Fourteenth Technical Information Exchange Workshop
Oakland Operations Office
Oakland, California
Oakland Marriott City Center

Session I: Engineered Caps

Introduction

The session explores innovative methodologies and case studies for the prevention of leachate generation migration from landfills and effective strategies for the monitoring of moisture content and chemistry adjacent and within landfills.

Water Balance Performance of Six Different Landfill Covers

Stephen F. Dwyer (505-844-0595, sfdwyer@sandia.gov), SNL

A large-scale demonstration comparing six different landfill cover designs is currently being monitored in Albuquerque, NM. Monitoring consists of quantifying water balance variables (precipitation, surface runoff, lateral drainage, percolation, and soil moisture changes) and vegetation characteristics as they relate to evapotranspiration and erosion. The demonstration has constructed two cover designs that meet minimum requirements for RCRA Subtitle 'D' and RCRA Subtitle 'C', respectively, to serve as baselines. Four alternative cover designs were built side-by-side with the regulatory baselines for direct comparison. The demonstration is widely accepted within the regulatory community. This paper gives an overview of the first two-year's water balance data and reveals the applicability of these alternative designs in arid and semi-arid regions. The performance equivalence and lower construction costs make the alternative covers the better choice for arid environments. Planned and actual deployments with alternative cover design technologies are also discussed.

Radionuclide Contaminant Hydrogeology and Remediation Options for Landfills at the LLNL Site 300 Explosives Test Site

Michael J. Taffet (925-422-6114, taffet1@llnl.gov), LLNL

From 1959 to 1989, explosives test debris containing tritium, depleted uranium, and metals was disposed in 4 unlined landfills (Pits 3, 4, 5, and 7) in alluvial fill at LLNL's Site 300 test site. Since the El Nino of 1982-83 and in subsequent wet winters, water table rise and lateral flow of water into the pits has mobilized plumes of tritium and uranium in ground water. LLNL has defined the hydrogeology of the tritium and depleted uranium plumes emanating from the landfills. Because: 1) there is no efficient and "off-the-shelf" technology for treating tritium in ground water, and 2) the tritium plumes are not a threat to water-supply aquifers, the regulatory agencies are prepared to accept a monitored natural attenuation (MNA) remedy for tritium in ground water. However, the agencies will require that we prevent further release of contaminants from the landfills. A finite element model of local ground water flow and tritium transport has been built to forecast the distribution of tritium in ground water in time and space. This model will be used to define the fate of tritium already in ground water and for a worst-case scenario where all remaining tritium enters ground water. Additionally, treatment of depleted uranium in ground water will be required. LLNL is currently evaluating potential techniques to prevent water from entering and leaching landfill wastes. We are also investigating and testing reactive agents that could be emplaced to create a permeable reactive barrier for passive *in-situ* removal of uranium from the ground water.

SRS Vadose Zone Monitoring and Estimating Deep Flux

Heather Holmes Burns (803-952-3725, heather.holmes@srs.gov), Westinghouse Savannah River Company

A comprehensive, state-of-the-art vadose zone monitoring system (VZMS) has been deployed at the Savannah River Site (SRS) and is being used to verify performance of low-level radioactive waste (LLW) disposal units. The disposal units are located in the E-Area Low-Level Waste Facility (EALLWF), which is adjacent to an older burial ground complex that received radioactive wastes from 1952 to 1995. Because of the proximity of the older disposal units, previous tritium contamination in the groundwater would mask any potential contributions from the EALLWF. The vadose zone system was designed to overcome this limitation, provide long-term monitoring capabilities, and meet monitoring requirements identified in DOE Order 435.1 (Radioactive Waste Management Order).

The Protective Cap/Biobarrier Experiment: A Study of Alternative Evapotranspiration Caps for the INEEL
Amy D. Forman and Jay E. Anderson

The Protective Cap/Biobarrier Experiment (PCBE) was established in 1993 at the Idaho National Engineering and Environmental Laboratory (INEEL) to test the efficacy of four protective landfill cap designs. The fundamental purpose of the PCBE is to design a low maintenance, cost effective cap that utilizes local and readily available materials and natural ecosystem processes to isolate interred wastes from water received as precipitation. Some specific objectives for this experiment are to: 1) compare the hydrologic performance of caps having biobarriers with that of soil-only caps and that of caps based on EPA recommendations for RCRA caps; 2) examine the effects of intrusion barriers placed at different depths on water percolation, water storage capacity, plant rooting depths, and water extraction patterns; 3) to evaluate the performance of caps receiving higher precipitation than expected under either the present climate or that anticipated in the foreseeable future; and 4) to compare the performance of a community of native species on ET caps to that of caps vegetated with a monoculture of crested wheat grass. To address these objectives, four evapotranspiration (ET) cap designs, planted in two vegetation types, under three precipitation regimes have been monitored for soil moisture dynamics, changes in vegetative cover, and plant rooting depth in this replicated field experiment.

Session II: Geographic Information Systems I

Introduction

The Geographic Information System session presents GIS tools and spatial data technologies applied in ecological risk assessment, waste site characterization and remediation, subsurface characterization, transportation and nuclear safeguards, and environmental remediation decision making.

GeoTracker
Brendan Dooher (dooher1@llnl.gov, 925-423-1359), LLNL

GeoTracker is a system designed by LLNL, in cooperation with the California State Water Resources Control Board (SWRCB), to assist the Board manage over 15,000 active Leaking Underground Fuel Tank (LUFT) sites around California. GeoTracker was designed to collect regulatory and environmental data, and to assist regulators in protecting drinking water wells. The initial structure included an Internet shell, based on the MapBlast.com model, that allows easy access to LUFT sites and drinking water receptors in a geographical context. Initially, the data associated with both groups, LUFT sites and drinking water wells, were only regulatory and low accuracy locations. The GeoTracker interface, however, was designed to allow the owners of the sites (regulators and water agencies) to interactively update the data and locations, allowing an iterative upgrading of accuracy. In 2000, the California legislature introduced Assembly Bill 2886, which required that raw LUFT environmental data such as groundwater levels and chemistry had to be submitted to the database by Responsible Party consultants. The groundwater chemistry had to be submitted electronically over the internet in a relational database founded on the US Army Corps of Engineers Electronic Data Format (EDF), whose structure is public domain and has had developmental input from analytical laboratories. Once a period of time had passed, AB2886 required that all other

contaminated groundwater sites in California had to follow suit, including the Lawrence Livermore National Laboratory and Site 300 Superfund sites. So far, this data submission has been an incredible success, with over 100,000 submissions of electronic data. This talk will describe the types of data placed in the system, and how this data will be used in the future in order to properly assess and manage California groundwater.

LandTrek: Bernalillo County, NM and Sandia National Laboratory
Richard Brusuelas (rbrusuelas@mercury.berno.gov) and Kevin Troutman (505-314-0321, ktroutman@mercury.bernco.gov), Bernalillo County Environmental Health Department, John Lee, DOE/OAK, Michael Lippman, Blue Raster LLC, and Denise Bleakly, SNL

The Bernalillo County Environmental Health Department is developing a LandTrek World Wide Web site that will initially display groundwater monitoring data collected by the Department. Future data to be displayed will include site investigation data, Brownfields assessment and characterization data, and other pertinent regulatory information for specific properties. Bernalillo County plans to use the LandTrek site as a regulatory tool, as well as a public outreach vehicle.

Geographical Information Science and Environmental Justice
Olof Hansen (415-972-3328, hansen.olof@epa.gov), EPA Region 9

Geographical Information Science is helping EPA Region 9's Waste Division support an Environmental Justice initiative in Los Angeles County, California. The initiative was a joint Federal (U.S. EPA Region 9), State (California Department of Toxic Substances Control) and local (City and County of Los Angeles, and City of Vernon) community-based project, targeting inspections of hazardous waste facilities in minority and low income neighborhoods of Central Los Angeles that are located in close proximity to schools. The mapping and prioritization for facilities inspections was completed with Geographic Information System (GIS) tools, using data supplied by EPA, the State of California, USGS, and the US Census. The neighborhood analysis of waste sites near to schools was accomplished in Region 9's Desktop GIS system based on ArcView. To our knowledge, this was the first U.S. EPA project targeting inspections for regulated facilities with both an Environmental Justice as well as a children's health emphasis.

GIS Technologies for Archival, Cataloging, and Retrieval of Digital Imagery for Waste Site Characterization and Remediation
Halkard E. Mackey, Jr., Tracy J. McLane, and Jerry Philpot, Westinghouse Savannah River Company

GIS technologies provide the key to unlocking historical photographic records of waste site operations and activities within the DOE complex. For example, the Savannah River Site (SRS) has over 40,000 frames of vertical and oblique photography covering the time period from pre-SRS in 1938 to 2001. However, much of this imagery was collected in a variety of formats and for different projects, and thus was not easily accessible to users. With a variety of file locations, image formats, data types and spatial extents, a means to archive, catalog, and easily retrieve this valuable resource with a user-friendly interface was needed. Using these innovative approaches, this rich and valuable historical resource provides information about the location and activities for over 500 waste sites on SRS and places it at the finger tips of the SRS Environmental Restoration community, thus accelerating characterization, evaluation, remediation, and closure activities.

Session III: Technology Transfer

Introduction

This session presents several examples of how new and emerging technologies are being deployed throughout the Department of Energy (DOE) complex, Canada and Mexico. New and dynamic

technologies are being moved into the marketplace across all of North America, through collaborative efforts between national governments, DOE and private companies. These teaming efforts are proving to be quite successful, by reducing risks to human health and the environment, sustaining quality of life standards, improving waste disposal efficiency and environmental security, and providing economic benefits to citizens, while promoting the growth of commerce throughout the continent. In addition, this session explores the emergence of high technology incubators, and their relevance, benefit and viability in promoting technology transfer through partnerships with government and the private sector. All of the presentations in this session speak to these themes, in a manner that will highlight the benefits that have been, and will be, gained by technology transfer.

Evaluation of Directed and Passive Remediation Technologies under the Innovative Treatment and Remediation Demonstration Program

Malcolm Siegel (505-844-5426, msiegel@sandia.gov), Sandia National Laboratories

The Innovative Treatment and Remediation Demonstration (ITRD) Program (1993-2002) attempts to facilitate transfer of innovative remediation technologies and concepts from commercial vendors, universities and National Laboratories to DOE Sites. This presentation will highlight some of the methods evaluated for use at DOE sites under ITRD guidance during FY02. The remediation strategies ranged from active to passive approaches and included directed treatment methods for removal of chlorinated solvents, chromium and explosives at Pantex, passive venting of VOCs at Los Alamos and monitored natural attenuation of strontium at Hanford.

Mitigating the Risk to Human Health with Technology Deployment: The National Border Technology Partnership Program

Gary L. Scott (505-234-7336, scottg@wipp.carlsbad.nm.us), DOE Carlsbad Field Office

The Rise in population along the border of the United States and Mexico can be correlated with the exponential industrial growth as a result of the La Paz agreement of 1983 and the North American Free Trade Agreement. Along with this industrial growth comes environmental degradation and impacts to human health. We observe high incident rates of hepatitis A, anencephaly, acute asthmatic attack, encephalitis, dengue fever and other diseases in areas along the border. Human security is directly associated with environmental security and eventually falls on the auspices of government for accountability. The U.S. Department of Energy in cooperation with the US-Mexico Border Health Commission is actively pursuing the mitigation of environmental degradation through technology deployments in an effort to reduce the risk to human health. This effort must simultaneously ensure the existence of a strong socio-economic environment that sustains a quality standard of living for all border communities. Currently, the National Border Technology Partnership Program has demonstrated several technologies proven to mitigate waste streams and enhance opportunities to reduce human health risks. This paper will address two areas: First to provide background information concerning the relationship to industrial and population growth coupled with health risks along the expansive 2000 mile border between the United States and Mexico; and second, to depict successes in the program thus far that enhance environmental and human securities without negatively impacting the industrial capabilities. This latter effort is accomplished by illustrating the methodology to identify health issues, match technology solutions to an industrial sector need, and provide feedback in real time application.

E-Manifests: Electronic Manifests for Hazardous Waste Shipments

Michael Barclay (703-841-8022), DPRA Incorporated

In Canada, the Ontario Ministry of the Environment (MOE) launched an electronic manifest system earlier this year. Ontario's electronic manifest system, the Hazardous Waste Information Network (HWIN), is the first electronic manifest system in North America. It allows waste generators to prepare manifests on-line and for the parties to the manifest transactions – generators, carriers, and receivers – to complete all manifest business transactions on-line. The US Environmental Protection Agency (EPA) has issued a draft rule which will become final within the next year allowing waste generators to use electronic manifests in lieu of paper manifests to support shipments of hazardous waste. This presentation will describe EPA's electronic manifest rule, and implementation issues associated with EPA's rule. It will describe Ontario's

HWIN system including an overview of its functionality. Issues related to the transition of Ontario industry from paper to electronic manifests will be examined, and the cost benefits of electronic manifests will be presented. Finally, the presentation will explore the applicability of electronic manifest systems in the DOE complex.

Technology Transfer and the High Technology Incubator
Sam Doctors (510-749-3977, doctors@greenstart.org), Advancing California's Emerging Technologies (ACET)

This presentation will focus on technology transfers from the ACET operated environmental/biotechnology/energy incubator at the former Alameda Naval Air Station located in the former Navy Materials Laboratory Building. This incubator opened its doors in May 1998. It contains twelve fully equipped chemistry laboratories, four other 'dry' laboratories, and six office spaces. ACET is in the process of building a new 40,000 square foot laboratory-based incubator building in the East Bay. It will, when completed, house forty high technology start-up environmental, energy, & biotechnology companies as well having room for an additional twelve to fifteen foreign high technology companies to be represented in the U. S. It will also have modern classrooms, video-conferencing and other appropriate amenities.

Session IV: Exit Strategies and Technology Life-Cycle Costs

Introduction

One of the goals of the Assistant Secretary Jesse Roberson is to reduce the cost and time required to complete the Environmental Management (EM) clean-up mission. To achieve the cost and time savings goals, good and reliable life-cycle cost estimates must be developed and continually updated. Life-cycle cost estimates considers all costs associated with the project from the design to the project closeout, and the necessary long-term stewardship of the project site. Cost effectiveness of an environmental technology or a remediation approach cannot be determined unless it is compared on a life-cycle cost basis. Because of the nature of the work, developing costs estimates for the EM program and the various EM projects in a comparable, consistent, and traceable manner is difficult - not only for the cost estimators, but especially for the project and program managers who have little time or resource to develop or review the estimates. The goal of this session is to provide information, lessons learned, and tools for cost estimators and project and program managers to better manage cost and to develop more accurate and reliable cost estimate. The Exit Strategies and Technology Life-Cycle Cost Session will consist of a series of topics related to life-cycle cost estimating for innovative or emerging technologies, for environmental and decommissioning projects, and project exit strategies and the costs associated with closing a project. Presenters will represent Department of Energy Field Offices, Headquarters personnel, other Federal Agencies, and contractors and private sector firms. In addition to the presentations, there will be an audience and panel discussion on issues related to cost engineering, specifically availability of cost database and collection of cost data; sharing of cost information between sites, organizations, and agencies; usefulness of existing cost information; need for consistency and standardization; tools and software that are available (within EM, DOE, and other agencies or organizations); how to implement changes; and other challenges faced in developing and reviewing cost estimates.

Estimating Life Cycle Costs of Environmental Restoration Projects for Different Exit Strategies Using LLNL's PERM Process
Richard Woodward (woodward5@llnl.gov, 925-422-1885), LLNL

The Practical Environmental Restoration Management (PERM) process has proven to be effective in estimating cost-to-complete for environmental restoration at Lawrence Livermore National Laboratory's (LLNL) two Superfund sites. The PERM process relates regulatory agreements, site characterization, remedial alternatives and predictive modeling of cleanup to scope of work, schedule and cost of the program. It combines both build out and long-term operations. The process allows site managers to rapidly assess impacts of changes in scope, schedule, and remedial alternatives in order to balance their budget to cost. If there is a request to display impacts of different remedial alternatives, the results are quickly available for review. By including inflation and operational efficiency, life cycle costs are easily available.

D&D Cost Estimating Lessons Learned
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Los Alamos National Laboratory has developed an engineering systems approach for the removal of excess or abandoned buildings/structures. This system has been tailored for inclusion of out-year planning with definitive characterization data and a formal report suitable for inclusion in the bid packages. This leads to a defensible government estimate and the make or buy decision for each structure/building. By using out year planning characterization efforts, each fiscal year can be started with a full demolition effort and no planning delays. The program is now capable of responding to requests for additional performance goals.

Environmental Cost Analysis System (ECAS)
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The Environmental Cost Analysis System (ECAS) has been developed by the Department of Energy (DOE), Office of Environmental Management (EM) to collect, store, maintain, analyze, and report project costs. ECAS is a Web based database and analysis tool that captures the actual costs of completed DOE projects and the costs of specific technologies used in the projects. The ECAS fulfills the DOE need to capture detailed cost data and understand those parameters that impact DOE EM project costs. Users are to input data as each phase of the project is completed. For operations and maintenance costs and related activities, data is to be collected annually. The minimum data input is Level III of the Environmental Cost Element Structure (ECES); the use of Levels IV and V is optional.

Environmental Management Applied Cost Engineering Team Efforts
Bryan Skokan (301-903-7612, bryan.skokan@em.doe.gov), DOE/HQ

The U.S. Department of Energy (DOE), Office of Environmental Management (EM) is responsible for remediation and management of hazardous, radioactive, and mixed wastes at its sites throughout the country. The EM effort represents a large financial investment and a considerable challenge for the DOE program and project managers. Specifically, the collection and sharing of useful cost data and development of cost estimates are difficult. Cost data are essential for developing project cost estimates, baselines, contracting, improving efficiencies, benchmarking, and for numerous other purposes. This paper will focus on some of the key initiatives that the DOE EM via the Applied Cost Engineering (ACE) Team is taking to improve environmental cost management and cost estimating. Some of the of these efforts that will be discussed are: standardizing cost definitions; collecting and analyzing cost data from completed projects; development of area cost factors; and latest efforts to develop fast, accurate, easy to use cost estimating models for EM work.

Development of a Robust Approach for Cost Engineering and Analysis by the Innovative Treatment and Remediation Demonstration Program
Malcolm Siegel (505-844-5426, msiegel@sandia.gov), Sandia National Laboratories

The Innovative Treatment and Remediation Demonstration (ITRD) Program attempts to compare the costs of alternative technologies as it facilitates the use of innovative remediation technologies on DOE sites. This paper describes the efforts of the ITRD program to establish a robust approach for estimating deployment costs for innovative remediation technologies. First, examples of uncertainties in historical cost estimates from ITRD projects are examined to suggest root causes for the large uncertainties. The

effects of these uncertainties on the decisions to employ innovative technologies are described. The potential impact of contract structure on the willingness of site contractors to use innovative technologies is analyzed, based on a series of interviews with a cross section of DOE and Contractor personnel. Next, the appropriate role of different levels and kinds of cost estimates (Planning vs. Feasibility vs. Preliminary vs. Detailed and Point Estimate vs. Stochastic) are described and examples from ITRD projects are given. A review of engineering cost analysis software is described next and recommendations for their use at various stages of cost estimation in technology evaluation are given. Finally, the coordination of the ITRD cost analysis effort with other DOE and Interagency cost engineering projects is discussed.

Session V: Accelerating Site Closure/National Focus Project

Introduction

In the summer and fall of 2001, the Top-to-Bottom Review Team conducted a comprehensive review of the EM program and its management systems, with the goal of identifying opportunities for significantly improving program performance. On February 4, 2002, the Team issued its findings and identified a systematic problem with the way EM was conducting its closure activities, particularly at its smaller sites. The Team concluded that EM cleanup and closure programs focused more on "risk management" and less on "risk reduction." Consequently, EM life-cycle costs continue to escalate. In response, EM-1 solicited proposals from across EM for project managers to effect programmatic changes and enhancements. Soon after, the National FOCUS Project was formed.

National FOCUS Project Overview

Cynthia V. Anderson (803-725-3966, cynthia.anderson@srs.gov), DOE Savannah River

Having evolved from the EM Top-to-Bottom Review, the National FOCUS Project is an internal business improvement initiative that is tasked with developing a corporate strategy to consolidate, integrate and accelerate the completion of EM cleanup and the subsequent closure of EM's small sites. This will be accomplished by bringing the sites under one corporate framework that considers their relative complexities and future users. Included in this framework is the chartering of the FOCUS Groundwater Response Clearinghouse to promote a corporate approach to groundwater responses (remediation, monitoring and source control) and to serve as a forum for real-time interaction between Headquarters and Field offices on related issues.

Core Team Approach to Decision-Making

Rich Dailey (202-586-7117, richard.dailey@hq.doe.gov), DOE/HQ

A business framework will be developed that promotes effective problem solving, appreciates regulatory authorities, encourages stakeholder participation, and results in cleanup decisions that are timely and cost-effective. This framework includes the use of a *Core Team* of empowered decision-makers representing the federal and state regulatory agencies and the DOE field office. The respective site contractor(s) supports this team. The core team, by consensus, defines, scopes plans, and directs by defining objectives of the project from initiation through completion.

Waste Disposition Hub Concept

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The FOCUS Project will coordinate with other Top-to-Bottom initiatives for the timely disposition of waste and materials. A corporate approach to waste disposition is the use of "hubs," where waste from small sites is consolidated at larger, better equipped sites for the purpose of final characterization, packaging and

shipment to its final disposal facility. This waste disposition hub approach is intended to improve the overall disposition of waste streams across the DOE complex. The National FOCUS Project will charter and execute a Waste Disposition Clearinghouse to facilitate FOCUS Sites cleanup and closure.

Better Performance-Based Contracts and New Ideas
Charlie Dan (303-966-8485, charlie.dan@rf.doe.gov), DOE Rocky Flats

To facilitate accelerated closure of FOCUS sites, the contractual mechanisms through which work is planed and executed can be improved. While performance-based contracts can expedite cleanup and closure, other acquisition strategies can also accomplish the same end at more competitive rates. Such strategies may include Blanket Ordering Agreements and small, minority-owned or woman-owned business set-asides.

Session VI: Natural Attenuation

Introduction

Appropriately applied monitored natural attenuation may be a cost effective remediation and stabilization component for the management of hazardous organics, metals and radionuclides in both soil and groundwater. This session will focus on practical issues associated with the application of Monitored Natural Attenuation (MNA) at DOE sites under remediation. Characterization and monitoring critical parameter needs as well as regulatory, and engineering issues associated with the development of an MNA to a variety of contaminants of concern including tritium, high explosives, chlorinated solvents, metals as well as inorganic compounds will be discussed. This session will draw upon experts who have helped develop MNA protocols and guidelines for both DOE and US EPA as well as site cleanup managers who have successfully applied MNA remedies.

Application of Monitored Natural Attenuation at Department of Energy Sites
Steve Golian (301-930-7791, steven.golian@em.doe.gov) and Blaine Rowley (301-903-2777, blaine.rowley@em.doe.gov), DOE/HQ

This presentation will provide an overview of the U.S. Department of Energy (DOE) Office of Environmental Management (EM) direction on the appropriate application of monitored natural attenuation (MNA), including when, where, and how it should be evaluated and utilized. It will encompass past EM developed MNA guidance and tools, and recently released ground water optimization guidance on transitioning to MNA. In addition, a complex-wide overview of DOE sites planning or deploying MNA remedies will be provided.

Critical Parameters for MNA of Chlorinated Solvents
Terry C. Hazen (510-486-6223, tchazen@lbl.gov) and William Stringfellow, LBNL

Tetrachloroethylene (PCE) and trichloroethylene (TCE) were once thought to be recalcitrant in the environment; however, we now know that there are a number of pathways both abiotic and biotic that can completely degrade both of these contaminants in the subsurface. Biodegradation of PCE and TCE is common in nearly all types of environments and can occur in many environments at rates sufficient to satisfy monitored natural attenuation goals. The pathways are quite different, depending on whether the groundwater or soil has become anoxic or not. Anaerobic pathways of PCE and TCE can result in the complete dechlorination or the accumulation of more toxic daughter products like vinyl chloride. Under anaerobic environments, dichloroethylene (DCE) and vinyl chloride (VC) are biodegraded more slowly then PCE or TCE and under some conditions may not be degraded at all. On the other hand, aerobically PCE cannot be biodegraded at all and VC and DCE are degraded very quickly, while TCE is degraded more slowly. Critical to understanding the natural attenuation capacity of any environment is the presence of oxygen, pH, and the redox potential. These parameters will indicate what types of biodegradation are possible. In addition, the presence of total organic carbon and other limiting nutrients will also suggest if

sustainable natural attenuation is possible. Measurements of changes in daughter product inventories (DCE &VC) will also be critical as part of a good monitored natural attenuation strategy. As always, these measurements must be balanced with a thorough understanding of the geology and hydrology of the site, including the source term and all potential risk receptors. Examples from several sites will be presented.

Sensitive and Reliable Monitoring of In Situ RDX Transformation

Harry R. Beller (925-422-0081, beller2@llnl.gov), LLNL

We have developed a state-of-the-art analytical method for documenting monitored natural attenuation (MNA) of RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), an explosive that has contaminated groundwater at numerous DOE and DoD facilities. An important element of MNA is the detection in groundwater of distinctive products of degradation or transformation. Using bacteria enriched from an RDX-contaminated aquifer at LLNL Site 300, we identified distinctive nitroso-substituted products of anaerobic RDX metabolism: MNX (hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine), DNX (hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine), and TNX (hexahydro-1,3,5-trinitroso-1,3,5-triazine). These compounds are powerful indicators of RDX transformation because (1) they have unique chemical features that reveal their origin as RDX daughter products and (2) they have no known commercial, industrial, or natural sources.

Advances in Monitored Natural Attenuation of Metals and Radionuclide Contaminants

Patrick V. Brady (505-844-7146, pvbrady@sandia.gov), Sandia National Laboratories

Implementation of MNA to achieve final site closure at metals/radionuclide-contaminated sites requires overcoming a number of unique technical and regulatory obstacles. Obvious questions that must be answered include: 1) For those sites where MNA is to be relied upon after early source removal - When should active remediation cease and when does active remediation work against MNA?; 2) For strongly sorbed contaminants - How should sequential extraction arrays be developed to best communicate MNA mechanisms and support long-term monitoring?; and 3) How does implementation of metals/rad MNA overlap with active and/or passive remediation of commingled organic contaminants. Question 1 can be answered with a new javascript subroutine, *MNAendpoint*, which will be described and will soon be added to DOE's MNA web-based site-screening tool *MNAtoolbox* (http://www.sandia.gov/eesector/gs/gc/na/mnahome.html). Question 2 will be addressed using a recent survey of sequential extraction deployments in the U.S. and abroad. Question 3 will be considered on the basis of recent field experience at a number of metals and radionuclide-contaminated sites. We propose that with recent advances in the understanding of field-scale metals/radionuclide MNA, combined with rapidly accumulating, well-documented case studies will provide very clear clues to the most effective pathways (monitoring plans, stakeholder interactions, etc.) to site closure.

Acceptance of a Monitored Natural Attenuation Remedy for a Tritium Plume at Lawrence Livermore National Laboratory (LLNL) Site 300

Leslie Ferry (925-422-0060, ferry2@llnl.gov), LLNL

Site 300 is a Department of Energy (DOE) owned and University of California operated, remote experimental test facility located in the rugged Altamont Hills east of Livermore, California. About 60 miles southeast of San Francisco, Site 300 's past defense program practices, including high explosives testing, have resulted in releases of tritium to ground water. Tritiated water poses a particular challenge for DOE Environmental Restoration Programs as there are currently no cost-effective small-or medium-scale technologies available to treat tritiated water. In 2001, an Interim Record of Decision for the remediation of LLNL Site 300 was signed between DOE and the State and Federal regulatory agencies. A Monitored Natural Attenuation (MNA) remedy was selected for the tritium plume emanating from the Building 850 firing table. This is one of the first Records of Decision signed in the DOE complex that includes a MNA remedy.

Natural Remediation at the Savannah River Site Lessons Learned

Cary Tuckfield (803-725-8215, cary.tuckfield@srs.gov), and Michael Heitcamp, Savannah River Technology Center

Session VII: Sampling and Monitoring

Introduction

Case studies for the application of groundwater sampling technology: Decreasing waste and cost while increasing effectiveness

The Purge Water Management System at SRS

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The Purge Water Management System (PWMS) is a closed loop non-atmospheric contact technology to reduce the volume of Investigation Derived Waste (IDW) generated during the sampling of groundwater monitoring wells. This technology allows the IDW or purge water to be stored in a tank during sampling. The purge water is then returned to the original aquifer without significantly altering ground water quality. Traditional methods of sample collection require the purging of 2-4 well volumes of contaminated groundwater prior to collection of the routine sample. In the past, purge water was either discarded on the ground adjacent to the sampled well or containerized for disposal, depending upon the level of contaminants in the purge water. The PWMS technology reduces the volume of containerized purge water by temporarily retaining it within a dedicated fiberglass tank and then returning it to the originating aquifer. The purge water does not contact the atmosphere in order to minimize the potential for chemical changes to the groundwater sample.

The EasyPump and other New Approaches to Monitoring Ground Water Chemistry at LLNL

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To continue to meet data quality objectives (DQOs) in the face of increasing budgetary constraints, the EasyPump and other new sampling technologies are being used to sample ground water for chemical analyses at Lawrence Livermore National Laboratory (LLNL). Conventional sampling methods usually involve purging three well casing volumes and achieving stability of various water quality parameters prior to sampling. A costly byproduct of this sampling method is the production, treatment, and disposal of large volumes of pre-sample purge water. This usually requires dedicated sampling vehicles, high voltage generators, and substantial technician hours. The EasyPump, a sampling technology developed at LLNL, is designed to collect a specific depth sample within a well while avoiding the collection of purge water and it's associated costs. The EasyPump provides sampling results that are equivalent to the MicroPurge technique while at the same time reducing equipment costs, eliminating pre-sample purge water, reducing sampling time, and reducing health risks to the sampler.

Low Purge Volume Sampling Technique for the Collection of Groundwater Samples at Brookhaven National Laboratory

Douglas Paquette (631-344-7046, paquette@bnl.gov), BNL

Brookhaven National Laboratory's integrated groundwater monitoring well network is used to verify that prevention and restoration activities are effective. The groundwater monitoring well network currently consists of nearly 1,100 wells located both on site and in off site areas. During 2001, BNL collected groundwater samples from 714 monitoring wells during 2,739 individual sampling events. Eleven active research and support facilities were monitored, and six volatile organic compound plumes and eight radionuclide plumes were tracked. Until recently, the standard procedure for sampling groundwater monitoring wells called for the removal of three to five well casing volumes before samples could be collected. However, research conducted over the past ten years indicates that high volume purging of monitoring wells prior to sample collection may not be necessary to provide data that are sufficient quality

for environmental surveillance and regulatory decision-making. During 1995 and 1997, BNL conducted a sampling study to determine whether a low purge volume sampling technique could be used at its site.

Advancements in Groundwater Monitoring at the Idaho National Engineering and Environmental Laboratory
Leah V. Street, LLNL

Advancements in groundwater monitoring techniques at the Idaho National Engineering and Environmental Laboratory (INEEL) have increased efficiencies and reduced costs. For example, groundwater is sampled using low-flow purge water methods at the northern portion of the INEEL. This method has reduced purge time and costs associated with managing, treating, and disposing purge water. Also, the INEEL developed and installed advanced tensiometers in several wells and boreholes to track water movement. They record data continuously, and a radio link transmits the data. Additional advancements need to be made to existing sampling and monitoring techniques to further improve groundwater programs. For example, low-flow purging techniques at greater depths are needed. Measurement devices with increased sensitivity and capabilities to determine measurements remotely and in-situ are also needed. Also, remote locations without existing utilities (electrical, phone, etc.) need to be accessed and secured.

QED Micropurge, Low-Flow Sampling Technology at Sandia
Sue Collins and Gary Bailey, Sandia National Laboratories

Low-flow groundwater sampling is the most technically defensible and cost-effective sampling method used at Sandia National Laboratories, New Mexico (SNL/NM). SNL/NM currently performs groundwater sampling two ways: with low-flow bladder pumps (QED ™) and traditional large-volume air-piston pumps. Low-flow sampling performance at SNL/NM has been found to be consistent with expectations set forth in literature. Using low-flow methods, SNL/NM has been able to collect samples that are more representative of groundwater chemistry. With traditional large-volume sampling, wells at SNL/NM were often pumped dry and many required more than 24 hours to sufficiently recover. Traditional sampling methods at SNL/NM also had been generating higher turbidity. With low-flow sampling, SNL/NM was able to achieve parameter stability with little head loss and turbidity readings that meet or exceed regulatory requirements.

Advanced Monitoring Systems Initiative Achievements
John B. Jones, Nevada Operations Office, and Edward H. Hohman, Bechtel Nevada

The Advanced Monitoring Systems Initiative (AMSI) is a joint project involving the National Nuclear Security Administration Nevada Operations Office, Bechtel Nevada, and Sandia National Laboratories. AMSI's main purpose is to expedite the development, testing and evaluation of advanced sensors and monitoring systems for applications in environmental management and other areas of national interest. AMSI is a flexible, vertically integrated program having an end-user focus. AMSI can be applied incrementally, or as a complete process. This presentation will focus on AMSI activities conducted in FY02. There were six demonstrations of monitoring systems for environmental management applications in FY02. Contaminants measured included tritium, volatile organics, soil water content, technetium, and isotopic radiation. Each demonstration will be discussed, and follow-on activities will be identified. Other FY02 achievements will also be discussed.

Session VIII: Deactivation and Decommissioning

Introduction

The D&D session presents information on both in-progress and completed D&D projects at various facilities. Presentations will review the project scope of work, the methods used to conduct the work, technologies and unique approaches employed and lessons learned.

Reactor Interim Safe Storage (ISS) Project
Michael A. Mihalic (509-373-1382, MaMihali@BHI-erc.com), BHI

The Reactor Interim Safe Storage (ISS) Project is currently working to decommission the retired plutonium-production reactors on the Hanford Site. This involves placing the reactor cores in safe storage, which consists of reducing the footprint of the reactor site by ~80% and enclosing the reactor block in a "cocoon" made of the reactor's shield walls and a refurbished roof. The F Reactor is currently undergoing the ISS process. One of the major phases in this process is cleanout of the fuel storage basin (FSB), which is a reinforced-concrete basin about 745 m^2 and 6 m deep that was used to store spent fuel. When production operations at F Reactor ceased, the water in the basin was drained down to approximately 1 m and then the basin was completely filled with soil. The bottom of the basin (and pickup area) contained contaminated sludge, as well as miscellaneous equipment that remained in the basin from the initial deactivation. By November, demolition of the F Reactor FSB will be nearly complete and the decommissioning of the H Reactor FSB will be in progress.

Decommissioning and Demolition of Sodium Facilities at the Former Energy Technology Engineering Center
Kendal Robinson (818-586-5254, kendal.s.robinson@boeing.com), Boeing Rocketdyne

The Energy Technology Engineering Center (ETEC) conducted testing of components for sodium-cooled reactors in a non- nuclear environment. ETEC has been declared surplus to the Department of Energy's (DOE) mission and its sodium test facilities are undergoing decommissioning and demolition (D&D). This paper discusses the removal of bulk sodium from facilities, the removal of sodium from system components, and the removal of residual sodium from sodium wetted piping. The demolition of sodium systems and the balance of the test facilities will also be discussed with reference to utilities and above and below grade structures. Regulations, which affect the management/processing of, removed sodium and demolition activities will also be discussed. Lessons learned from the D&D of at least six test facilities ranging in size from small scale development labs to the largest sodium pump test facility in the world are discussed.

The Space Action Team (SAT) D&D of the LLNL Chemistry Building
Mathew Robison (925-422-9975, robison2@llnl.gov) and Diane Cuyle (925-424-6094, cuyle1@llnl.gov), Lawrence Livermore National Laboratory

The Chemistry Building at Lawrence Livermore National Laboratory (LLNL) used highly toxic materials and gases, and an extremely wide array of radioisotopes was by the building's researchers throughout its life. To meet the U.S. defense mission, building space was constantly evolved, adapted, or modified. Facility disposition planning began in the early 90s. In 1998, the last occupants were transferred and the building officially became surplus. D&D planning began in 1998 with the first phase; the original B101 south wing initiated in Feb. 2002. That D&D of this portion of B101 is the primary focus of this presentation. The SAT use of a task driven Integrated Safety Management System (ISMS) compliant plan implemented by a unique multi-discipline team has lead to successful project completion. The demolition of the south wing, originally scheduled to take twelve months, was completed in ten months, and under budget. This presentation will provide a brief overview of the demolition time line, our creation and use of historical operations maps, zone controls and sequence maps will also be presented. We will demonstrate how our multi-skilled specialized SAT "SWAT" teams are utilized to resolve high hazard potentials without loss of schedule, or change orders. Our lessons learned from the demolition of the south wing will be presented.

Space Action Team (SAT) D&D of B177
Greg Stremel (925-423-4454, stremel3@llnl.gov), Lawrence Livermore National Laboratory

LLNL is currently decontaminating and demolishing legacy facilities that have been used for a wide range of DOE Research and Development projects. Building 177 (B177) is a 14,440 square foot facility, constructed in five phases from 1956 through 1982. The building was principally a support building used

by the AVLIS program (Atomic Vaporization Laser Isotope Separation) to conduct scale up and demonstration for a variety of uranium enrichment experiments. In 1999 the program was abruptly terminated and the building, and all its R&D equipment was transferred to the LLNL Deputy Director Strategic Operations (DDSO) pending disposition. This presentation will discuss lessons learned from B177 that include elements of the building transfer and deactivation; historical profiling; deactivation; and characterization.

Applying Rocky Flats D&D Experience to the Plutonium Finishing Plant
C. A. Negin (301-668-7177, cnegin@pec1.net), Project Enhancement Corporation

With regard to decommissioning, several facilities at Rocky Flats (RF), and Building 771 in particular, share similarities with the Plutonium Finishing Plant (PFP) at Hanford. The similarities are for building construction, types and sizes of process and support equipment, historical conduct of processes, predominant form of contamination, the need to de-inventory stabilized nuclear material, and challenges for waste management/waste disposal. Both projects have had plutonium stabilization campaigns as pre-requisites to decontamination and demolition activities. As a result of the similarities and RF's schedule lead, significant efforts have been made to apply lessons learned and experience to PFP. Excellent results have been achieved through the joint collaboration of the DOE field offices at Richland and Rocky Flats, the prime contractors at both sites (Kaiser Hill and Fluor Hanford), and EM-20's Office of Integration and Disposition through its National Facilities D&D Initiative (NFDI). The presentation represented by this abstract will discuss several specific examples of the results.

Solving the Project Planning/Implementation Conundrum
Paul Corrado (925-423 2152, corrado1@llnl.gov), Lawrence Livermore National Laboratory and Rob Gamble (803-926 0740, Motacorprg@aol.com), MOTA Corporation

How do you plan the next project using the same resources needed to implement the current one? It's a common problem. LLNL recently solved the dilemma by partnering with MOTA Corporation in a unique way. By partnering with the consultant using LLNL's process, the Project Development Phase of a complex follow on D&D project was completed in a record 3 months. This included the historical site assessment, sampling plan, work break down structure, project execution plan, and an integrated project schedule, and cost estimate. The keys to success were participation, preparation, cooperation, and communication. What worked most efficiently was adoption of an accepted successful project development process. This required LLNL disciplines to review, rather than create, the required technical documents. Consultant improvements were encouraged, reviewed, and where effective, adopted by LLNL during the process. Project information for the MOTA Corporation was prepared and placed in a separate workspace with phone lines, copy machine, etc. MOTA was set up and running an hour after they arrived. A LLNL client liaison was assigned to work collaboratively with the consultant to ensure success. This presentation will focus on the benefits of this successful collaboration.

Session IX: Packaging and Transportation

Introduction

This session is designed to address critical issues related to consolidation of nuclear materials to support accelerated risk reduction and site closure. A panel of experts will address critical issues of packaging and transportation, and nuclear materials movement from a variety of perspectives. These perspectives are from shipping and receiving sites, DOE corporate needs, and integrated planning. The overall theme is resolving Issue 10 from the Top-to-Bottom Review: *A better approach to packaging and transportation should be developed, including both EM internal actions and improved coordination with other involved parties.* The lead presentation will focus on the new EM project approach to resolve Issue 10.

EM Perspective

Frank Sheppard (301-903-4982, frank.sheppard@em.doe.gov), EM/HQ

- Background on Top-to-Bottom Review (TTBR)
- Accelerated consolidation of nuclear materials
- Issue 10, Packaging and Transportation
- Packaging and transportation linkage to nuclear materials consolidation and accelerated cleanup and closure

Lessons Learned: A Shipping Site's Perspective
Dave Hicks (303-966-3122, dave.hicks@rf.doe.gov), Rocky Flats

- Nuclear materials shipments on the critical path
- Packaging needs
- Package development and related issues
- Path forward
- Lessons learned

Lessons Learned: A Receiving Site's Perspective
Allen Gunter, SR

- Program and political issues
- Storage capabilities
- Treatment and final disposition
- Packaging receiving issues
- Lessons learned

Lessons Learned: A Safe Secure Transport Perspective for Shipment of EM Nuclear Materials
Cal Irvin, (505-845-5283, cirvin@doeal.gov), AL

- Capabilities
- Schedules and priorities
- Acquiring needed assets and budgets
- Issues
- Lessons learned

Today's Priorities: DOE Corporate Packaging and Transportation Needs and Solutions
Gary Lanthrum (505-845-5277, glanthrum@doeal.gov), AL

- Complex-wide needs assessment
- Suite of packages
- Regulatory issues and NRC certification
- Programmatic roles and responsibilities
- Transportation safeguards issues and perspectives

Nuclear Material Disposition: Integrated Planning for EM Nuclear Material Disposition
Gary DeLeon (301-903-7668, edgardo.deleon@em.doe.gov), EM/HQ

- EM requirements
- Materials at RF, RL, and ID
- Integration strategy
- EM priorities and schedules
- Political/institutional issues
- Stakeholder interactions

Session X: Innovative Remedial Approaches

Introduction

This session identifies innovative remedial approaches that are being investigated and deployed to expedite cleanup and lower risks.

Rocky Flats Closure Legacy Project

Joe Legare (303-966-2282, Joe.Legare@rf.doe.gov), Rocky Flats Field Office and Dottie Brown (301-903-4925, dorothy.brown@em.doe.gov). DOE/HQ

The guiding principles for EM, as outlined in the Top-to-Bottom Review, involve applying risk-based strategies, integrating effective contract management techniques and realigning DOE internal business practices to accelerate the cleanup and closure of designated sites. Phase I of the Rocky Flats Closure Legacy Project captures the key leadership and planning decisions associated with these strategies which are driving the accelerated closure of the Rocky Flats Environmental Technology Site (RFETS). Closure seemed a distant dream in early 1995, when the DOE estimated the cleanup of Rocky Flats would take approximately 65 years and cost over $37 billion. For cleanup and closure of the site to become a reality, a new vision was needed. With the Accelerated Closure Concept RFETS is currently on track for closure in December of 2006 and at a total project cost of $7 billion. Establishing and implementing the accelerated closure concept was only possible through innovative and groundbreaking strategies of political support (among the DOE site leadership, contractor leadership, the DOE political leadership and key Congressional committees), regulatory applications and relationships, project management and control, and contract development and management. Rocky Flats Closure Legacy outlines the four major areas of accelerated site closure as *Congressional and Executive Administration Support*, *Regulatory Framework*, *Creating and Implementing a Closure Project*, and *Contract Approach.*

ElectroChemical Remediation Technologies (ECRTs)

Joe Iovenitti (510-450-6141, jli@weiss.com), Weiss Associates

ElectroChemical Remediation Technologies (ECRTs) are a geophysical-based suite of electrochemical remediation technologies, discovered in Germany about 15 years ago. ECRTs use a proprietary alternating current (AC)/direct current (DC) signal to generate reduction - oxidation (redox) reactions in the contaminated soil or sediment (soil) to remediate a site, either in-situ or ex-situ. Weiss Associates (Weiss) is re-introducing ECRTs into the US along with our Direct Current Technology partners: Electro-Petroleum, Inc. and Electro Chemical Processes, LLC, the technology development firm. These technologies can remediate metals and organics in soil, sediment, sludge, and ground water. The technology developer has taken an Edisonian approach to remediate over 2 million metric tons of soil in over 50 projects in Europe. Current major demonstration projects in the U.S. involve a wide range of contaminants and geohydrologic environments.

In-Situ Thermal Desorption

Ralph Baker (978-343-0300, rbaker@terratherm.com), TerraTherm

TerraTherm has license to a remediation process, In-Situ Thermal Desorption (ISTD), which is a clean closed system that is simple, fast, and does not move or disturb the soil. The operations are low profile, quiet and cause little disruption to adjoining communities, commercial centers or industrial operations.

Prompt Gamma Neutron Activation Analysis (PGAA)

Glenn Garabedian (925-422-6144, Garabedian1@llnl.gov), Lawrence Livermore National Laboratory

PGAA is a non-destructive, in-situ technique that obviates the need for sample handling. The application will be to characterize legacy material, non-radioactive as well as radioactive, without breaching the container, extracting a sample, doing a laboratory analysis, and exposing a worker to the risk of handling unknowns. Since neutron energies may be selected to penetrate any potential container type and many of the prompt gammas are high energy, PGAA allows the analyst to 'see' through the container. Furthermore, given the fact that a newly developed miniature neutron generator that outputs high neutron intensities using either a deuterium-deuterium (D+D) or deuterium-tritium (D+T) mode of generation, concerns about radiation doses from a nuclear reactor have been eliminated.

Streamlining the Environmental Remediation Process
Norma Castañeda (303-966-4226, norma.castaneda@rf.doe.gov), DOE RFFO, and Lane Butler, Annette Primrose, Lee Norland, and Marcella Broussard, Kaiser Hill, LLC

The Rocky Flats Environmental Technology Site is expected to close in 2006 after achieving accelerated cleanup and Site closure in a manner that is safe to workers and the public, and is protective of the environment. The Environmental Restoration Program developed a streamlined approach for completing environmental remediation work in conjunction with the appropriate State and Federal regulators and stakeholders. This approach integrates the regulatory and technical strategies for environmental remediation and facilitates closure in an accelerated and environmentally responsible manner by streamlining schedules and eliminating unnecessary or redundant steps. Using the streamlined approach to the ER activities at the Site and applying this to the regulatory, technical and Site requirements will result in safe, compliant and swift closure of the Site.

Technical Assistance to Closure Sites
Doug Maynor (937-865-3986, doug.maynor@ohio.doe.gov), DOE-Ohio

Session XI: Geographic Information Systems 2

Introduction

The Geographic Information System session presents GIS tools and spatial data technologies applied in ecological risk assessment, waste site characterization and remediation, subsurface characterization, transportation and nuclear safeguards, and environmental remediation decision making.

GIS Tools for Integrated Ecological Risk Assessment
Tracy J. McLane (803-952-6953, Tracy.mclane@srs.gov) and Sadika M. Baladi, Savannah River Site

In order to more efficiently conduct ecological risk assessments (ERA), an automated system integrating ERA protocols and geographic information system (GIS) was developed at the Savannah River Site. The system consists of a relational *Microsoft Access* database, the *Arcview* GIS software, and customized ERA GIS tools. The tools allow users to model risk to ecological receptors for each subunit and/or operable unit. The database links unit-specific media concentrations (soil, surface water, sediment), receptor parameters, environmental screening values (ESVs), unit-specific background media concentrations, bioaccumulation/ bioconcentration values, and toxicity reference values (TRVs). The GIS tools calculate exposure doses (EDs) and hazard quotients (HQs), as well as evaluate the lines of evidence criteria needed for uncertainty discussions of the contaminants of potential concern. This application also produces the summary reports that are required in the ERA. The ERA process utilized is based on the latest available United States Environmental Protection Agency (US EPA) guidance, as well as, on input from the staff of US EPA Region IV and the South Carolina Department of Health and Environmental Control (SC DHEC). The integration of the ERA and GIS reduces the cost and the time needed to produce such evaluations, and identifies data gaps that need to be addressed in a more timely fashion.

Enterprise GIS Design
Paul M. Rich (505-667-1850, pmr@lanl.gov), Marc S. Witkowski, Gordon N. Keating, and Thomas L. Riggs, LANL

An increasing number of organizations are challenged with implementing a robust enterprise geographic information system (GIS) capable of serving spatial data to a large number of individuals through information sharing and interconnected networks. In the past, numerous technological roadblocks hampered the successful implementation of enterprise GIS. With the advent of high-speed networks, increasingly fast computers, intelligent spatial data serving technologies, and improved data architecture,

the newest challenge involves integration of the various technological components. This integration can be viewed as an inevitable stage in the evolution of GIS. Herein, we present a design and conceptual framework for implementation of enterprise GIS. In particular, we focus on three critical components: 1) recognition of the roles of participants in the process (data providers, data managers, and GIS users), 2) the concept of a complete geospatial data cycle, and 3) the design of spatial data warehouses.

Mapping Land Use/Institutional Controls at BNL
Michael Lippman and Natalie Hopkins, Blue Raster LLC, and Mary Daum, BNL

Brookhaven National Laboratory has been active in improving a number of processes to reduce risk, improve stakeholder relations, and control costs of its environmental cleanup program. Integrating Long Term Stewardship (LTS) responsibilities into existing sitewide programs is an important goal of LTS transition planning. Part of the stewardship responsibility for these cleanup areas is to maintain land use and institutional control of these sites at BNL to ensure that workers and the public are not exposed to unacceptable levels of contamination. As part of a pilot project, BNL assessed its information needs to support these LTS activities and examined the potential value of more web-based information management applications. It was concluded that a web-based application could provide real benefits by providing information to stakeholders about waste areas, land use controls, and historical radiological releases and spills. The website that has been developed provides brief information on each of the BNL waste sites, their cleanup status, contaminants of concern, and dynamic maps depicting land use and land use restrictions. It defines the scope of activities intended within each waste site, so that stewards and stakeholders have a clear understanding of the restrictions and stewardship responsibilities. Users can click on the web-based map to access available information, including data stored within the map layer, links to distributed databases, links to scanned documents, and a listing of other (non-digitized) related documents and their locations. In addition to seeing information on the screen, the user can download, use and print the information that is retrieved. The screen map can be inserted into a preformatted page with legend and scale bar, and then saved as a graphics file. Data retrieved from a database can also be saved in a format readable in standard spreadsheet or word processing software. This will provide the user with the capability to combine and use data from different data sources.

GIS Applied to Analyzing Scenarios of Energy Production Expansion in the Counties and Municipios of the California-Baja California Border Region
James B. Pick, University of Redlands and Doug Mende, IS-MS Inc.

Energy demand is increasing rapidly in the counties and municipios of the California-Baja California Border region, due to rapid population and industrial growth. This study analyzes the projected increase in the region's energy supply, based on growth scenarios over the next decade for production of natural gas, geothermal, hydro, liquid natural gas, and alternative energy i.e. solar, wind, and tidal. GIS was utilized to analyze the spatial locations of energy production and distribution relative to population and urban consumption. The environmental impacts of each scenario are analyzed.

The Nuclear Regulatory Commission GIS site: Gen&SIS
Chuck Hall, Lee Neher, Kris Chubb, Lynn Wilder, LLNL

The original Gen&SIS (Geographic Environmental Navigation and Siting Information System) was developed by LLNL in the early 1990s based on first one than a second LLNL-developed GIS. These systems, written in C++, were web-accessible but required remote users to have X-server software. Eventually security and firewall concerns cut off access channels requiring "users" to resort to telephoning requests to Kris, who developed each geospatial analysis and map as a custom output. We have completely rebuilt the Gen&SIS interactive web-based GIS using Active Server Pages and Arc IMS. One of the interesting features that may be of most interest to the DOE GIS community is that we have built a nation-wide 20-layer data set organized in a data structure that permits very rapid query response against a large, complex database. This is possible because of the unique way we have organized the data. We divided the continental US into three regions. Then, we modified the UTM projection system to allow a 100-km overlap in each UTM zone. This means that anywhere a user chooses to query data, there is an uninterrupted 100-km area free of data tile seams available for analysis and display. The user can navigate

via either a draw down list of sites or pair of degrees-minutes-seconds coordinates that takes users, in an Arc IMS map canvas, to a user-specified radius of the desired location. Among the data layers available for query are road network, population and environmental justice categories of minority and poverty status by Census block group, hill shade, water bodies and rivers, political boundaries, floodplains, airports, tornado and hurricane tracks, fault lines and earthquake epicenters, EPA Toxic Release Inventory sites, places (cities) and urban areas. Users can generate reports that are formatted for NRC environmental documentation.

Analyte Display of Characterization Data using ArcView
Larry Koffman (803-725-1038, larry.koffman@srs.gov), Savannah River Site

A novel customized ArcView project was developed to allow for easy and rapid display of characterization data collected at a waste site. This tool was used to present results to regulators and made explanation of the data far easier than in the past. The site had 83 sample locations, samples taken at 5 or more depths, and analysis for up to 154 analytes, resulting in a total of 37,000 analyte results. A simple form menu allows a user to choose the analyte of interest, the depth of interest, and the exceedence criteria of interest, and the results are immediately displayed on a map of the site with symbology that shows any exceedances. This ArcView project will be demonstrated as part of the presentation.

A GIS-Based Analysis and Ranking Algorithm for Well Abandonment
James S. Bollinger (803-725-1417, james02.bollinger@srs.gov), Savannah River Site

The Savannah River Site has installed more than four thousand groundwater wells over the past five decades. Some of these wells were constructed with corrodible casing materials in deep aquifer units and are located in areas of known groundwater contamination. A sophisticated application has been developed in a GIS framework to evaluate the potential for aquifer cross contamination and to identify wells that need to be sealed and abandoned. The algorithm accounts for vertical hydraulic gradients, screened hystrostratigraphic elevations, well construction materials and age, and potential screen zone confining unit penetrations. Output from the algorithm includes a detailed evaluation of the likelihood of cross-contamination for each well and will be used to implement a structured well abandonment program at SRS.

Session XII: Ground Water Remediation

Introduction

The ground water remediation session focuses on the use of innovative technologies to remediate contaminated ground water. The session focuses us on current advancements in remediating uranium, tritium, metals, as well as volatile organic compound remediation by natural attenuation, bioremediation, barriers, and other methods.

Phytoremediation, Bioremediation, and Natural Attenuation Projects at the Savannah River Site
Robert Blundy (803-972-6788, robert.blundy@srs.gov), WSRC

A total of five large production nuclear reactors were constructed and operated at the Savannah River Site over the period from 1952 to 1988. All of these reactors were of a similar design and had similar methods of operation, together with similar patterns of waste disposal, with the consequent resulting groundwater contamination. Because SRS is located in a humid climate, groundwater is relatively shallow and possesses a number of vulnerable surface streams. Major categories of groundwater pollution in the reactor areas are described in this paper, with successes to date in plume remediation together with natural remediation based technologies that are being considered for future actions.

Removal of Uranium and Hexavalent Chromium from Waters using Aerogel-Granular Activated Carbon Composites

Sabre Coleman (925-422-3430, coleman2@llnl.gov), LLNL

Scientists and engineers in the LLNL Environmental Restoration Division in collaboration with scientists and chemists in the Chemistry and Material Sciences Directorate are developing, testing, and applying Aerogel-Granular Activated Carbon (GAC) Composites for the removal of dissolved uranium and hexavalent chromium from ground water. LLNL's Site 300 has uranium contaminated ground water and its Livermore site has hexavalent chromium in its ground water. These composites have application in ex-situ pump-and-treat ground water systems, and in reducing liquid waste volumes. The technology has the potential for expansion to drinking water treatment; mining, medical, and pharmaceutical waste treatments.

In Situ Redox Manipulation Treatment of Chromate Contaminated Groundwater at Hanford
Jonathan Fruchter (509-376-3937, john.fruchter@pnl.gov), PNNL

As a legacy of weapons production at the U. S. Department of Energy Hanford Site in south central Washington State, several chromium (VI) groundwater plumes are currently impinging on the Columbia River. Due to the depth of contaminant plumes in the Hanford 100 Areas (average 25 meters below the ground surface), in situ redox manipulation (ISRM), which can be installed through conventional groundwater wells, was selected. The in situ redox manipulation (ISRM) technology, developed by Pacific Northwest National Laboratory, creates a permeable subsurface treatment zone that reduces mobile chromate in groundwater to an insoluble form. The permeable treatment zone is created by reducing the ferric iron (Fe(III)), present as surface oxides) to ferrous iron (Fe(II)) within the aquifer sediments. Some of the ferric iron in 2:1 smectite clays is also reduced. This is accomplished by injecting sodium dithionite ($Na_2S_2O_4$) into the aquifer. The sodium dithionite serves as a reducing agent for iron, changing the ferric iron to ferrous iron within the aquifer sediments.

Removal of Uranium from Waters using Phosphate Minerals and Electricity
Mike Taffet (925 422 6114, taffet1@llnl.gov), LLNL

Scientists and engineers in the LLNL Environmental Restoration Division (ERD) are developing, testing, and applying natural and novel materials and techniques for the removal of dissolved uranium from ground water. These techniques have application in in-situ permeable reactive barriers (PRBs), in ex-situ pump-and-treat systems, and in reducing liquid waste volumes. We are conducting research on two processes. The techniques involve the use of apatite ($Ca_5(PO_4)_3(OH,F,Cl)$) and electrically charged plates. To optimize these processes, we are discerning the kinetics and equilibrium chemistry of uranium sorption and precipitation, aging effects on precipitated and sorbed phases, and the effective capacity of these materials. We are studying uranium removal by several forms of apatite (Apatite II-fish bone, cow bone char, rock apatite, pure mineral apatite, and ceramic apatite). The removal mechanism, whether a surface process or precipitation of an insoluble phase (e.g. autunite: $Ca(UO_2)_2(PO_4)_2{:}10H_2O$ or other uranyl phosphate solid) is not well-constrained, especially at typical dissolved uranium concentrations. Flow-through cells containing electrodes create an electrical/chemical environment within the flow stream that can precipitate out dissolved uranium for removal by filtration or settling. The technique, termed electrical coagulation, is being tested by ERD in removing uranium from ground water.

Application of Thermally Enhanced Vapor Extraction at Lawrence Berkeley National Laboratory
Iraj Javandel (510-486-6106, ijavandel@lbl.gov), LBNL

A plume of contaminated groundwater was found near the site of the first Berkeley Lab cyclotron. Detailed investigations have identified the source area and determined the vertical and lateral extent of the contamination. The total mass of dissolved chlorinated hydrocarbons, the main contaminants in the plume, was estimated to be about 7 kilograms. The source area is located within heterogeneous geologic materials consisting of both volcanic and sedimentary rocks. The hydraulic conductivity of these materials varies between 10^{-5} and 10^{-9} m/s. A combination of soil heating and vapor extraction techniques was used in a pilot test to remove the chlorinated hydrocarbons from very low permeability geologic materials of the source area. Resistive heating raised soil temperature to a maximum of 200 degrees Celsius. Three heaters, each of approximately 5.3 kilowatts capacity, were placed in three wells at 20 to 40 ft. depth. Heater wells were drilled 6 ft. apart, at the apexes of an equilateral triangle. Both liquid and vapor were

extracted from a well at the center of the triangle. Two instrumented wells were installed within 2 ft. of one of the heaters. Temperatures were measured along the heater well casings, the extraction well and at various depths in the instrumented wells. In addition, soil gas probes and lysimeters were installed at various depths in the instrument wells. Soil vapor and soil water from all sampling points were collected and tested periodically. Flow rate and chemical composition of soil gas samples collected at the top of the extraction well were measured. The total mass of perchloroethene, trichloroethene and carbon tetrachloride removed through vapor extraction exceeded 500 kilograms during the 14-month long pilot test.

Innovative Approach to Groundwater Remediation at the Rocky Flats Environmental Technology Site

Annette Primrose, Kaiser-Hill (303-966-4385, annette.primrose@rfets.gov) and Norma Castenada, DOE/RF

There are several shallow, contaminated groundwater plumes at Rocky Flats Environmental Technology Site (Site). All discharge to surface water inside the Site boundaries. As a result of accelerated Site closure, the groundwater remediation strategy has changed from installation of traditional, technically sophisticated high-maintenance designs to installation of innovative, passive treatment systems that are low profile and are designed for long-term operation with minimal maintenance. The recent groundwater remedial actions consist of three reactive barriers have been installed and are operational, and a treatability study is ongoing that is proving the effectiveness of bioremediation. The Site recently conducted a treatability study to evaluate the effectiveness of HRC® for enhancing in situ bioremediation of volatile organic compounds (VOCs) in low groundwater flow regimes common at the Site. This study indicates that this newer, safer, and more effective technology could be used for the treatment of VOCs and other organic contaminants in groundwater and soils. HRC® is a proprietary, environmentally safe, food quality, polylactate ester formulated for slow release of lactic acid. The lactic acid released by HRC® and similar type products stimulates the degradation of chlorinated VOCs by making low concentrations of dissolved hydrogen available to enhance natural microbial dechlorination.

Session XIII: Vadose Zone

Introduction

The Vadose Zone Session is a forum to discuss basic and applied scientific studies of vadose zone processes, innovative technological approaches to characterizing contaminant fate and transport in the vadose zone, and practical lessons learned from remediation of contaminated soil and fractured rock in the vadose zone within a DOE complex. Presentations in this session focus on the effective use of scientific and technological resources in designing, managing, and evaluating environmental risks associated with the migration of contaminants through the vadose zone, and will highlight efforts to minimize the risk and costs for environmental restoration and waste management programs at DOE sites. Specific examples of the demonstrated and potential transfer of monitoring and remediation technologies between sites are also discussed.

R&D Needs for Vadose Zone Characterization, Modeling and Remediation

Skip Chamberlain (301-903-7248, grover.chamberlain@em.doe.gov), DOE/HQ

As we have funded research over the years we have taken a single-minded approach to develop one tool that can do it all for any clean-up effort. We have certainly learned that this is not the case and as we progressed through the years it was apparent that a stronger bond is required between the modelers, characterization and monitoring communities. The ability to develop predictive models is apparent but are they really capable of seeing the future. Characterization of a site's current parameters is available but how do we predict what will happen if a failure occurs. The 2002 International Containment Technology Workshop focused on modeling and characterization of containment systems and their ability to protect the environment. This is most applicable to the vadose zone protection at Hanford and Idaho in addition to

stewardship at the closure sites of Ohio and Rocky Flats. Many remediation projects, including containment and stabilization of contaminants, have been completed.

Source Term Validation of Buried Mixed Low-Level Waste Using In Situ Vadose Zone Drive Probes
Phillip M. Wright (208-526-3315, wrigpm@inel.gov), Joel M. Hubbell, James D. Herzog, and Mark D. Ankeny, Idaho National Engineering and Environmental Laboratory

Need for new technologies to assist in cleanup and closure of DOE sites have been compiled by several groups. One of these needs is for better characterization of the properties of the subsurface and of contaminants. INEEL has built and deployed a series of new subsurface probes in order to help with this task. The performance of these probes and lessons learned are reviewed.

Implementation of the Hanford Science and Technology Roadmap
Mark D. Freshley (mark.freshley@pnl.gov, 509-373-3963), PNNL

The Hanford Groundwater Protection Program, formerly the Groundwater/Vadose Zone Integration Project, was established in 1997 to provide an approach at the U. S. Department of Energy (DOE) Hanford Site. The Groundwater Protection Program includes a Science and Technology Project, which uses a roadmap for planning science and technology research needed to address subsurface problems at the Hanford Site and to develop scientific understanding, information, and models needed to support Site milestones. Work scope identified in the roadmap is addressed by focused, site-specific investigations funded through the Integration Project and the Environmental Management Sciences Program (EMSP). The EMSP research has addressed a number of key scientific issues associated with the vadose zone at the Hanford Site, including questions of soil waste site inventories and source terms, water and contaminant movement in the vadose zone, chemical speciation of tank wastes, and geochemical behavior of key contaminants such as cesium-137, uranium, strontium-90, and chromium. The results of scientific investigations, including contributions from EMSP, have been incorporated directly into milestones for site characterization. The characterization milestones are part of the remedial investigation/feasibility regulatory process for the Hanford Site. The EMSP partnership has been one of several recent activities at the Hanford Site that has created important, positive cultural changes among those involved in Site cleanup. The strong linkage between the EMSP program and the Hanford Site has been accomplished without compromise to the scientific quality of the EMSP program.

Vadose Zone Research at Yucca Mountain—Results Obtained and Lessons Learned
G. S. Bodvarsson (gsbodwarsson@lbl.gov, 510-486-4789), LBNL

The Yucca Mountain site in Nevada has been under investigation as a potential geological repository of high-level nuclear waste for over twenty years. Recently, Congress overrode a veto by the State of Nevada and approved the President's recommendation to make the site the first U.S. geologic repository for both commercial and defense spent fuels. Comprehensive studies of geological, geophysical, geochemical, hydrological, and geomechanical characteristics of the subsurface rocks have been carried out at Yucca Mountain through testing and analysis of data from surface investigations, deep boreholes, and underground tunnels. Long-term investigations of the natural environment at Yucca Mountain have yielded several important findings and lessons learned. The major findings and lessons learned from long-term Yucca Mountain investigations are expected to be applicable to solving many vadose zone problems at sites with fractured rock throughout the country. Although not detailed here, there has been a steep learning curve (over the last decade or so) with respect to the relative importance and usefulness of the various characterization methods, instrumentation, field test designs, and modeling approaches. The new approaches developed at Yucca Mountain have contributed to making this project successful, and the lessons learned should greatly aid in the characterization and remediation of many contaminated vadose zone sites.

Subsurface Long-term Stewardship and Vadose Zone Research and Development Programs and Needs Second Annual Forum and Workshop for Federal and State Agencies and NGOs
Stephen J. Kowall (kowasj@inel.gov), Idaho National Engineering and Environmental Laboratory and Steve Wassersug (swassersug@getf.org), Global Environment & Technology Foundation

The U.S. Environmental Protection Agency's (EPA) Region 10 Office in collaboration with the U.S. Department of Energy (DOE ID) are seeking a more focused, coordinated, and effective science and technology dialogue on vadose zone and long-term stewardship issues that influence our national ability to manage groundwater resources. A second annual forum was held on September 18-19 in Seattle, Washington to explore in detail how the federal research community and key stakeholders, including states, can work together to develop solutions to these subsurface science challenges. Public and private owners of contaminated sites face similar vadose zone environments that deal with long-term stewardship questions. The significant national interest in protecting our groundwater calls for a cooperative, coordinated effort among all parties engaged in vadose zone and long term stewardship research. The outcome of the forum, identified areas where shared resources could optimize research implementation that will ultimately provide tools to better meet requirements and address needs, will be discussed.

Field Projects for Characterizing Transport through the Vadose Zone at the Lawrence Livermore National Laboratory

K. J. Jackson (925-422-6053, Jackson8@llnl.gov), C. R. Carrigan, and D. J. Bishop, Lawrence Livermore National Laboratory

Transport of aqueous and non-aqueous fluids through the vadose zone is an issue of considerable importance to environmental stewardship at many DOE sites. Several efforts at the Lawrence Livermore National Laboratory (LLNL) have contributed to a better understanding of the quantitative nature of vadose zone transport in general and to site-specific options for the environmental management of the LLNL sites. In an effort to quantitatively assess the transport properties of the vadose zone at LLNL, we have pursued the concept of a Vadose Zone Observatory (VZO). This facility provides a field laboratory that is used to carry out controlled, well-instrumented, and cost-effective field experiments related to multiphase fluid flow in a heterogeneous vadose zone. Our approach has been to carry out "plume release" experiments and analyze the data using detailed numerical models. Three efforts will be addressed in this paper.

Session XIV: Long-term Stewardship

Introduction

During the past decade, the U.S. Department of Energy (DOE) has made significant progress in addressing the environmental legacy of the Cold War. It has reduced the risks and costs associated with maintaining protective conditions across the DOE complex. However, in spite of that effort, the majority of DOE sites will not be cleaned up to the point where they can be released for unrestricted use and unlimited access. Factors such as technical infeasibility, excessive worker risk or environmental damage, programmatic priorities, and costs dictate the extent to which sites are undergoing remediation and the consequent end-states achieved. When cleanup is completed, most DOE sites will require some level of long-term stewardship to ensure protection of human health and the environment from hazards that remain after the cleanup is complete. It is the role of the long-term stewardship program to ensure that all activities required to ensure protectiveness take place and that future stakeholders have access to the information necessary for them to evaluate the consequences of events and proposed changes over time.

Progress/Status of Top-to-Bottom Review/Activities

Jonathan Kang (301-903-7178, jonathan.kang@em.doe.gov), DOE/HQ

Currently, the approach to addressing long-term stewardship strategies and responsibilities are being evaluated, as discussed in the EM's Top-to-Bottom review. Part of the evaluation is to clarify and/or develop strategies, policies and guidance for the long-term stewardship program, as well as clarify roles and responsibilities for management of long-term stewardship within the Department, both at Headquarters and the Field. This will include reviewing the approach to planning at the site level as well as transferring responsibility for long-term stewardship activities after EM's cleanup actions are complete. This paper,

and the following discussions during the workshop, will provide an opportunity to provide feedback on the evaluation of the long-term stewardship program and the recommendations on the path forward. This will provide a unique opportunity for the audience to ask questions and fully understand the long-term stewardship program and anticipated direction.

LTS at Near-Term (2006/2008) EM Mission Completion Sites

Long-term Stewardship Planning for Rocky Flats
John Rampe (303-966-6246, john.rampe@rf.doe.gov), DOE/RF

The Department of Energy (DOE) Rocky Flats Field Office (RFFO) is currently working at an accelerated rate to cleanup and close Rocky Flats by FY 2006. In line with DOE policy and the recommendations of the Top-to-Bottom Review Team, RFFO is dedicated to planning for long-term stewardship (LTS) post-closure, ensuring the protection of human health and the environment. They are preparing an LTS strategy for the site and expect to submit it to DOE Headquarters in January 2003. RFFO has begun to incorporate LTS values in its remedy planning, specifically incorporating stewardship evaluations in their remedy selection decisions. The Stewardship Working Group has aided this process with their Stewardship Toolbox; an analytical matrix designed to aid in including LTS requirements into site's remedial selection process. Additionally, pursuant to the Rocky Flats National Wildlife Refuge Act, RFFO is working with the USFWS to facilitate the creation of the Rocky Flats National Wildlife Refuge.

Long-term Stewardship Planning for the 1998 Mound Plant Property
Liz Hocking, Mound

The Top-to-Bottom Review declared that the preferred approach for near-term closure sites such as Mound was to have DOE and regulators agree on (1) a risk reduction program to protect public health and safety, and (2) a monitoring program that ensures continuation of that protection. The closure plan for Mound is unique among the large EM sites because the site will be cleaned to an industrial use and, although land ownership will transfer to a private party, DOE will be responsible for ensuring the effectiveness of institutional controls to ensure safe land use. Several land parcels at the 1998 Mound Plant Property have already transferred out of federal ownership. Long-term stewardship planning at Mound will result in a risk reduction and monitoring program that capitalizes on existing local, state, and federal government activities and real estate principles and practices to develop a layered approach to ensuring the success of the institutional controls. Responding to findings of the data needs assessment and uncertainty analysis are other key elements of long-term stewardship planning at Mound. Existing and emerging long-term stewardship issues at Mound that influence plan development include local government concerns about assumed liability and community confidence in the federal government's long-term commitment to site stewardship.

LTS at Sites with On-going DOE Missions

Albuquerque Operations Office
Deborah Griswold, DOE/AL

The Albuquerque Operations Office (AL) has EM management responsibilities at four major sites and several minor ones. The four sites and their accelerated completion dates are Los Alamos National Laboratory (2015), Pantex Plant (2008), Sandia National Laboratories (2006), and Kansas City Plant (2006). The current proposal by EM is to transfer long-term stewardship (LTS) responsibilities at these sites to the site landlord, the National Nuclear Security Administration. Ideally this transfer will be accomplished as quickly after EM mission completion as possible in order to meet the goal of minimizing EM work scope. Several issues will have to be resolved before these transfers can take place. AL has been has been working to provide leadership, advocacy and consistency in the timely resolution of these issues.

Long-term Stewardship Streamlining and Integration at Three Small Sites with Continuing Non-EM Missions
Susan Heston (630-252-2381, Susan.Heston@ch.doe.gov), DOE Chicago Operations Office

The Department of Energy (DOE) Chicago Operations Office (CH) has three sites, or portions of sites, that are entering into long-term stewardship over the next several years. These sites (Argonne National Laboratory East, IL; Argonne National Laboratory West, ID; and Brookhaven National Laboratory, NY) are national laboratories with continuing non-EM scientific research and development missions under the DOE Offices of Science or of Nuclear Energy. Ongoing remediation at Argonne West (phytoremediation of inactive release sites) is expected to be completed early in FY 2003. Brookhaven and Argonne East are being considered for accelerated cleanup in accordance with the "small sites" initiative under EM's February 2002 Top to Bottom Review. In late FY 2001 and through FY 2002, the EM Office of Long Term Stewardship co-sponsored a pilot project under CH to facilitate planning for nearer-term "transfer" sites and to promote an exchange of information and "lessons learned" across the complex. Key elements of the project included identifying site-specific requirements for long-term stewardship; evaluating the current status of CH sites in meeting these requirements; identifying areas with potential for improvement (such as streamlining of monitoring requirements); and evaluating the extent to which long-term stewardship elements are captured or could be incorporated within existing site systems such as Environmental Management Systems.

Environmental Stewardship is the *Only* Promising Solution to Uncertainty
Diana Hollis, Los Alamos National Laboratory

Environmental stewardship is needed when toxins remain in the environment and pose a risk to the health of humans and/or the health of ecosystems. These toxins are allowed to remain in the environment because some combination of risk, cost, and technical impracticability precludes their clean up. Here, risk is the probability that a living organism will be exposed combined with the probability that the exposure will result in a negative health impact. Since probability is an expression of uncertainty, environmental stewardship is fundamentally an exercise in uncertainty management. This concept is recognized by the National Academy of Science's National Research Council, which states: "Future risks from residual wastes cannot be predicted with any confidence… Because uncertainty is inherent…step-wise planning for DOE legacy sites must be systematic, integrative, comprehensive, and iterative in its execution through time, adaptive in the face of uncertainty, and active in the search for new and different solutions." Fully concurring that these attributes are desirable and necessary in long-term environmental stewardship programs, LANL is using quantitative, system-scale, and probabilistic decision-support methods to plan and implement its stewardship program. Probabilistic methods are appropriate because uncertainty (quantified by probability) is the single manageable variable in the risk equation. Our approach is based on the safety assessment/safety case approach promoted by the international Nuclear Energy Agency in the design of nuclear waste repositories. Disposal of long-lived nuclear waste poses most of the same challenges as LANL's long-term environmental stewardship program. In a stewardship context, a safety case is a synthesis of the state of knowledge and associated uncertainties at any given stage of program development that, via system models, expresses the uncertainties associated with residual environmental toxins. Coupling the concept of a safety case with formal decision analysis, LANL will objectively identify those uncertainties that must be reduced or resolved to enhance safety (certainty) over the course of the stewardship program, and address which uncertainties will be addressed (and how) over the next phase(s) of the stewardship.

LTS at Sites with Post 2008 EM Mission Completions

Long-term Stewardship Considerations for a Site with a Continuing Mission
Ralph Skinner (865-576-7403, SkinnerRM@oro.doe.gov), DOE/Oak Ridge

Over the past fifty years the production and research activities performed by the Department of Energy (DOE) in Oak Ridge, Tennessee have left a legacy of contaminated sites and facilities at the East Tennessee Technology Park, the Y-12 National Security Complex, and the Oak Ridge National Laboratory. DOE has made significant progress in addressing this environmental legacy and has reduced the risks and costs associated with maintaining protective conditions at its sites. However, most of the contaminated sites, media, and facilities will likely not be remediated sufficiently to permit unrestricted use of soil, groundwater, and surface water due to factors such as technical impracticability, public and worker risk and

environmental damage, and costs. Since residual contamination will remain in most cases, DOE is committed to conduct long-term stewardship activities to assure that remedies remain protective.

"Retroactive" Information Management for a (Successful) Long-term Stewardship Program
William C. McQuiston (208-526-7373, mcquiswc@id.doe.gov), Idaho Operations Office

Part of the Cold War Legacy DOE now faces, was the tendency to not adhere to the tenets of Life-Cycle Management – planning for the end. Those who are now implementing information management systems face the challenges of providing the Department, the public, regulators and other agencies, accurate and complete data and information necessary to carry out the functions of Long-term Stewardship. These challenges begin with what to do with the legacy of tens of thousands of records left behind by programs which gave little regard to the disposition of their records, and range to the need to "migrate" data from databases which transcend decades of platform changes, data structure changes and data definition changes, without the benefit of documentation. In essence, this paper is about "retroactive data Management" applied to achieve "proactive Information Management" for long-term stewardship purposes.

Session XV: Operational Integration and

Introduction

This session demonstrates efficiencies reducing risk through a variety of unique and related program options. Presenters describe site-specific efforts to reduce risk through operational program integration and through applying acceptable regulatory alternatives. Site representatives will describe and interrelate several examples of each typo of risk-reduction opportunity.

A Truly Integrated, Truly Risk-Reducing Environmental Protection Program
Diana Hollis (505-665-8469, dhollis@lanl.gov), LANL

There are many models for success in risk-based program optimization, notably: the EPA Region 6 Corrective Action Strategy; the DoD Remediation Process Optimization Program; the ASTM Risk-Based Corrective Action Standard Guide; the EPA/DOE Principles of Environmental Restoration; the NRC NuReg 1549. Los Alamos National Laboratory (LANL) is integrating salient portions of these initiatives into an adaptive *Environmental Risk Management System*, which will be used by program managers to allocate funds to environmental protection activities that get the most risk-reducing "bang" for their share of the Federal buck. By inviting and encouraging broad membership in a team that will develop "decision rules" for allocating resources across the entire spectrum of environmental protection activities conducted at the Laboratory, and bringing sound scientific methods and business practices to bear on the decision analysis, we hope to gain the trust and confidence of our internal and external stakeholders by objectively demonstrating our commitment to protecting environmental resources for current and future generations. This talk will map the findings and recommendations of the *Top-to-Bottom Review* with available individual resources and with LANL's application of those resources in a truly integrated, truly risk-reducing program.

EPA Region 6 Corrective Action Strategy Flexible Risk-Based/Performance-Based Cleanups
Rick Ehrhart, US Environmental Protection Agency, Region 6

The traditional RCRA process of facility investigation, risk assessment, corrective measures study, remedy selection and remedy implementation typically requires decades to complete, is costly, and often is not proportional to the risk that is posed at a site. In 1998, Region 6 initiated the development of the Corrective Action Strategy (CAS) a Regional corrective action streamlining guidance document, to address program impediments by accelerating corrective action through the use of practical performance-based, risk-based approaches to site characterization and cleanup. The document was released on the Region 6 web page in December 2000. Over the past two years the CAS team has been working with Region 6 States and other

EPA Regions on facility specific projects to demonstrate the benefits. This presentation will provide; 1) a comprehensive overview of the Region 6 CAS, 2) show how the CAS addresses DOE Environmental Management Program issues (i.e., help move EM toward an Accelerated Risk-Based Cleanup Strategy) described in the February 4, 2002, Top to Bottom Review Team Report, and 3) provide specific examples of where the CAS is being used at facilities to quickly assess and mitigate site risks.

RCRA Landfill Closure
Sharissa Young (505-284-6185, sgyoung@sandia.gov), SNL

Soil and debris excavated from the Chemical Waste Landfill (CWL) at Sandia National Laboratories (SNL/NM) are listed hazardous wastes. Similarly, project-generated debris and wastes, such as personal protective equipment, plastic sheeting, and wooden pallets, that were used in the exclusion zone and may have come into contact with the excavated materials also are defined as listed waste, even though no measurable concentration of hazardous constituents may exist on these materials. A contained-in determination under RCRA was approved for the Chemical Waste Landfill in January 2002. This approval allows many of the project-generated materials and a few of the excavated debris items to be managed as non-hazardous waste, thus allowing the release of these materials to be based more closely on the risk posed by the materials. The result is the acceleration of the project schedule and an anticipated cost reduction.

Catalytic Chemical Oxidation of Tritiated Mixed Waste as a Route to Disposal
Li-Yang Chang, LBNL

In the absence of options for tritiated mixed waste, Lawrence Berkeley National Laboratory (LBNL) initiated a treatability study using catalytic chemical oxidation (CCO) technology. We also pursued the appropriate legal status of this waste by petitioning to obtain a Determination of Equivalent Treatment (DET) for the CCO method and requesting a Delisting of the treatment residues. In summary, a complete solution has been demonstrated for a small volume of previously unmanageable tritiated mixed waste. The waste was treated under the authority of a state-approved treatability study. The hazardous component was destroyed using CCO technology, the residual tritiated water (HTO) was condensed from the treatment gas stream, and much less than 1% of the radioactivity was emitted during the treatment process. If an incinerator had been used for this combustion treatment, the radioactivity would have been released to the environment with the other gas products. Analyses of the condensed HTO showed that the hazardous components were totally destroyed. Based on these results, the EPA has proposed to grant LBNL both the DET and Delisting Petition [67 FR 147,49649 (07/31/2002)]. This will allow the radioactive component to be packaged for disposal at a permitted low-level radioactive waste (LLRW) facility, completing the management of this difficult waste stream.

Oak Ridge Accelerated Completion Strategy
Dave Adler (865-576-4094, AdlerDG@oro.doe.gov), DOE/ORO

The U.S. Department of Energy (DOE) Oak Ridge Operations (ORO) has developed a plan to accelerate completion of the Oak Ridge Environmental Management Program by 6 years and reduce approximately $2 billion in total lifecycle costs. Our cleanup strategy is a risk-based approach that focuses first on those contaminant sources that are the greatest contributors to risk. While risk reduction is the major cleanup driver, another factor that was considered is mortgage reduction, since there is a finite amount of funding available to accomplish cleanup. The risk-based priorities and mortgage reduction strategy was used to develop a reservation wide sequence of remediation projects that achieve risk reduction goals on an accelerated basis and accelerate completion of ORR cleanup at a significant life cycle cost savings.

Risk Reduction in Environmental Cleanup: Meeting the Challenge at the Savannah River Site
Mark Amidon (803.952.7781, mark.amidon@srs.gov), Bechtel Savannah River Incorporated

In the early days, environmental cleanup at the Savannah River Site focused was on risk management. The push was to demonstrate technologies that would actively remove contamination to achieve cleanup. Eventually, cheaper ways to cleanup the legacy of environmental impact were sought as budgets were

shrinking and existing systems were becoming more and more expensive to operate and maintain. Recently, SRS began evaluating and deploying technologies that could be utilized to improve the reduction in risk while still maintaining cost effectiveness. Since there are both active and passive systems in operation at SRS, enhancements were pursued. Over the course of the past 10 years, SRS has gone from active to passive systems to more enhanced passive systems, where warranted. With the deployment of the enhancements, it is believed that these processes will help bridge the gap between active and passive systems. This bridge will enhance risk reduction over passive systems, increase cost effectiveness, and improve overall risk reduction.

Lessons Learned for the Baseline Human Health Risk Assessment at Brookhaven National Laboratory Operable Unit V

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In 1998 the Operable Unit V Remedial Investigation Report presented information on the nature and extent of contamination within Operable Unit V, including the Peconic River, and assessed the risk to human health and the environment. A draft Proposed Remedial Action Plan was proposed and later rescinded in 2000. The decision for cleanup of the Peconic River sediment was deferred as a result of input received during the 2000 public comment period. Concerns submitted by members of the public focused on reducing wetland damage. Inherent in the comments was the need to further evaluate technologies that might be able to clean the sediment with less disruption to the wetlands, and a request to conduct additional sediment, fish and vegetation sampling to provide better definition of the areas requiring cleanup. This information was considered necessary before public acceptance of a remedy could be achieved and a final decision could be made. A baseline risk assessment was conducted for Operable Unit V and was reported in 1998. Another baseline risk assessment was conducted that addressed radiological concerns in 2000. Subsequently another baseline risk assessment was performed concentrating on human health in 2002. This re-evaluated the potential risk related to the Peconic River from chemical contaminants and radionuclides based on additional data collected.

Session XVI: Ground Water Characterization

Introduction

The ground water characterization session focuses on the use of new technologies or unique methodologies to characterize contaminants in the ground water or characterize plume extent and behavior. The session emphasizes technology advancements and characterization case studies.

Refinement of a Conceptual Hydrogeologic Model Using AquaTrack

Robert Ferry (925-422-9884, ferry1@llnl.gov), CE2 Corporation

AquaTrack is an innovative technology used to delineate the extent and saturated thickness of ground water bodies using geophysics. Electrodes are placed in existing monitor wells and a small alternating current is injected into the body of groundwater to be mapped. The strength of the resulting magnetic field generated by the flow of current in the ground water is measured at the ground surface using a grid pattern, and indicates the saturated thickness of the aquifer being investigated. DOE recently conducted an AquaTrack survey in the Building 830 area at Lawrence Livermore National Laboratory Site 300 where steep topography limits drilling locations. The lateral extent and relative thickness of two aquifers were mapped. The degree and areas of hydraulic interconnection between the aquifers was also obtained. These data were compared to existing information from monitor wells and other sources. The results of the AquaTrack survey are being used to refine the conceptual hydrogeologic model and to assist in siting additional ground water and soil vapor extraction wells, and may also result in fewer wells being necessary.

Contamination from Sampling Materials used at the Pantex Site

Dale Stout (806-477-6327, dstout@pantex.com), Pantex and Tyler Gilmore (509-376-2370, tyler.gilmore@pnl.gov), PNNL

In an effort to acquire more depth discrete samples from the Ogallala aquifer at the Department of Energy's (DOE) Pantex Plant, Texas, the prime contractor installed several new but generally proven multi-level, multi-port sampling systems. Initial sampling of these systems detected benzene and other volatile organic compounds that were unexpected and unexplained. BWXT Pantex, LLC and DOE investigated the source of the benzene including the possibility of offsite sources, errors in laboratory reporting, the introduction of contaminants during the well installation process, or possibly contamination from the sampling equipment itself. A Technical Assistance Team was assembled to evaluate the source or sources for benzene. One of the team's recommendations was to assess whether the sampling equipment material could be a source of benzene and other volatile organic compounds. As part of this investigation, laboratory testing of the sample equipment material was conducted. Results from the laboratory tests indicated that the equipment material did, in fact, contribute volatile and semi-volatile organic compounds to the groundwater samples.

Implementing Ground Water Cleanup using a Hydrostratigraphic Analysis-Based Conceptual Model
Charles Noyes (925-422-8820, noyes2@llnl.gov), LLNL

At the Lawrence Livermore National Laboratory (LLNL) Livermore Site, the properties of ground water flow were used to define a series of hydrostratigraphic units (HSUs) within a thick sequence of previously undivided, heterogeneous alluvial sediments. A methodology using multiple independent data sets was used to define the HSU boundaries. The methodology employs an iterative process to minimize uncertainty in the HSU correlations. Monitoring of the ground water system under stressed conditions during extraction well pumping and during long-term pumping tests provided the most effective data set for identifying and verifying the HSU boundaries. The HSU framework has allowed for the mapping of a complex network of co-mingled contaminant plumes, each of which can be traced back to their respective source areas. Ground water cleanup systems at the site have been designed to treat and capture individual contaminant plumes and are optimized with respect to their location, geometry, and mobility. This strategy has proven successful at LLNL, based on over 10 years of remediation history.

Helium-3/Helium-4 Ratios in Soil Gas as an Indicator of Tritium Contamination near the 618-11 Burial Ground, Hanford Site, Washington
Khris Olsen (509-3276-4114, kb.olsen@pnl.gov), PNNL

An extensive investigation of helium isotopes in soil gas samples was conducted around the perimeter and down gradient of the 618-11 Solid Waste Burial Ground, which is located in the southeastern section of the Hanford Site, in southeastern Washington State. Helium-3/helium-4 ratios (normalized to ambient air helium-3/helium-4 ratio) were determined and used to locate vadose zone sources for tritium and define the extent of a tritium groundwater plume associated with releases from the burial ground. Soil gas samples were collected and analyzed for helium isotopes using a rare-gas mass spectrometer. The results of groundwater sampling indicated the highest level of tritium was found at well 699-13-3A directly adjacent and down gradient of the burial ground. Tritium concentrations ranged from 5.3 million to 8 million pCi/L and represented a localized plume originating from the burial ground. The plume appears to be moving along a narrow path in an east-northeast direction, as indicated by the soil gas. The tritium groundwater plume migrated 950 meters (3,100 feet) down gradient of the burial ground, and the spatial distribution of tritium in groundwater is consistent with the pattern revealed by the soil gas survey results.

Characterization of Natural Attenuation and Sources of Nitrate Using Stable Isotope Ratios
Vic Madrid and Harry Beller (925-422-0081, beller2@llnl.gov), LLNL

We are conducting an interdisciplinary study to characterize the distribution and fate of nitrate in groundwater at LLNL Site 300, a high-explosives test facility in the semi-arid Altamont Hills of California. Site 300 groundwater contains nitrate concentrations ranging from < 0.5 to >200 mg NO_3/L. Nitrate concentrations exceeding the drinking water standard (45 mg NO_3/L) occur in known anthropogenic source areas but also in areas where no anthropogenic sources have been identified and no anthropogenic chemicals have been detected. Part of this study involved the analysis of stable isotope signatures of nitrate

(i.e., delta ^{15}N and ^{18}O values) in groundwater and in chemical reagents that were potential sources of nitrate at Site 300. Delta ^{15}N and ^{18}O values of
all groundwater nitrate samples fell within the range of values typical for soil nitrogen and septic waste. At this site, septic waste can only account for a small fraction of the total nitrate mass in the groundwater. Two potential anthropogenic sources of nitrate, nitric acid and barium nitrate (a commonly used mock explosive), exhibited markedly different delta ^{15}N and ^{18}O signatures than those of nitrate in site groundwater. Thus, isotopic data suggest that these two reagents are not significant sources of nitrate to the groundwater. Several lines of evidence, including dissolved oxygen concentrations, delta ^{15}N and ^{18}O signatures for nitrate, and excess N_2 data, strongly suggest that low nitrate concentrations in bedrock aquifers result from denitrification. Low dissolved organic carbon concentrations (< 2 mg/L) suggest the role of an inorganic electron donor for this microbially-mediated process. A possible electron donor is pyrite, a prevalent mineral in the aquifer. The confined bedrock aquifers, therefore, appear to be essentially "self-remediating" with respect to nitrate. Long-term nitrate concentrations in recharge-area monitoring wells are relatively constant, suggesting a balance between rates of nitrate loading and removal by denitrification.

Session XVII: Pollution Prevention

Introduction

The Pollution Prevention (P2) session focuses on P2 techniques and processes to reduce waste streams and emissions typically encountered during cleanup and D&D activities as well as ongoing site operations.

Waste Generation Comparison of Four Technologies for Decontamination of Plutonium Contaminated Gloveboxes

John McFee (303-793-5231, john.mcfee@shawgrp.com) and Kevin Barbour; Shaw Environmental, Inc., and Ellen Stallings, Los Alamos National Laboratory

The Los Alamos Large Scale Demonstration and Deployment Project (LSDDP) in support of the US Department of Energy (DOE) Deactivation and Decommissioning Focus Area (DDFA) has been identifying and demonstrating technologies to reduce the cost and risk of management of transuranic element contaminated large metal objects, i.e. gloveboxes. Several demonstrations were conducted at the Los Alamos National Laboratory (LANL) by the LSDDP to document the cost and risk associated with decontamination of crated large metal objects. The focus of the demonstrations was identification of a recommendation for a technology that could be used on a crated glovebox line that was crated and stored in the early 1970s. The demonstrations involved side-by-side decontamination of plutonium contaminated gloveboxes in an active facility at LANL. Data will be presented on the waste types and volumes generated using the various technologies. The resulting data can be used by D&D managers to identify cost, risk, and waste reduction benefits of these technologies demonstrated in a controlled environment.

Walking Through the Brambles

John Marchetti, NNSA/HQ

With the disappearance of monies to support environmental programs such as pollution prevention, it is imperative that we keep a positive spin and use innovative methods to work within the "mission" framework of our organizations by impressing upon the program offices the importance of designing pollution prevention into processes from the very beginning. There are times, more often than not, that we need to walk through the brambles to reach the fruit.

The Deployment of Decommissioning Products for Reuse

Bart Sellick, LLNL

During decommissioning, residual programmatic equipment can usually be dismantled and the components sent to salvage for recycling. This wastes the design, engineering, and manufacturing which most likely exceeds the value of the individual components. LLNL has made an effort to relocate equipment so that it may be used as it was originally intended rather than dismantled for salvage. The beneficial result of this effort has been waste reduction, and cost savings the utilization of the technical expertise that went into the equipment.

The Assets for Value Salvage Program
Bill Maciel, LLNL

The LLNL Assets for Value Salvage Program has been established to reduce D&D costs by using the value of excess or surplus equipment and material in exchange for D&D services provided by a Subcontractor. The material is taken by the Subcontractor and resold or recycled, thereby generating value. In FY02 LLNL successfully awarded four subcontracts using this method. The Program is managed by the Space Action Team (SAT), and is administered by a committee representing SAT, Procurement, Property Management, and Plant Engineering.

Berkeley Lab's ROI Projects for Reducing Use of Radioactive Materials in Life Science Research
Li-Yang Chang and Tony Linard, LBNL, and Karin King (925-422-0756, karin.king@oak.doe.gov), DOE/OAK

Since 1996, the DOE/Oakland Office sponsored Return-on-Investment (ROI) program has funded 13 projects in the Life Science Division of Lawrence Berkeley National Laboratory (LBNL) for innovative approaches to eliminate and/or significantly reduce use of radioactive materials. The purchase of these 13 projects, installed in 6 separate buildings, as well as the effort of sharing the new instruments and methodologies across more than 20 separate research groups, has greatly reduced the quantities of both low-level radioactive and mixed wastes generated by the Life Science Division. The average payback of these 13 implemented projects is less than 2 years. Because of the outstanding result of this waste minimization and ROI effort, LBNL received a pollution prevention award from DOE/OAK in 2001.

Selection of Cleaning Technology for Ultrahigh Vacuum Applications in a High Energy Physics Research Laboratory
Richard Cellamare, SLAC

Replacing ozone-depleting solvents is a challenge in high energy physics experiments. When the parts and equipment being cleaned must be returned to a particle accelerator, contamination can interfere with subatomic particle experiments. SLAC began by using x-ray photoelectron spectroscopy to compare the cleaning performance of existing and new cleaning methods. Once a method was in place to determine how clean is clean, SLAC tested various solvents and selected a near zero emission vapor degreaser technology. The result is a dramatic reduction in solvent emissions from the facility's metal finishing operations. The challenges associated with implementing a new technology and achievements in reducing solvent emissions are discussed.

Session XVIII: Regulatory Acceptance

Introduction

This panel will present a variety of perspectives on the topic of regulatory acceptance of new and innovative remediation technologies. Speakers from federal and state regulatory agencies will discuss regulatory requirements, strategies and opportunities for gaining regulatory acceptance, and the experiences and developments that have created the unique path to regulatory acceptance for remediation technologies and techniques. Speakers from the private sector will share their experiences and insights in working with

regulators, responsible parties and stakeholders to develop remedies that have gone from proposal to implementation.

The participants on this panel will include:
Paul Hadley, California Department of Toxic Substances Control and representative for the Interstate Technology and Regulatory Council (ITRC)
Ned Black, USEPA Region 9
Barbara Cook, California Department of Toxic Substances Control
Steve Morse, San Francisco Regional Water Quality Control Board
Evan Cox, GeoSyntec Consultants
Craig DeRemer, Strategic Connections, LLC

Session XIX: Moving Forward: EM Science and Technology Program's New Direction

How S&T is Helping Rocky Flats Meet Closure Deadlines
Dave Maloney

How S&T is Helping Fernald Meet Closure Deadlines
Paul Pettit, Fluor

The Office of Science and Technology, with the assistance of the National Energy Technology Laboratory, has a formal technical assistance program to provide expertise to help the site meet their needs. Technical experts from the national laboratories, industry and academia are provided to the DOE site submitting a request for assistance. During FY02, technical assistance teams were convened at the Fernald site to provide recommendations for enhancing the current baseline for a number of projects. These projects include: the Silos Project (waste retrieval, treatment, packaging, and transportation for Silos 1, 2, and 3), remediation of VOC-contaminated soils, treatment of uranium in leachate and at the Advanced Wastewater Treatment Facility, options for waste disposition from sampling, and distribution coefficient determination for the aquifer. This presentation will focus on the successes and lessons learned from the technical assistance requests completed in FY02 at the Fernald site.

Accelerated Site Technology Deployment (ASTD) Program Successes
Dawn Kaback, Concurrent Technologies Corporation

DOE's Office of Science and Technology (OST) initiated the Accelerated Site Technology Deployment Program (ASTD) in 1998 to accelerate cleanup throughout the weapons complex by promoting the deployment of new technologies at multiple sites. Between FY1998 and FY2002, OST sponsored 93 projects at 22 DOE sites. These projects provided efficient and effective solutions to DOE problems related to subsurface contamination, deactivation and decommissioning, underground storage tanks with radioactive waste, and transuranic and mixed waste. The OST funding was leveraged with the site end-users to reduce the risk of trying a new or alternative technology. A requirement to deploy the technology at more than one site promoted communication and sharing of lessons learned across DOE sites. This presentation will highlight project accomplishments and keys for successful implementation

Innovative Subsurface Characterization Using CPT Tools
Martin Amos (MAMOS@pantex.com, 806-477-6458), BWXT Pantex, LLC

Residual industrial solvents are currently the most significant challenge for the successful completion of many large groundwater and soil cleanup efforts at the Department of Energy's waste sites. The Pantex Plant has a critical need to accurately and efficiently characterize subsurface volatile organic compound

(VOC) contamination below a number of key solid waste management units (SWMUs) to determine if major unidentified sources of VOCs are present. The objective of this work was to deploy a suite of innovative characterization technologies and samplers to identify and define residual VOCs in vadose source zones. A suite of CPT (cone penetrometer test) based tools were used to identify and characterize the location of source areas at high risk SWMUs. This work was a coordinated effort by Pantex Plant, Savannah River Technology Center personnel, and the Corps of Engineers Tulsa District.

The Innovative Treatment and Remediation Demonstration (ITRD) Program (1993-2002): Lessons Learned and Recommendations for Future Technical Assistance Programs

Malcolm Siegel (505-844-5426, msiegel@sandia.gov), Sandia National Laboratories

The Innovative Treatment and Remediation Demonstration (ITRD) Program was initiated in 1993 to overcome barriers to the implementation of innovative remediation technologies at DOE Sites. Over the last decade, the DOE EM program structure changed, our understanding of the scope of remediation became clearer and new aspects of the legal and contractual relationships among vendors, Site managers and DOE became important. This presentation will give an overview of the ITRD program history, describe the elements of the ITRD process that were most effective, and suggest the challenges that future technical assistance programs will have to meet.