italics after each challenge):

1) Incorporating LTS considerations into cleanup decisions.

It is difficult to get anyone to take a longer term view. There are poor tools, little training, and no standard guidance to assist in this effort.

2) Ensuring continued effectiveness of LTS through multiple changes in property ownership.

Deed restrictions are "murky" when land leaves federal control.

3) Ensuring public access to information about residual hazards.

The Grand Junction Project and the Weldon Spring site are currently working on ways to better organize and preserve such data.

4) Ensuring reliable and sufficient funding.

This issue evinced the most concern in public comments on the Draft. Annual appropriations are not suitable, but a better method isn't obvious.

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5) Maintaining continued partnerships with state, local, and Tribal governments.

Ways are being sought to integrate "outside the fence" systems with inside the fence problems. Funding for local groups is an issue.

6) Developing mechanisms and technologies to promote the sustainability of LTS.

The LTS program needs to be aware of technology improvements and, as better technologies surface, make sure they are used. This can also influence the selection of end states.

7) Building the concept of pollution prevention into planning processes for new missions and facilities.

The LTS program is now seeking public comments on the draft study, and hopes it has communicated the LTS challenges well. It is clear that socioeconomic and environmental justice issues pose problems for field sites but the current LTS study only mentions those issues, it doesn't "solve" them.

For more information, contact Robert E. Hegner at (202) 863-7027 or by e-mail at: rhegner@icfconsulting.com.

Results of the NDAA Long-Term Stewardship Report to Congress

For the purposes of the National Defense Authorization Act (NDAA) report, Long-Term Stewardship (LTS) was defined as: *All activities necessary to ensure the protection of human health and the environment following completion of cleanup, disposal, or stabilization at a site or a portion of a site. Long-term stewardship includes activities including all engineered and institutional controls designed to contain or to prevent exposures to residual contamination and wastes.* NDAA requires that sites or portions of sites where residual hazards remain after cleanup be identified. The NDAA LTS Report will be published in two volumes. The first will summarize LTS activities, including cost and schedules, while the second will provide site-specific summaries and tell the LTS story for each site as of October 2000.

The study considered a total of 166 sites including 128 where DOE is expected to perform LTS activities. The primary focus of the NDAA Report is on 67 sites where cleanup is expected to be complete by 2006. For the limited data set provided for LTS costs, it is roughly estimated that LTS costs will average about $100M/year after cleanup is complete, and a study of LTS "cost drivers" is underway. However, there are significant uncertainties in these cost estimates. For example, it has been found that as much as ~$4B will be required for pump and treat at DOE sites alone; uncertainties in LTS costs have been noted and it is expected that long-range estimates (beyond 2006) are less accurate than near term estimates.

The presenter, Janet Bashaw, Project Performance Corporation, closed her talk with a discussion of "next steps." She felt it important that: sites identify an individual responsible for LTS; an agency-wide framework for LTS be devised to promote consistency; LTS elements be built into life-cycle planning; and the transition between closure and LTS be better defined.

For more information, contact Janet Bashaw at (703) 748-7001 or by e-mail at: jbashaw@ppc.com.

The Question of Long-Term Stewardship Responsibilities at Facilities with Continuing Non-EM Operations

DOE Albuquerque Operations Office (DOE-AL) led a working group that developed a discussion paper on Long-Term Stewardship (LTS) responsibilities at sites with continuing non-Environmental Management operations after site cleanup. The group addressed the following issues, and discussed options to address them:

1) Is the transfer of LTS the right choice?

2) What process will be used to transfer LTS responsibilities?

3) Has LTS been adequately and consistently scoped?

4) What are the financial obligations and risks associated with LTS and how will necessary funding be ensured?

A DOE policy statement on LTS transfer is expected by the end of calendar year 2000 that will require the site landlord and EM to agree on conditions of LTS transfer. The site landlord and EM must agree that the EM mission has been completed, LTS planning is in place, budget authority has transferred, and accountability has been addressed through a memorandum of agreement between the site landlord and EM.

DOE-AL has started LTS related activities at all of its sites and includes environmental stewardship scope, schedule, and cost, in all of its project baselines. LTS is understood to be integral to cleanup and not the result of hitting an "on/off switch." Innovative technologies are seen as being critical to LTS life-cycle cost control, but technologies must be sustainable. Of interest are how LTS information will be made available to stakeholders on Defense Programs (DP) sites and how the LTS ethos will become integrated into the DP culture. It is thought that LTS considerations will need to help shape routine operations at DOE sites and that the LTS plan becomes a living document so it can adapt to site changes and newly available technologies.

For more information, contact Deborah D. Griswold, U.S. Department of Energy, Albuquerque Operations Office, at (505)845-4239 or dcouchman-griswold@doeal.gov.

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Long-Term Stewardship—A Perspective from the States

The Southern States Energy Board (SSEB) is an interstate compact formed in 1960 that represents sixteen southern states, Puerto Rico, and the US Virgin Islands. It is one of several multi-state forums for interagency cooperation on environmental issues (others include the Western Governors' Association, the Environmental Council of the States, and the Interstate Technology and Regulatory Cooperation Work Group [ITRC]) that potentially link environmental interests in almost every state in the nation. The DOE Long-Term Stewardship (LTS) mission, which is predicated on the notion that sites will not be remediated to levels that permit unrestricted future use, impacts the states. SSEB is actively interested in LTS implementation.

Specific issues of interest include: institutional controls; information management/dissemination [Weldon Spring will create a museum on site to discuss site history and remaining hazards]; oversight and enforcement; monitoring and maintenance; periodic reevaluation of protective systems and remedial options; long-term funding mechanisms [e.g., a trust fund has been set up at an Oak Ridge CERCLA site that will receive $1M/year for 14 years and then be self supporting]. SSEB intends to convene a forum of technology users, developers, state regulators, and affected citizens to explore LTS opportunities and challenges. They will also offer training to DOE, states, and technology users on LTS issues requiring multi-state input.

The presenter, Cain Diehl, SSEB, also provided information on a forthcoming ITRC LTS document being prepared by their Radionuclides Team. It will provide information on technology needs, challenges, successes, and failures associated with disposal facilities, ground water plumes, land use restrictions, and information management. It is due to be published in January 2001.

For more information, contact Cain Diehl at (770) 242-7712 or by e-mail at: diehl@sseb.org.

National Science and Technology Needs and Applications for Long-Term Stewardship

The Idaho National Engineering and Environmental Laboratory (INEEL) is trying to understand what science and technology (S&T) is needed to successfully implement Long-Term Stewardship (LTS) at DOE sites. LTS needs were collected from the Environmental Management (EM) Needs Management System and from interviews with operations personnel at INEEL, the Grand Junction Project Office, and Weldon Spring. This resulted in a preliminary "baseline" of LTS needs for the DOE Complex. The LTS needs were distributed among the following technical categories:

1. Surveillance & Monitoring — 65 needs.
2. Subsurface Science – 57 needs.
3. Caps and Covers – 12 needs.
4. Physical Barriers – 12 needs.
5. Information Management – 9 needs.
6. Ecosystem monitoring – 2 needs.
7. Toxicity – 2 needs.
8. Non Science and Technology (S&T) – 13 needs.

The relative numbers of needs in each category are not so significant, but the categories into which the needs grouped might represent appropriate categories of LTS S&T needs.

Simultaneous with the needs assessment, INEEL conducted a survey of environmental technologies applicable to LTS [available as the Baseline Technology Inventory Report]. The Initial Needs Assessment and Baseline Technology Inventory Report are intended to be "living documents." They will be accessible on the web for technology developers and users alike. These reports will continue to be refined and updated as new information is gathered.

In FY2001, INEEL will develop an LTS S&T Roadmap to identify where investments in S&T are most critical to the LTS program. The roadmapping process will be directed by an Executive Committee with representation from DOE, the national laboratories, other agencies, industry, and universities to ensure objectivity and credibility. The goal is an initial LTS S&T Roadmap that identifies candidates for investment of S&T funds, is complex-wide, includes other agency input, and is consistent with DOE and EM Guidance.

For more information, contact Roger Mayes, INEEL, at (208) 526-1234 or by e-mail at: mayera @inel.gov.

Long-Term Performance: SCFA Activities, Functional Applications for the Long-Term Stewardship Program

The Subsurface Contamination Focus Area (SCFA) has reviewed its program against about 200 Site Technology Coordinating Group (STCG) Long-Term Stewardship (LTS) technical needs and found that the majority fall within three SCFA Work Packages:

- Less than 25% in Vadose and Saturated Zone Characterization, Monitoring, Modeling and Analysis.
- Less than 20% in Waste Containment/Stabilization Verification and Monitoring
- About 10% in Long-Lived Caps.

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SCFA is working with the Characterization, Monitoring, and Sensor Technology Crosscutting Program on buried sensor development, remote sensing and remote data collection, and on verification and monitoring. For verification and monitoring, SCFA is following a three tiered approach. Real time construction monitoring will identify construction flaws while mobilized, and thereby increase confidence in design and construction. After construction "as-built" drawings will lead to greater regulatory and stakeholder acceptance.

The third tier, long-term performance monitoring, is easy to claim but hard to do in practice. The unprecedented long-term performance requirements implied by LTS means that a very comprehensive implementation process must be instituted. Stakeholder input, regulatory requirements and guidance, and up-front risk evaluations must be blended with important performance parameters (e.g., regional environmental performance envelope, failure mechanism envelope, transitional mechanisms envelope) to arrive at operational performance envelopes that succeed in the time scales relevant to LTS.

SCFA is committed to optimize science and technology investments to minimize risk to human health and the environment from contamination at DOE sites, while minimizing long-term costs to the Federal government. It actively collaborates with other agencies (e.g., DoD, EPA, and NASA) to coordinate investments and provide solid technical solutions to subsurface problems that each agency shares. It is actively supporting DOE's LTS mission.

For more information, contact Mike Serrato, U.S. Department of Energy, Savannah River Operations Office, at (803) 725-5200 or by e-mail at: michael.serrato@srs.gov.

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Combining Technology and Pollution Prevention for Cost Savings at Multiple Sites

The Department of Energy (DOE) has supported site project management by developing solutions to common technical needs across projects and between sites. These efforts have obtained varied degrees of success.

The DOE Ohio Field Office and its five sites started a group in 1998 to improve cost savings, resolve common technical issues, and investigate and evaluate waste management alternatives. Waste management, processing and disposal constitute 40% of the budget for Ohio's closure sites. The team uses value engineering tools and life cycle analyses to weigh possible solutions.

The group's initial effort for cost savings deployed a concrete crushing unit to be shared among the Ohio sites, using common permitting and procedures experience and technical expertise. Cost savings efforts also include re-use of contaminated equipment by commercial companies, recycling of electronics, and evaluation of PCB (Polychlorinated Biphenyl) treatment and disposal alternatives.

For more information, contact Dick Govers, Chamberlain Group, at (804)528-4365 or rgovers@chamberlaingroup.net.

Cost Effective Cleanup using "Green" Environmental Restoration Technologies

Site 300 at Lawrence Livermore National Laboratory (LLNL) was established in 1955 as a remote explosive test facility in the Altamont Hills east of Livermore, California. Testing at Site 300 has resulted in 73 releases and 36 plumes containing volatile organic compounds, tritium, metals, nitrates, depleted uranium, pechlorate, fuel compounds, and high explosive compounds.

Ahmet Suer, WSRC, staffing the Savannah River exhibit, was the TIE site lead for the Augusta 2000 Workshop

A ten-year schedule was recently negotiated with regulators for remediation of the site, however, DOE budget allocations warrant more efficient and cost-effective remedial options. "Green" environmental restoration technologies have been proposed to meet Site 300 remedial needs. Green technologies are those which allow rapid and "below detection limit" clean-up, minimize construction costs, provide low operations and maintenance, conserve energy, incorporate local physical conditions, minimize or eliminate secondary wastes, emphasize complete contaminant destruction rather than removal, and have no adverse effects on the environment or wildlife.

Several green technologies are under investigation for deployment at Site 300. These include in-situ bioremediation, phytoremediation, iron filings, and barometric soil vapor extraction.

For more information, contact John Ziagos, LLNL, at (925)422-5479 or ziagos1@llnl.gov.

Session XII - SCFA: Natural Remediation Processes: Lessons Learned through Research, Development, and Application

This session focused on the state of science in developing and applying natural remediation processes for subsurface contamination. Panelists addressed outstanding research and development issues associated with various technologies, monitoring, risk management, cost considerations, and regulatory issues.

Using Phytoremediation to Address the Challenge of Metals and Radionuclides in Subsurface Soils

Phytoremediation is the use of plants to clean the environment, and includes both non-accumulators and high accumulators. Non-accumulators work by exudating into the soil and changing the rhizosphere, while high accumulators uptake metals and accumulate these in the foliage. Bright

Michael Barainca, DOE-HQ (right) and Paul Wichlacz, INEEL (center) take a few moments to chat before returning to their sessions

applications of phytoremediation include rhizofiltration of waste streams; phytoextraction of heavy metals, metalloids, and radionuclides in surficial contamination to the depths of roots; phytodegradation using plant enzymes to transform contaminants; phytovolatization or methylation; and phytostabilization/immobilization for contaminants that are subject to redox reactions. Emerging paradigms include phyto-assisted bioremediation, use of rhizosphere metabolites as energy sources for natural microbes, phytobuffering, and the use of rhizosphere metabolites to facilitate redox reactions. Major limitations of this technology include the accumulation of contaminated plant biomass, disruptive harvesting of the biomass, and the limited treatment depth.

Willows and poplars have been used in Europe for years to treat wastewater containing heavy metals. Poplars are able to degrade both organic contaminants (e.g., trichloroethylene, dioxane, atrazine) and heavy metals (e.g., mercury, lead, arsenic). Fast-growing trees are being tried at a settling pond at the Savannah River Plant, and these are working well with nickel but not uranium. Cadmium at 1.5 milligrams/hectare can also be removed and the accumulation of nickel and cadmium by the trees is increased when these are mixed. Differences in the degree of metal uptake have been found in different clones of a hybrid poplar, and elevated concentrations of metals yield less uptake. Exposing the clones to mixed metals changes the uptake dynamics. This work has shown the importance of plant species screening and the need for a better understanding of plant physiology to predict how phytoremediation will work.

Phytoextraction - using plants to remove contaminants from the environment - is cost effective, elegant, publicly acceptable, and backed by science. Steps required for its application include site selection, site characterization and assessment, phytoextraction technology selection, crop production, amendments application (e.g., EDTA to chelate lead), harvesting, biomass disposal, and results evaluation. The technology removes only that fraction of the contaminant that is bioavailable and hence a risk to human health. Work by Florida State University in Poland is providing a large field-scale demonstration of this technology. Full-scale deployment at a Savannah River firing site is being proposed.

For more information, contact Mike Kuperberg, Florida State University at (850)644-5516 or mkupe@mailer.fsu.edu.

Natural Analogs for Performance-based Monitoring

Natural analogs can provide a tool for assessing long-term performance of engineered covers to supplement field monitoring and numerical studies.

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These use information from natural and archaeological settings as a clue to the future for refining the engineering process, defining values for model parameters, forming hypotheses and selecting treatments for field studies, projecting long-term performance of existing covers, and designing covers that mimic natural systems. For example, plant succession sequences under similar soil conditions can aid understanding of plant ecology on side slopes of covers. Natural and archaeological soils can be used to assess soil thickness needed over capillary barriers, impacts of root penetration on hydraulic conductivity, and side-slope designs for slope stability while minimizing water infiltration. Tree rings, packrat middens, pollen, and snails can be examined to see how forest boundaries have changed from the late Pleistocene to today. Looking at the past history with natural analogs could help with public acceptance of projected performance and save money in long-term monitoring.

For more information, contact Jody Waugh, MACTEC-ERS, at (970)248-6431 or jwaugh@doegjpo.com.

Bioremediation: Emerging Applications, Challenges, and Lessons Learned

Microbial life on earth vastly exceeds all the plant and animal biomass combined, suggesting a huge potential for bioremediation of contaminants. Factors that determine the effectiveness of bioremediation include molecular parameters such as size, shape, and concentration and environmental characteristics such as mechanical accessibility, pH, and redox potential. Aerobic versus anaerobic environments make a huge difference in how degradation occurs.

Bioremediation technologies include bioreactors, injections into the contaminated zone, biofilters, prepared beds, and biopiles. Use of bioremediation at the "D" Area Oil Seepage Basin at Savannah River reduced organic contamination to non-detectable levels in less than 6 months. A biopile used at a Polish factory destroyed 81 percent of the contamination in 18 months; 50 percent of the contamination was removed very quickly but surfactants were needed to make the remaining contamination bio-available. Bioremediation also succeeded in removing 80 percent of the selenium at the Panochie site. Aerobic landfill bioremediation increased biodegradation by a factor of 30 and stabilized the refuse mass in 2 versus 30 years.

In biostimulation, compounds are added to cause indigenous organisms to remediate the environment, whereas bioaugmentation involves the addition of organisms to the environment; the latter works for new spills and recalcitrant contaminants. Genetically modified organisms are also being developed as biosensors for biodegradation, adhesionless strains to enhance movement, and tracers.

There is now evidence that microbes can degrade deuse non-aqueous phase liquids (DNAPLs) if water is present and can convert chromium VI to chromium III. Bioremediation promises significant cleanup that is safer, faster, and cheaper for even the most recalcitrant contaminants. However, an understanding of subsurface biogeochemistry is critical and new delivery and sampling techniques are needed.

For more information, contact Terry Hazen, Lawrence Berkeley Laboratory, at (510)486-6223 or tchazen@lbl.gov.

Monitored Natural Attenuation: Deciding When, Where, How, and How Much

Enhanced in-situ bioremediation is being used at Idaho National Engineering and Environmental Laboratory's (INEEL's) Test Area North for a trichloroethylene (TCE) plume that is 200-400 feet deep in fractured basalt. This reductive dechlorination uses chlorinated solvents as electron acceptors but inorganic electron acceptors may compete. A Record of Decision for this plume was issued in 1995 and called for pump and treat, but it provided for treatability studies of five technologies. The study of in situ bioremediation was to demonstrate that TCE biodegradation is enhanced through electron donor addition. The study found that 3 percent sodium lactate addition is optimal and most microbial activity was at the bottom of the aquifer. Once lactate addition stopped, degradation continued for 6 months, perhaps due to the presence of different microbial species. For this technology, redox conditions and the presence of electron donors are critical.

Monitored natural attenuation has also been examined at INEEL's Test Area North. These studies found that TCE concentrations are not increasing over time and the concentrations are actually decreasing near the source with an aerobic TCE degradation half-life of 8-17 years. Dispersion is not constant in time because it is driven by concentration gradients, and this could lead to over-prediction of the effects of dispersion. A model that includes degradation is closer to the observed concentrations. Data indicate that an oxidative mechanism is occurring, raising the question if this is aerobic co-metabolism. At the Test Area North, indigenous micro-organisms are degrading TCE; this is a slow process, but it will allow the site to reach its cleanup goal in less than 100 years and is faster than protocols would suggest. Standard methods for predicting performance need to separate dispersion from degradation.

For more information, contact Kent Sorenson, INEEL, at (208)526-9597 or sorenks@inel.gov.

Session XIII - FRAMES Demonstration Session

The software platform "Framework for Risk Analysis in Multimedia Environmental Systems" (FRAMES) was presented and demonstrated for session participants. FRAMES is a software platform that allows easy "Plug and Play" of models and databases for integrated environmental and human health assessments. It has been and continues to be developed by Battelle at the Pacific Northwest Natonal Laboratory in support of the Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), U.S. Nuclear Regulatory Commission and U.S. Department of Defense application needs. The four agencies have combined efforts to advance the environmental modeling science by supporting future development of FRAMES to meet assessments of all these agencies and to facilitate continued collaboration.

The FRAMES session consisted of a 45-minute presentation describing FRAMES and 2001 development plans. After the presentation, a 45-minute demonstration of the software was provided. There were several attendees, with a good cross section of regulators and DOE contractors. Regulatory Staff from EPA, the South Carolina State Department of Heath, and the South Carolina State Department of Transportation were involved in the discussion on benefits of integrated environmental modeling. The demonstration provided attendees first hand experience with FRAMES and its functions.

FRAMES allows for the use of a suite of analytical models that use detailed information and, with relatively limited resources, results in expanded integrated impact analyses. This "meso" level analysis can easily consider expanded lists of contaminants, uncertainty studies, and numerous "what-if" scenarios that are usually too resource prohibitive for detailed studies. FRAMES also allows for the next phase of analysis, which is more detailed and focused (e.g., use of numerical models). The "micro" level analysis can provide decision-makers with answers that have a high degree of certainty and confidence. The FRAMES software platform allows for multiple levels of analysis in an efficient and cost-savings way.

FRAMES is an open-architecture, object-oriented system that provides an environmental database. The software aids the user in constructing a Conceptual Site Model that is real world based. Further, the software allows the user to choose the most appropriate models to solve simulation requirements and presents graphical packages for analyzing results. FRAMES currently contains sockets for a collection of computer models that simulate elements of a source, fate and transport, exposure, and risk-assessment modeling - and more sockets can easily be added.

TIE and DOE EMs Lessons Learned Program go "hand-in-hand." Mary McCune, DOE-HQ (left) is the lead for both the Lessons Learned Program and TIE Workshop

For more information, contact John Buck, PNNL, at (509) 376-5442 or by -mail at: john.w.buck@pnl.gov.

PMT Meet at TIE

The Project Management Team (PMT) met in Augusta, Georgia, on November 16, 2000 following the Technical Information Exchange (TIE) Workshop. PMT consists of senior contractor management representatives from eight Department of Energy sites. This group of experts, which meets regularly, came together in conjunction with the workshop to further define their working relationship with the Office of Integration and Disposition, EM-20, and to discuss common issues across the sites that may benefit from integrated solutions.

The Team defined their charter, their EM-20 deliverables, and the their roles and responsibilities during a facilitated morning session,. They met with David Huizenga, EM-20 Deputy Assistant Secretary, in the afternoon to discuss the deliverables proposed and to obtain his concurrence. Following approval of the deliverables, PMT members discussed pressing site issues with Huizenga. The team will work closely with EM-20 staff to develop recommendations for the issues raised and, in addition to weekly teleconferences, made plans to reconvene during April 2001.

Session XIV - Overcoming Barriers to Long-Term Monitoring Technology Deployment

The Technology Information Exchange Workshop provided a forum for the identification and communication of important new technology developments for environmental remediation within the DOE Complex. In addition, it provided a forum for discussion about what seems to be working well, and what is not.

A panel of 5 professionals was invited to review some specific and familiar Long-Term Monitoring (LTM) technologies and to summarize what they see as pressing issues, barriers, and roadblocks to the deployment of these technologies and DOE facilities around the country, regardless of where they were originally developed.

Cary Tuckfield, WSRC, reviews session issues at the break during his "Barries" session at TIE

Workshop attendees communicate better when session rooms are small and the setup is informal

This panel was composed of:

- Dr. Joe Rossabi, a graduate of Clemson University in Environmental Engineering and presently employed as a geoscientist at the Savannah River Technology Center working with DNAPL characterization and remediation technologies
- Bob Bainer, a 26 year veteran of technical management experience and 12 of these years in environmental remediation at the Lawrence Livermore National Laboratory. Bainer is presently the LLNL Site Restoration Project Leader
- Herb Levine, a consulting hydrogeologist in the Superfund environmental remediation program for the US Environmental Protection Agency, Region IX
- Carl Jacobson, a chemical engineer with MACTEC, the managing contractor for the DOE Grand Junction Office he works on the environmental remediation of uranium mine tailings at Superfund sites in the DOE complex
- Marianna DePratter, a geologist with the South Carolina Department of Health and Environmental Control, the state regulating authority she has 10 years experience working with RCRA facilities, 5 of these with the Savannah River Site

Each panelist presented a summary of their experience with related technologies and identified the top issues that face DOE and its contractors to complete the environmental restoration within its collection of facilities in preparation for long-term stewardship. The audience was encouraged to participate with the panelists in the discussion after each panelist's remarks. These issues, barriers, and roadblocks can be grouped into three categories, viz. technical, practical, and systemic. After Szilagyi discussed facility disposition priorities committee working groups gave status reports.

Technical issues:

- What part of the plume should be monitored in the long-term, nearer to the contaminant source or to the leading edge of the plume?
- How clean is clean? We can't expect to remove all, or even most, of a contaminant located in fine grained soil horizons in typical heterogeneous environments.
- In situ technology: Should we drive development to that end?
- Monitoring (i.e. sampling) frequency? For constituents of concern only? Use of "guard" wells?
- Role of remote sensing?

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- Accurate well placement/screening in order to reliably intercept flow paths.

Practical issues:

- Remediation decisions subsequent to implementation of LTM systems are only as good as the data are accurate and precise, i.e. couple monitoring to Data Quality Objectives (DQO) process?
- Large data set summarization methods are needed for assessing monitoring effectiveness.
- Need monitoring technology selection method or criteria
- Need cost/benefit analysis criteria.
- How to compensate for the loss of institutional knowledge from retirements and the "long arm" of industry.

Systemic issues:

- Lack of adequate site conceptual model.
- Lengthy and complicated technology approval process impedes the sorting through and testing of emergent technologies.
- How to meet the RCRA regulatory guidance to protect the public and environment and streamline the technology deployment process at the same time?

Perhaps the most energized discussion centered on the current system, or lack thereof, for providing incentive to one DOE facility to accept and deploy technology developed at another. By collective experience and consensus, it was agreed that this was the largest roadblock or barrier to technology deployment within the DOE complex, and a crucial item for DOE headquarters review.

For more information, contact Cary Tuckfield, Westinghouse Savannah River Company, at (803)725-8215 or cary.tuckfield@srs.gov.

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FY01. At that level of effort, the Lead Lab will exceed the initial goal of providing 100 definitive recommendations or solutions to end-users in FY00 and FY01. In addition to integrating basic science and research into technical assistance efforts, the Lead Lab is researching ways to increase the exchange of information and equipment between sites and other Focus Areas.

For more information, contact Jack Corey/ Department of Energy-Savannah River at (803)725-1134 or john.corey@srs.gov.

Science Advancing Solutions into the 21st Century

Since 1996, the Environmental Management Science Program (EMSP) has invested approximately $250 million in research projects conducted at 90 universities, 13 national laboratories, and 22 other governmental and private laboratories. More than forty percent of the funding in EMSP supports research to address issues associated with subsurface contamination problems. Significant advances have been made over the last four years in scientific areas such as geochemistry, hydrogeology, geophysics, analytical chemistry, instrumentation, microbial science, and plant science. A recent National Research Council report identifies four high priority areas for future research investments: location and characterization of subsurface contaminants and characterization of the subsurface; conceptual modeling; containment and stabilization; and monitoring and validation.

For more information, contact Mark Gilbertson/Department of Energy, Environmental Management Science Program at (202)586-5042 or mark.gilbertson@em.doe.gov.

Identifying Opportunities for Applied Research

Since 1992, more than 110 projects have been sponsored by Industry and University Programs (IP/UP) to foster private sector companies and universities to solve cleanup problems at DOE sites, including SCFA/IP technology demonstrations and deployments at Savannah River, Hanford, Oak Ridge, Fernald, Idaho, Ashtabula, Sandia, and others. Through an applied research call in FY01, IP/UP will work in partnership with SCFA, Characterization Monitoring Sensor Technology (CMST), Efficient Separations Program (ESP), and the sites to address needs such as characterization, monitoring, and modeling; separations and treatment barriers design/components; validation; and long-term monitoring. In particular, there are strategic partnering opportunities to address access/delivery in difficult subsurface conditions, Deuse Non-aqueous Phase Liquid (DNAPL) characterization, tritium monitoring in the vadose zone and groundwater, treatment of metals in soil, and treatment of radionuclides in vadose and saturated zones.

For more information, contact Karen Cohen/National Environmental Technology Laboratory at (412)386-6667 or cohen@netl.doe.gov

Don't forget to send in your abstract for the TIE 2001 Workshop!

Session XV - ITRD Panel Session

The ITRD Program: Overview of Goals and Accomplishments in FY2000

The objectives of the Innovative Treatment Remediation Demonstration (ITRD) Program are to accelerate deployment of innovative characterization and remediation technologies and to generate cost and performance data to support adoption of innovative technologies to address site-specific needs. ITRD Program activities involve:

- organizing Technical Advisory Groups and Performance Evaluation Groups,
- screening applicable technologies,
- developing, testing, and demonstrating programs,
- maintaining a web-based data base of commercial vendors,
- organizing technology forums, and
- coordinating activities across Department of Energy (DOE) Programs.

Projects/technologies requesting ITRD assistance may be proposed by DOE Headquarters, DOE Sites, or the Subsurface Contaminant Focus Area Group (SubCon). In addition, existing ITRD projects may be expanded. Expert teams comprised of professionals from DOE, the Environmental Protection Agency (EPA), universities, and commercial sectors provide support. Technologies are analyzed via modeling, treatability studies, and risk evaluations. Promising technologies are recommended for pilot studies to provide cost and performance data. Technologies that meet ITRD criteria are then recommended to DOE for deployment.

DOE sites receiving ITRD assistance in FY2000 include Hanford, Los Alamos, Mound, Oak Ridge, Paducah, Pantex, Portsmouth, and Savannah River.

For more information, contact Malcolm Siegel, Sandia National Laboratory, at (505)844-5426 or msiegel@sandia.gov.

Hanford 100N Area ITRD Project

The purpose of the Hanford 100N Area ITRD Project is to identify and evaluate innovative technologies that can be used to resolve the strontium 90 (Sr-90) ground water contamination problem at the site. Sr-90 contaminated reactor cooling water leached from surface discharge trenches into the ground water. The highest levels of contamination are at the Columbia River shoreline. Sr-90 is mobile and easily bioaccumulated.

Available remedial baseline technologies are barrier walls and pump and treat. Neither of these technologies are affective in reaching remedial goals. The ITRD Team evaluated 35 technologies, and conducted ground water modeling and bank stability studies. Remedial alternatives retained for further consideration include soil flushing, clinoptilotite treatment wall, natural attenuation, sheet pile/cryobarrier, soil stabilization, and phytoremediation.

For more information, contact Cecelia V. Williams, Sandia National Laboratory, at (505)844-5722 or cvwilli@sandia.gov.

Paducah Ground Water ITRD

Ground water at the Paducah Gaseous Diffusion Plant contaminated with trichloroethylene (TCE) and technetium 99 (Tc-99) has migrated off-site and is approaching the Ohio River. Multiple source areas have been identified. The remedial approach strategy is source removal and reactive treatment at the site boundaries, natural attenuation of the dissolved plume, and 70 years of monitouring.

The ITRD project began in early 1999. The team evaluated 28 potential technologies. Pilot tests were conducted on three technologies and these technologies have been recommended for deployment; Permeable Treatment Walls/Zero-Valent Iron, C-Sparge, and Six-Phase Heating. Zero-valent iron placed in permeable treatment walls removes both TCE and Tc-99. C-Sparge is a recirculating well technology employing ozone to destroy TCE in place. Testing is being conducted to determine if Tc-99 can be removed by placing ion exchange resins in the recirculating wells. Six-Phase Heating volatilizes TCE by heating the soil to the boiling point of TCE. A vacuum extraction system captures the volatilized TCE and a surface treatment system removes the TCE from the vapor.

For more information, contact Wu-Ching Cheng, Sandia National Laboratory, at (505)844-4059 or wcheng1@sandia.gov .

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Combination Air/Sparge Soil Vapor Extraction System at the Mound OU-1 Site

The vadose zone and ground water at the DOE Mound Site in Miamisburg, Ohio has been contaminated with volatile organic compounds (VOCs) resulting from past operations. The baseline remediation technology is pump and treat (P&T). P&T is not an efficient technology because it only partially remediates the saturated zone and is not particularly affective in either cost or time.

The ITRD project was initiated in 1995. A four-acre capped landfill was selected as the demonstration site (Mound OU-1) and 20 potentially applicable technologies were evaluated. The remedial approach deployed as a result of the evaluation was a combination of air sparge and soil vapor extraction technologies. The air sparge/soil vapor extraction system consists of valved extraction wells, valved French drains, and air injection wells where operators can adjust airflow to optimize removal rates.

Reported results have been exceptional. Total VOCs extracted during a three-year period using the baseline technology of pump and treat was approximately 30 pounds. Total VOCs extracted the last 2.5 years using the air sparge/soil vapor extraction system have been approximately 3,500 pounds. The air sparge/soil vapor extraction system operation is maximized by "real time" process monitoring and directed air sparge to facilitate removal of VOCs from stubborn tight formations.

For more information, contact Gary Brown, Ph.D., Sandia National Laboratory, at (505)845-8312 or gbrown@sandia.gov.

ITRD Explosives Project at Pantex and LANL

An ITRD project for explosives in soil, surface water, and ground water was started in January 1998 at Pantex and Los Alamos National Laboratory (LANL). Water discharges from high-explosive machine shops created soil contamination containing TNT, RDX, HMX, and barium.

Ex-situ soil treatment technologies evaluated included composting with manure to biochemically breakdown the explosives, zero valent iron for nitro group reduction or pretreatment for biodegradation, and DADAMEND®, a biochemical oxidation/reduction treatment. An in-situ soil treatment technology evaluated was anaerobic bioreduction. In situ ground water treatment technologies evaluated were anaerobic, chemical oxidation, and chemical reduction. An ex situ ground water treatment technology of granular activated carbon was evaluated.

Reported cost analysis comparisons for baseline and ITRD innovative technologies for Pantex are as follows: baseline technology of excavation and off-site disposal ($31M) to innovative treatment of in situ biotreatment ($8M). Reported cost analysis comparisons for baseline and ITRD innovative technologies for LANL (excluding excavation) are as follows: baseline technology of off-site treatment and disposal ($1.5M) to innovative composting, zero-valent iron, or DADAMEND® ($0.4M).

These technologies are still being evaluated and, although final results are not in, some preliminary results are promising.

For more information, contact James M. Phelan, Sandia National Laboratory, at (505)845-9892 or jmphela@sandia.gov.

Hanford ITRD Project for Carbon Tetrachloride Plume Transport and Attenuation Assessment

In addition to assisting DOE Sites in evaluating, demonstrating, and deploying innovative technologies, the ITRD program assists in setting up and running models to provide interpretations that can be applied to real situations. This is the case in the assessment of carbon tetrachloride (CCl4) plume transport and attenuation for the Hanford Site.

CCl4 is dispersed over an area of about 10 km^2 in the ground water at Hanford. Attenuation mechanisms such as partitioning to the aquifer solids and hydrolysis reactions may limit the migration of CCl4. Whether these mechanisms can attenuate the plume prior to contamination reaching the compliance point is dependent on the rate and extent of the attenuation and the magnitude of the contamination source. Transport simulations were conducted to estimate the amount of remediation necessary to reduce the source of contamination to a level where natural attenuation mechanisms can mitigate the remainder of the plume prior to contamination reaching the compliance boundary. The uncertainty in this estimate due to uncertainty in the input parameter values was also evaluated.

The conclusions of this study are: 1) if no additional CCl4 reaches the ground water, then compliance concentrations likely will not be exceeded, 2) if 10% or more of the CCl4 reaches the ground water, then compliance concentrations likely will be exceeded, 3) the breakpoint exists between 1% and 10% that defines the amount of CCl4 in the source zone that needs to be removed, and 4) the parameters with the greatest impact are Kd, Ka, and porosity. Recommendations are: 1) ground water sources must be identified and quantified, 2) refined parameter estimates would help better define the impact of the source on the compliance boundary, and 3) vadose zone modeling would provide an improved understanding of the ground water source.

For more information, contact Richard J. Cameron, Pacific Northwest National Laboratory, at (509)372-8023 or richard.cameron@pnl.gov.

Session XVI - GIS Panel Session

Meeting Users Needs': Practical Integration of GIS

Russell Beckmeyer, Westinghouse Savannah River Company, discussed development of an Enterprise Environmental Data and Geographical Information Systems (E&GIS) Data Center at the Savannah River Site (SRS). Prior to its development, geophysical information consisted of an eclectic collection of geochemical, geotechnical, and structures data. The effort to develop a centralized information system and data warehouse started in 1996. The enterprise system that has evolved in this relatively short time span is a truly user friendly data center, a data clearinghouse, and a distributed data warehouse. In addition, the data center is mirrored at both the regional Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control.

The system utilizes a 1 Gbps Ethernet LAN as the backbone to tie the three main SRS areas together, and to provide users with web access. Oracle™ is the primary database format, but images are also included. Applications software includes ArcInfo™, ArcVeiw™, 3D Analyst™, and Spatial Analyst™. Russell provided a good overview of the system architecture and a brief review of configuration control and information management systems in place.

The result of this dedicated work is a comprehensive collection of GIS information, with large sets of environmental and geotechnical data and fifty years of historical photography, which is available to all SRS personnel through one integrated GIS interface. According to Russell, a key to the success of this effort has been the focus on practical application of commercial off-the-shelf technology and strong service-based interaction with the data providers and the information users. Also, the partnering with SRS regulators has led to beneficial GIS-based virtual conferencing.

For more information, contact Russell Beckmeyer at (803) 925-6845 or by e-mail at: rrb@srs.gov.

GIS Considerations for Closure

Denise Bleakly, Sandia National Laboratories (SNL), provided perspectives on problems being encountered in the planning process for closure of data information systems for remediation sites being closed and sites transitioning to long-term storage. The SNL Environmental Restoration (ER) Project began in 1990. The ER Management Team determined in 1991 that the use of Geographical Information Systems (GIS) was key to successful implementation of remediation strategies. SNL Environmental GIS (EGIS) has been in existence since that time.

Today EGIS contains data for over 200 ER sites, consisting of over 27,000 electronic files related to over 9,000 maps, figures, and diagrams. There are 2,300 GIS data layers stored on about 30 Gbytes of space. In addition, sampling data requires about 16 Gbytes, stored in a separate database. The ER Project will be completed in 2004. The problem, then, is what to do with all of this data.

Denise discussed the EGIS approach to closure, noting that about 25% of the data is of use to other programs or projects. The closure approach includes:

- **GIS Indexing Project** Current GIS structure is based on data categories. The indexing project will test the process of indexing ER site specific data on a site by site basis, with the goal of developing a process to be used for archiving data pertaining to the cleaned up sites.
- **Long Term Data Management Strategy** The purpose this effort is to find an internal repository for Sandia specific data. This includes developing a spactial data warehouse to store common data for all of SNL. Some "core" ER site data will remain active as part of Long-Term Stewardship – the definition of this data is currently being worked on.
- **EGIS Transition Plan** The purpose of this effort is to transition data and resources to new projects over the next two-to-three years. Current scenarios include the data warehouse and long-term stewardship projects. EGIS is also performing an in-house analysis to look at GIS needs into the future.
- **SNL Long-Term Stewardship** This project includes obtaining public input for the SNL Long-Term Stewardship plan, associated with information management and institutional controls.

Denise highlighted a real problem associated with archiving GIS information. Stored database dataset information in an electronic format becomes obsolete and unusable with time due to changing software systems and evolution of hardware platforms.

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Storing hard copies doesn't provide a solution either, because GIS software systems query the available data sets differently for each specific solution, in an interactive process. The crux of this problem is that archived information will be lost over time due to processing software and hardware evolution.

In closing, Denise noted that Long-Term Stewardship issues are just now beginning to be discussed and considered, and Information Technology issues need to be a part of these discussions.

For more information, contact Denise Bleakly at (505) 284-2535 or by e-mail at: drbleak@srs.gov.

Soils Geochemistry Anslysis with ArcView Geographic Information Systems Software

James Bolinger, Westinghouse Savannah River Company, discussed the use of ESRI's ArcView™ Geographical Information Systems (GIS) software to access the large quantity of soil geochemistry data in the Savannah River Site (SRS) central database. A software extension has been developed for ArcView that allows users to interact with the data from a simple dialog.

The user chooses the specific constituent, the soil project name, and the measurement units. ArcView does the rest – it retrieves the requisite data from the database, processes it to average duplicate results, and ensures all measurements are converted to consistent units. Since soil data is taken at discrete depth intervals, the user is given a choice of intervals to be analyzed. The data is then processed into ArcView themes for display on a planimetric map.

Using this new ArcView extension, soil data that once required hours to retrieve and plot can now be displayed for analysis in minutes.

For more information, contact James Bolinger at (825) 725-1417 or by e-mail at: james02.bolinger@srs.gov.

Emergency Communications Network GIS Facility Mapping Project

The Bechtel Nevada Geographical Information Systems (GIS) team at the Department of Energy (DOE) Remote Sensing Laboratory has compiled facility-level GIS data sets for all major DOE facilities across the nation, in support of the Emergency Communications Network (ECN) at the DOE-Headquarters Emergency Operations Center. Data was compiled in a coordinated effort with the individual facilities, to gather and update GIS and Computer Aided Drawing (CAD) data sets. It was then processed into a common database format at RSL to be used for ECN GIS applications.

This data has also been used to assembly hardcopy atlas products and to populate a large database used for emergency response and emergency management GIS applications. The data has been incorporated into an "ECN Only" Intranet web page application, through which the user may interactively view and query. Results of this extensive effort have provided the only known database for facility-level mapping of all major DOE facilities in the country.

Russ Cofffey, Bechtel Nevada, discussed the project and provided some insight into the problems and techniques used to amass and process this facility information. He also discussed the level of detail provided by the system, noting that each site should look at the information included for their respective site to assure the overall quality. All in all, an interesting project and interesting discussion.

For more information, contact Russ Coffey at (702)794-1071 or coffeyjr@nv.doe.gov.

GIS Management of Waste Units at the Savannah River Site

Larry Koffman, Westinghouse Savannah River Company, related a Savannah River Site (SRS) Geographical Information Systems (GIS) success story regarding spatial data. He defined GIS success in terms of:

- easy access to enterprise data for analysis, decision making, and communication, and
- data quality improvement through user feedback from applications.

Historically, SRS maps were made by a computer aided drafting (CAD) group, and were project oriented rather than enterprise oriented. In 1996, the Department of Energy requested a site map showing all waste unit locations. The resulting composite map had about a dozen locations being shown off site. This prompted the decision to use Global Positioning Statellite (GPS) technology to field verify locations as a waste unit baseline.

Baseline GPS field work and conversion of the information to GIS data layers was completed during the spring and summer of 1997. This information was then reviewed by project teams, and further field work occurred in the spring of 1998 to resolve questions. Following further review and resolution of questions, the first release on Compact Disc (CD) occurred in December 1998, with formal release as an SRS base data layer, with metadata, occurred in March 1999.

A parallel effort occurring during this time was the consolidation of all programmatic data relative to the waste units. The result of these joint efforts is an enterprise data system which is web based for easy user access. ESRI's ArcView™ Internet Map Server (IMS) was used to put maps on the web, providing

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the user with interactive zoom, pan, and identification capabilities. The waste unit map shows all waste unit locations, provides U.S. Geological Survey quad sheets as background, provides detailed infrastructure in the background when zoomed, and can identify waste unit or well identification by clicking.

Larry closed the discussion with the following insight gained through this experience:

- data is the key to GIS success,
- invest in data on the front end to realize results on the back end,
- a data steward is needed for enterprise data (single record copy),
- configuration control is needed, along with easy access for users,
- applications will grow naturally once data is available, and
- applications foster user feedback, which in turn improves the data.

For more information, contact Larry Koffman at (803)725-1038 or larry.koffman@srs.gov.

GIS Applications for Watershed Risk Analysis and Data Needs Evaluations

Tracy McLane, Bechtel Savannah River Site, discussed a Geographical Information Systems (GIS) project developed to display and evaluate the vast amount of environmental, geographic, and hydrogeologic data available for the Savannah River Site's (SRS's) Integrator Operable Unit (IOU) program. The IOU is performing Remedial Investigation/Feasability Study (RI/FS) Baseline Risk Assessments on surface water bodies within the site's six watersheds. These surface water bodies are referred to as IOUs because they ultimately integrate all site-related contaminants to points of potential receptor exposure.

The project assembles the graphic and tabular data in a user-friendly format which enables analysis of every aspect of the conceptual site model. The most significant feature of the IOU GIS project is a customized utility application, which allows users to perform real-time human health and ecological risk evaluations, obtain statistical summaries, and create time series plots of the environmental data of interest. Unlike previous hard copy deliverables, a fully automated compact disc effectively communicates the maps, tables , and hundreds of thousands of analytical records from a relational databse. This enables reviewers to select and manipulate the graphic and/or tabular data of interest, and to customize it to their specific evaluation needs.

For more information, contact Tracy McLane at (803) 952-6953 or by e-mail at tracy.mclane@srs.gov.

National Deactivation and Decommissioning Committee Meeting in Augusta, Georgia

In July 2000, the National Decontamination and Decommissioning Committee (under the old EM-40 Organization) was integrated with the National Deactivation Committee (under the old EM-60 Organization), to form a new single entity, the National Deactivation and Decommissioning (D&D) Committee (Under the new EM-20 Organization). The D&D Committee, chaired by Andy Szilagyi and Mary McCune from DOE HQ, includes representation from EM-30, 40, and 50, and consists of representatives from all DOE sites involved in D&D activities. The Committee conducted its initial semi-annual working meeting on November 16, 2000, in conjunction with the Technical Information Exchange (TIE) Workshop held in Augusta, Georgia. The meeting was conducted as an open forum and all TIE Workshop attendees were invited to participate.

Szilagyi opened the meeting with introductions and welcomed the first time members and guests. He briefly explained the new committee's organization, structure, and purpose. He went on to describe the technical support that can be made available to committee members and their respective sites by the National Facility Deactivation Initiative (NFDI) team, which is managed through the D&D Committee. NFDI strategic objectives are to strengthen D&D project management expertise across the complex, accelerate site D&D programs, develop and maintain tools to assist in D&D project planning and execution, and develop long-term D&D strategies. After Szilagyi discussed facility disposition priorities, committee working groups gave status reports.

Facility Disposition Priorities

Szilagyi indicated an interest by both internal and external parties on how disposition (deactivation and decommissioning) actions are prioritized and questioned how the individual sites prioritized D&D activities. He divided the concerns into three areas:

1) prioritization of facility transition and disposition activities outside of Environmental Management's (EM) control (i.e., managed by DOE operating programs),
2) prioritization of facility disposition activities among facilities that are planned to be dispositioned and are currently managed by EM, and
3) prioritization of EM facility disposition activities vis-à-vis other, EM work scope such as waste management, environmental restoration, etc.

The Facility Disposition Long Range Planning Working Group agreed to expand their scope to address the last two prioritization concerns.

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Session XVII - Long Term Stewardship: Lessons Learned Panel Session

Composite Analysis - The Right Tool for the Long-Term Stewardship Job

A copy of the poem "Blind Men and an Elephant" was presented as a handout to accompany this presentation. The correlation between this poem and "The DOE Long-Term Stewardship Elephant" were noted. Points were made on the evaluation of Environmental Management's approach from a stove piped view with simplistic approaches and actions to a holistic view that included the Defense Nuclear Facilities Safety Board recommendations and factored-in things like risk and residual inventories.

Three analysis were discussed in detail: 1) a hierarchical method that identified the need for a site-wide global analysis; 2) a composite analysis; and 3) a performance assessment to ensure complete data collection. In addition, factors comprised in this comprehensive environmental management systems approach were highlighted:

- long-term protection of public health, safety, and environment,
- completion of remediation and disposal programs,
- integration of land-use planning, facility decommissioning, environmental restoration, and waste disposal, and
- providing safety and cost-effective site-wide environment management systems.

The Savannah River Site (SRS) composite analysis was highlighted, and the methodology used was outlined. Specific results for the SRS location and the magnitude of peak individual doses and conclusions were also presented.

For more information, contact James R. Cook, Savannah River Technology Center, at (803) 725-5802 or jim.cook@srs.gov.

Institutional Control for Remediated Sites - An Idaho National Engineering and Environmental Laboratory Case Study on Long-Term Stewardship

The discussion began with how institutional controls (ICs) are related to the Idaho National and Engineering and Environmental Laboratory (INEEL) Record of Decision (ROD) process (i.e., land use, work procedures, fences, postings), where five RODs have recently been signed. Although each of the five sites was very diverse in terms of types of historical releases and contaminants, the ICs were handled in a similar consistent manner. ICs at these sites form the framework for long-term stewardship (LTS) of CERCLA sites with contamination left in place after remediation at INEEL.

The Environmental Protection Agency Region 10 Institutional Control Policy and facility-wide requirements were outlined to show how they relate to INEEL's IC and LTS programs. Several points related to the implementation of ICs and examples of the effectiveness of these controls were presented. Lessons learned from this implementation were also provided.

For more information, contact Deborah Wiggins, INEEL, at (208) 526-9989 or wigg@inel.gov.

State of the Art of Long-Term Stewardship, a Holistic Approach

The Grand Junction Office (GJO) has been conducting stewardship activities for over ten years, since the Long-Term Surveillance and Maintenance Program was established and assigned to GJO in 1988. Using GJO as an example, one can determine what needs to be done with LTS and how to get an LTS program implemented.

GJO does analog studies to get the holistic approach to LTS. This approach includes planning, remediation, implementation, and protection. Examples of remediation planning and implementation activities at sites like Hanford, Washington, the Pinellas STAR Center in Florida, and Monticello, Utah were discussed. One can see the results of remediation at these sites, and what is left afterwards. The key is to think in terms of deviations, with a recommendation robust enough to accommodate all those identified deviations. A list of the sites in the LTS Surveillance and Management program was provided in the presentation.

The holistic approach is a global concept that begins with determining what is needed as a result of activities from the cold war legacy, to LTS planning, remediation, LTS implementation and protection of the earth.

For more information, contact Art Kleinrath, U.S. Department of Energy, Grand Junction Office, at (970)248-6037 or akleinrath@doegjpo.com.

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Risk, Information, and Long-Term Stewardship Decision Processes

LTS involves continuing risk management so long as contamination resides at a site. Think about LTS as a course study in recapping the risk information into a process! Risk and cost are primary factors in the decision making. In addition, there is always the need to know past, present, and future in order to implement a successful LTS program, with an assessment of future events and how they will affect the stewardship plan. While planning LTS programs, one must realize what can go wrong or require attention.

Another major point in a good stewardship program is to conduct assessments and be responsive. Remember that even if cost and risk are factored out, stewardship may still be required. Determining risk initially and throughout stewardship requires information to be available and accessible. LTS contains five different components: 1) a contaminant system, 2) land use controls, 3) a monitoring systems, 4) an information management system, and 5) an organizational system. A diagram identifying the decision process cycle for information management, which is a key to periodic assessments of stewardship risks and costs, was displayed. Another key to information management is answering stewardship questions and benefiting from lessons learned. Historical examples like Site A/Plot M were used to recognize the importance of the iterative nature of LTS and how it can be used at different sites.

Two final points were made to recap - remember the factors related to thinking about and doing stewardship by identifying and designing a stewardship program to accommodate several things that can affect stewardship, and the need to periodically re-evaluate stewardship risk and costs.

For more information, contact Elizabeth K. Hocking, Argonne National Laboratory, at (202) 488-2425 or ehocking@anl.gov.

LLNL Environmental Restoration Stewardship Model: Coupling Science, Engineering and Cost

The National Defense Authorization Act LTS data call raised several issued related to LTS, such as when should LTS begin and what are the costs associated with LTS. In response to these and other related issues, Lawrence Livermore National Laboratory (LLNL) developed a program management tool for integrating hydrogeology, engineering, and program/project management. A diagram on the transition to stewardship presenting the methodology and logic to this management tool was presented and discussed. LLNL calls the application of this system, the Practical Environmental Restoration Management Tool (PERM Tool). PERM is a non-site specific, decision support tool for evaluating the effects of regulatory evaluations, and available resources on project scope, schedule, and cost. This tool is needed to provide site managers with a rapid method of evaluating the effects of proposed changes to variables on project duration and total cost.

For more information, contact Dick Woodward, Lawrence Livermore National Laboratory, at (925)422-1885 or woodward5@llnl.gov.

Lessons Learned with Long-Term Stewardship at Nevada Operations Office Sites/Performance Assessments

This presentation consisted of a briefing on Environmental Management program activities at the Nevada Operations Office (NV) while using the right technology applications. NV is looking at technologies to assist in characterization and remediation of surface soils and transuranic and low-level waste disposition. In support of the Underground Test Area and Industrial Sites at Nevada, there are 150 borings which serve as a basis for their stewardship model - along with its water migration monitoring data.

For more information, contact John Jones, U.S. Department of Energy, Nevada Operations Office, at (702)295-0532 or jonesjb@nv.doe.gov.

Stakeholder Participation in Lessons Learned with Long-Term Stewardship Measurements

The first important point to remember is that it only takes 1 (one) stakeholder to bog down the entire system. The public plays a key role when it comes to stakeholder involvement. Often an End-Use Working Group is used in evaluating the final land use operations readiness review. The majority of stakeholders are primarily concerned with availability of future funding to perform stewardship activities. Stakeholders do not believe the Department has made any guarantees when it comes to funding LTS needs. Thus, it helps to develop an LTS Management Plan with input and involvement from the stakeholders. To help stakeholders learn more about the LTS program, there are Internet linkages for operations and facilities and for operational readiness review missions.

For more information, contact Ralph Skinner, U.S. Department of Energy, Oak Ridge Operations Office, at (865)576-7403 or skinnerrm@oro.doe.gov.

Session XVIII - Regulator/Stakeholder Panel Session

Early State Regulatory Involvement Through ITRC

A key role of the Interstate Technology & Regulatory Cooperation (ITRC) initiative is "Creating tools and strategies to reduce interstate barriers to the deployment of innovative environmental technologies." ITRC is a state-led initiative that involves organizations in 38 states and the District of Columbia. Sponsored by the Environmental Council of States, Western Governors' Association, and Southern States Energy Board, ITRC boasts representatives from the public, tribes, academia, and industry. Funding is provided by the Department of Energy (DOE), Environmental Protection Agency (EPA), and Department of Defense.

ITRC has formed technical teams and also provides products and services to aide in the deployment of innovative technologies. These include technology overviews, case studies, technical/regulatory guidance (previously referred to as protocols), and training. ITRC members are recruited through training courses held nationwide. Success of the initiative is tracked as states integrate ITRC policies into their regulatory guidance. Internet-based training is also available, and has been instrumental in ITRC reaching 6,000 students located in the U.S., Europe, Asia, and Australia in just the past three years.

Impacts of using ITRC products are illustrated in over 50 examples from 15 states, all of which cited savings in both time and cost. Use of ITRC guidelines aides in; reducing time for regulatory approval and facilitating broader acceptance, increasing confidence to approve the use of innovative technologies, and providing consistency and predictability - leading to further time and cost savings and economies of scale. Potential work areas have been identified and categorized in six areas; remediation, monitoring and data handling, sampling and characterization, contaminant specific, risk assessment, and non-remediation.

ITRC's national training effort includes a 1½-day course in the Accelerated Bioremediation of Chlorinated Solvents. This course is targeted at 12 locations, and is sponsored by ITRC, RTDF, and EPA. Internet training opportunities are also available in the following areas: natural attenuation, enhanced in situ bioremediation, permeable reactive barriers, and phytoremediation. These Internet training sessions are two hours in length and are lead by national experts from academia, industry, and government. Training is offered to individuals, large groups, and global audiences.

For more information, contact Cain Diehl, Technology Programs Analyst, Southern States Energy Board, at (770)242-7712 or diehl@sseb.org or www.itrcweb.org.

Stakeholder Involvement in Long-term Stewardship Through System Dynamics and Group Model Building

Long-term stewardship is generally defined as the "Integration of all activities required to maintain an adequate level of protection to human health and the environment from the hazards posed by nuclear and/or chemical materials, waste, and residual contamination remaining after cleanup is completed." INEEL, like other organizations, has experienced a problem with applying this definition in the field.

INEEL identified the following key long-term stewardship development needs:

1) a total systems approach to remediation and long term stewardship (e.g. take all of the concepts and blend them into one plan),
2) an approach to identify, define, and model the key components of ecological health and associated indicators to help evaluate options for long-term environmental stewardship, and

Rich Daily, DOE HEadquarters, leads his "Papers to Progress" session at TIE

3) a process including all stakeholders in stewardship development and planning.

These three ideas were then combined to develop a more specific objective of "Combining system dy-

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namics with electronic meeting software to develop an integrated process/tool to guide a diverse group of stakeholders to come to a consensus on long-term management of DOE lands." The term "stakeholder" refers to state and local regulators, EPA, DOE, and current and future land owners of the site(s). Stakeholders must be involved in the process because they have a history of rejecting technical solutions when they are not.

INEEL is now looking to system dynamics as a means of addressing complex problems involving diverse stakeholders. This process, developed at MIT in the early 1970s, was originally used to model and improve business practices. System dynamics is a universal language that facilitates integrated and cooperative environmental planning and assessment, computer modeling geared toward learning and development of insight, and a dynamic process that integrates both "soft" and "hard" data. This process has been applied in several areas over the past thirty years including environmental change, economic development, social unrest, urban decay, psychology, and physiology.

A simple outline of the modeling process is:

1) problem definition - identify the problem or question and the top number of elements. This includes listing the variables, reference modes, and problem statement,
2) momentum policies - define the links between the elements. Also known as casual loops,
3) dynamic hypothesis,
4) build the model - it may not be necessary to complete this step because by this point the stakeholders should see and understand the system,
5) analyze model behavior - stakeholders should view and critique the model, and
6) test policies over time.

One Fortune 500 company reported losing over $75 million per year due to poor meeting practices, illustrating the importance of bringing stakeholders together effectively. One means of improving effectiveness is to conduct electronic meetings. This practice ensures that everyone has an equal say and also provides a complete and immediate record of the meeting. Three formats for electronic meetings include distributed office (people participate at the same time from different places or work stations), meeting room (everyone is in the same room participating in real time), and Internet (questions are posted and answered over several days and people participate at various times throughout).

INEEL successfully applied system dynamics in urban sustainability, waste site vegetative cap design, greenhouse gas emissions, modeling the Snake River System, and the aluminum industry. Several other research projects involving system dynamics are now underway. Citizen's Advisory Board members are involved in INEEL's efforts; however, electronic meeting software has not been used with these public stakeholders because "we are far away from everyone being comfortable with work stations."

Streamlining the process depends upon the group of stakeholders involved. The "digital divide" must be considered because results are biased toward those who use the Internet. When attempting to determine whether or not a group is representative of the larger stakeholder group, a model should be developed, posted to and run on an outside web server. This thinking will help to illustrate factors that were overlooked so they can be included in the future.

For more information, contact Jacob J. Jacobson, Idaho National Engineering and Environmental Laboratory, at (208) 526-3071 or jake@inel.gov.

Stakeholder Involvement in Budget Request Development

DOE seeks stakeholder input concerning the issue of budget development for several reasons, including the fact that it helps to ensure better decisions. Not only is this practice consistent with the EM Public Involvement Plan at the Nevada Operations Office (DOE/NV), it is also part of a National Environmental Management Initiative. DOE has learned that it is crucial to involve stakeholders as early as possible, and that meetings should focus on the submittal of budgets.

DOE/NV involved the local Citizen's Advisory Board (CAB), regulators, county representatives, stakeholders, and its own staff members and contractors in two public meetings in February 2000. Meeting objectives included providing an overview of the Federal Budget Process, examining EM project budgets and expected accomplishments, developing Fiscal Year 2002 priorities, and soliciting input on the level of funding.

Meeting highlights included breakout sessions covering project activities with DOE Project Managers and playing an investment game related to spending the $75 million budgeted for EM Programs at DOE/NV. Participants were given money in the form of "pogs," which they were directed to spend on the following seven projects; underground test area, soils, low-level waste, offsites, industrial sites, mixed low-level waste, and transuranic/mixed transuranic waste. These seven projects were then given a priority ranking for Fiscal Years 1999-2002 based on the amount that was "spent."

The management team from DOE/NV used the results of stakeholder involvement to compile a list of stakeholder priorities. Results were identifiable because stakeholders and CAB members were given different colors than DOE contractors and staff. In the end, the underground test area project ranked as the first priority with both CAB members and the public.

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Four main lessons learned are attributable to the meetings between DOE/NV and its stakeholders. They include:

1) distribute invitation letters with no more than a one-page project description,
2) continue teaming with CAB to enhance program credibility,
3) schedule meetings around community events, and
4) demonstrate how previous input has changed the program.

One session participant followed-up the presentation of the "Lessons Learned" by referring to the Final FFERDC (Federal Facilities Environmental Restoration Dialogue Committee) Report published in 1996. This report, he said, demonstrates the value of bringing together regulators and stakeholders. The International Association for Public Participation (IAP2) was also mentioned as an organization that promotes interaction between regulators and stakeholders.

The presenter, Kevin Rohrer, was asked how DOE/NV's site contractor feels about the meetings and the motivational game. "They love it" he replied, and went on to inform participants that contractor personnel attend budget workshops and are encouraged to voice their views and submit ideas for discussion. Finally, Rohrer noted, the key to a successful meeting is good facilitation and the establishment of ground rules and objectives prior to commencing discussion.

For more information, contact Kevin J. Rohrer, U.S. Department of Energy Nevada Operations Office, at (702)295-0197 or rohrer@nv.doe.gov

Public Involvement Challenges Ahead for the INEEL Environmental Restoration Program

The Idaho National Engineering and Environmental Laboratory (INEEL) is faced with a dynamic situation regarding the issue of buried waste, and has gone so far as to hire a reporter respected by stakeholders to communicate INEEL's position to them. Reuel Smith described the history of both INEEL and public involvement in its Environmental Restoration Program.

Prior to 1989, INEEL was limited in its communication with the public. Improved and proactive communications in recent years have generated a more informed public which is generally supportive of INEEL's activities and CERCLA decisions. However, both stakeholders and the media are sensitive about projects involving the Snake River Plain Aquifer. Stakeholders' main concerns are present and future impacts on the aquifer, storage and burial of TRU waste, and airborne emissions from several site facilities and from range fires.

Smith presented photos of old practices, dating back as far as 1958, and explained how and why the waste was buried in each example. He then informed participants that INEEL is conducting an ongoing Remedial Investigation/Feasibility Study (RI/FS) for the entire buried waste area. This effort began five years ago, and agencies are expected to make recommendations two years from now. This final decision must be both protective of human health and the environment and technically defensible. To date, INEEL has already conducted 27 RI/FSs. Current remedy options include institutional controls, containment, in situ treatment, retrieval/treatment/disposal of buried wastes and combinations of these options.

Stakeholder involvement in each RI/FS is critical because the entire process is in jeopardy if stakeholders do not understand the issues. Since stakeholder views and values are important, INEEL's outreach efforts include increasing public involvement in budget issues and in developing a comprehensive Community Relations Plan. Experience has shown the public is more willing to accept government decisions when their values and suggestions are included. Smith commented, "People want the truth. They'll accept what happens if it's based on truth. Honest discussion of the issues is key."

For more information, contact Reuel Smith, Idaho National Engineering and Environmental Laboratory, at (208)526-3733 or mrs@inel.gov.

Conference Announcement

2001 International Containment & Remediation Technology Conference and Exhibition, June 10-13, 2001, Orlando, Florida. Sponsored by U.S. Department of Energy, U.S. Environmental Protection Agency, U.S. Navy, Dupont, National Aeronautics & Space Administration, and the IT Group. The purpose: to advance the deployment of innovative technologies and showcase many R&D efforts for developing technologies. The conference will emphasize the remediation and containment of DNAPL's, heavy metals and radionuclides through case studies in either technical focus areas. Abstracts are welcome. For more information visit the website at http://www.containment.fsu.edu. Workshops and case studies of site characterization/remediation efforts and exhibits are offered.

Session XIX - Emerging Waste Management Practices Panel Session

Mildred Keith provided a brief update on the status of transuranic (TRU) waste drum retrieval operations at the Department of Energy (DOE) Savannah River Site (SRS). Removal of 8800 TRU drums, which were buried in shallow pits at the SRS burial grounds, has been completed. The removal operation was completed two years ahead of schedule and well under projected costs, because the condition of the drums, many of which were buried for more than 10 to 15 years, was excellent and because of a close working relationship with the stakeholders.

The drums' excellent condition is believed to be due to their burial in a tight clay, which prevented moisture from degrading them. Because of their condition, no drums had to be overpacked. TRU waste had to be removed from some boxes. All drum venting operations went well (venting was necessary because of the potential for hydrogen buildup within the drums).

Close communication with the state and federal regulators, DOE customers, and the local Citizens Advisory Board throughout this project provided for continual support. This was the first project of this type to be completed in the DOE Complex.

Application of Lessons Learned in Assuring Future Success of the ORR EMWMF

This presentation focused on lessons learned from work involving construction of the Environmental Management Waste Management Facility (EMWMF) at the DOE Oak Ridge Reservation (ORR). This facility is a disposal cell being constructed for receipt of CERCLA waste generated by DOE operations in Tennessee. This effort is being conducted as a two-phase procurement (pre- and post- Record of Decision). Design was completed in October 2000, with monitoring wells currently being installed. The total cost of the project is projected to be $35 million. This is relatively inexpensive when compared to commercial disposal facility disposal costs ($100/cu. yd. versus $1,000/cu. yd).

Lessons learned for this project include the use of on-site disposal because of its relatively low cost, planning for possible future expansion, and implementing a flexible waste acceptance criteria that is performance based while also defining physical attributes of waste to be received. The project is designed to be operations-driven. Privatization tends to work well in on-site disposal facility construction because construction activities deploy proven technologies and no research and development is needed.

For more information, contact J. Pat Hopper, Waste Management Federal Services, Inc., at (865)425-0002 or by e-mail at: jphopper@gtsduratek.com.

Disposition of Nuclear Weapons Generated by Remedial Activities

Bob Galloway, Sandia National Laboratories, described efforts to remove all materials from a small (approximately 1/3 acre) landfill at Sandia which contained classified and unclassified nuclear weapon components. The decision to remediate the landfill was made because a trichloroethylene (TCE) ground water plume was discovered in the vicinity. Even though the landfill has since been ruled out as the source term for the TCE, remedial activities have continued. The project is expected to be finished in 2001. The landfill contains components and subassemblies, mock-ups, and prototypes. Prior to remedial actions, old records were reviewed, older personnel interviewed, and databases searched to attempt to determine what may be in the landfill. What has been found, however, has not always matched these historical references. A sorting order was used to determine how the landfill contents were dispositioned.

Much of the waste recovered is recyclable, with about 40,000 pounds of metal left onsite to be dispositioned (held up due to the current moratorium on recycling scrap metal). Little mixed waste has been uncovered. This operation has been conducted with a project cost of $15 million. Demilitarization is not a high priority because there is no regulatory driver. Funding and facilities, therefore, are not available to assist with this type of effort. Demilitarization has been conducted using rudimentary methods. While a classification group has the final authority on how recovered materials are classified, classification efforts have tended to be variable, in part, due to vague DOE orders. Recycling has been found to be an attractive option to minimize cost.

For more information, contact Bob Galloway, Sandia National Laboratories, at (505)844-0972 or rbgallo@sandia.gov.

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Waste Maximization

The central premise of waste maximization is that large quantities of waste should be shipped at one time to take advantage of economies of scale during transportation. When shipping large quantities, there is less paperwork, ALARA (as low as reasonably achievable) benefits are realized, less inspecting is required, and material and handling costs are lower per unit volume of material transported.

Railcars have been designed to safely transport large quantities of radioactive wastes. These railcars can handle a large number of B-25 boxes or other waste containers. Since most DOE facilities have rail spurs, transportation by rail is a cost-effective option. No high level waste has been shipped to date. There would be security considerations that would have to be implemented for this type of waste. Of note is that the number of accidents per truck have increased over the past ten years, but the number of accidents per train has decreased.

For more information, please contact Kenneth M. Grumski, MHF Logistical Solutions, Inc., at (724)452-9300 or ken_grumski@mhfls.com.

Chemical Reactions in Liquids Induced by High Frequency Electric Fields

Mr. Alexander Babchin discussed the use of high frequency electric fields to treat wastes. The central point was that an increase in conductivity will increase chemical reactivity. A high voltage is not required to achieve destruction of a material. Experiments were conducted with several dielectric reaction systems and off-gases measured. Based upon the ratio of certain released gases, the thermodynamic temperatures were estimated. These estimated reaction temperatures ranged from 2000 to 4200 degrees centigrade. This technology may be a viable way to treat undesirable organic liquids such as methyl tertiary butyl ether, carbon tetra chloride, trichloroethylene, tetrachloroethylene, and polychlorinated biphenyl.

For more information, please contact Alexander Babchin, Alberta Research Council, (780)450-5035 or babchin@arc.ab.ca.

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Also consistent with her goals for expediting cleanup is Warren's penchant for involving the public in environmental decision, planning, and cleanup processes - a necessary and important ingredient in bringing environmental projects to successful closure. In this regard, she expressed her appreciation for DOE's efforts to involve all stakeholders in their environmental and stewardship activities.

As an aside, Warren commented that another definition for "accelerating cleanup" is "making mistakes faster." This is okay, however, because we improve our techniques and expertise by actually doing the work, finding the real problems, and then fixing them.

The main theme of the address focused on successful technology deployments. Warren highlighted four key aspects of new technology deployment which, in her experience, are necessary for success:

- First and foremost, you need a champion - someone who ardently believes in the technology and brings his or her excitement and energy into the process. This champion will also prevail in times of doubt or questioning.
- Next, you need the decision to deploy innovative technologies. This requires a management and staff willing to pick the projects, defend the costs and find the funding, and be willing to take a risk.
- Third, involve others. This TIE Workshop is an excellent forum for involving others.
- And fourth, benchmark together. Work together with other organizations and agencies, for example, DOE working with EPA through MOU agreements. Take technologies to other sites, including EPA Superfund sites. Continue to bring new people into the benchmarking process. Lastly, continue to improve the technologies.

Camilla Warren, EPA Region 4, encourages TIE Workshop attendees to involve the public in their envirnomental cleanup process

Warren closed by thanking us for the opportunity to speak, and for making her a part of the workshop. She also wished everyone success.

Session XX - Ground Water Panel Session

Integrated Technical Assistance for Focused Remediation: Oak Ridge Y-12 Plant DNAPLs in Fractured Bedrock and CCl4 in Ground Water

Several programs are available within the Office of Environmental Management (EM) that can provide technical assistance and expertise to help solve pressing environmental cleanup problems. Michael Krstich, Environmental Management Solutions, provided a "work in progress" overview of an on-going ground water remediation project at the Oak Ridge Y-12 Plant.

The problem: Ground water in the Upper East Fork Poplar Creek watershed contains carbon tetrachloride (CCl4) in quantities greater than permitted by the Environmental Protection Agency for drinking water sources. The contaminated ground water is migrating beyond Oak Ridge Site (OR) boundaries. Ground water is located 400-500 feet below the surface, primarily in fractured bedrock.

The source of the contamination is considered to originate from dense non-aqueous phase liquids (DNAPLs) contained in the fractured bedrock underlying an area of the Y-12 Plant located in the watershed, stemming from accidental releases of chlorinated solvents – CCl4, tetrachloroethylene (PCE), and trichloroethylene (TCE) – during plant operations dating back to 1943.

Project Overview: The DOE-OR and Bechtel Jacobs Y-12 Project Team contacted the ITRD (Innovative Treatment Remediation Demonstration) and TechCon (Technology Connection) programs in the summer of 1998, requesting support for their evaluation of remedial alternatives and to assist in development of their Engineering Evaluation/Cost Assessment (EE/CA) for the plume remediation. A Technical Advisory Group (TAG) was formed which led to a draft EE/CA in February 1999, focusing on a bioremediation-enhanced pump and treat remedy. Biostimulation and bioaugmentation treatability studies and ground water modeling efforts were initiated, leading to startup of a pump and treat system in June 2000 – and a commitment to continued evaluation of treatment technologies to enhance pump and treat operations.

The Idaho National Engineering and Environmental Laboratory (INEEL) and the ASTD (Accelerated Site Technology Deployment) Project Team was contacted in July 2000, because of the Site's success in deploying bioremediation and monitored natural attenuation of TCE in fractured rock, in lieu of pump and treat. This effort led to development of a Treatability Study Deployment Plan (TSDP) for Y-12 bioremediation. The INEEL deployment process places emphasis on development of a thorough Site Conceptual Model. TAG activities, therefore, have focused on filling in SCM data gaps to improve remediation activities.

Currently, the project is progressing on a two-phase deployment plan: Phase 1, FY-2001 – installation of tracer test wells, numerical modeling, and design of a pilot test; and Phase 2, FY-2002 – installation of pilot biostimulation wells to test field activity.

Conclusion: Krstich concluded the discussion by pointing out that the integrated technical assistance process:

- provides a thorough evaluation of alternative technologies by experts in the field,
- resulted in an appropriately designed pilot test that meets project remediation objectives,
- includes regulatory acceptance throughout the process, and
- leads to successful technology deployment for long-term remediation of the site.

For more information, contact Michael Krstich, Environmental Management Solutions at (513) 697-6682 or by e-mail at: mak@fuse.net.

Evaluation of Active Treatment Alternatives for Remediation of a Nitrate Plume at the Monument Valley, Arizona, UMTRA Ground Water Site

Kenneth Karp, MACTEC-ERS, discussed alternatives being evaluated for remediation of a nitrate plume in a surficial aquifer beneath a mining/milling site in Monument Valley, Arizona. The Number 2 Mine was the largest producing mine in Arizona, operated by the Vanadim Corporation of America from 1943 to 1968. Site ownership reverted to the Navajo Nation in 1968.

Source of the contamination is the mill tailings area associated with milling operations, which included heap-leaching operations. The mill buildings

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were removed after 1968, and the tailings were moved to an UMTRA (Uranium Mill Tailings Remedial Action) disposal cell in the 1992-1994 time frame. The ground water contamination remains, however, in a plume that is about a half-mile wide and a mile long, containing an estimated 540,000,000 gallons of water. The compliance strategy is active remediation in combination with natural flushing and monitoring. Contaminates of concern are uranium, sulfate, and nitrate.

Alternatives for remediation considered a mix of pumping strategies combined with an array of treatment technologies, ranking the solution possibilities on effectiveness, ability to implement, and cost. Well field designs were evaluated using the BruteForce Optimization Code and were based on both "consumptive use" (not returning the treated water to the aquifer) and "nonconsumptive use" (returning the treated water to the aquifer). Treatment technologies considered included distillation, ion exchange, spray evaporation, and land farming (phytoremediation).

These efforts have resulted in selecting a consumptive use land farming remediaton strategy. Pilot studies are being initiated to address stakeholder uncertainties, including:

- soil-water balance management,
- soil nitrate management,
- sulfate chemistry and pedogenesis (rock formation), and
- toxicity of nitrate, sulfate, and other contaminants of concern.

For more information, contact Kenneth Karp, MACTEC-ERS, at (970) 248-6564 or by e-mail at: ken.karp@doegjpo.com.

Economical and Reusable Ground Water Treatment Solutions Developed at LLNL

Robert Bainer, Lawrence Livermore National Laboratory (LLNL), discussed the history and development of ground water treatment facilities at the Laboratory, with special emphasis on modular units that may be used and reused at various locations around the site. Ground water contamination was discovered in 1983, leading to the site being added to the National Priorities Superfund List in 1987. A record of Decision was signed in 1992, approving seven treatment facilities with eighteen extraction locations.

The initial treatment facilities were large, costly permanent facilities with expensive pipelines to move water from the extraction wells to the treatment locations. Due to the high costs and also to space limitations, smaller mobile and more economical treatment units were developed starting in the mid 1990s. The focus is now on engineered plume collapse – employing the right technologies at the right place at the right time. The mobile treatment units allow the right technologies to be deployed at the plume sources to both prevent down-gradient movement and plume collapse.

Four modular treatment units have been developed to meet these needs: the Granular Activated-Carbon Treatment Unit (GTU), the Miniature Treatment Unit (MTU), the Solar Powered Treatment Unit (STU), and the Portable Treatment Unit (PTU). The GTU facility is a nine-foot long by four-foot wide unit that is weather resistant and attached to a skid. It treats water flows up to about 45 gallons per minute (gpm) and utilizes granular activated carbon to remove contaminants.

The MTU facility is also nine-foot long, four-feet wide, and is weather resistant and attached to a skid. It treats water flows up to about 22 gpm and uses an air stripper to remove contaminants from the water. The air/vapor effluent stream then passes through granular activated carbon to remove contaminants.

The STU facility is enclosed in an eight-foot long, four-foot wide, and four-and-a-half-foot high housing that is attached to a skid. It treats water flows up to about 5 gpm and utilizes activated carbon to remove contaminants. It uses solar panels and battery backup to operate, making it adaptable for remote areas or for areas where electrical power in not available.

The PTU facility is housed in a twenty-foot long, eight-foot wide, and eight-foot high cargo-type shipping container. It treats flows up to about 45 gpm using an air stripper to remove contaminants from the water. The air/vapor effluent then passes through granular activated carbon to remove the contaminants.

Bainer also briefly discussed more recent developments: In Situ Catalytic Reductive Dehalogenation Units for treatment of Volatile Organic Compounds (VOCs) with tritium, and Electro osmosis (EO) for movement of VOCs through fine-grained sediments.

Using engineered plume collapse strategy and treatment capabilities described, LLNL is rapidly removing contaminant mass, and at a much much greater rate than predicted in their fifty-year model.

For more information, contact Robert Bainer, LLNL, at (510) 422-4635 or bainer1@llnl.gov.

Operational Status of Reactive Barriers for Treatment of Ground Water at Rocky Flats Environmental Technology Site

Three passive reactive barrier systems are operating at Rocky Flats Environmental Technology Site (RFETS). Ground water is collected by simple French drains, and treatment is accomplished with in-ground treatment cells that contain the reactive media. Clean water is then discharged to the ground water.

The treatment cells contain zero valent iron to treat Volatile Organic Compounds (VOCs) and radionuclides and a sawdust/iron media to treat nitrates and radionuclides. The cells are designed to maintain water even during dry periods.

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This technology results in passive ground water collection and treatment systems which:

- protect surface water by intercepting and treating ground water prior to entering surface water,
- are effective in low flow, low pereability regimes,
- have minimal infrastructure and maintenance requirements, and
- are effective in treating VOCs, radiological and nitrate contaminated ground water.

The systems at RFETS are working well – the East Trenches plume system has treated approximately 2.5 million gallons of water and the Solar Ponds plume system treated a total of 46,905 gallons from March through September, 2000. Flows through the East Trenches system ranged from 1.6 to 8 gallons per minute (gpm) and averaged 3.5 gpm. Flows through the Solar Ponds system ranged from 0 to 3.8 gpm, with flows through the system following precipitation events.

For more information, contact AnnettePrimrose, Kaiser Hill, LLC.,at (303) 966-4385 or by e-mail at: annette.primrose@rf.doe.gov.

Uranium Removal from Contaminated Ground Water at Fernald Using Ion Exchange Technology

The Fernald site utilizes five ion exchanges systems to remove uranium from waste water, storm runoff water, and ground water. These include the Advanced Wastewater Treatment Expansion System, the Storm Water Runoff Treatment System, and the Remediation Wastewater Treatment System. All systems utilize Dowex™ 21K, 16 to 30 mesh, strongly basic anion ion exchange resin in the chloride form. The Advanced Wastewater Treatment Expansion System has an 1800 gallons per minute (gpm) capacity, and provides clarification, multi-media filtration, and aeration. The ion exchange system consists of three trains of two vessels each, configured as lead and lag vessels in series. The piping and valving arrangement allows either vessel in the train to serve as lead or lag. The system uses 315 cubic feet of resin.

The Storm Water Runoff Treatment System has a 700 gpm capability, and provides clarification and multi-media filtration. The ion exchange system consists of two trains of three vessels, configured as a lead and a lag vessel in series, with the third vessel in standby. The piping and valving arrangement allows the vessels to be configured to serve in any function. The system uses 130 cubic feet of resin.

The Remediation Wastewater Treatment System has a 400 gpm capability and provides clarification, multi-media filtration, and activated carbon filtration. The ion exchange system consists of one train with three vessels, configured as a lead and lag vessel in series, with the third vessel in standby. Again, the vessels may be configured to serve in any function. The system uses 130 cubic feet of resin.

Two attendees cngrossed in discussion before workshop sessions begin

Ground water influent from aquifer remediation contains up to 100 parts per billion (ppm) uranium. Storm water runoff contains from 200 to 600 ppm, and remediation waste water typically contains 1,000 to 2,000 ppm uranium. The regulatory limit is 20 ppm for discharge water, and the Fernald administrative action level is 10 ppb for aquifer re-injection water.

After providing this backdrop, Chris Sutton, Flour Daniel Ferald, Inc., presented an overview on the exacting and rigorous procedures that have been developed and employed for both operation of the ion exchange systems and the regeneration and monitoring of the resins used in them. Through a combination of laboratory testing and actual experience, the procedures assure maximum resin life and effective resin regeneration. He reviewed the resin regeneration cycle used and summarized their lessons learned:

- take pre- and post regeneration resin bed core samples,
- monitor uranium concentration of eluate,
- ensure sufficient contact time [of the brine with the resin],
- put regenerated resin in service first in the lead position to evaluate performance, and
- perform laboratory regenerations as a troubleshooting tool.

Experience and lessons learned also contribute to their operating strategy. Briefly summarized, the strategy is:

- regenerate each vessel once per year [regardless of resin loading],
- regenerate the lead vessel when the lag vessel effluent exceeds 20 ppm uranium,
- monitor influent and efflent uranium concentration daily for each vessel, and
- routinely monitor performance of the resin.

For more information, please contact Chris Sutton, Fluor Daniel Fernald at (513)648-5441 or chris.sutton@fernald.gov.

Session XXI - SRS Facility Disposition Program Session

The Facilities Disposition Division (FDD) at the Savannah River Site (SRS) is responsible for managing the site's Facility Disposition Program. The excess facilities at SRS are categorized into two groups: 1) those essentially abandoned in place, with little or no continuing surveillance and maintenance program and 2) those shutdown and transferred to the disposition program in a controlled manner. While there are more requirements and the number of excess facilities is growing at the site, the budget for disposition of the facilities is not escalating to match the needs.

Nine papers were presented during Session XXI that addressed all aspects of the Facility Disposition Program at SRS including: facility transition, surveillance and maintenance, risk management, decision analysis, deactivation, decommissioning, use of advanced technologies, and long range planning tools. The presentations were focused on how each aspect of the program is geared toward working within the current budget environment while reducing cost and risk in inactive excess facilities.

A brief history and description of SRS was provided as well as the current budget and site missions, which includes the Facility Disposition Program. Methodologies, procedures and processes to safely implement the requirements of DOE Order 430.1A, Life Cycle Asset Management, were identified and explained in detail. The Guides associated with DOE O 430.1A were referenced as the SRS guidance for the planning and execution of disposition activities. The transition, deactivation, and decommissioning (including decontamination) phases of a facility's life cycle were addressed in various presentations. Several site-specific examples were given that provided the audience with very good illustrations of the successes and lessons learned that have been experienced to date in:

- reducing the cost of surveillance and maintenance,
- using a risk-based method for prioritizing hazard reduction activities at inactive facilities,
- exchanging unneeded assets for dismantlement and removal services,
- identifying and deploying disposition technologies,
- planning for long-range facility disposition, and
- other activities associated with the transfer, deactivation and decommissioning of SRS excess inactive facilities.

For more information, contact Dave Yannitell, Westinghouse Savannah River COmpany at (803)725-4605 or david.yannitell@srs.gov.

Argonne National Laboratory - East Received the U.S. Environmental Protection Agency, Region 5, Fiscal Year 2000 Resource Conservation and Recovery Act Corrective Action Facility Progress Award

On January 18, 2001, the Argonne National Laboratory - East (ANL-E) received the U.S. Environmental Protection Agency (EPA), Region 5, Fiscal Year 2000 Resource Conservation and Recovery Act (RCRA) Corrective Action Facility Progress Award for investigative and remedial activities at the site. The Award was presented to ANL-E in downtown Chicago during EPA's RCRA Corrective Action Program Workshop.

The Illinois EPA issued a RCRA Permit to ANL-E in September 1997. The ANL-E has worked closely with the Illinois EPA so that a substantial amount of investigation and remediation activities have been completed to date at this facility. Major completed activities include capping old landfills; installing ground water monitoring and remediation systems; removal of contaminated soil; and in-situ treatment of contaminated soil. The ANL-E has also utilized innovative treatment technologies for remediating contaminated soil/ground water, including enhanced steam stripping; soil mixing with iron addition, and phytoremediation. Only nine solid waste management units (SWMUs), out of the original 52 SWMUs identified in the RCRA permit for ANL-E, still need to be addressed. Conceptual plans are in place to address these units in the near future. ANL-E is scheduled for an Environmental Management geographic site completion in FY 2003.

For more information contact Shirley Frush, U.S. Department of Energy, Headquarters at (301) 903-8159 or email shirley.frush@em.doe.gov

Session XXII - Innovative Remedial Technologies Panel Session

FY2000 Technology Deployments on the Richland Environmental Restoration Project

Kim Koegler, Bechtel Hanford, Inc., reported on improved technologies that have been recently deployed at the Hanford Site. Projects deploying these technologies include: 1) the Canyon Disposition Initiative, 2) the Ground Water/Vadose Zone Integration Project, 3) the Remedial Action and Waste Disposal Project, and 4) the F and DR Reactors Interim Safe Storage (ISS).

The Canyon Disposition Initiative is using several innovative technologies with potential cost savings of $1 billion compared to using conventional technologies. These include an ultrasonic liquid level detection technology to non-intrusively characterize liquids in vessels, an overview video system to provide remote visual characterization of drain line outfalls, a drain line characterization robot, an in situ object counting system to non-intrusively analyze samples, and a remote concrete coring system.

The Ground Water/Vadose Zone Integration Project deployed in situ redox manipulation for chromium, passive soil vapor extraction for carbon tetrachloride, and wireline retrievable tools for cone penetrometers. The project conducted a vadose zone transport field study using crosshole electromagnetic imaging, ground penetrating radar, seismic profiling, high-resolution resistivity methods, and advanced tensiometers. The project also conducted a clastic dike study using an advanced air-minipermeameter to measure permeability, and infrared imaging to characterize extremely small-scale features.

The Remedial Action and Waste Disposal Project increased the efficiency of site soil characterization and remediation through the use of innovative technologies. Small diameter geophysical logging systems and passive neutron detectors were deployed.

The F and DR Reactors Interim Safe Storage project is isolating reactor core enclosures for interim safe storage with an advanced characterization system that was deployed to characterize and "free-release" portions of building concrete.

For more information, contact Kim Koegler, Bechtel Hanford, Inc., at (509)382-9294 or kjkoegle@bhi-erc.com.

EarthSaw® Field Demo: Construction of a Bottom Barrier with Soft Buoyant Grout

This presentation described an innovative approach for isolating buried hazardous and/or radioactive waste in landfills through a new side and bottom barrier construction method. The EarthSaw® method is a patented process that makes it feasible to construct a thick and impermeable bottom barrier under a contaminated landfill area without disturbing the buried waste or exposing personnel to its hazards. The process can be designed for sites of varying types and sizes. Ernest Carter, Carter Technologies Company, described their Vertical Block Method which has been successfully demonstrated, and is summarized below.

The Vertical Block Method involves cutting a vertical trench around or partially around a contaminated site to a depth lower than the desired bottom barrier. A high gravity slurry is pumped into the trenches. A cable saw device is then placed at the base of the slurry trench and mechanically slices a cut horizontally through the earth beneath the buried waste. The high specific gravity grout slurry flows into the horizontal cut, and since the slurry is more dense than the earth, it causes the severed block of earth to become buoyant. Additional grout flows into the cut increasing the final thickness of the bottom barrier as the block of earth floats upward like a barge in a rising tide. The thin cut, made by a cable saw or diamond wire saw, may be increased to a thickness of several feet.

There were no inherent depth or size limitations reported for the barrier. The process should work just as well below the water table in a vadose zone. Variations of the process will allow it to work in both soil and rock. The grout forms an impermeable barrier encapsulating the waste. Selection of the right grout should be based on chemical and mechanical requirements, as well as moisture levels and similar technical characteristics.

For more information, contact Ernest E. Carter, PE, Carter Technologies Company, at (281)495-2603 or cartertech@prodigy.net.

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Performance Assessment of In Situ Remediation Involving DPAPLs

This presentation focused on the comparison of three performance assessment (PA) methods used to evaluate the presence/remediation of dense non-aqueous phase liquids (DNAPLs) in the subsurface. PA methods are used to draw conclusions about the volume, mass, or saturation of DNAPLs. The methods evaluated were ground water sampling, soil coring, and partitioning interwell tracer tests (PITTs).

The use of ground water sampling provides information that is qualitative, not quantitative, due to numerous potential subsurface combinations of DNAPL volume, saturation, composition, and spatial distribution. Consequently, ground water sampling is not an effective method to evaluate and quantify DNAPL presence.

Soil core data may, in some instances, be used to give a semi-quantitative estimate of the volume of DNAPLs in the surface -- if sample spacing is close and a large number of samples are collected, and the cores are careful handled to minimize contaminant volatilization. This method can be costly and time intensive.

PITTs involves injecting tracers into the subsurface via injection wells, extracting ground water at down gradient extraction wells, and then analyzing tracer movement, that is, measuring changes in concentrations through time. Properly designed and executed PITTs provide a means of accurately and quantitatively measuring DNAPL volume and assessing the performance of a remediation method. PITTs sweep the interval of the aquifer between the injection and extraction wells. As such, they sample a much greater volume of the aquifer relative to soil cores, and are much less biased by sample size.

For more information, contact John Londergan, Duke Engineering and Services, Inc., at (512)425-2028 or jtlonder@dukeengineering.com.

Petro Bond® Oil Solidification Polymer: Helping to Solve Oil Waste Problems in the DOE Complex

This presentation focused on the utilization of the oil solidification polymer Nochar Petro Bond® at the Department of Energy (DOE) Miamisburg Environmental Management Project (MEMP), commonly known as the Mound Site. The DOE Office of Science and Technology, Deactivation and Decommissioning Focus Area sponsored the project as a Large-Scale Demonstration and Deployment Project (LSDDP). The purpose was to compare the Nochar Petro Bond® oil solidification process to baseline options for treatment and disposal of mixed oil wastes -- incineration, long-term storage for decay, and existing organic solidification agents.

At the Mound site, approximately one curie of tritiated mixed waste lubricants was successfully solidified. The solidified material met waste acceptance criteria at the Nevada Test Site and was shipped there for disposal. The Toxicity Characteristics Leaching Procedure (TCLP) values were found to be several magnitudes below burial site limits for the specified metals. Plans are to collect and solidify the remaining mixed waste inventory, over 50,000 curries throughout the Mound Site, by 2005.

The process was reported to be safe, easy to use, cost effective, and capable of being completed within a reasonable timeframe. Ashtabula, Sandia National Laboratory, Princeton Plasma Physics Laboratory, Rocky Flats, and Savannah River are DOE sites that have expressed an interest in the process.

For more Information, contact Ward G. Brunkow, The Chamberlain Group, Ltd., at (937) 865-3826 or brunwg@doe-md.gov.

Integrated Characterization of a TCE Contaminant Plume within a Basalt Aquifer in Southeastern Idaho

The Idaho Water Resources Research Institute, working with Idaho National Engineering and Environmental Laboratory (INEEL) scientists and engineers, participated in a research project to determine the effectiveness of natural attenuation and enhanced bioremediation of a trichloroethylene (TCE) ground water plume in fractured basalt underlying the Test Area North (TAN) area of INEEL. The geologic, hydrogeologic, geochemical, and biochemical processes influencing the fate and transport of the TCE plume were studied and modeled.

The Idaho Water Resources Research Institute was established in 1965 to be a collaborative effort of all Idaho colleges and universities to conduct research, educate, and disseminate information on Idaho water issues. The TAN project was funded through a DOE grant and was supported by the DOE Office of Science and Technology. The project started in March 1996 and ended June 2000.

The study concluded that enhanced in situ bioremediation was a viable remedial alternative in the degradation of the TCE plume. Enhanced in situ bioremediation of the TCE plume was successfully demonstrated at TAN. As a result, the innovative technology "enhanced in situ bioremediation" has been identified as the preferred alternative in the TAN Record of Decision, a reversal of the previous preferred alternative of pump and treat.

For more information, contact Katherine Owens, University of Idaho, Idaho Water Resources Research Institute, at (208)282-7905 or kathyo@uidaho.edu.

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Remediation of Ecologically Sensitive Wetlands Contaminated with Cs-137 Using Micaceous Minerals

The Savannah River Site (SRS) has over 3,000 acres of wetlands that are contaminated with 564 curries of cesium-137 (Cs-137). The Cs-137 at SRS is highly mobile and poses a significant remediation challenge to the Department of Energy. One explanation for the high mobility is that kaolinite soils which have poor sorptive properties, dominate the site. SRS tested a hypothesis of adding naturally occurring micaceous minerals (micas and illites) to the wetlands to see if they would sequester the Cs-137 and, thereby, reduce its mobility.

A "proof-of-concept" study was conducted to test the hypothesis and produced encouraging results. Addition of two micaceous minerals to Pond B sediments significantly reduced Cs-137 desorption. Specific mineral characteristics were identified for use in this study, and should be considered when selecting quarried minerals for implementing this technology. The technology appears to offer a non-intrusive, in situ approach for immobilizing Cs-137 in ecologically sensitive wetlands. The benefits of using this technology are; 1) less expensive than the baseline technology of grout and refill, 2) minimal environmental damage to wetlands, and 3) reduced human and ecological risks.

For more information, contact Daniel Kaplan, Westinghouse Savannah River Company, at (803)725-2363 or daniel.kaplan@srs.gov.

Dynamic Underground Stripping and Hydrous Pyrolysis/Oxidation of PCE and TCE at Savannah River Site

Dynamic Underground Stripping (DUS) and Hydrous Pyrolysis/Oxidation (HPO) are two innovative technologies that were developed at Lawrence Livermore National Laboratory (LLNL) and have been successfully demonstrated and deployed by the Department of Energy (DOE) there and at other sites. The two technologies are similar and may be used together. DUS is a combination of steam injection with vapor and ground water extraction. HPO involves the destruction of underground volatile organic compounds [e.g., trichloroethylene (TCE) and perchloroethylene (PCE)] through oxidation in the presence of injected steam.

DUS and HPO are in the early stages of being deployed to remediate ground water contaminated with TCE and PCE at the Savannah River Site (SRS) former Solvent Storage Tank Area. The target zone for steam injection extends over an area of approximately 100 feet by 100 feet, and to a depth of 160 feet below ground surface, the deepest application to date of DUS/HPO.

SRS is in first two months of a 6 to 9 month deployment. The site is using existing soil vapor extraction wells, ground water extraction wells, and treatment systems. Early results are promising. The subsurface is heating up nicely and PCE concentrations in the extracted vapor and ground water are increasing.

For more information, contact Dave Parkinson, Integrated Water Technologies, at (805) 966-7757 or dave@integratedwater.com.

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Facility Disposition Long-Range Planning Working Group

McCune announced that a charter for the Facility Disposition Long-Range Planning Working Group has been developed. Several cost estimating models, including the detailed Remedial Action Cost Estimating and Requirement (RACER) system and the Rough Order of Magnitude (ROM) model developed by the Idaho National Engineering and Environmental Laboratory (INEEL) had been reviewed. Estimating methods have been reviewed with the Applied Cost Engineering (ACE) team to gain their endorsement and to coordinate their efforts to define a standardized process for long-range facility disposition actions. At the suggestion of Szilagyi, the working group agreed to investigate preparing a ROM estimate for the Rocky Flats Closure Project for future comparison with actual data, since the site was actively pursuing closure and was experiencing different results than the other DOE sites.

Technology Loan Working Group

The intent of the Technology Loan Working Group was to develop a system to alert personnel in the D&D community of technologies available within the complex, and to develop procedures to facilitate lending equipment from one site to another for specific D&D activities. Dave Yannitell, Westinghouse Savannah River Company, informed the Committee that he had made arrangements to piggyback on an existing DOE Web site, called “The Exchange.” The Exchange was established by the DOE EM Office of Science as a mechanism to facilitate transfer of government property no longer needed at the site that originally purchased the material to a site in need of the property. Yannitell also indicated that DOE had an existing Personal Property Loan Agreement (DOE F 4420.2) for loaning government property between sites. Committee representatives were encouraged to add D&D equipment they could potentially loan to

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Huizenga Closes Out Another Successful Workshop

Dave Huizenga, Environmental Management's (EM's) Deputy Assistant Secretary for Integration and Disposition (EM-20), congratulated participants for making the Twelfth Technical Information Exchange TIE Workshop an overwhelming success, saying he was pleased to observe TIE and its growth beyond Environmental Restoration. He recognized the workshop as being a favorable contrast from the annual Waste Management conference held in Tucson.

Huizenga envisions the workshop as an opportunity for bringing people together to work in partnership, collaborate on projects, and work toward the same goals – cleaning up the Department of Energy's (DOE's) environmental problems. He is a believer in lessons learned, and TIE provides the forum for sharing project information, new ideas, and problem solutions. The sessions were good for pointing out site issues and activities. He is also acutely aware of the lack of communication between sites across complex and believes senior management needs to recognize this in their site budgets – making funding available, and then encouraging wider interaction between technology and program staff.

He was equally impressed with workshop collaborations between site attendees and their regulators. It is important for regulators to be involved with EM activities from the beginning in order for DOE to be more efficient and effective. Huizenga suggested TIE investigate possibilities of joining together with the Interstate Technology and Regulatory Cooperation (ITRC), perhaps running concurrent sessions and encouraging participation from the Department of Defense, EM's Office of Science and Technology, state and local governments, and the Environmental Protection Agency.

Huizenga also considers the TIE Quarterly to be an excellent tool for continuing communication across the complex. With respect to the Quarterly, he was encouraged to look through the most recent copy and read the many excellent comments provided by past workshop participants.

In closing, Huizenga challenged workshop participants to share their success stories and lessons learned with him. He would like to see examples of costs savings, collaborations between sites, and successful technology applications at one site being adopted by another. He would also like to hear examples of information or ideas gleaned by workshop attendees, which were applicable for implementing at their respective sites.

Huizenga encourages sites to foster the integration of activities with other sites. He agreed to set aside funding for TIE to implement attendees' noteworthy suggestions and ideas. With TIE's scope expanding and the obvious need for continuing communications across the complex, Huizenga committed to continued support for these workshops.

If you have any questions or would like to submit your success stories to Dave Huizenga, please forward them by e-mail to Sherie Earle ten Hoope, Project Enhancement Corporation, at sher@fred.net or call Sherie at 301-668-7177.

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others on The Exchange, and to communicate the process to their constituents.

Executive Briefing Working Group

It is generally agreed that the priority for D&D at Project Completion Sites is lower than that of other missions and that resulting budgets are frequently less than desired. Accordingly, a task force was initiated to develop an executive briefing for senior site management to emphasize the importance of D&D. Angelia Adams, DOE SRS, indicated the briefing will have a "boiler plate" approach for use at any site, and will also be tailored to site-specific issues. The briefing will consider the following topics: defining the importance of D&D to the sites; stating the advantages of actively pursuing D&D actions and the disadvantages of deferring them; defining how DOE HQ can help by looking beyond EM; establishing a standardized cost methodology for D&D activities; removing the constraints imposed by the year-to-year funding process; maintaining funding realized due to reductions in surveillance and maintenance (S&M) within the D&D program; and using D&D funding effectively.

Facility Safety Bases

Jeff Kerridge, DOE Rocky Flats Field Office (RF), said the Authorization Bases (AB) at RF related to D&D work has caused a lot of problems. Both workers and managers have difficulties understanding what needs to be done, since the current work is D&D and the AB documents were written for production activities. Kerridge indicated RF is currently preparing a generic AB for three of the former production facilities in order to ensure controls appropriate for the D&D work are applied.

Deactivation and Decommissioning Focus Area (DDFA) User Steering Committee

Mary McCune and Jim Goodenough, DOE Richland Operations Office, listed the DDFA User Steering Committee roles and responsibilities. These included: providing consensus agreement on reviews of budgets, work packages, and Multi-Year Program Plans; participating in mid-year and year-end reviews; being informed on project peer review and discussions; and serving as a proponent of DDFA audits and peer reviews. The Committee will also serve as technical advisors on com-

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From Paper To Progress: Putting Decision Making In The Forefront Of Environmental Restoration And Property Transfer Programs

At the Savannah River Site, Paducah Gaseous Diffusion Plant, and Mound Plant, DOE project managers and their regulators wanted to accelerate their progress toward reaching environmental restoration (ER) goals. To improve the performance of their ER programs, these sites explored integrating decision-based approaches into their management strategies, which had historically been document driven. By establishing practices that emphasized decision-making and open communication between DOE, regulatory agencies, and supporting technical staff, management actions shifted from simply meeting document requirements to accelerating cleanup decisions.

A key initiative promoting decision-based approaches used at all three of these sites is presented in the Principles of Environmental Restoration Course (See Highlight 1). The ER Principles provide guidelines to focus project teams on decision-making, good communication, and teamwork to better manage project schedules and resources.

Below is a summary of the site-specific approaches discussed at the TIE Workshop.

Savannah River Site

At the Savannah River Site (SRS), decision makers and project teams realized that for many of their projects the focus on document completion has long overshadowed effective decision-making. In the spring of 1999, DOE-SR, the US Environmental Protection Agency (USEPA), and the South Carolina Department of Health and Environmental Control (SCDHEC) agreed to suspend all milestones on a number of Remedial Investigation/ Feasibility Study (RI/FS) projects in order to more clearly define problems, and re-scope potential solutions. Through the efforts of the three agencies and their technical staff, a new approach was developed to improve communication and facilitate decision-making.

This new approach was based on a framework that explicitly links the fundamental ER project decisions (i.e., Is there a problem warranting action and how will that problem be responded to?) to the technical activities that support them. Under the new approach, a core team of representatives with decision-making authority (DOE, USEPA, and SCDHEC) and a project team of technical experts (contractors and agency support staff) convene scoping meetings to make key project decisions. A "scoping summary" captures the decisions made and identifies any remaining uncertainties to be resolved in subsequent project phases. The approach reduces the amount of effort for project documentation by encouraging continuous updates throughout the project, and limiting document requirements to only those directly supporting a decision.

The interagency collaboration and development of the new approach has been readily implemented, and achieved immediate benefits. Projects have achieved significant cost and schedule savings associated with eliminating unnecessary technical analyses and minimizing documentation and review cycles. Savannah River has reduced the number of documents that require more than one revision, and eliminated the formal feasibility study for a number of projects where the agencies reached consensus on the straightforward solution early on. Perhaps the most significant benefit associated with the approach is the value of the working relationships and trust that the agencies have established by working together.

Paducah Gaseous Diffusion Plant

The agencies overseeing and directing the Paducah Gaseous Diffusion Plant's cleanup effort recognized they needed to make improvements to the current project management approach in order to complete cleanup by 2010. Further, the scrutiny of the clean-up effort was magnified by a series of General Accounting Office and Department of Energy-Office of Environment, Safety and Health audits. These efforts consistently identified that improving communication and teamwork between DOE and their regulators would improve decision-making efficiencies (e.g., fewer document reviews, arriving at consensual decisions quicker, improved baseline estimates), therefore reducing the strain on the site's schedule and budget. As a result, Paducah decided to implement the core team approach to revise the site management plan and subsequent activities.

The core team, consisting of decision makers from DOE, the Kentucky Division of Waste Management, Kentucky Radiation Control Branch, and USEPA Region 4, began by developing a Paducah OU strategy that outlines site wide cleanup priorities and a decision-making process. For each Operable Unit (OU), an OU-specific strategy is developed, which systematically evaluates and prioritizes the solid waste management units (SWMUs). This results in identification of early actions and high priority investigations, allowing the core team to prioritize activities. Once the OUs are identified and prioritized, the core team establishes individual OU project core teams to handle the technical detail of planning and implementation. To support the core team efforts, meetings are scheduled as necessary either in person or via conference calls (currently once a month in person and once through a conference call). During these meetings, the core teams strive for "real-time" consensus on project problem definition and key project decisions, therefore reducing the time spent on document preparation, review, and approval.

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As a result of the meetings, the core team has made progress towards establishing effective communication between the agencies and is beginning to make progress towards site cleanup. To date, the core team has come to consensus on the current and future land use and remedial action objectives, facilitating cleanup strategies that are consistent with the site's end state. The team has successfully binned over one-third of the Surface Water OUs in the last four months and expects to complete the binning in December 2000. In addition, the core team has successfully planned and finalized a cleanup strategy for of the North-South Diversion Ditch that will exceed remedial action objectives.

Mound Plant

At Mound, DOE, USEPA and Ohio EPA identified an opportunity to reduce lifecycle costs and accelerate site closure by changing their approach to decision making. Initially, they had planned to address the plant's ER issues under a set of Operable Units (OUs), each of which would include a number of potential release sites (PRSs). However, after initiating remedial investigations for several OUs, they realized the OU approach was inefficient. As a result, a new approach was developed that would evaluate PRSs as individual units rather than the traditional method of evaluating them in OUs.

Based on the ER Principles, the site implemented a new strategy called "Mound 2000" for improving implementation of environmental restoration projects. Under the Mound 2000 strategy, the site and its regulators worked as a core team to reach consensus on all decisions necessary to determine how each PRS should be addressed. Their efforts focused on using existing information to determine if a PRS required "No Further Action", "Further Assessment", or "Removal". Binning the PRSs by using existing information allowed the projects to focus on data collection at only those units where further assessment was required. Straightforward projects with a clear problem could then move directly to action. Further, the core team identified the specific points at which stakeholder input would be solicited. Because the site obtained agreement from the regulators on the appropriate approach for each PRS and reviewed stakeholder input throughout the process, the preferred cleanup approach was readily accepted.

Implementation of the Mound 2000 strategy has successfully reduced the original life-cycle baseline by 17 years and more than one billion dollars. By following the decision logic of the strategy, DOE and its regulators maximize the use of existing information, ensure all data collection supports decision-making, and capitalize on removal action authorities. The Mound 2000 process also reduces and simplifies the administrative requirements associated with documenting decisions. In addition, stakeholders and the general public have confidence in the public participation process and associated documentation.

Highlight 1: Principles of Environmental Restoration

- Building an effective core team is essential.
- Clear, concise, and accurate problem identification and definition are critical.
- Early identification of likely response actions is possible, prudent, and necessary.
- Uncertainties are inherent and will always need to be managed.

A detailed description of the ER principles can be found in the "Principles of Environmental Restoration" course provided by DOE's National Environmental Training Office (NETO). Course materials can be obtained at http://tis.eh.doe.gov/oepa/workshop/restoration.html.

Questions asked during the panel session

- Did you (Steve Golian and Rich Dailey; DOE-HQ) have resistance from the sites to implement a new approach?

  o Rich – Not really. The core team approach is not exactly a Headquarters program, so the sites can decide whether it is the correct approach for them or not. If they decide to use it, we can provide technical assistance at their request. These three sites all requested technical assistance.

- Does the core team work together on formats of documents and tables?

  o Paducah – The format wasn't correct and was technically inadequate. They need to move to a clear approach, but it doesn't necessarily have to be standardized. Documentation and communication of data is one area of particular concern. Data needs to be validated and integrated in a common database.

  o Mound – The documents were initially descriptive but didn't necessarily help make any decisions. The format wasn't the key issue, it was the content that needed adjustment.

  o SRS – The format was good but the content was less than desirable. This made the process of getting to a decision very difficult. So again, the issue was solving content problems, not format.

- How did core team approach affect the contractor and contract structure? Profitability?

  o SRS contractor - DOE's contract incentivizes new technology and administrative structure. There is a large cost savings if you can do work more efficiently (e.g., streamline the feasibility study phase).

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petitive procurements; provide consensus of proposed Large Scale Demonstration and Deployment Projects (LSDDPs); review communications products, plans, and strategy; assist in deployment of improved D&D technologies; and provide lessons learned to sites on improved D&D technologies. More involvement with technology reviews conducted by the National Energy Technology Laboratory (NETL) is being considered.

Dose Based Release Criteria

Jeff Lively, MACTEC-ERS in Grand Junction, Colorado, provided a follow-up on the status of the process to release radiologically contaminated facilities based on dose-based release criteria. He indicated that most agreement states have adopted NRC criteria rather than DOE Order 5400.5, Radiation Protection of the Public and the Environment. The potential for significant cost savings by using site-specific dose-based criteria, coupled with MARSSIM statistical survey methods, needs to be emphasized to senior level DOE management. Lively presented a project at the DOE Grand Junction Project Office where the process was successfully employed that saved significant cost and time and resulted in the unrestricted release of the facility.

Message from Dave Huizenga

Dave Huizenga, Deputy Assistant Secretary, Office of Integration and Disposition (EM-20), was in attendance. Committee members from various sites provided Huizenga with their site-specific concerns.

Huizenga told the Committee that D&D, from an EM perspective, is just beginning and the D&D Committee is a clear link to what will be done in the future. There is definitely more work to do than is currently funded and there is a need to spend resources and support D&D at DOE sites. He mentioned innovative approaches that EM is looking at, such as a shared savings concept for funding deactivation and decommissioning projects.

Huizenga added that the Committee should serve as the technical arm and foundation for D&D issues and must plant seeds for the new administration, since there will be new opportunities to address these issues. He expressed a desire to better understand what the Committee has accomplished to date and understood there would be even bigger problems with additional facilities being transferred to EM from DOE operating programs (opening of the "pipeline") beginning in FY 2002.

The Committee told Huizenga that senior management at project completion sites consider D&D a relatively low priority and believe there is little, if any, visible support from DOE HQ. Huizenga indicated he and his Associate Deputy Assistant, Patty Bubar, plan to visit the sites beginning early in 2001 to gain a better understanding of the D&D needs at each site. The Committee felt that not only EM-20 but also management from the EM Offices of Site Closure (EM-30) and Project Completion (EM-40) should participate in on-site reviews to better understand the D&D needs and situations. The Committee expressed a concern that without this level of review nothing would change in providing budget for D&D activities.

Facility Transitions into the Environmental Management Facility Disposition Program

Szilagyi said the requirements contained in DOE Order 430.1A, Life Cycle Asset Management (LCAM), would continue to be the basis for planning facility transfer activities. He also felt the two-year time line identified in LCAM was reasonable in most cases to identify and plan the work and to develop a Memorandum of Agreement (MOA) between the operating program and EM. There is still much to be learned to make the facility transfer process run smoother. The actual facility review process must have earlier field involvement. EM should

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- Was there panic when the time out was called?

  o SRS Contractor - Not exactly, but people were worried. They were concerned about advancing in one direction and then having to catch up. They had worked hard so that they wouldn't be in the typical recovery mode. The core team re-arranged the baseline and schedule based on what the contractor could produce (or reduce) and what the regulators could handle.

- How did you handle data at SRS and Mound?

  o SRS - Data was visualized using ArcView. One big key to success is the presentation of the information being used for decision making.

- How long did it take to convert the data to an easily viewable format like Arcview?

  o SRS - In 1996, the data was scattered all over the place. It took three years to develop the current ArcView system.

- How has the change of people affected the core team approach at SRS?

  o We have had to start the trust process between new regulatory representatives and the rest of the core team. However, the scoping summaries have been extremely helpful to understand past decisions and the process in general.

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draft the MOA jointly with the operating program and improve the current process, and should move up both programmatic lines simultaneously to expedite approvals. Copies of all pertinent reports and documents must get to the right people. He indicated a budget had been prepared to do some D&D work on pipeline facilities when they are transferred to EM beginning in FY 2002.

Szilagyi reported that a planning meeting was held with the Offices of Defense Programs, Environmental Management, Nuclear Energy, and Science on September 27, 2000, to initiate the planning for FY 2003 facility transfers. At the meeting, Szilagyi pointed out that it is important to understand the basis for transferring facilities, and a suggestion was made to jointly develop a prioritization scheme – perhaps during a 3-4 day workshop to resolve the issues. Szilagyi indicated the operating programs were currently developing and prioritizing their excess facilities lists. He said DOE HQ will continue to maintain personal involvement in the walk-downs but wants to delegate more of this effort to EM site representatives, i.e., to perform initial screening and collection of preliminary facility information. A proposed list of facilities for transfer in FY 2003 will soon become available for field review. DOE HQ walk-downs should begin in January and February, followed by the development of the MOAs in February and March. The financials should be worked up through two levels by May.

Final Thoughts

Grand Junction Office suggested sites communicate more site-specific lessons learned. Savannah River would like to see the Committee have more input to the meeting agendas and, as a Committee, be more proactive in responding to Huizenga's needs and requests. NETL needs to share more information with the D&D Committee regarding what Deactivation and Decommissioning Focus Area (DDFA) is all about, and avoid canned presentations. The Committee needs to be proactive in producing products (policies, accomplishments, technology needs, etc) that will enhance and expedite deactivation and decommissioning activities at all DOE sites involved with disposition.

The next D&D Committee meeting is scheduled for April 2001 and will be held in either Golden, Colorado (Rocky Flats to host) or in Miami, Florida, in conjunction with the NETL DDFA Mid-Year Review and Symposium.

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