SUBSURFACE CONTAMINANTS FOCUS AREA (SCFA) LEAD LABORATORY – PROVIDING TECHNICAL ASSISTANCE TO THE DOE WEAPONS COMPLEX IN SUBSURFACE CONTAMINATION

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ABSTRACT

The Subsurface Contaminants Focus Area (SCFA), a DOE-HQ EM-50 organization, is hosted and managed at the Savannah River Site in Aiken, South Carolina. SCFA is an integrated program chartered to find technology and scientific solutions to address DOE subsurface environmental restoration problems throughout the DOE Weapons Complex. Since its inception in 1989, the SCFA program has resulted in a total of 269 deployments of 83 innovative technologies. Until recently, the primary thrust of the program has been to develop, demonstrate, and deploy those remediation technology alternatives that are solutions to technology needs identified by the DOE Sites. Over the last several years, the DOE Sites began to express a need not only for innovative technologies, but also for technical assistance. In response to this need, DOE-HQ EM-50, in collaboration with and in support of a Strategic Lab Council recommendation directed each of its Focus Areas to implement a Lead Laboratory Concept to enhance their technical capabilities. Because each Focus Area is unique as defined by the contrast in either the type of contaminants involved or the environments in which they are found, the Focus Areas were given latitude in how they set up and implemented the Lead Lab Concept.

The configuration of choice for the SCFA was a Lead-Partner Lab arrangement. Savannah River Technology Center (SRTC) teamed with the SCFA as the Focus Area's Lead Laboratory. SRTC then partnered with the DOE National Laboratories to create a virtual consulting function within DOE. The National Laboratories were established to help solve the Nation's most difficult problems, drawing from a resource pool of the most talented and gifted scientists and engineers. Following that logic, SRTC, through the Lead-Partner Lab arrangement, has that same resource base to draw from to provide assistance to any SCFA DOE customer throughout the Complex. This paper briefly describes how this particular arrangement is organized and provides case histories that illustrate its strengths in solving problems and offering solutions. The program is designed to minimize red tape, maximize value, and to rapidly and cost effectively disseminate solutions to common problems facing the DOE.

INTRODUCTION

The U.S. Department of Energy Environmental Management's Office of Science and Technology (DOE EM-50) utilizes Focus Areas to coordinate its approach for environmental research and technology development. This Focus-Area-centered approach places full responsibility for all investments, science through deployment, under the management of the Focus Areas.

In March, 1999, EM-50 requested that each Focus Area implement a Lead Laboratory initiative. The objectives of the Lead Laboratories were to enhance the technical resources available to the Focus Areas for addressing end-user technology needs, to ensure a strong technical foundation for interactions between the Focus Areas and the technology end-users, and to provide a full range of scientific, engineering, and management expertise to the Focus Areas. The goal of this initiative is to more effectively utilize the knowledge capital within the Department that DOE has developed through its extensive work in environmental research for over 40 years and from the active and productive Environmental Remediation program that has been in operation for over 10 years. The SCFA Lead Laboratory's objectives are to utilize this knowledge and experience base to rapidly and cost-effectively provide effective solutions to different sites that have a similar problem, and to minimize the learning curve at sites that are starting to remediate a problem that has been addressed at other DOE sites.

This paper describes the organization, technical expertise and selected examples of technical assistance conducted by the Subsurface Contaminants Focus Area's Lead Laboratory since its inception in FY00.

ORGANIZATION

The SCFA Lead Laboratory is a virtual laboratory that is coordinated by the Savannah River Technology Center; however, the source of expertise resides throughout the DOE complex. Each of the participating facilities (Table 1) has a point of contact that acts as the access point to that entity's expertise. These team members are the portals that allow SCFA to access the technical experts present at the facility. Funding is placed with each point of contact at the start of the fiscal year to pay for required services of the experts so that fund transfer is not an impediment to rapid resolution of the assistance requested. In addition to acting as the conduit for technical assistance, the points of contact provide experts for technical reviews, strategic planning and other activities requested by the SCFA.

Table I. Participating Facilities in SCFA's Lead Laboratory
and their Points of Contact

LABORATORY	PRIMARY CONTACT
Ames	Martin Edelson
ANL	Jim Helt
BNL	Terry Sullivan
INEEL	Larry Hull
LANL	David Janecky
LBNL	Terry Hazen
LLNL	Roger Aines
ORNL	Tony Palumbo
PNNL	Wayne Martin
SNL	Eric Lindgren
SRTC	Bob Aylward
Bechtel	Jerry White
Kansas City	Curtis Valle

TECHNICAL EXPERTISE

The SCFA Lead Laboratory design allows technical experts in a wide array of disciplines to be available to assist the DOE complex with subsurface contamination issues. To date, the majority of experts have been hydrologists, geologists, chemists, remediation equipment developers, bioremediation specialists, and geochemists. The Lead Laboratory is also able to reach outside of DOE for unique expertise. The Lead Laboratory has utilized Corp of Engineers personnel with expertise in remediation of explosives and private sector participants with expertise in characterization technologies to meet specialized requests.

ACHIEVEMENTS

In the first two years of operation (FY00and FY01) SCFA's Lead Laboratory assisted SCFA with Multi-Year Program Plans, Annual Performance Plans, the Strategic Plan, formulation of the Technical Targets concept, the 2001Needs responses, and technical assistance.

The Lead Laboratory considers the SCFA technical assistance program consisting of ITRD, TechCon, and the Lead Laboratory of greatest value for the end-users. In the first two years of existence, the SCFA completed 102 technical assistance tasks for DOE sites (Figures 1 and 2). This national network of technical experts offers assistance as requested by end-users at DOE facilities to help them find workable solutions for their subsurface and groundwater problems. While technical assistance is often one-on-one, some problems often require a multidisciplinary approach. The Lead Laboratory's ability to quickly connect to the technical expertise of scientists and engineers from the national laboratories and deploy them to trouble spots has helped the DOE to respond to some highly visible issues.

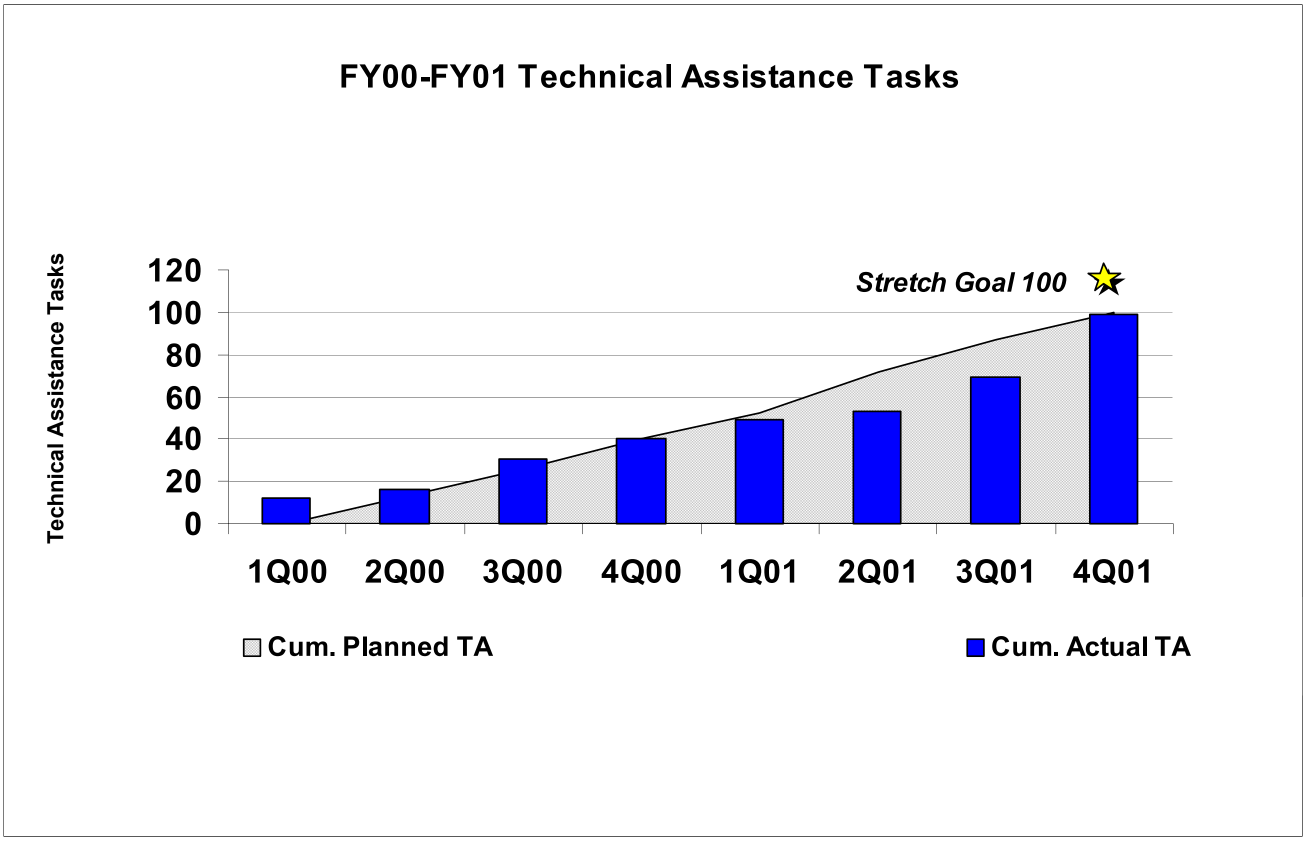

Fig. 1. Technical Assistance Metrics for FY00 and FY01

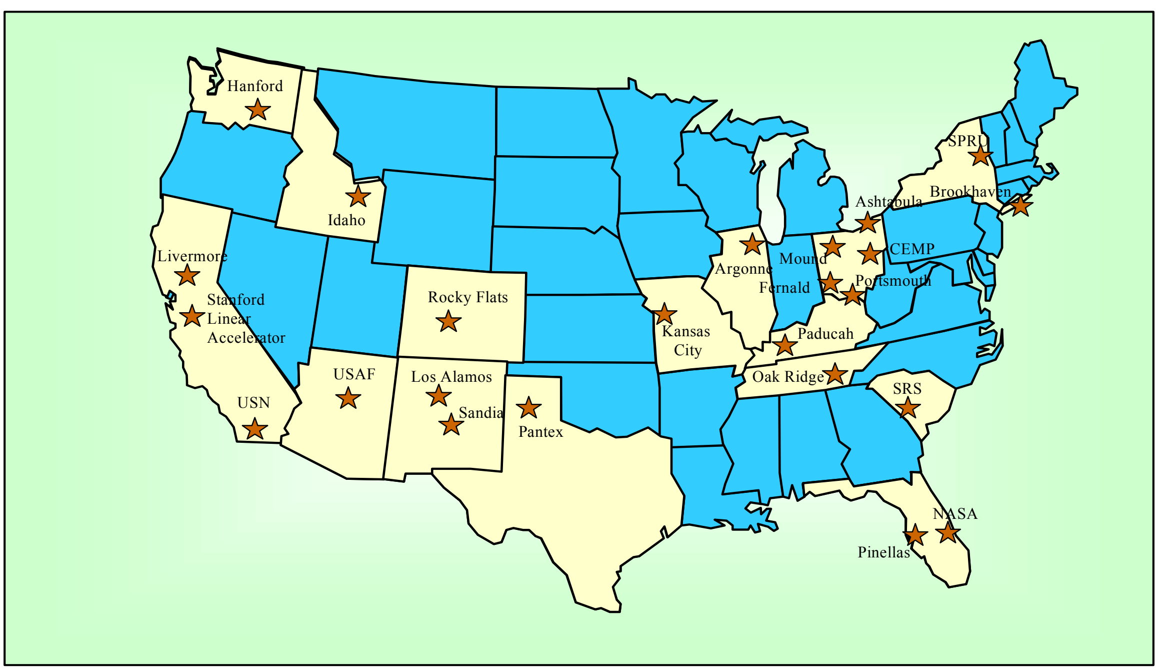

Fig. 2. Locations Where Technical Assistance has been Completed

Technical assistance was provided mainly to small and closure sites without access to a major environmental research division although, on occasion, technical assistance was provided to major facilities to provide outside experts that were working specifically in the areas of concern. The wide range of technical assistance tasks led by the SCFA Lead Laboratory are illustrated by the assistance provided to Pantex and the Separations Processing Research Unit.

PANTEX

Following the public announcement of the discovery, in March 2000, of trichlorethylene in the Ogallala Aquifer below the northwestern area of the DOE 's Pantex Plant near Amarillo, Texas, the Secretary of Energy directed the U.S. Department of Energy, Office of Environmental Management, to assemble a team of experts from across the DOE complex familiar with TCE contamination and associated monitoring and technology issues. This team was further directed to provide the most current information to Pantex officials and aid the site in developing a response plan.

The team's report identified three integrated technical areas of emphasis for evaluation and resolution of the ground water contamination by TCE beneath the Burning Grounds section of the Pantex site. These areas are conceptual modeling, characterization, and remediation. The team's technical recommendations are focused on a multi-stage approach to characterization, which will lead to the specific understanding necessary for definition, evaluation and implementation of a remediation strategy for this contamination. The characterization activity has three primary goals:

- Define the distribution of vapor phase TCE in the vadose zone between contaminated soils near the surface and the Ogallala Aquifer.
- Define the vertical distribution of TCE contamination in the Ogallala Aquifer in the wells where it has been found.
- Define the characteristics of the vadose zone structure, combined with borehole and well construction, that may provide specific pathways and impediments to contaminant transport.

Results of this combination of approaches will allow refinement of a conceptual model to resolve the questions:

- Is the source of TCE contamination internal to the Burning Grounds and/or external from other sources in the DOE Pantex Plant or from the Formerly Used Defense Sites on the Pantex property?
- Is transport from the Burning Grounds dominated by vapor phase transport or, alternatively, by dissolved aqueous or liquid TCE transport?

Characterization and refinement of a conceptual model for TCE contamination, distribution and inventory is necessary so that an effective remediation program can be designed and deployed. It is expected that recommended remediation strategies for the contamination in the Ogallala Aquifer below the Burning Grounds will include aggressively pursing source term removal.

The recognition that Pantex operations and other regional activities have the potential to contaminate the Ogallala Aquifer led to identification of four high level recommendations:

- The DOE Amarillo Area Office should continue to strengthen its efforts to improve public outreach and achieve greater stakeholder participation.
- A second SCFA Lead Laboratory technical assistance team, with the appropriate areas of expertise, should be provided to support Pantex efforts to review the site's southeastern plume characterization data with an emphasis on remediation strategies for the perched water in the southeastern portion of the site.
- The site should move forward with current field demonstrations and treatability studies and develop and aggressively pursue an integrated strategy for ground water remediation at Pantex.
- The DOE Amarillo Area Office should consider pursuing, with other contributing sites and organizations, a proactive regional approach in the Panhandle to protect the Ogallala Aquifer from migration of subsurface contamination.

Pantex is actively pursuing these recommendations within their available budget. Specific results will be discussed at the time of the presentation.

SPRU

The Separations Process Research Unit (SPRU) facility in northeast New York State near Schenectady on the Knolls Atomic Power Laboratory site was used from 1950 to 1954 to help develop and optimize the Redox and Purex processes for extracting uranium and plutonium from irradiated nuclear fuel. SPRU consists of two main buildings. The first is a two and one-half story, 23,000 square foot chemical process building. The second is a three-story 27,000 square foot waste processing building. An underground concrete pipe tunnel connects the two buildings and there are concrete vaults containing tanks adjacent and integral to the waste processing building.

The DOE Oakland Operations Office submitted a technical assistance request to the Subsurface Contaminants Focus Area at the end of calendar year 2000. The request asked for technical assistance to support the characterization activities related to the cleanup of SPRU. The request cross-cuts three of the DOE EM-50 Focus Areas: Subsurface Contaminants, Deactivation and Decommissioning, and Tanks. Technical assistance activities provided information on approaches used throughout the DOE complex for both radiological and chemical characterization of soils and ground water, characterization technologies for decontamination and decommissioning, characterization technologies for radioactive waste storage tanks, and data quality objectives pertinent to SPRU.

Soils and Ground Water at SPRU

This SPRU technical assistance task had three objectives:

- provide approaches for determination of background that have been used throughout the DOE complex and in New York State; identify problems in the implementation of these approaches,
- provide specific information on approaches to determine background of mercury, PCBs, uranium and plutonium, and
- provide information on statistical tools and approaches used to analyze soil characterization data in the determination of background.

Appropriate data and comprehensive responses to these objectives are available in the report "Methods and Approaches for Determination of Background Concentrations of Potential Contaminants in Soils at the Separations Process Research Unit, Schenectady, NY", from Terry Sullivan, Environmental and Waste Technology Group, Brookhaven National Laboratory. The documentation was provided by Deborah Carlson, PNNL; David Janecky, LANL; Mark Kaiser, Iowa State University; John Kubarewicz, Bechtel Jacobs, Oak Ridge; David Miller, Argonne National Laboratory; Brent Pulsipher, PNNL; Robert Roback, LANL; Jeff Ross, Bechtel Savannah River; George Stephens, Jr., Argonne National Laboratory; and Terry Sullivan, Brookhaven National Laboratory.

Decontamination and Decommissioning SPRU Facilities

This technical assistance task addressed characterization technologies for decontamination and decommissioning the SPRU facilities. The report presents details on a suite of technologies that have cost reduction and worker protection as the primary drivers behind their selection. The report describes technologies that have been used in the DOE complex for:

- pipes-fluid/holdup material detection,
- pipes-interior inspection,
- pipes-exterior inspection/hot spot location and quantification,
- sampling and survey,
- environmental investigation/sampling, and
- access

The technical assistance report is titled "Decontamination and Decommissioning Focus Area Technical Assistance: Overview of Technologies for Characterization of the SPRU Facility for Decommissioning", and is available from Mark Antkowiak, Energetics, Inc., Morgantown, W.V.

SPRU Tanks

The SPRU Facility has one 5,000-gallon and six 10,000-gallon horizontal stainless steel tanks with radioactive waste sludge heels ranging from 3 to 16 inches in depth. The larger tanks are 10.5 feet in diameter and 19 feet long. They are housed in a vault (dimensions: 24x14x16 ft) about 9 feet below an earth and gravel fill grade. The vertical distance from the top of the grade to tank bottom is about 25 feet. Currently the tanks can be accessed through a 3-inch ID vent riser (which necks down to 2 inches) near the tank top and is located along the horizontal center. The tanks also have a larger flange access within the vault and several process lines access the tanks from the operational corridor. Total estimated inventories in all the tanks are 8.5 Ci of Pu and 68 Ci of fission products.

The Tanks Focus Area was requested to provide guidance on methods for obtaining representative samples from the tanks such that inventories of fissile, radionuclide, and chemical waste contaminants could be validated and to discuss innovative characterization techniques that have a potential to reduce radiation exposure during sampling.

The report discusses in detail:
- below riser sampling methods to access the tanks via the existing risers,
- representative sampling below risers via power fluidics,
- off-riser sampling methods through small diameter risers,
- small sampling end effectors for tank waste walls,
- sampling through process lines into the tanks,
- regulatory analytes of concern for closure of radioactive waste tanks,
- number of samples required for representative sampling,
- regulatory analytes of concern for closure of radioactive waste tanks, and
- number of samples required for representative sampling.

The report titled "Tanks Focus Area Technical Assistance to Support Characterization Activities Related to the Cleanup of SPRU" is available from the author, Tom Thomas, Idaho National Engineering and Environmental Laboratory.

SPRU Data Quality Objectives

The Data Quality Objectives team was to advise and recommend to the SPRU project team the radiological characterization data quality objectives utilized at other DOE sites. This area cut across the experience and expertise of both the SCFA and the Deactivation and Decommissioning Focus Area (DDFA). Working collaboratively, the SCFA and DDFA assembled a team of experts across the DOE complex with the prerequisite complementary knowledge of, and experience with, DQOs at other DOE sites. The customer team requested that the DQO issues be addressed in the following areas:
- the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) process and its use during the scoping and characterization phases of facility/site assessment studies,
- below grade characterization of subsurface structures,
- health and safety issues,
- facility, material, and waste characterization, and
- site characterization

Highlights of each sub-team's individual summary report are provided below.

Sub-team on MARSSIM Process

The sub-team stated that the design of any sampling and analysis plan or radiation survey plan hinges on having a reasonable estimate of which nuclides are present and their respective derived concentration guidance levels (DCGLs). These factors must be known in order to select field instruments, survey scan rates, sampling techniques, and analytical methods. Two computer codes are identified for determination of DCGLs. The sub-team pointed out several factors of importance to the development of DQOs and emphasized the need to keep regulators and stakeholders informed about how decisions are made on DCGLs, cleanup criteria, and the characterization plan, as well as what these decisions are based on.

The sub-team on DQO and characterization methods complemented this response by comparing how the DQO process using the MARSSIM methodology is applied differently in the three phases of deactivation and decommissioning characterization (scoping, characterization, and final survey). The difference in DQO implementation on a final status survey versus the scoping and characterization surveys lies in the decision rule and associated decision errors because of dissimilar requirements for the data during each phase. An implementation example of the DQO process for deactivation and decommissioning characterization of the Brookhaven Graphite Research Reactor (BGRR) was given, as well as a reference document on its sampling and analysis plan.

Sub-team on Below Grade Characterization

The objective is to advise on the sampling methodology for determining contaminant penetration in concrete. The sub-team used as a case example a recently completed project titled "Deployment of Innnovative In Situ Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites." Based on the success of this project, this approach is being used currently to provide support to the Brookhaven Graphite Research Reactor for characterization and evaluation of the below grade air ducts.

Sub-team on Health and Safety Issues

The objective was to advise on real-time measurement of plutonium, beryllium, and asbestos in air as well as on measurement of beryllium on swipe samples. The sub-team provided summary information on lessons learned. Such lessons included the need to obtain knowledge of solubility class and particle size distribution for airborne radiological contamination; the need for analytical methods not only to support worker health and safety decisions, but also to support risk assessment; and the need for establishing less costly surrogate measurements in place of full suite analyses for all samples.

Sub-team on Facility, Material, and Waste Characterization

The objective was to advise on waste characterization protocols and quality assurance for: (1) defensible data to meet waste acceptance criteria of an offsite disposal facility and (2) supporting recycling as an alternative remedial strategy, especially of steel and other building materials. Here, the general strategy used by the Argonne National Laboratory's deactivation and decommissioning projects to gain approval of waste shipments to DOE-Hanford site for final disposition was provided.

Sub-team on Site Characterization

The objective was to advise on emerging field technologies for characterizing surface and subsurface soils to support risk assessment. Several actions were outlined for developing the DQO process for site characterization and remediation. These included the importance of a sampling design, as well as the consideration of evaluating economic consequences as provided by the SmartSampling approach, to minimize the total cost of a remediation project.

CONCLUSIONS

These and the other technical reports provided in response to the 102 technical assistance requests illustrate the value to the requesting sites of technical assistance. The data supplied would be impossible to retrieve from the literature. Access to the time and knowledge resident in the DOE complex's personnel would be difficult to find and utilize without the Points of Contact provided by SCFA's Lead Laboratory. The broad range of expertise available to assist with hands-on experience is only possible when one appreciates that DOE and its contractors have a potential candidate employee pool for technical assistance in the thousands.

The detailed reports accompanying the technical assistance tasks clearly illustrate the desire by the DOE technical community to willingly share their expertise and knowledge with problem holders. The collective capable experience willing to respond effectively and timely to a technical assistance request is awe-inspiring. The DOE community is enriched by the interactions between the end-users, the technical community, and the DOE oversight personnel. The concentrated knowledge that is evident in the written documentation that is the product of the technical assistance is evidence of the deep and enduring capability of the technical members of the DOE complex. Now that the Environmental Restoration world is mature and the experience level is significant, it behooves the Department to expand the role of technical sharing to efficiently and effectively implement its restorative mission.