HSS

Office of Health, Safety and Security

U.S. DEPARTMENT OF ENERGY

Analytical Services Program Fiscal Year 2009 Report

MAPEP

U.S. Department of Energy

Office of Health, Safety, and Security

Table of Contents

Figures

Photos

Tables

Appendices

Acronyms

AMESH	Assistant Manager for Environment, Safety and Health
ASP	Analytical Services Program
AWE	Atomic Weapons Establishment
CAP	Corrective Action Plan
CDC	Center for Disease Control
DHS	Department of Homeland Security
DoD	Department of Defense
DOE	Department of Energy
DOECAP	Department of Energy Consolidated Audit Program
DQO	Data Quality Objectives
EDS	Electronic Data System
EM	Office of Environmental Management
EPA	Environmental Protection Agency
FY	Fiscal Year
HSS	Office of Health, Safety and Security
IAEA	International Atomic Energy Agency
ILAC	International Conference on Accreditation of Laboratories
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LM	Office of Legacy Management
LOC	Letters of Concern

LOO	Letter of Obligation
MAPEP	Mixed Analyte Performance Evaluation Program
MEO	Most Efficient Organization
NELAC	National Environmental Laboratory Accreditation Conference
NIST	National Institute of Standards and Technology
NNSA	National Nuclear Security Administration
ORO	Oak Ridge Office
OUO	Official Use Only
POC	Point of Contact
PT	Proficiency Testing
QA	Quality Assurance
QC	Quality Control
QSAS	Quality Systems for Analytical Services
RESL	Radiological and Environmental Sciences Laboratory
RTP	Radiological Traceability Program
SNL	Sandia National Laboratories
SOP	Standard Operating Procedure
SPADAT	Systematic Planning and Data Assessment Tools and Training
SRS	Savannah River Site
TNI	The NELAC Institute
TSDF	Treatment, Storage and Disposal Facilities
UK	United Kingdom
UTL	Upper Threshold Limit
US	United States
VSP	Visual Sample Plan

Executive Summary

This report provides an overview of the Department of Energy (DOE) Analytical Services Program (ASP) activities for Fiscal Year (FY) 2009. The ASP is managed through the Office of Health, Safety and Security (HSS), Office of Corporate Safety Analysis, Office of Corporate Safety Programs. Component elements of the ASP are the:

- Systematic Planning and Data Assessment Tools and Training (SPADAT) Program;
- DOE Consolidated Audit Program (DOECAP); and
- Mixed Analyte Performance Evaluation Program (MAPEP).

These Programs provide integral support to DOE programmatic and operational efforts throughout the Nation. Defensibility of chemical and radiochemical data, including the data collection strategy, the integrity of the analyses, and the documentation and use of the results is critical to all DOE operations. These planning, auditing, and performance testing activities are primary vehicles for assuring quality and reliable data are available for decision-making to support on-going mission critical operations and functions; environmental remediation; clean-up projects; and long term legacy management surveillance. Auditing of commercial waste vendors assures increased accountability for the disposition of radioactive and chemical waste from DOE sites under the requirements of DOE Order 435.1, *Radiological Waste Operations*. Audit quality, risk management, safety, data quality, cost reduction, and efficiency are attributes promoted through effective implementation of the ASP components and are value added to the Department and its field sites.

With over 5000 users, the SPADAT Visual Sample Plan (VSP) software tool continues to be widely recognized as the tool of choice for systematic planning and Data Quality Objectives (DQO) process implementation. VSP is currently focused on design and analysis for the following applications:

- Environmental characterization and remediation;
- Environmental monitoring and stewardship;
- Response and recovery of chemical/biological/radiation terrorist events;
- Footprint reduction and remediation of unexploded ordnance sites; and
- Sampling of soils, buildings, groundwater, sediments, surface waters, and subsurface layers.

DOE leverages financial investments made by the United States (US) Environmental Protection Agency (EPA), Department of Defense (DoD), Department of Homeland Security (DHS), United Kingdom Atomic Weapons Establishment, and Center for Disease Control (CDC) to develop the VSP software to support statistical sampling design and data decision assessments. The DOE Office of Legacy Management (LM) has also partnered with HSS to jointly sponsor several VSP improvements focused on trend modeling, well redundancy evaluations, analyte redundancy assessments, and upgrading geospatial plume modeling and mapping. Advances were made during the year to enhance and extend VSP application for facility management, design, and security.

HSS, DOE field site, and intergovernmental agency attendance at VSP training continued in FY09. Two training sessions completed at the Oak Ridge Office (ORO) and one training session completed at Los Alamos National Laboratory (LANL) utilized leveraged cost sharing approaches between the various participants. Previous training has been provided at ten other DOE sites and new training opportunities are being planned for the coming year.

In FY09, a total of 43 DOECAP audits were conducted at analytical environmental laboratories and commercial waste treatment, storage and disposal facilities (TSDF). These audits identified a total of 275 findings leading facilities to take corrective actions. As a result of these annual audits and the resulting follow-up actions, facilities are continuing to provide DOE and its contractors quality data results for defensible decisions and increased confidence that wastes have been properly treated and disposed. The FY09 audits validated closure for over 89% of all open findings from FY08 and documented improved performance by the laboratories and waste facilities. At the request of multiple DOE field contract holders, the Program successfully instituted auditing of two non-radiological TSDFs. As a result of these audits and corporate management attendance at the ASP Workshop, Clean Harbors, a major non-radiological waste treatment corporation, will be instituting Quality Assurance (QA) Program Plans for all their facilities. In addition, the DOECAP implemented an interim finding identification process, increased its Program participation from the DOE complex, and increased interactions with National consensus standard and interagency quality assurance working groups. As a result of DOECAP FY09 consolidated activities, the necessity for an estimated 110 independent field audits was eliminated, resulting in an estimated annual cost savings to the Department in excess of $3.6M, along with additional savings to the audited facilities.

Continuing DOECAP challenges encompass the need to expand the number of Federal auditors participating in audits and increasing the overall cadre of volunteer auditors and Points of Contact (POCs). Efforts will continue in FY10 to enlist increased DOE site and contractor participation in the DOECAP at all levels, and to recognize the intrinsic contributions and benefits of this Program to achieve its goals to investigate, remediate, dispose, and monitor current and legacy issues within the Complex. As funding resources remain constant or potentially decrease in the future and Program implementation costs increase due to inflation, new options to the Program's approach will be required. In order to sustain the Program's current level of excellence, innovations and efficiencies will continue to be explored.

The MAPEP provides important quality assurance oversight for environmental analytical services under contract with DOE by performing semiannual Proficiency Testing (PT) and evaluation of both DOE onsite and commercial analytical laboratories. MAPEP PTs help ensure the accuracy of analytical results reported to DOE field element sites and provide an efficient means for laboratories to demonstrate analytical proficiency. Field managers receive the assurance that environmental data results are valid and reliable. This translates into more confident decision-making relative to environmental remediation, clean-up projects, and regulatory compliance. Performance data for all matrices from a MAPEP test session (i.e., Series) are also reported to DOECAP, Headquarters' Program Line Management, DOE Field Offices, Sample Management Offices or contractors, participating laboratories, and audit personnel to support quality assurance oversight and quality improvement. The demonstrated laboratory performance on these test samples has been exceptional.

Over the year MAPEP distributed PT samples to more than 100 domestic laboratories and 19 foreign laboratories which resulted in over 25,000 analyses being reported and evaluated. These activities included radiological cross-calibration with Middle Eastern laboratories in cooperation with the US State Department, the International Atomic Energy Agency (IAEA), interaction with Nuclear Test Ban Treaty participants, and laboratories monitoring Chernobyl. A more proactive approach has been established to notify analytical laboratories and DOE contract holders of failed PTs in order to improve performance between test sessions and on-site DOECAP audits. In addition, increased effort will be made toward ensuring participating laboratories are actively supporting DOE missions and field interests.

Conclusion

Confidence in decisions affecting the health and safety of DOE workers, the public, the environment, and our national security assets is a priority for HSS. Risk management must be supported by data that are the right type, quality, and quantity. SPADAT, DOECAP, and MAPEP help site personnel establish: data confidence; statistically defensible sampling; optimally planned data gathering efforts; and assurance that programmatic DQOs support decisions and meet regulatory acceptance.

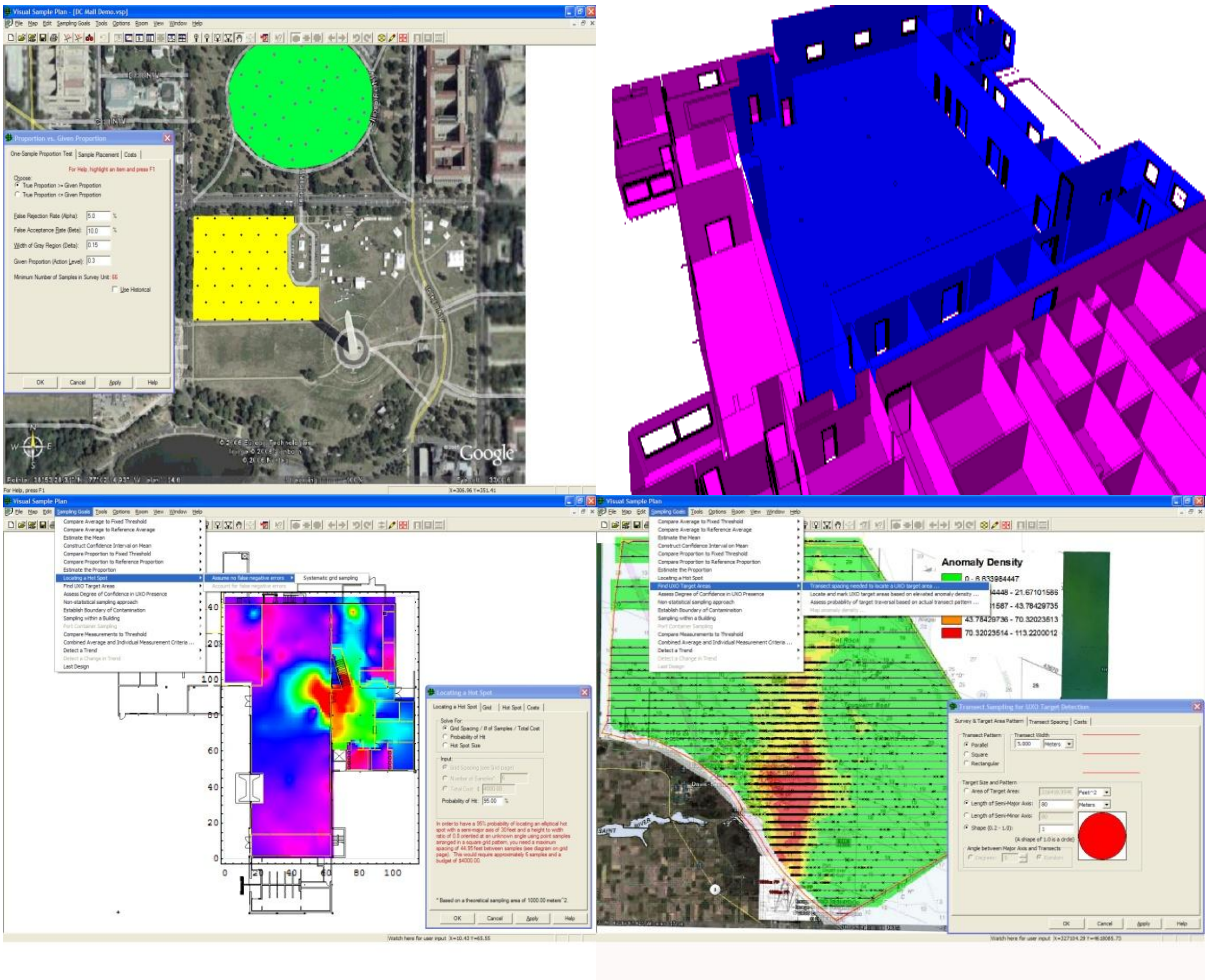
In 2009, ASP activities continued to effectively support all Departmental elements with a corporate approach that provides environmental data quality assurance in a cost-effective manner. In coordination with several other Federal agencies, the ASP continued to: develop software toolkits supporting sampling plans and data assessment; participate on national standards laboratory accreditation committees, interagency task forces, and intergovernmental audits; provide input from DOE to national consensus standards for auditing analytical laboratories; and strengthening the Program's recognition and credibility throughout the Nation.

To sustain and create even greater capability within the Program's resource limitations, the ASP plans three key initiatives for FY10. First, create incentives and leverage to increase program line and field support for consolidated audits and proficiency testing. Second, execute an increased number of non-radiological treatment, storage and disposal facility audits. Third, expand VSP toolkits to provide additional value for program line and field organizations.

HSS will continue to support this corporate approach to the ASP in close partnership with program offices and field elements. Refer to the following websites for additional information: http://vsp.pnl.gov/; https://doecap.oro.doe.gov/; and www.inl.gov/resl/mapep/ .

1.0 Systematic Planning and Data Assessment Tools and Training (SPADAT) Program

Before environmental data are gathered and analyzed, it is imperative that a systematic planning process be employed to ensure that high quality data are obtained to support confident decisions. In order to manage risks, data collection and analysis must adequately control the potential for risk of incorrect decisions. After data gathering, statistically rigorous data analyses must be performed to assess quality and decision confidence. Too often the right quality and quantity of data are not obtained the first time resulting in significant cost increases and time delays. In an effort to make decisions right the first time and streamline the design and analysis process, systematic planning and statistical data assessment tools are being developed and deployed across the entire DOE Complex through the SPADAT Program.



DOE is supporting the development of DQO methods and tools, and providing training to facilitate better, faster, and more cost effective approaches to meet regulator requirements. Minimizing data gathering and assessment burdens for DOE site applications includes accelerated environmental cleanup, facility decontamination and decommissioning, and legacy management.

1.1 Background and Scope

Whether for environmental compliance, building decontamination, facility security, or long-term monitoring; data collection and analysis must be well supported for DOE's many data-driven decisions. Balancing confidence in decisions against increased costs is a real challenge and DOE recognizes the need to account for all inherent sampling and analytical uncertainties using valid statistical techniques when arriving at decisions based on sample results.

SPADAT provides easy to use defensible sample design and data analysis tools to adequately balance costs against decision quality. The SPADAT Program develops and deploys expert, user-friendly software that employs sophisticated statistical methods for designing defensible sampling plans and performing statistical analyses in a visually appealing environment. Design and analysis tasks that often took weeks or months are now accomplished in hours or days. These tasks include: determining the required number of samples; evaluating tradeoffs between cost and decision probabilities; determining sample locations and GPS coordinates; importing data; creating and testing exploratory data plots; and testing statistical confidence levels. This technology is transferred throughout DOE during intensive hands-on training sessions. Tools from the SPADAT Program are being employed at every major DOE site.

1.1.1 Visual Sample Plan (VSP)

VSP is a sampling design and decision support software tool that helps determine the number and location of samples required to support a variety of data-driven decisions. Now with over 5000 users, VSP is used to perform data quality assessments and statistical tests to determine whether decisions can be supported with required levels of confidence.

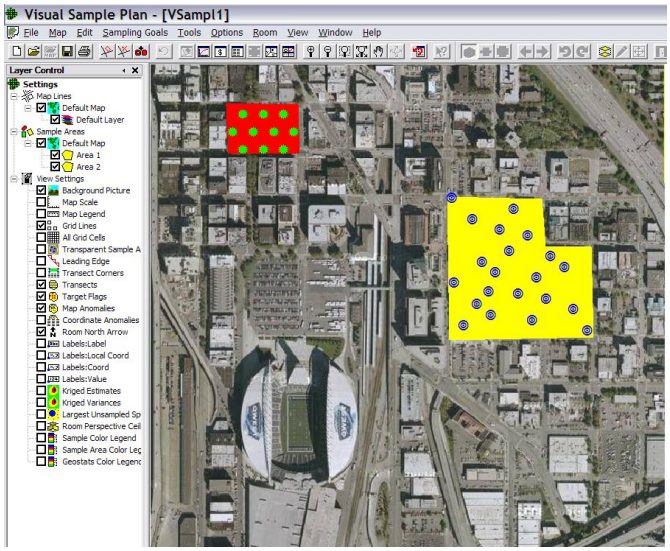


Figure 1.1 – DQO Directed Sampling Design

VSP interfaces with Geographical Information Systems and Autocad software such that maps, floor-plans, or high resolution images can be imported into VSP and sampling locations visualized. VSP

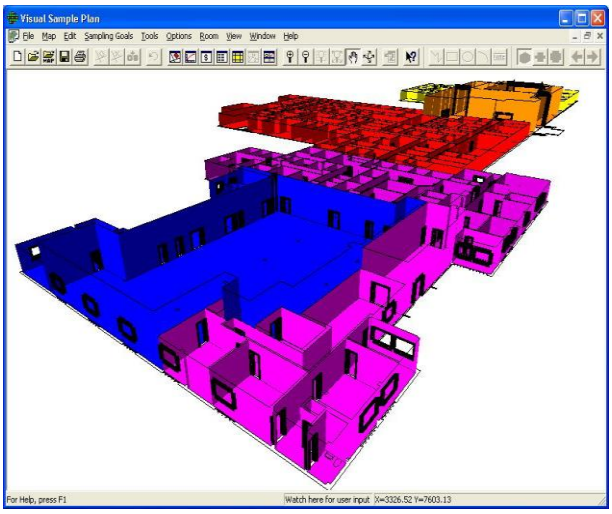
supports a variety of statistical sampling approaches including simple random, systematic, sequential, stratified, rank-set, collaborative, adaptive cluster, transects, and judgmental. Decisions based on mean results or individual measurements and trends are supported.

Applications include multiple increment sampling design, with-in building surface sampling for decontamination and decommissioning, sampling of soils, surface water, sediments, groundwater, and streams. VSP is being used at over 25 DOE sites for virtually all of these types of applications.

1.1.2 Example Applications

Although there are numerous VSP applications across the DOE complex, at the 2009 HSS ASP Workshop four applications were featured. They are representative of VSP's use and value across DOE as well as international sites.

A **Los Alamos National Laboratory (LANL)** legacy beryllium machine shop in operation from the early 1950s to 1999 is undergoing decontamination. VSP was used to develop a statistically valid sampling strategy that will ensure with 95 percent confidence that 95 percent of all surfaces in the shop area are less than the beryllium free release limit. Without VSP, a judgmental sampling approach would have been used and five times as many swipe samples would have been collected. By using VSP a **$24,000 cost savings** and an **80% time reduction** were achieved. The LANL Beryllium Program plans to use VSP on all future beryllium remediation projects.



At the **Portsmouth/Paducah Project Office**, VSP is used in Project Planning, DQO development, and Sampling Plan Development. VSP has been used on numerous Paducah and Portsmouth remediation projects including ditches, soil piles, facilities, and burial grounds. The use of VSP has led to a **more structured approach** to sample plan development, allowed the contractor to develop **defendable sampling plans** prior to regulator meetings, and, generally, **improved communications** between DOE and the regulators. It is estimated VSP reduced the number of planning meetings required; saving approximately 16 hours of meeting time for 10 people or $24,000 in costs.

At the **Nevada Test Site** restoration efforts were launched for several industrial and soils sites. Initially biased judgment sampling was used, but VSP probabilistic sampling approaches were developed for large land areas suspect of radiological contamination. The new VSP multiple increment sampling approach

(Figure 1.2) was deployed to **ensure representative samples** and to minimize analytical costs. **Analytical burdens were reduced** while maintaining detection capabilities.

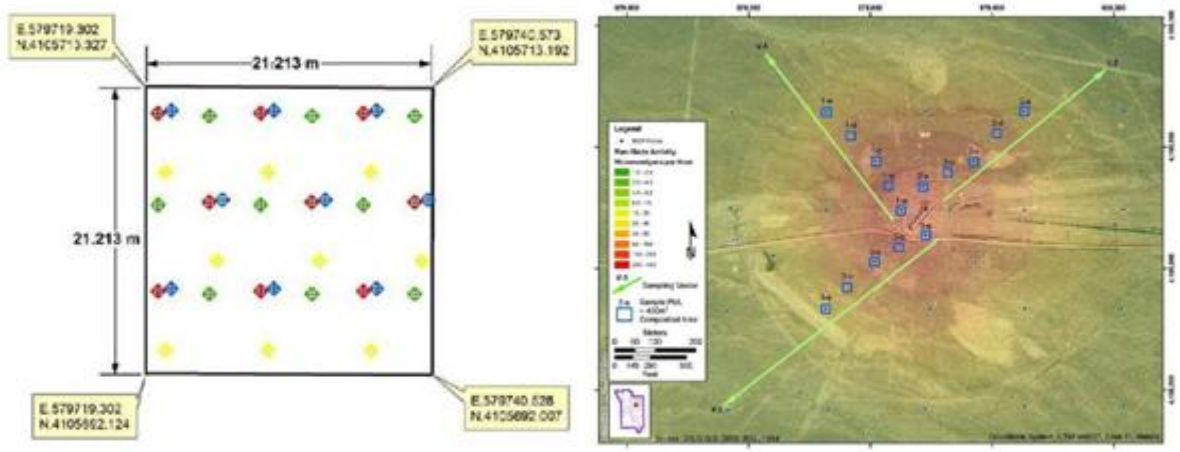


Figure 1.2 – Multiple Increment Sampling Design for Soils at DOE Nevada Test Site

As an example of benefits accrued beyond DOE field site applications, a **Canadian former refinery site**, used VSP to develop a probability based grid sampling plan to determine remedial excavation requirements with a confidence level of 90%, using prior knowledge of the frequency distribution of lead in soils. VSP was used to optimize the first and second phase of sampling in order to achieve a defensible balance between cost and acceptable risk. The sampling and remediation cost without the use of VSP would have been $1.75M but by utilizing VSP to derive an **optimal sampling approach** the actual cost was $0.63M, a **64% reduction** in cost.

Photo 1.1 – VSP Class Participants Working Through Case Studies on Their Own Laptops

1.1.3 Training at DOE Sites

To facilitate transfer of technology and ensure that the tools are useful and are being applied across the DOE Complex, several training courses have been developed and provided. The objective is to institutionalize systematic planning for environmental decision-making and provide the tools necessary to support all aspects of systematic planning and the DQO Process. As new methods are added to VSP, additional training materials are added. The current 3.5 day training course consists of a 2 day general course directly followed by a 1.5 day more advanced section. These courses are cost shared with the benefitting DOE site or another government agency, such as

EPA. Classes provided over the past year have all presented cost sharing advantages. Courses are hands-on with all participants working on laptops through multiple realistic case studies. Two or three courses are offered each year and the courses fill quickly. In the past five years over 15 courses have been presented and well over 500 DOE, EPA, and state regulatory personnel have been trained. Feedback has been extremely positive from participants and includes recommendations for improving the software. Refer to Section 1.2. for further details.

1.1.4 Leveraging DOE's Investment and Other Agency Investments

DOE is able to leverage significant VSP financial investments by EPA, DoD, DHS, UK AWE, and CDC. For example, a recently developed module tailored towards DOE's need for radiological survey designs was facilitated by adopting and tweaking DoD sponsored VSP modules for unexploded ordnance surveys. There are many examples of such leveraging of other agency sponsored VSP modules and capabilities for use on DOE accelerated cleanup, legacy management, and decommissioning applications. A few recent examples of leveraging are shown in Table 1.1.

Recent Non-DOE VSP Investment	Sponsoring Agency	DOE Adaptation/Application/Benefit
Unexploded Ordnance Transect Design Module (six year investment)	DoD	Radiological survey transect design module (used UXO module with some slight changes)
Unexploded Ordnance Density Mapping Module	DoD	Geostatistical mapping of radiological survey data (added quantitative data ability)
Map Layering Developments	DHS/EPA	Beryllium facility decon (ability to handle multiple floors within building)
VSP Validation	DHS	Validation that VSP is calculating correctly (massive QA performed)
Revamped Data Entry System	DHS	All DOE users now have more accurate, easily applied data entry system in VSP
Item Sampling Module	UK-AWE	Sampling of drums/items or auditing
Expert Mentor	EPA/UK	Guides the DOE user VSP module selection
Outlier Tests	EPA/UK	Ability to detect/explore data outliers
Combined Judgment and Random Sampling	CDC/DHS	Allows DOE user to include judgment samples with random samples to decrease costs
VSP Menu Restructuring	DHS	Improved ease of use for DOE user
Visualization Properties Control Bar	EPA	New controls on sidebar for controlling most visualization functions

Table 1.1 – Examples of DOE Leveraging Other Agency VSP Investments

1.2 FY09 SPADAT Program Activities and Accomplishments

1.2.1 VSP New Developments

In FY09 the SPADAT Program included several new VSP method developments, enhancements, and training courses. The added methods and enhancements were in response to needs identified by DOE users as high priority requirements. Each of these new developments are outlined and illustrated below.

- Radiological Survey Design and Analysis

DOE sites often perform radionuclide surveys resulting in near continuous transect sampling data. Methods that were developed for DoD's unexploded ordnance program were modified to make them

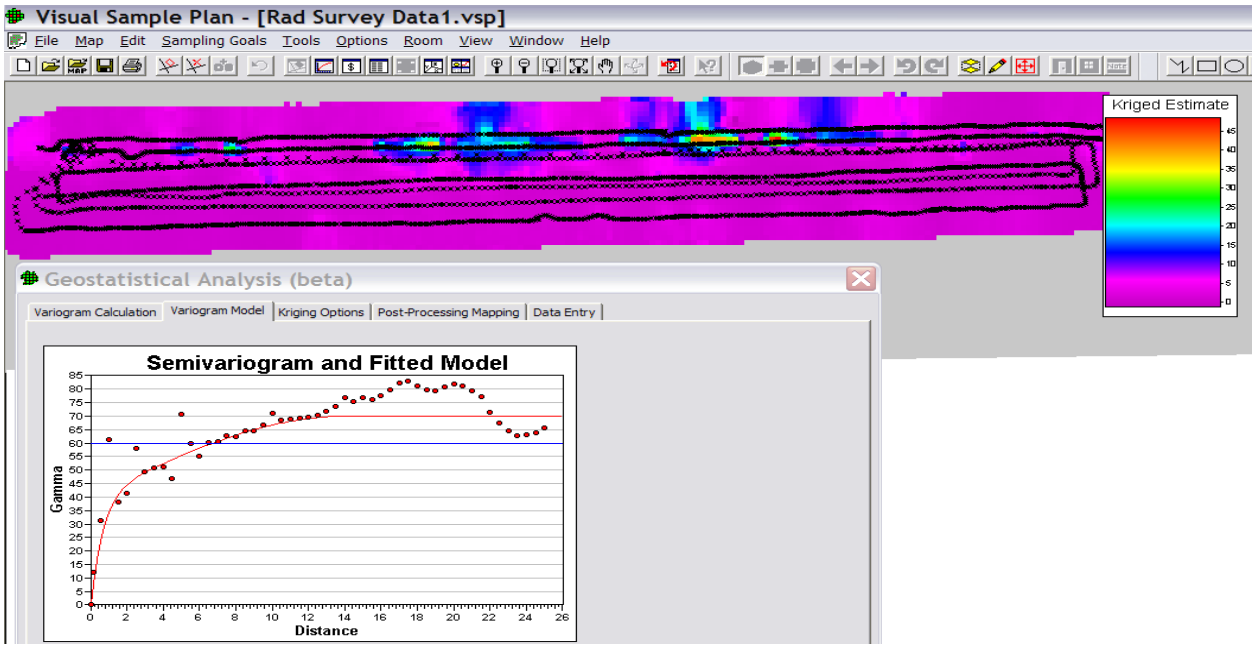


Figure 1.3 – Radiological Survey Geostatistical Analysis

applicable to radionuclide survey data. Some of the underlying methodology had to be changed to use the quantitative data that is obtained through radionuclide surveys as compared to the qualitative (presence/absence) data obtained from geophysical surveys. But all the underlying VSP framework and statistical design and analysis techniques were able to be ported over to this new radiological survey design and analysis module. The module helps determine the transect spacing required to detect a radionuclide "hotspot" and performs geostatistical analyses of the survey results to identify hotspots and map the radionuclide concentration.

- Confidence Interval Data Analyses

In previous VSP versions, sampling design options were offered when the objective was to compute a confidence interval on the mean. However, no data analysis option existed. In FY09, DOE-HSS sponsored the addition of a data analysis feature for importing data and computing confidence intervals.

Both parametric and nonparametric methods were included in order to handle cases when the data are not normally distributed.

- Visualization and Sample Area Combining Enhancements

Several visualization improvements have been supported in FY09 including 3-D enhancements. These provide the VSP user with tremendous flexibility as they visualize their site and sample locations for both indoor and outdoor applications. Additionally, users can carve out certain areas within their sites where samples will not be taken due to inaccessible spaces or structures within the footprint of the site. In FY09, modifications were made to allow the user to uncombined previously combined sample areas.

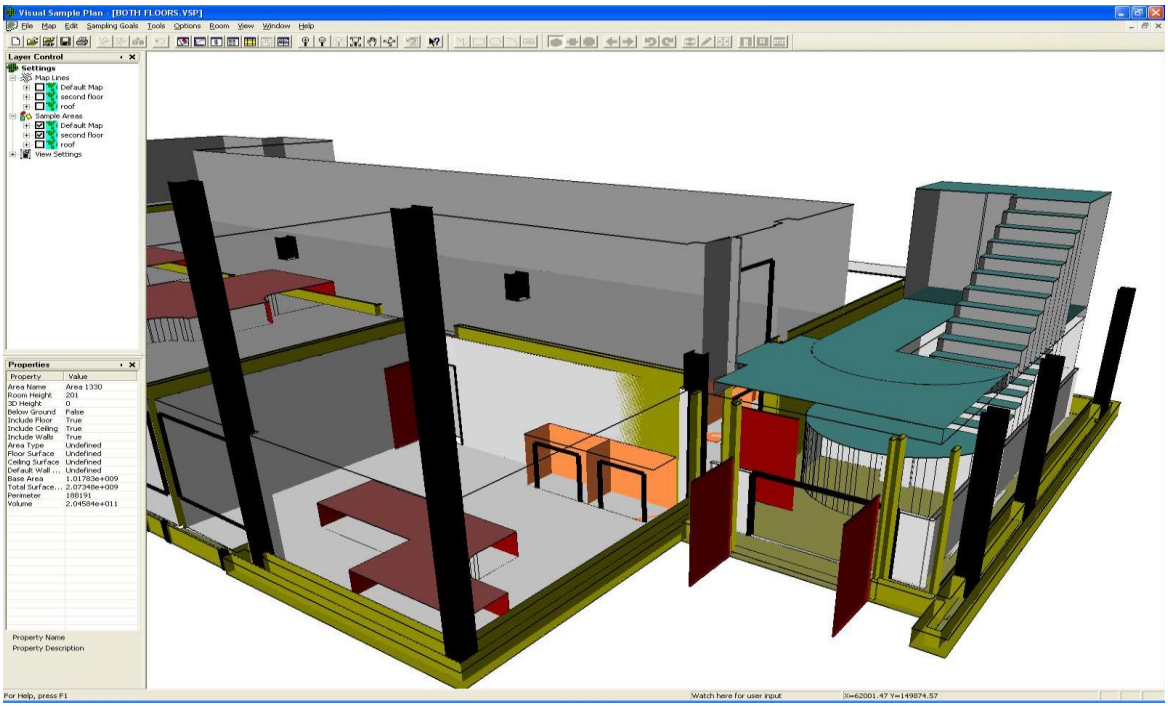


Figure 1.4 - Improved 3-D Visualization and Layering Options

- Outdated Sequential and Stratified Sampling Modules Revised

Sequential and stratified sampling modules were some of the very first developed within VSP. As a result, they are not very user friendly and the stratified module supported sampling design approaches but no data analysis. Beginning in FY09, these modules are being completely revised. They incorporate the new data entry features and permit the user to perform statistical analyses on the resulting data.

- Multiple Increment Hotspot Sampling

Multiple increment sampling approaches are being used to improve sample representativeness while minimizing analytical burdens. However, they are often criticized because hotspots can be averaged out and go undetected. The mathematics for a new method to strategically composite samples without losing the hotspot location information was initiated under this Program. This method is being refined and published with plans for incorporation into VSP in the future.

- Google Map Integration

Many DOE users have desired to have a more robust interface between VSP and Google Map or Google Earth that allows them to import images and calibrate them easily in VSP. In FY09, a better mechanism was developed to support Google Map imports and calibrations.

1.2.2 DOE LM Partnership

In FY07-09, a partnership between HSS and LM developed to support enhancements to VSP focusing on legacy management objectives. LM was already using VSP on several of its sites and recognized the significant cost savings, streamlined acceptance by regulators, and time savings that this SPADAT program had to offer. LM provided additional funding to support specific tasks that would benefit LM directly as well as other DOE sites. The resulting FY09 additions are listed below.

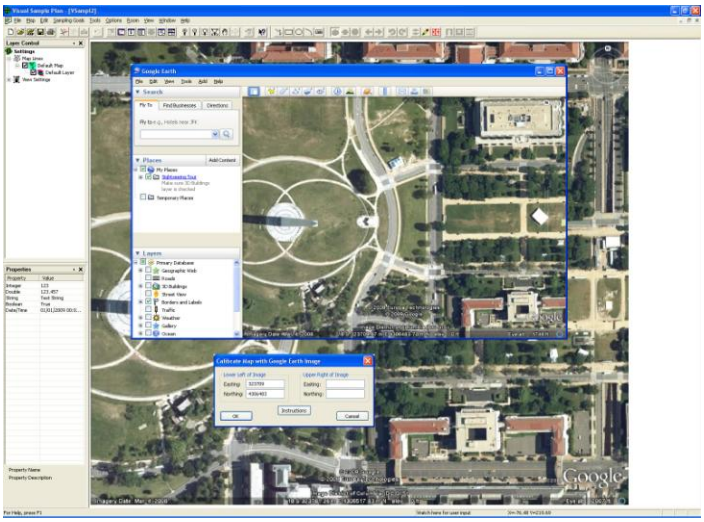


Figure 1.5 - Improved Options for Importing Google Maps into VSP

- Well Redundancy and Well Addition Optimization

LM sites and other DOE sites have extensive well monitoring networks. Some wells may be redundant whereas additional wells may be needed to adequately monitor plumes. Geostatistical methods have been developed and added to VSP to support both well redundancy evaluations and well additions. This method explores the spatial relationships between wells relative to contaminant concentration data and helps the user determine whether wells might be eliminated while preserving important plume information. On the next page, Figure 1.6 shows VSP output from the well redundancy evaluation module. Because the geostatistical models in this VSP module are complicated, several help and guidance features were added.

- Implementation Support and Training Course

LM identified many sites where VSP modules would be applicable. They provided the SPADAT program with funding to support assistance with implementing the VSP methods on their sites. Several sites are using VSP and Pacific Northwest National Laboratory is providing statistical support at various sites. In November 2009, a 2 day training session was held in Grand Junction, CO focused entirely on the VSP methods and tools that are pertinent for LM applications. Over 50 project managers participated during the executive summary section and expressed a desire to use several of the VSP modules on their sites. Significant cost and time savings are envisioned as these tools are implemented.

- Temporal Redundancy Evaluations

Significant cost savings are achieved by justifying reductions in sampling frequency, especially for sites where long term monitoring is required. Geostatistical methods have been adapted to support temporal

sampling redundancy evaluations instead of spatial redundancy. Individual variogram, composite variogram, and iterative thinning algorithms are being added to VSP for temporal redundancy analysis.

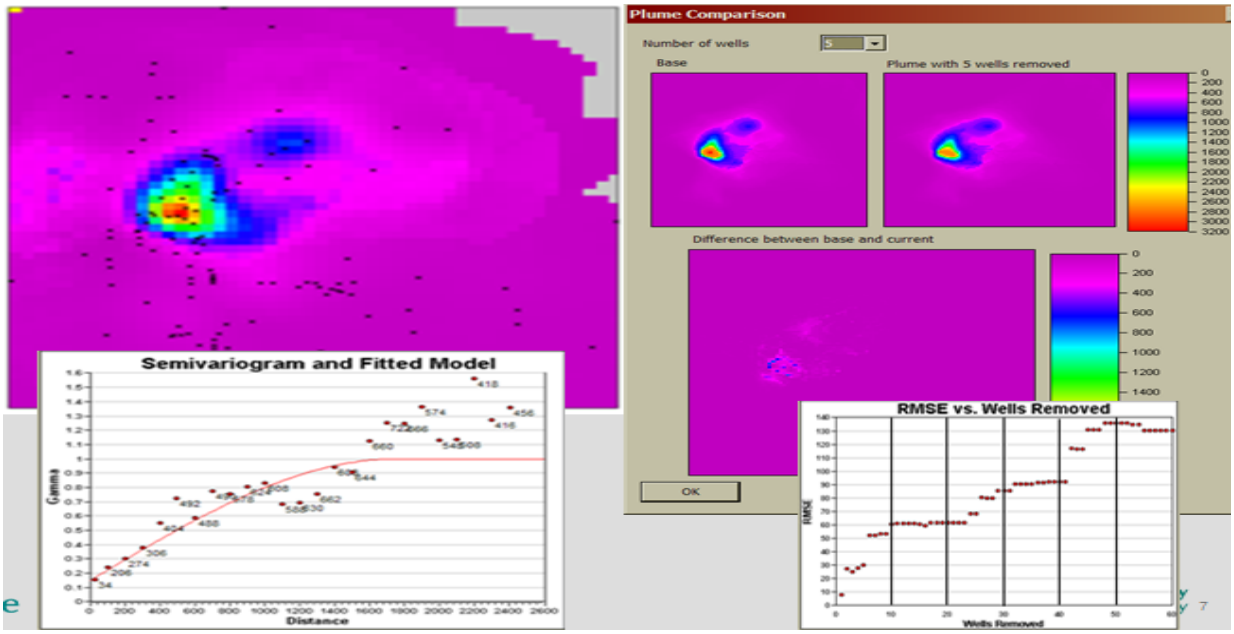


Figure 1.6 - Well Redundancy Module Showing Plume Maps Before and After Removal, Uncertainty Effects, and Semivariogram

- Probability and Uncertainty Spatial Maps

Geostatistical spatial models can sometimes be misleading if uncertainties are not well understood and visualized. Uncertainty maps are being added to address this concern. Probability maps are also being added to support quick evaluations of site areas where the probability of exceeding some threshold of concern or regulatory limit is high. Figures 1.7 and 1.8 show probability maps where the probability of exceeding some cadmium threshold is color coded. These maps integrate the concept of confidence into spatial estimates.

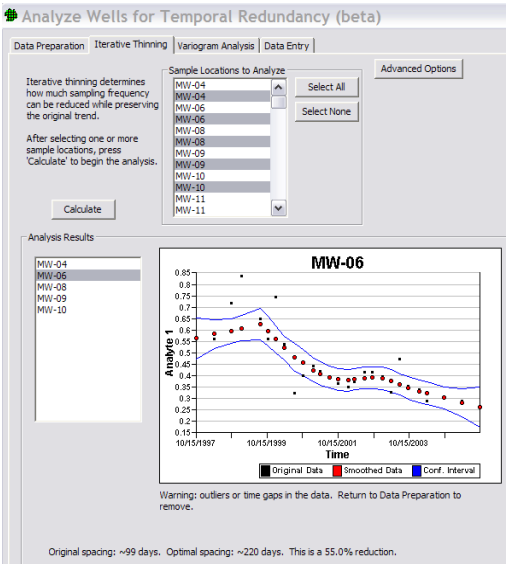


Figure 1.7 -VSP Temporal Redundancy Module Showing a Possible 55% Reduction in Sampling Frequency

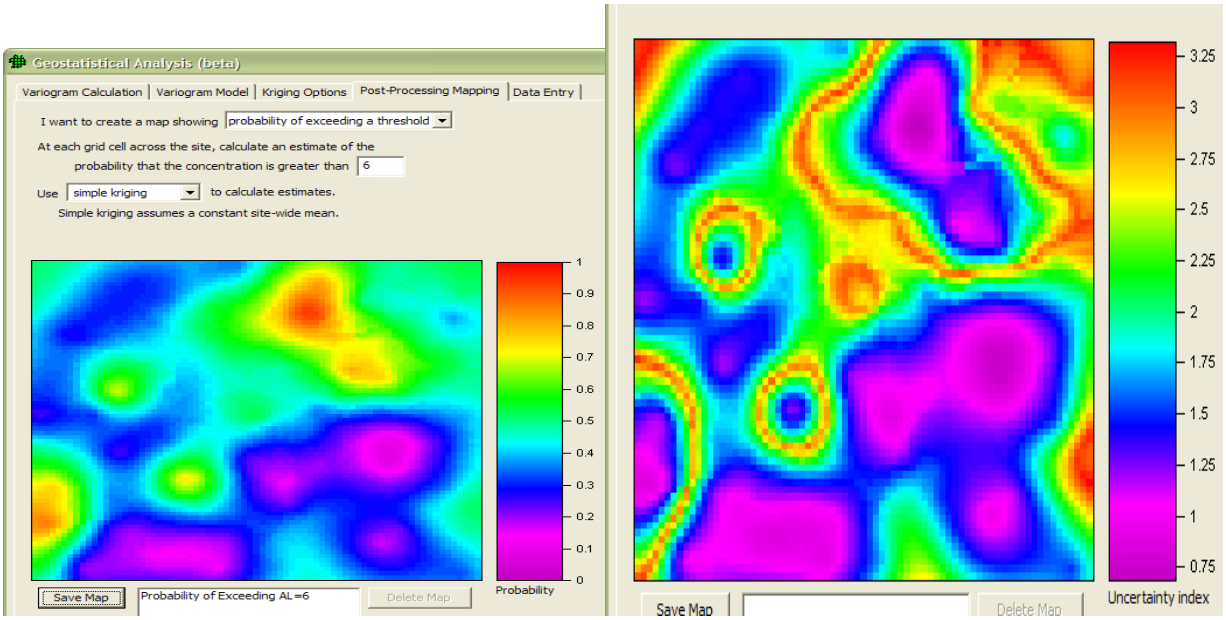


Figure 1.8 - Probability Map (left) Showing Probability of Exceeding Some Limit and Uncertainty; Index Map (right) Showing Areas Where Uncertainty is High Relative to Contaminant Threshold

1.2.3 Training at DOE Sites

In FY09 several training activities sponsored by the SPADAT Program were accomplished. Training has been conducted previously at the Idaho National Laboratory, Paducah and Portsmouth Sites, Oak Ridge Sites, LANL, Sandia National Laboratory (SNL), Lawrence Livermore National Laboratory (LLNL), Hanford Site, Pantex, Las Vegas, Grand Junction, Savannah River Site (SRS), and Mound Site. In FY09, the updated, extended 3.5 day course was conducted for DOE site personnel and affiliated regulators at Oak Ridge (two classes needed due to demand), LANL/SNL, and Argonne National Laboratory. These have each been cost shared with the benefiting DOE site or another US government agency (DHS, EPA).

Course evaluations continue to be extremely positive with many participants stating this has been the best, most useful training they have received in some time. Site personnel are armed with tools that can help them produce timely, defensible sampling designs and to perform statistical assessments. The courses involve not only DOE staff and contractors, but also regulators and tribes.

The hands-on VSP course provides the participants an opportunity to work through over 30+ case studies using various VSP modules and gives them experience in manipulating and visualizing results. By using VSP, site managers working with regulators can quickly evaluate tradeoffs between sampling designs and together develop optimal, defensible approaches.

1.3 FY10 SPADAT Program Goals and Challenges

The following provides a summary of opportunities for SPADAT Program improvement.

1.3.1 VSP Additions and Appropriate Use of Software Tools

At each of the VSP training courses, feedback regarding additional VSP needs was generated in the form of a "wish-list" by all the DOE and regulator participants. This wish-list outlines the statistical methods and VSP enhancements that DOE field sites believe would be most valuable to add in the future to help them meet their site needs. HSS plans to support development of some of those VSP methods and enhancements in FY10 and the out-years based on available funding. Some of these improvements include:

- Effluent Monitoring Methods (Control Charts) (FY10 task, completion 12/10)
- Redesign all dialogs to be in sentence form for ease of use (FY10 task, completion 12/10)
- Hotspot Delineation and Remediation Volume/Cost Estimation (FY10 task, completion 12/10)
- VSP Version 6.0 Users Manual and Release Testing (FY10 task, completion 12/10)
- Within Building Sample Design and Visualization Improvements (FY10 task, completion 12/10)
- 3-D Sampling Designs for Piles and Ponds
- Quasi/random/adaptive fill/systematic options added to all sample placement tabs
- 3-D Hotspot Sampling Options Added
- Expert Mentor Flowchart and Updates
- Compare Average to Background Nonparametric Unequal Sample Size Module Added
- Multiple Increment Hotspot Sampling
- Spatial Correlations Adjustments for Classical Statistical Tests
- Nonparametric Upper Threshold Limit (UTL) Calculations

1.3.2 Additional VSP Training Courses and VSP Users Meeting

The new 3.5 day VSP training has only been offered at three DOE sites. There are many new VSP users as well as some long-time VSP users who have become proficient with the basic VSP functions. As evidenced by the high demand, there continues to be a significant need for both the general and the advanced training sessions. Nearly all participants register for both sessions.

In FY10, the 3.5 day VSP course will be offered at two DOE site locations. The two locations currently under consideration are Livermore, CA and Lexington, KY, although other locations will be considered if the needs and priorities shift. Cost sharing options with some of the benefiting DOE program offices, as well as other governmental agencies, is being explored through communication with both line management, field site management and various federal agencies (e.g., EPA, DoD, etc.). Courses sponsored by EPA, Nuclear Regulatory Commission, and the UK are also planned in FY10.

In FY10, a new VSP Users Group Meeting is being planned in conjunction with the HSS ASP Workshop to be held in September 2010 in Seattle, WA. The purpose of this meeting will be to provide DOE users and other inter-governmental partners with training on the latest VSP developments, solicit feedback and guidance on future plans and needs, and to provide a forum for sharing of DOE Systematic Planning and VSP applications.

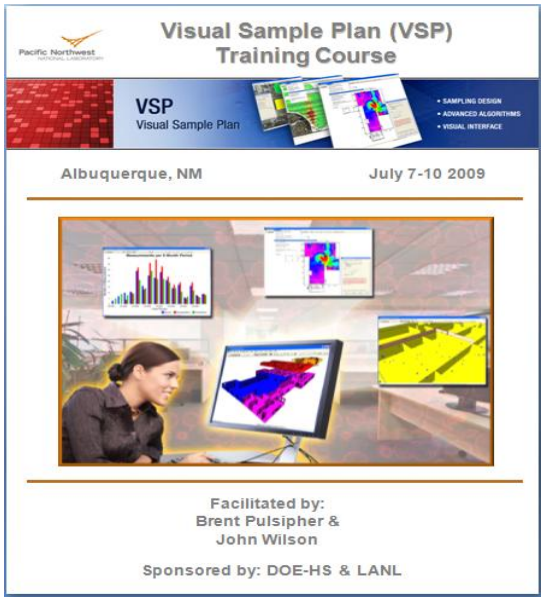


Figure 1.9 - Cover of VSP Training Manual for Albuquerque Course

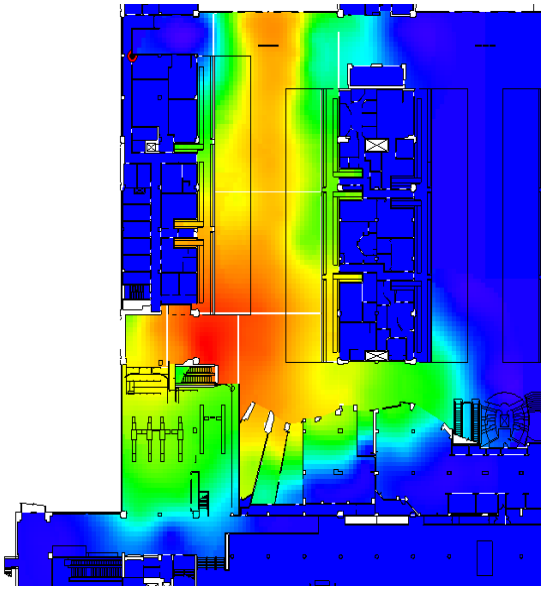
1.3.3 Partnership Leveraging

DOE is leveraging significant investments in VSP by several government agencies. This results in significant cost savings for DOE in a cost sharing approach. These investments support new methods development and additional VSP enhancements to tool kits for field applications. Some of the upcoming developments include the following:

- Stratified sampling routines for various surfaces within buildings
- Proportional allocation of samples based on some criteria (less samples in areas less likely to be contaminated)
- Microsoft Vista and OS-7 compatibility
- Training course materials expansion
- Expert Mentor updates and expansions
- Dispersion model guided sampling
- Multi-stage adaptive sampling

- Collaborative sampling for UTLs
- 3-D zooming and maneuvering improvements
- External building surface sampling
- Sampling designs that account for false detection rates
- 3-D kriging and visualization
- Nearest Neighbor and Inverse Distance Spatial Modeling
- Air sampling design strategies

By leveraging these other agency investments, DOE site VSP users will have access to methods and tools that will help them design and analyzed data in a more defensible, timely, appropriate manner across a wide range of potential applications.



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2.0 Department of Energy Consolidated Audit Program (DOECAP)

Continuing oversight of DOE subcontracted analytical laboratory and treatment, storage, and waste disposal vendors is a critical component of the Department's responsibility to ensure quality and defensible environmental data and services are being provided to the government in support of environmental remediation, site environmental monitoring, and waste management missions. The DOECAP conducts annual audits of analytical laboratories and commercial waste TSDFs that have contracts or agreements to provide services to multiple DOE sites and projects. DOECAP audits are performed on behalf of, and with the participation of, sites throughout the DOE Complex and across all Departmental program line organizations. DOE Program Offices and sites (i.e., laboratory and TSDF contract holders) participate voluntarily in the DOECAP and are motivated by the historically demonstrated benefits of participation by providing lead auditors, auditors, and POCs to support the Program. This voluntary participation continues to be vital to the success and viability of the Program. Additional Program information is available on the DOECAP Electronic Data System (EDS) at **https://doecap.oro.doe.gov/.**

These annual audits motivate the laboratories and TSDFs to maintain an awareness of DOE contractual requirements; redouble their efforts to meet local, state, and federal regulations; be consistent with state and federal programmatic requirements; ensure data quality; and competently treat and dispose of DOE waste. DOE environmental and waste managers gain a higher confidence that the work completed is accurate; reduces risk and liability; and improves regulator acceptability.

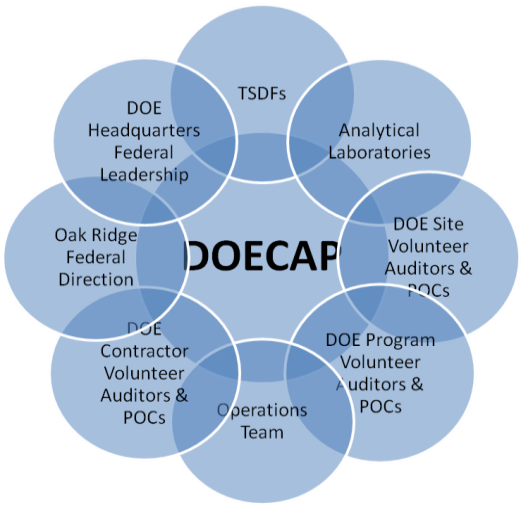


Figure 2.1– DOECAP an Integrated Participatory Program

2.1 Background and Scope

The DOECAP has been supporting DOE for the past ten years in response to the DOE Office of the Inspector General and General Accounting Office reports citing inefficiency, redundancy, and ineffectiveness regarding audits conducted by the Department. The Program promotes the following goals and objectives:

- Eliminate audit redundancy;
- Standardize audit criteria and processes;
- Establish a cadre of technically competent trained auditors;
- Establish a uniform system to track and complete corrective action documentation; and
- Provide a mechanism to disseminate information and lessons learned.

Photo 2.1– DOECAP TSDF Audit

Recent FY09 activities have also incorporated audits of hazardous waste TSDF operations. The Program continues to provide DOE beneficial services through:

- Consolidating audit planning, scheduling, coordination, and implementation;
- Achieving cost savings for the Department, estimated at $3.6M for FY09 through the elimination of approximately 110 redundant audits;
- Developing and maintaining standard audit procedures, including standardized audit reports;
- Implementing standard auditor qualification requirements;
- Establishing a cadre of DOE and contractor auditors and POCs from across the DOE Complex;
- Coordinating and centralizing audit findings and corrective actions;
- Establishing and maintaining the EDS to consolidate and disseminate information; and
- Interacting with regulatory agencies to establish national consensus standards enabling increased uniformity, understanding, and consistency between oversight agencies (EPA, DoD, states, etc.).

Specific cross-cutting value added benefits derived through effective implementation of the DOECAP include:

- Risk Management – Reduced risks and liabilities for the Department associated with the quality of analytical data used in environmental decision making, and the proper disposition of low-level mixed radioactive waste and chemical waste.

- Cost Reduction – Consistent savings to the Department and taxpayer are derived through audit consolidation and eliminating the need to conduct over twice the number of audits throughout the DOE Complex.

- Efficiency – Increased efficiency through the use of centralized DOECAP functions and establishment of uniform technical and analytical quality standards.

- Audit Quality – Improved audit quality and consistency as a result of enlisting qualified technical experts from across the DOE Complex and using standardized DOECAP processes (e.g., checklists).

- Data Quality – Improved analytical laboratory performance and data quality resulting from resolution of audit findings through implementation of the DOECAP corrective action process.

- Safety – Enhanced safety regarding the handling of DOE environmental samples and waste through verification of compliance with applicable standards and regulations, including conduct of DOECAP regulatory agency reviews as part of TSDF audits.

2.2 FY09 Activities and Accomplishments

2.2.1 Audit Performance

In FY09, a total of 43 DOECAP audits were conducted: 32 at environmental analytical laboratories, plus 2 follow-up surveillances; 7 at commercial TSDFs accepting DOE mixed and low-level radioactive waste and chemical waste; and 2 at commercial TSDFs accepting DOE hazardous chemical non-radioactive waste. Figure 2.2 depicts the approximately locations of the various audited facilities.

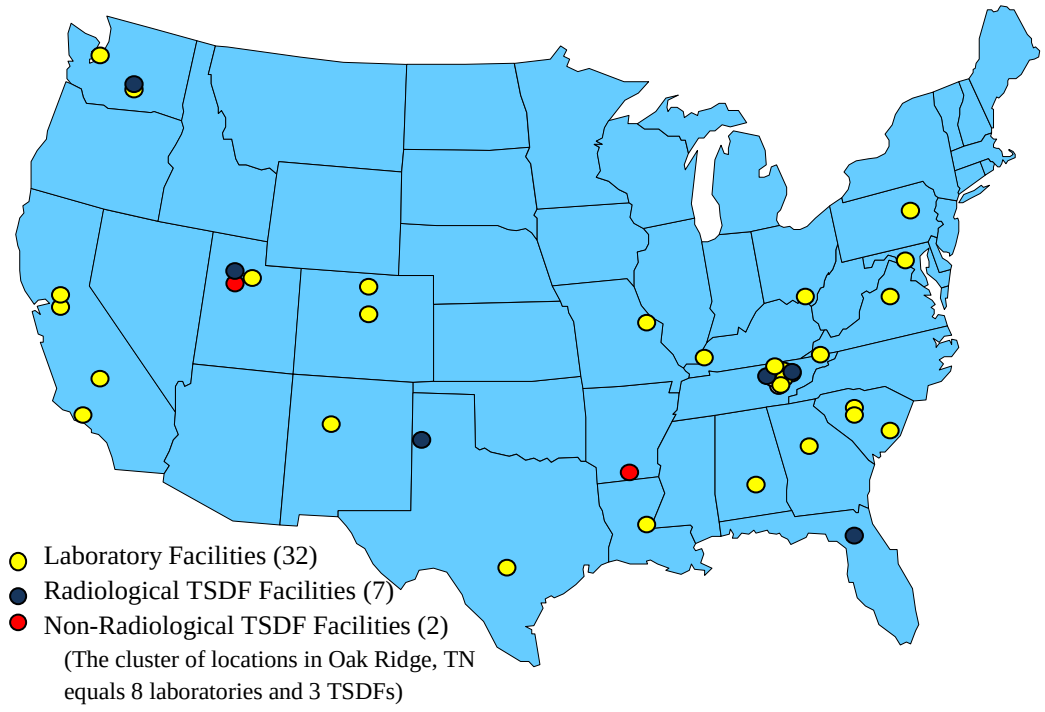


Figure 2.2 FY09 – DOECAP Evaluated Laboratories and TSDFs

While these audits were primarily initial and continuing qualification audits, one was conducted as surveillance for verification and acceptance of corrective actions and two were conducted as closure audits to remove laboratories from the process. The 34 FY09 DOECAP laboratory audits were conducted by teams filling a total of 160 audit positions, provided by 10 separate DOE sites, for a total of 330 auditor-days on site at the audited laboratories. The nine FY09 DOECAP TSDF audits were conducted by teams comprising a total of 70 audit positions, provided by 11 different DOE sites, for a total of 200 auditor-days on site at the audited TSDFs. A complete listing of laboratories and TSDFs audited by the DOECAP in FY09 is provided in Appendix A of this report.

2.2.2 Audit Results and Findings

A DOECAP finding is defined in DOECAP Procedure AD-1 as a factual statement issued from a DOECAP audit to document a deficiency. Findings are issued in two categories: Priority I and Priority II.

A Priority I finding represents a significant deficiency regarding key management, programmatic, or technical control, which in and of itself represents a concern of sufficient magnitude to potentially render the audited facility unacceptable to provide services to the DOE if not resolved via immediate or expedited corrective action(s). A Priority II finding is a documented deficiency representing a concern of sufficient magnitude relative to the procedures or practices of the audited facility that requires determination of a root cause and establishment of corrective actions to remedy the deficiency.

A total of 226 laboratory audit findings were issued. Seven were Priority I findings related to multiple PT failures for the same analyte on sequential rounds of testing. Four of these were adequately addressed and corrected by the impacted facilities during the course of the audit cycle. However, three involving selenium analysis at one laboratory and mercury and isotopic analyses at a second laboratory, still remain open items of concern for these laboratories. During the course of the TSDF audits, 49 Priority II findings were issued. The FY09 audit cycle was also able to document closure of 89 percent of previously issued DOECAP laboratory findings and 90 percent of previously issued TSDF findings.

All active facilities in the Program have demonstrated acceptable performance and have quality systems to support DOE site activities and needs. However, the following reviews generalized audit findings to illustrate the continuing effort required by all participants to strive for continuous improvement.

Common TSDF Findings

Figure 2.3 illustrates the percent distribution of FY09 TSDF findings by audit area. Evaluation of Priority II findings issued to TSDFs in FY09 identified common deficiencies and demonstrated an audit area distribution that will be helpful in developing a focus for next year's reviews.

The three primary audit areas where findings were made in FY09 were Industrial & Chemical Safety, QA, and Environmental Compliance & Permitting. FY10 auditing will increase attention toward these areas in

order to determine effective implementation of corrective actions while ensuring facilities have taken measures to prevent recurrence. Finding commonalities during TSDF audits were:

- Inadequate inspection and monitoring processes;
- Incomplete documentation and records;
- Waste storage and control not in compliance with regulations and Standard Operating Procedures (SOPs);
- Treatment of DOE legacy waste exceeding regulatory timeframes;
- Inadequate technical processes;
- Incomplete and inadequate SOP content;
- Practices not matching SOP direction;
- Transportation concerns regarding waste characterization, labeling, documentation, and packaging; and
- Inadequate labeling and posting (containers, placards, safety, etc.).

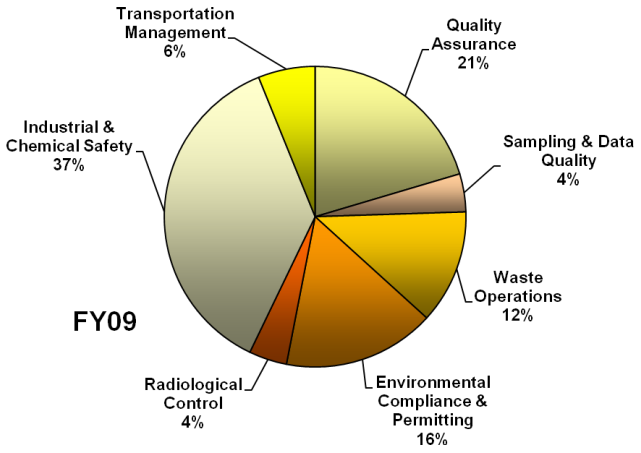


Figure 2.3 – TSDF Finding Distribution by Audit Area

Non-Radiological TSDF Lessons Learned

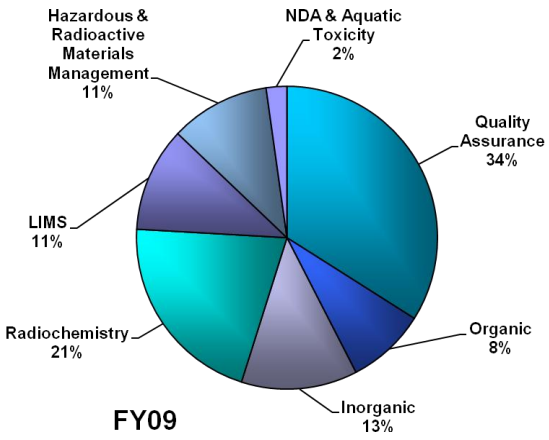
The Program's first time audits at non-radiological TSDFs were a learning experience for all concerned; the facilities, the auditors, and the Program. An on-site scoping visit to the Clean Harbors Aragonite Utah facility provided a solid information exchange and logistical base for conducting the subsequent audit. This pre-audit on-site scoping visit was not conducted for the Clean Harbors El Dorado Arkansas facility but would have provided a smoother introduction into the Program's processes and audit sequence for the operation. Understanding specific DOE contract requirements and Statement of Work information is needed to scope and conducting each audit. It may be necessary to adjust DOECAP TSDF audit checklists toward additional non-radiological issues. Finding commonalities during non-radiological TSDF audits were:

- The lack of comprehensive QA Plans;
- Inadequate surveys of incoming containers and drums from DOE facilities for potential radiological constituents;
- Analytical Quality Control (QC) practices not performed or documented properly; and
- Inadequate or incomplete SOP content;

Common Laboratory Findings

Evaluation of laboratory findings issued or left open in FY09 similarly reveal several common deficiencies across the facilities and a useful distribution between the various audit areas. Figure 2.4 illustrates the percent distribution of FY09 laboratory findings by audit area, while finding commonalities were demonstrated as:

- Analytical processes or QC practices not performed or documented properly;
- Inadequate or incomplete SOP content;
- Practices not matching SOP direction;
- PT failures;
- Electronic data security or training deficiencies;
- Inadequate document control;
- Inadequate sample temperature or preservation monitoring; and
- Laboratory safety issues.



2.4 – Laboratory Finding Distribution by Audit Area

2.2.3 Auditor Qualification and Training

Prospective DOECAP auditors and lead auditors are recommended for qualification by DOE sites in a particular audit area or areas. DOECAP Procedure AD-1, *DOECAP Policies and Practices*, establishes the requirements for auditor qualification documentation, evaluation and approval. Continuing certification is maintained by completing at least one DOECAP audit every two years and completing annual online required training. The Program was able to successfully train and qualify 4 more lead auditors and 11 more auditors during the period. As illustrated in Table 2.1, the qualified DOECAP laboratory and TSDF auditor pools increased during FY09.

	Lab	TSDF
Lead Auditors start of FY09	8	4
Lead Auditors ending FY09	11	5
Auditors start of FY09	45	49
Auditors ending FY09	50	55

Table 2.1 – FY09 DOECAP Lead Auditor and Auditor Qualification Status

Sites are encouraged to submit prospective auditors for qualification in all audit areas. Specific laboratory audit areas requiring additional qualified auditors are: Laboratory Information Management Systems and

Electronic Data Management; Hazardous and Radioactive Materials Management; and Lead Auditor positions. Specific TSDF audit areas requiring additional qualified auditors include Radiological Control and Industrial and Chemical Safety. The Program needs more Federal employees participating as team leaders and auditors, and requires increased DOE line management and field resources to adequately support projected future Program activities. Participation on an equitably shared basis commensurate with analytical contract volumes and usage of TSDFs for waste treatment and disposal is necessary to adequately implement the Program.

DOECAP Laboratory Audit Area	Auditors Qualified as of 9/30/09	DOECAP TSDF Audit Area	Auditors Qualified as of 9/30/09
Quality Assurance Management Systems and General Laboratory Practices	29	Quality Assurance Management Systems	19
Data Quality for Organic Analyses	16	Sampling and Analytical Data Quality	11
Data Quality for Inorganic and Wet Chemistry Analyses	22	Waste Operations	15
Data Quality for Radiochemistry Analyses	18	Environmental Compliance/Permitting	15
Laboratory Information Management Systems and Electronic Data Management	7	Radiological Control	10
Hazardous and Radioactive Materials Management	11	Industrial and Chemical Safety	10
Geotechnical, Aquatic Toxicology, or Non-Destructive Assay	5	Transportation Management	11

Table 2.2 – FY09 DOECAP Distribution per Audit Area

Table 2.2 illustrates the distribution of qualified DOECAP auditors at the end of FY09 per audit area. The Program continues to be challenged to fully staff all disciplines for the number of audits being scheduled.

2.2.4 Program Participation and Support

The fundamental DOECAP premise is that DOE sites will qualify and provide auditors to meet their needs, and the DOECAP will coordinate these resources to build Complex-wide teams to execute combined laboratory and TSDF audits. This overall consolidation lowers cost to any given site, as well as to the Department. Past Program success has been enhanced by sites designating appropriate POCs and submitting technically qualified personnel for qualification as DOECAP auditors.

All DOE site organizations are encouraged to contribute auditor resources on a proportionate basis commensurate with their laboratory and disposal facility usage. HSS continues its efforts to promote the benefits and values of the DOECAP and encourage site participation to establish a more equal sharing of auditor responsibilities and resources. Figure 2.5 identifies contributing sites and numbers of qualified auditors from across the DOE Complex that supported FY09 DOECAP audits.

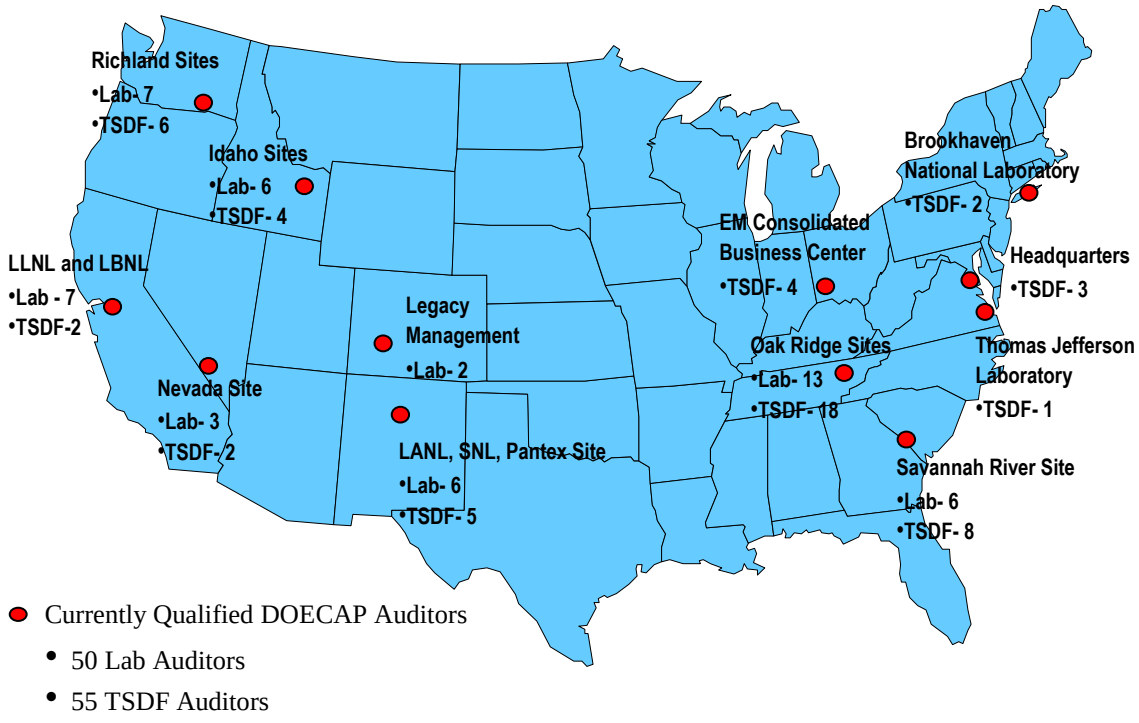


Figure 2.5 – FY09 Qualified DOECAP Laboratory and TSDF Auditors

Figures 2.6 and 2.7 on the next page illustrate DOE site participation in DOECAP audits of laboratories and TSDFs, respectively, for the past 3 years. These figures illustrate the increasing dependence of the Program for on-site auditing support from ORO and Operations Team personnel. A portion of auditor losses can be attributed to the reduction in auditors and participation due to the closure of Rocky Flats, Fernald, and Mound sites. However, there has been a simultaneous decrease in auditor funding and support from areas such as the LLNL, Lawrence Berkeley National Laboratory (LBNL), the Nevada Test Site, the SRS, and several National Nuclear Security Administration (NNSA) sites. Laboratory audit participation from LLNL and LBNL has decreased by half over the past three years, while contributions from SRS and Nevada have been cut by one third. In order to ensure continuing Program success, these sites and others need to increase their volunteer auditor contributions. ORO and the Operations Team can not be expected to continue to provide the level of on-site auditing staff as it has over the past several years or to continue increasing its contribution to the over all effort.

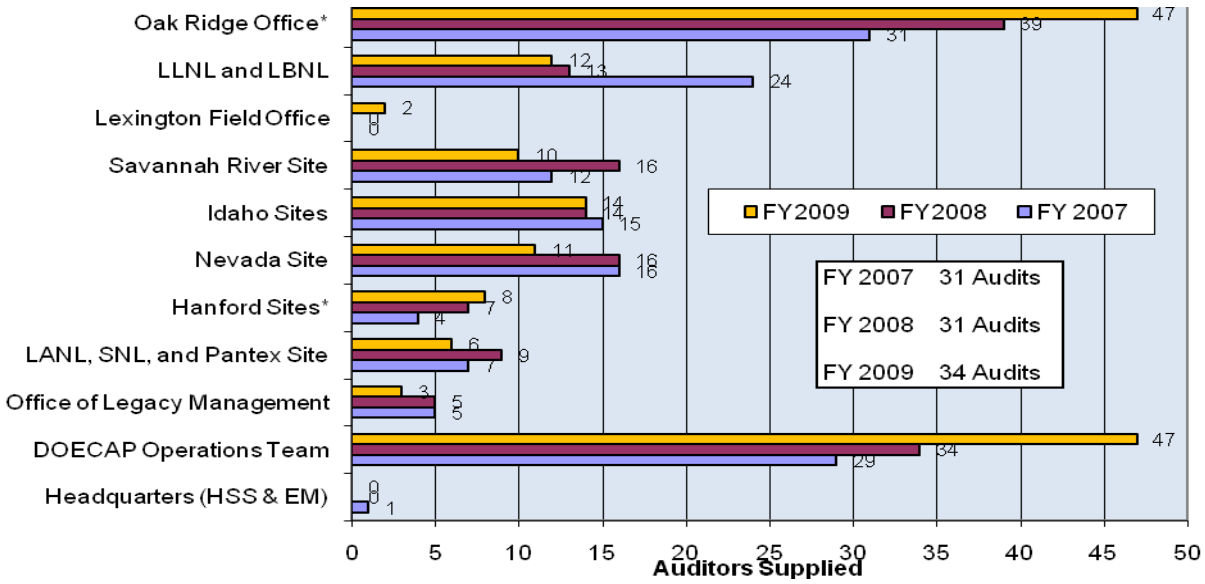


Figure 2.6 – DOECAP Laboratory Audit Participation for the Past Three Years

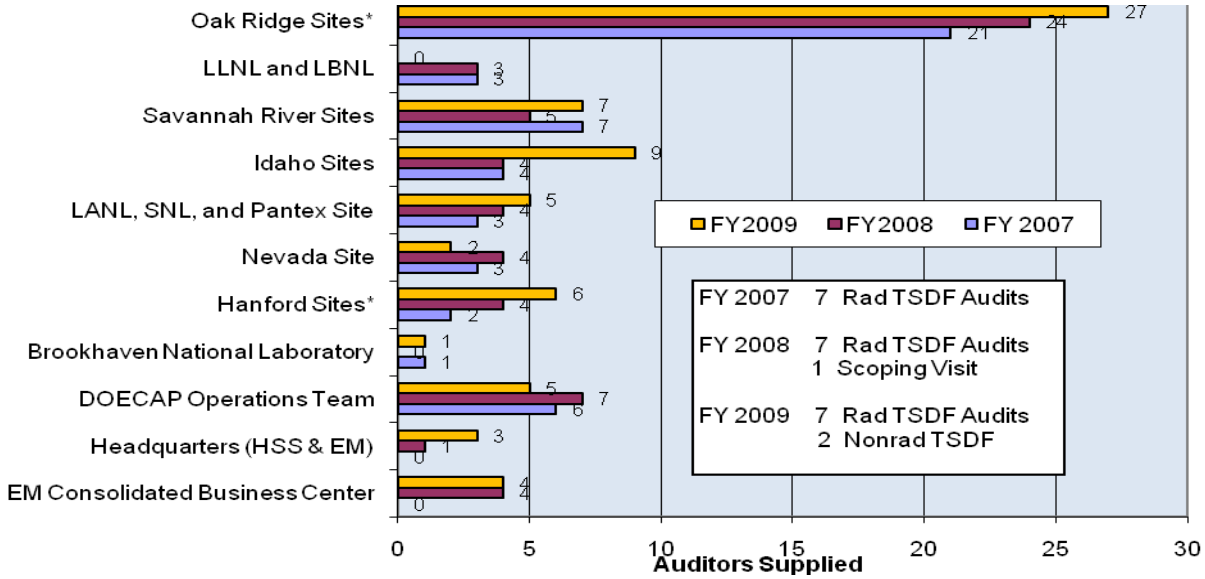


Figure 2.7 – DOECAP TSDF Audit Participation for the Past Three Years

*Oak Ridge Sites = East Tennessee Technology Park, ORNL, and Y12 Security Complex
Hanford Sites = PNNL, Richland Operations, and the Office of River Protection

2.2.5 Program Achievements in FY09

The Program had a very productive and successful year. In addition to the traditional work efforts, multiple new initiatives were started and/or completed during the course of the FY. The following table and discussion address these various FY09 achievements.

DOECAP Fiscal Year 2009 Goals & Initiatives	Achieved	Partially Achieved	Not Achieved
Implement Successful Laboratory and TSDF Audits	✓		
Introduce and Implement Non-Radiological TSDF Audits	✓		
Initiate Utilization of Interim Findings		✓	
Implement Official Use Only Procedures	✓		
Increase Program Participation, Auditors and Lead Auditors		✓	
Improve Program Processes and Procedures	✓		
Increase Program National Interactions	✓		
Complete Revisions to Program Documents	✓		
Update and Upgrade EDS Content and Operations		✓	

Laboratory and TSDF Audits

As indicated previously in Section 2.2.1 of this report, 43 DOECAP audits were successfully conducted in FY09, including 34 at analytical laboratories and 9 at TSDFs (radiological and non-radiological). These efforts were an increase of approximately 16% over the FY08 audit cycle and were accomplished within the same administrative budgetary scope.

Non-Radiological TSDF Audits

The FY09 goal to perform two pilot-audits of a non-radiological TSDF was achieved. The Clean Harbors facilities at Aragonite, Utah and El Dorado, Arkansas were audited with full compliments of auditors from the various DOE field sites utilizing these operations. Conducting these first-time audits did pose some new challenges for the auditors and facility personnel; however, all entities performed well, established good rapport, and completed the audit processes successfully.

Implementation of Interim Findings

An interim finding has been defined by the Program as a factual statement issued from the DOECAP to document a deficiency that is identified outside the scope of an on-site audit of a facility. This finding may be issued by the DOECAP against an audited facility in the event a deficiency is identified external to the normal on-site auditing process. This may occur during analytical data review processes, PT evaluation processes, interactions during waste shipment processes, etc.

Programmatic procedures to identify and issue these interim findings were established. During FY09 several interim findings were issued to analytical laboratories relative to poor PT results.

Implementation of Official Use Only

All DOECAP audit reports and Corrective Action Plans (CAPs) were designated as DOE Official Use Only (OUO) per a Headquarters memo at the beginning of the FY09 audit cycle. The Office of General Council determined that audit information would be handled in this manner to protect potential business proprietary information. This OUO policy, direction and implementation currently controls the dissemination of DOECAP information internally "within" the Department, its line organizations and field element sites for purposes of information exchange and lessons learned. The DOECAP has implemented policies, procedures, and training to properly implement OUO.

Increased Program Participation

The DOECAP continues to promote participation throughout the DOE Complex through coordination with the POCs and auditors. Continued support from the DOE sites including audit participation, conference call participation, and annual meeting participation has remained constant even though major DOE sites have been closed and other site budgets have diminished.

The Program filled 95% of the laboratory audit positions and 99% of the TSDF audit position during the course of the audit cycle. Eleven new auditors were added to the list of individuals qualified to participate in audits establishing a net gain of 12%. The continuing goal to recruit additional lead auditors was achieved in FY09 with the addition of two new Federal TSDF lead auditors from ORO and the Environmental Management (EM) Consolidated Business Center, and the addition of four new laboratory lead auditors from ORO, SRS, and LLNL. Despite this success the Program continues to require increased participation from all areas to equitably share the workload.

Photo 2.2 – DOECAP Laboratory Audit

Improved Program Processes and Procedures

Several initiatives were implemented during FY09 to improve the Program processes and procedures. These efforts focused on the following areas and concepts:

- Inclusion of an executive summary into all audit reports;
- Issuance of Training Guidance for Auditors-in-Training and for the qualified auditors who are their mentors;
- Inclusion of Non-Destructive Assay auditing into the Program;
- Obtaining and performing an initial review of TSDF contract and statement of work information for DOE sites; and
- Implementing required reading documentation for all POCs.

Increased Program National Interactions

Representatives of ASP participated in various conferences, workshops and meetings in FY09 and increased the visibility and status of the various component elements (DOECAP, MAPEP, and SPADAT). These interactions promoted the cooperation and sharing of lessons learned within DOE and between DOE and other governmental agencies. These activities included attendance at the Radiobioassay and Radiochemical Measurements Conference in October 2008, The National Environmental Laboratory Accreditation Conference (NELAC) Institute (TNI) Meeting in January 2009, the Waste Management Conference in March 2009, the DoD Data Quality Workshop in April 2009, the National Environmental Measurements Conference in August, and the RadWaste Summit in September 2009. Participation in these meetings and conferences continues to foster Program improvements, promote DOE interests into National Standards, share lessons learned with other governmental departments (EPA, DoD, etc.), and clarify the challenges and issues associated with analytical laboratories and waste operations.

In addition to these activities, the DOECAP Technical Operations Coordinator continues to serve as a member of the TNI Environmental Laboratory Advisory Board and is part of the Measurement and Technology Workgroup, while the DOECAP Operation Team Lead serves as a member of the Onsite Assessment Committee. The ASP Manager is on the TNI Board of Directors as an ex-officio member and on the TNI Laboratory Accreditation Systems Committee. The DOECAP Operations Team Lead also attended the NELAC Assessor Training course and qualified as a NELAC Assessor.

2.3 FY10 Goals and Challenges

The following summarizes goals and opportunities for improvement for the continued success of the DOECAP.

2.3.1 Program Participation and Implementation

Potential decline in DOECAP participation represents a primary barrier to continued Program success and viability. If the DOECAP is to continue to achieve success it is essential to increase and sustain participation throughout the Complex.

Proposed FY10/11 actions will continue to promote DOECAP participation throughout the DOE Complex, encourage Complex-wide involvement commensurate with use, and include initiatives to:

- Increase participation within Program Secretarial Offices beyond EM, with special emphasis on the NNSA, the Office of Science, and LM;
- Increase participation of POCs (Federal and contractor) by identifying individuals who will actively promote the Program and educate them to their full responsibilities to the Program;
- Promote audit participation that is commensurate with laboratory and TSDF utilization;
- Increase active participation by sites through teleconferences and the DOECAP annual meeting; and
- Identify and pursue opportunities to increase site participation, particularly sites that use DOECAP audit results without actively participating in the Program.

2.3.2 Continuation of Operations

While progress continues to be made to enhance and develop the Program, flat budgets throughout the Department will be a continuing challenge for Program operations to maintain momentum and provide effective services. Accordingly, FY10/11 goals include:

- Soliciting and qualifying additional DOECAP auditors throughout the year;
- Identifying and qualifying two additional TSDF Lead auditors (outside of the ORO community);
- Identifying and qualifying two or more additional Laboratory Lead auditors based on their level of experience and successful participation in the Program;
- Complete reviews and revisions to Program documents (Quality Systems for Analytical Services, Audit Checklists, Policies and Procedures AD-1, etc.);
- Maintain, monitor and improve the use and application of the Electronic Data System; and
- Increase the implementation of non-radiological TSDF auditing.

Photo 2.3 – Non-Radiological TSDF Audit

2.3.3 Institutionalization of the DOECAP

Throughout its history the DOECAP has remained a voluntary participation effort. In order to continue along these lines and remain viable the Program must continue to promote and accentuate its unique contributions and value to the DOE community. Accordingly, FY10/11 goals include:

- Briefing Field Site Management on DOECAP attributes and values;
- Incorporating DOECAP language into contract agreements with subcontracted environmental laboratories and TSDFs;
- Forwarding audit reports directly to DOE Field Managers transmitting information and awareness of the issues, identifying potential risks or liabilities, and promoting the Program; and
- Identifying and implementing more effective ways to communicate and market the value of the Program to the general DOE community.

3.0 Mixed-Analyte Performance Evaluation Program (MAPEP)

3.1 Background and Scope

The Mixed Analyte Performance Evaluation Program (MAPEP) is a PT program designed to help assure the quality and reliability of analytical data necessary for regulatory compliance and supporting DOE risk management decisions. The DOE's Radiological and Environmental Sciences Laboratory (RESL) administers MAPEP in cooperation with HSS. The MAPEP is the only PT program that targets identification and quantification of radiological and non-radiological constituents (i.e., mixed analytes) in the same sample for water and soil matrices. Air filter and vegetation matrices are also prepared for radiological constituents, and gross alpha/beta samples are provided for air filter and water matrices. MAPEP participants can effectively demonstrate their proficiency in radiological, stable inorganic and organic analyses from single-blind PT samples traceable to the National Institute of Standards & Technology (NIST). MAPEP is performance-based and does not specify the methodology to be used for the various sample analyses. Participation in MAPEP is required for laboratories performing environmental analytical services for the DOE and performance is a factor in awarding DOE service contracts. Laboratories participate in MAPEP based upon their application to RESL; a need to conduct analytical services in connection with DOE sites or programs; and a desire to produce high quality analytical data results. In addition, MAPEP has established cooperative agreements with international laboratories to participate in this Program.

Photo 3.1 – Proficiency Testing Standards

Photo 3.2 - RESL Staff Preparing MAPEP Samples for Shipment

The MAPEP PT program challenges analytical laboratories supporting DOE with radiological inorganic and organic analytes in real world samples. It is the only laboratory PT program that targets the performance of analytical laboratories based on low-level mixed-analyte matrices Complex wide. This semi-annual

testing of radiological, inorganic and organic analytes helps assure the quality of environmental data for regulatory compliance and environmental management decision-making processes for DOE field sites.

MAPEP samples are distributed twice a year in test sessions identified as "Series". A MAPEP Series refers to the complete set of water, soil, vegetation, and air filters per distribution. Within a Series the specific Study refers to the particular matrix and compound classification (e.g., Mixed Analyte Soil [MaS], Radiological Vegetation [RdV]). Laboratory performance on these PT samples is reported by RESL as "Acceptable" (A), "Acceptable with Warning" (W), and "Not Acceptable" (N) according to criteria described in the MAPEP Handbook, found on-line at http://www.inl.gov/resl/mapep. Performance results are reported to the individual participants and to the appropriate DOE Field Offices, Sample Management Offices, HSS, and other MAPEP stakeholders. MAPEP also provides a forum in which analytical deficiencies and areas for improvement can be identified, technical assistance can be requested, and various methodologies can be compared. Auditors from the DOECAP rely on the MAPEP PTs when conducting laboratory audits.

3.2 FY09 Activities & Accomplishments

3.2.1 Sample Distribution and Program Expansion

The MAPEP distributes seven sample types in four matrices twice per year: mixed-analyte soil, mixed-analyte water, semi-volatile organic water, gross alpha/beta water, radiological analyte vegetation, radiological analyte air filters, and gross alpha/beta air filters. In FY04 MAPEP transitioned from distributing one matrix (soil or water) per test session to providing four matrices (soil, water, air filter, and vegetation) per test session. Table 3.1 indicates total PT sample distribution by the MAPEP and analyses performed by participating laboratories. Figure 3.1 on the next page illustrates the distribution of PT samples to participating laboratories from MAPEP Series 17 through Series 21 by sample matrix. The table demonstrates the overall consistency in laboratory participation and matrix type distribution.

Fiscal Year	Series	Number of MAPEP Samples	# of Analyses by Laboratories
FY07	17 & 18	1136	13605
FY08*	19	582	7000
FY09	20 & 21	1040	13000

*Delayed shipping Series 20 to align shipment dates to new time schedule

Table 3.1 – Samples Distributed and Analyses by Laboratories

The 1040 samples for the MAPEP Series 20 & 21 test sessions were distributed to over 120 laboratories in February/March and August/September of 2009 (see Table 3.2 on the next page). Appendix C lists the participating laboratories in Series 21, including 17 foreign laboratories.

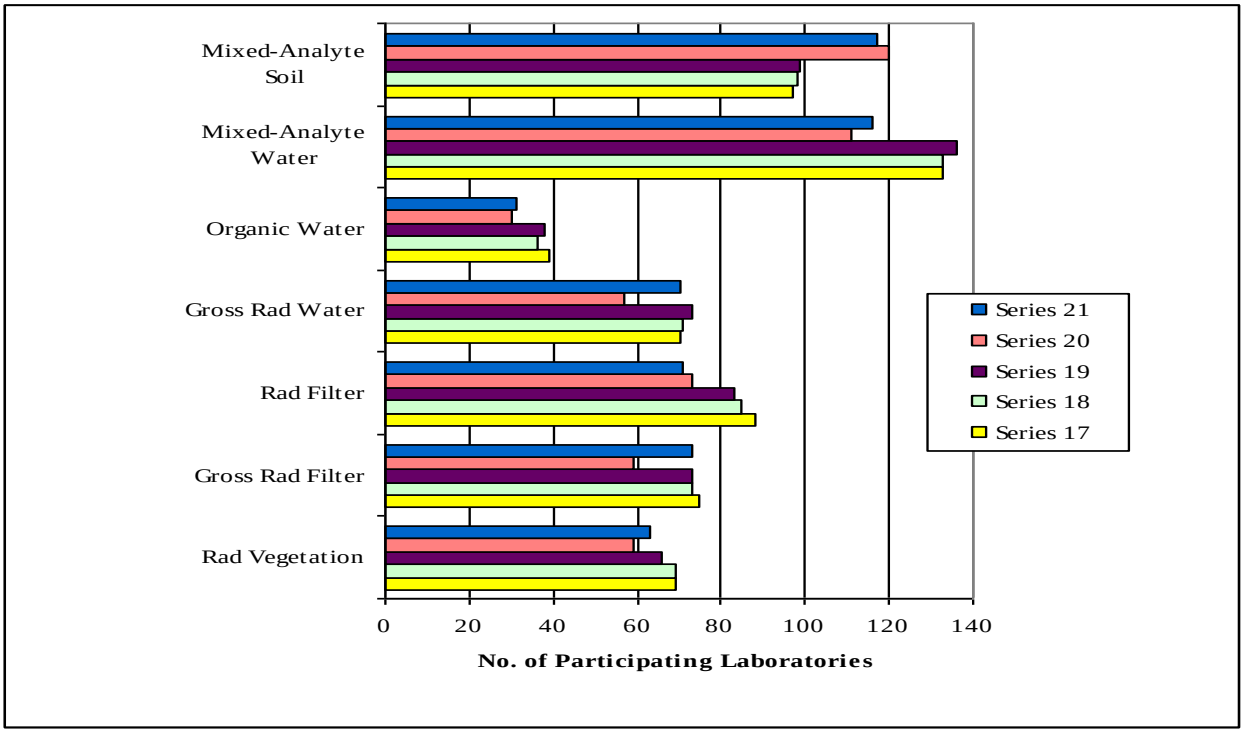


Figure 3.1 – MAPEP Distribution 2007-2009

MAPEP Series 20 & 21	Matrix Id.	Total Samples	Foreign Labs' Samples
Mixed-Analyte Soil	MaS	237	33
Mixed-Analyte Water	MaW	217	32
Semi-volatile Organic Water	OrW	61	0
Radiological Vegetation	RdV	122	14
Radiological Air Filters	RdF	73	11
Gross alpha/beta Water	GrW	144	21
Gross alpha/beta Filter	GrF	132	31

Table 3.2 – Samples Distributed to Participating Laboratories, MAPEP Series 20 & 21

Most foreign laboratories participate in MAPEP as part of the DOE-sponsored Radiation Measurements Cross-Calibration Project in the Middle East. This project is being facilitated through SNL and the IAEA.

Other foreign laboratories participate in MAPEP when DOE interests, cooperative environmental monitoring agreements, or national security interests are involved (e.g., Nuclear Test Ban Treaty participants, Western Europe air monitoring in response to the Chernobyl Accident, and other potential radiological sources, etc.).

Foreign laboratories are using MAPEP to establish quality assurance and cross calibration of radiological measurements crucial to:

- Responding in the event of a terrorist attack (e.g., dirty bomb);
- Promoting and monitoring nuclear nonproliferation treaties;
- Providing accurate environmental surveillance; and
- Promoting overall security in the region (i.e., Middle East).

3.2.2 Quality Issues Identified by MAPEP Proficiency Testing

Laboratories participating in the MAPEP are continually reviewed and evaluated for their historical performance. Performance is evaluated over the past two or three Series and across the matrices within the MAPEP. Series are evaluated for non-reporting of analytes during a false positive test or sensitivity evaluation. Upon identification of a potential analytical data quality problem, RESL issues a Letter of Concern (LOC) to the participating laboratory in order to help participants identify, investigate, and resolve potential quality issues. For example, if a laboratory reported results for Pu-239, but not for Pu-238, they would receive a "Not Acceptable" flag for Pu-238, since by reporting Pu-239, they also demonstrate the capability to analyze for Pu-238. Laboratories may fail to report an analyte if they suspect it is a false positive test or sensitivity evaluation. Laboratories have been repeatedly informed they must report a result for radionuclides that they routinely analyze or readily have the capability to analyze for DOE.

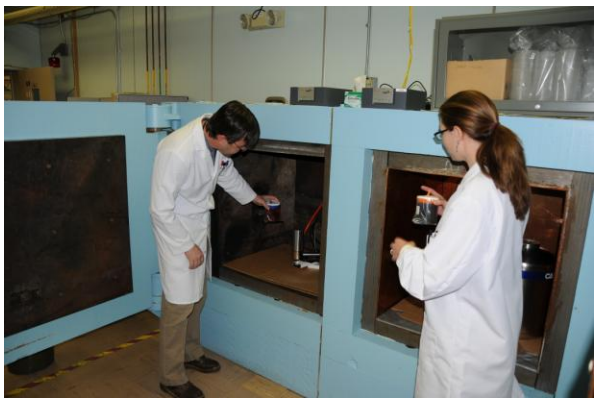


Photo 3.3 – Chemists Preparing MAPEP PT Samples for Gamma Analysis

Comparison of informaiton over the last few years indicates a consistent performance and a small number of concerns relative to the number of analyses being reported. The LOCs issued represent a small fraction of all the analyses performed by MAPEP laboratories during these timeframes. The actual percentage of quality concerns based on letters per number of analyses was consistent for both Series 19 and Series 20. Series 19 had 34 letters per 6,280 analyses or 0.5%, while Series 20 experienced 41 letters out of a total 6,540 analyses representing 0.6%. The demonstrated laboratory performance on these test samples has been exceptional. HSS, DOE Field Offices, and the appropriate site contractor personnel were sent copies of these letters in an effort to ensure all stakeholders were aware of the PT

results. LOCs specifically address areas of significance to DOE, and laboratory participation in PT programs is assessed during DOECAP audits. As part of the DOECAP/MAPEP interactive cooperation, seven instances of multiple PT failures for the same analyte on sequential rounds of testing were issued Priority I findings requiring immediate corrective actions.

A memo detailing the criteria used for issuing a LOC can be found at http://www.inl.gov/resl/mapep. The following paragraphs summarize the important quality issues identified by MAPEP during the Series 19 through 21 test sessions.

False Positive and Sensitivity Tests

In addition to laboratories demonstrating the ability to accurately report analyte concentrations well above detection limits, they should also be able to detect and accurately measure analyte concentrations at or near detection limits without incorrectly reporting false-positive results. The MAPEP program uses false-positive testing on a routine basis to identify laboratory results that indicate the presence of a particular radionuclide when, in fact, the actual activity of the radionuclide is far below the detection limit of the measurement. MAPEP includes false positive and sensitivity testing to avoid DOE programs and sites unnecessarily spending money and time re-testing when questions arise concerning reported data. Accurate testing near detection limits is essential to assure DOE's creditability with regulatory authorities and the general public. Table 3.3 provides the results of false positive and sensitivity tests that were included in MAPEP Series 20 and 21.

Series 20 Matrix	False Positive Test	Sensitivity Test
Soil	Se, Co-57	Co-60, Pu-239/240
Water	Sb, Cd, Co, Se, Cs-137	None
Air Filter	None	None
Veg.	Co-60	None

Series 21 Matrix	False Positive Test	Sensitivity Test
Soil	Ag, Cs-134	None
Water	Cr, Cu, Ag, Mn-54	Pu-238
Air Filter	Am-241, Cs-134	None
Veg.	Cs-134, Zn-65	Pu-239/240

Table 3.3 – False-positive and Sensitivity Tests Included in MAPEP Series 20 and 21

In a sensitivity evaluation the radionuclide is present at or near the detection level, and the difference between the reported result and the MAPEP reference value is evaluated based on the combined total uncertainties. Laboratories that do not detect the targeted radionuclide are identified. It is also possible to fail a sensitivity evaluation by reporting a false-negative. If the laboratory fails false positive or

sensitivity evaluations for two or more consecutive test sessions, a LOC is forwarded to the laboratory. In addition to identifying false-positive and false-negative results, the false-positive and sensitivity evaluation tests are designed to help participants ensure they are not under-estimating or over-inflating their total uncertainties.

The MAPEP will continue to include false-positive tests while including more sensitivity evaluations. The sensitivity evaluations work in tandem with the false-positive tests. Figure 3.2 graphically displays Series 20 False Positive Test results. Results are designated as "Acceptable" (A), "Acceptable with Warning" (W), or "Not Acceptable" (N). Matrices are identified as "MaS" for soil, "MaW" for water and "RdV" for vegetation. The laboratories show improvement over earlier performance for false-positive and sensitivity tests. This improvement was noted for laboratories testing for plutonium in water. At one time close to 50% of these facilities reported false positive results, while now these same laboratories rarely report false positives for plutonium in water.

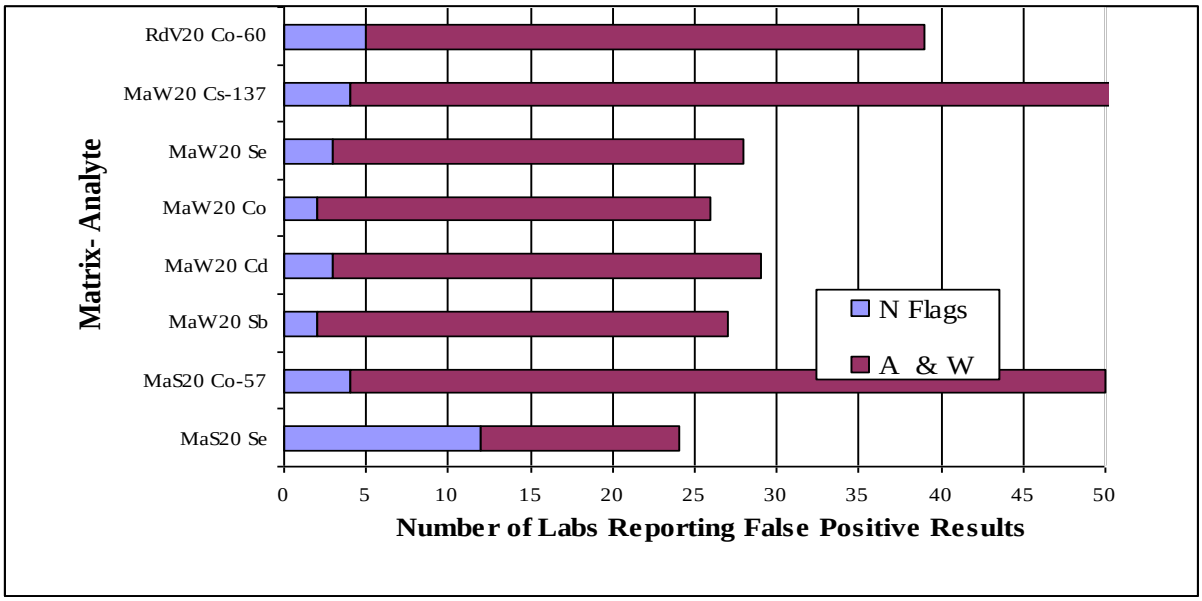


Figure 3.2 – Summary of False-positive Tests in MAPEP Series 20

Antimony Analysis in Soil

The MAPEP has identified the analysis of antimony in soils as an area of concern for most laboratories. NIST-traceable antimony standards have been spiked into MAPEP soil standards starting with Series 10. The diluent soil contains negligible amounts of antimony with essentially no background contribution. In earlier test sessions, only 3 of 24 labs (Series 10), 2 of 23 labs (Series 12), and 6 of 23 labs (Series 13) showed "Acceptable" or "Acceptable with Warning" performance for antimony. This was improved to 18 of 26 labs (Series 14) and 18 of 28 labs (Series 15). Recent Series have shown continued

improvement in laboratory performance, with "Acceptable" performance for antimony at 20 of 26 labs (Series 20), 24 of 24 labs (Series 21). All labs reporting antimony in Soil Study 21 (MaS21) received Acceptable or Warning Flags. Laboratories that have received consistent "Not Acceptable" evaluations for their antimony results in soil have been sent Letters of Concern. Figure 3.3 details the recent improved performance in the determination of antimony in soil compared to earlier test sessions.

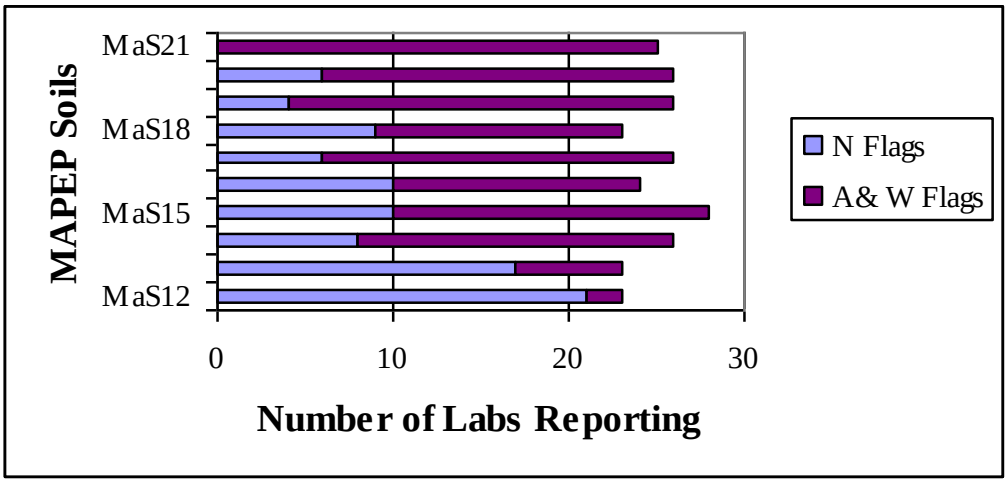


Figure 3.3 – Antimony Results for Soil Studies Series 12 - 21

Most laboratories are determining antimony with the hot acid leaching methods associated with EPA Method 3050. EPA Method 3050 (and the updated EPA Method 3050B) use multiple techniques for the preparation of soil samples, which means a laboratory must choose (if allowed by the DOE contract) the appropriate analytical technique for the specific analyte determination. The wording of EPA Method 3050B may also lend itself to varying interpretations regarding which sample preparation technique should be used. However the method states:

> *"Section 7.5 may be used to improve the solubility and recoveries of antimony, barium, lead, and silver when necessary. These steps are optional and are not required on a routine basis."*

A letter received from representatives of the EPA Headquarters - Office of Solid Waste confirmed that antimony in soil requires the use of the alternative Section 7.5 digestion technique to recover the environmentally available antimony. The EPA letter is on file with the MAPEP Coordinator. Accurate determinations of antimony in soil are required for DOE programs and sites to properly characterize radiological and non-radiological wastes for treatment and disposal.

Misidentification of Isomers in Organic Compounds

An issue of concern for the targeted organic components has historically been the misidentification of isomers that exhibit chromatographic retention times close to one another. Reporting laboratories that fail to accurately validate the quantification of components reported have received Letters of Concern for misidentification of those isomers. The number of letters being issued has remained small, usually about one per sample distribution; thereby, indicating that most laboratories are properly identifying component compounds for PTs.

3.2.3 MAPEP Web-Based Reporting and Query System Developments

The MAPEP has been continually improving the data reporting and data review portion of the Web Site at http://mapep.inl.gov. Improvements for the administrative reviews of MAPEP have been implemented on the web site. MAPEP has fully implemented changes to the MAPEP data reporting, data evaluation and customer reports portions of the MAPEP system. MAPEP has created a fully automated data handling system for the administration of the program as well as for the reporting of customer data, customer reports and review of laboratory information for auditors. Figure 3.4 illustrates one of the many query and graphic options available within the MAPEP Web Based System.

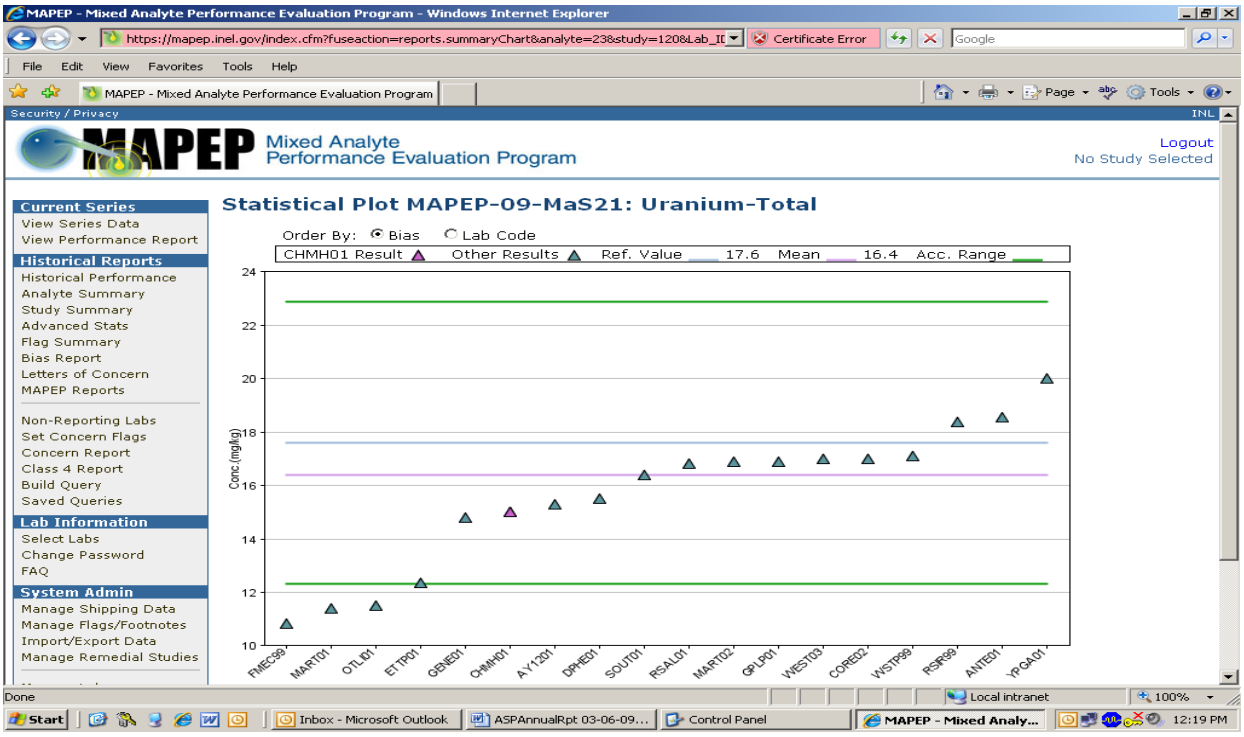


Figure 3.4 – Example of MAPEP Web-Based Online Graphics

3.2.4 Management and Program Highlights

MAPEP Remedial Samples Policy

The DOECAP issues Priority I Findings whenever a laboratory fails the same analyte in two (2) or more consecutive PT test sessions. Priority I Findings have a potentially significant impact on a laboratory since the lab may not be permitted to perform that analyte determination for DOE work until they successfully demonstrate, by passing a similar PT test, that the problem has been resolved. RESL has issued a policy that addresses how laboratories can request remedial MAPEP samples between designated test sessions. In the event of multiple failures that result in the issuance of a DOECAP Priority I Finding, the laboratory may contact RESL and request a sample from a previous MAPEP study or us their own remaining sample from a previous MAPEP study to identify the root cause of the failure.

Once a laboratory has demonstrated that they have resolved the root cause and can achieve acceptable results with previous MAPEP PT material, DOECAP will contact RESL and request a one time remedial PT sample for the laboratory. The laboratory will provide the results of the remedial study to RESL and the results will be evaluated using the same evaluation criteria applied for normal MAPEP studies. If the results are acceptable, the Priority I Finding can be evaluated for closure by DOECAP based on the documentation provided. If the results are not acceptable, the laboratory will be encouraged to continue resolution of technical problems but will not be provided a second remedial PT sample. The laboratory must then demonstrate competency by passing the PT for the analyte in the next scheduled MAPEP test session. A failure will automatically reactivate the Priority I Finding. The requests for remedial PT samples will be made solely through a request from the DOECAP and not from the participating laboratories. The ultimate objective is to establish the laboratory's capability to correctly determine the analyte of concern in the specific matrix and provide defensible analytical data. In these cases where repeat testing failures have occurred, an on-site follow-up surveillance may be made to document closure of the resulting DOECAP issued Priority I Finding.

RESL Reorganization

RESL reorganized its management and staff structure consistent with DOE recognition of the RESL Most Efficient Organization (MEO) as a successful Post Competitive Organization in the RESL A-76 Study. At the end of the FY09, the Letter of Obligation (LOO) signed by the RESL MEO and DOE's Procurement Division was terminated. The RESL organization was recognized as demonstrating cost savings through improved efficiencies in work activities and procurement of services. The elimination of the LOO allows RESL to fully develop its capabilities and technical assistance to support all DOE, federal, national, and international requests for quality radiological PT materials.

ISO 17025 Accreditation & Proficiency Testing Provider Accreditation (ILAC G13 and ISO Guide 43)

RESL has completed updating the RESL and MAPEP quality systems/procedures in accordance with the ISO 43 *Proficiency Testing by Interlaboratory Comparisons* as detailed in the International Conference on Accreditation of Laboratories (ILAC) Guide 13:2007 and ISO 17025:2005. Re-Accreditation was granted for both ISO 17025:2005 and ILAC G13:2007 by the American Association for Laboratory Accreditation on August 29, 2008.

Traceability of RESL to the National Institute of Standards & Technology

RESL currently is designated by HSS as the DOE reference laboratory for environmental analyses. RESL also maintains direct radiological traceability to NIST. The Radiological Traceability Program (RTP) provides for an annual exchange between NIST and RESL of test materials containing a number of radionuclides in various sample matrices (soil, water, air filter, vegetation, synthetic urine, and synthetic fecal). It is designed to provide a mechanism for evaluating the ability of RESL scientists both to prepare test materials of known radionuclide activities, and to correctly analyze test materials of unknown activities. PT standards are prepared by NIST, sent to RESL and analyzed by RESL for subsequent evaluation by NIST. RESL sends prepared PT standards to NIST for verification of the known reference values. This assures that the preparation and measurement processes at RESL are traceable to NIST. The two year cycle for the RTP traceability of MAPEP radionuclides and matrices to NIST has been completed in 2009.

MAPEP Presentations at the ASP Workshop 2009

The MAPEP maintains a close working relationship with the ASP. The MAPEP Team prepared and presented site updates, program updates and PT topics at the ASP 2009 Workshop in September 2009. The MAPEP Team continues working with the ASP and the DOECAP by participating in the bi-monthly conference calls and interacting with the DOECAP participants and laboratories throughout the year and at annual workshops. The MAPEP Team also hosts an annual workshop for participants and stakeholders at the Radiobioassay and Radiochemistry Measurements Conference.

Photo 3.4 – Chemist Analyzing MAPEP PT Sample for Alpha Emitting Radionuclides

3.3 FY10 Goals and Challenges

3.3.1 Letters of Concern

The MAPEP will coordinate with HSS Program management in updating LOCs to emphasize the importance of producing quality data, developing timely corrective actions for failed PTs, and promoting RESL technical assistance to help resolve PT issues and concerns. Laboratories having two consecutive failed test sessions for an analyte in a given matrix may also receive an additional LOC from HSS.

3.3.2 Program Promotion/Technical Assistance

The MAPEP will explore opportunities and actions to promote the Program and demonstrate its importance to present and future needs of the DOE Complex through documenting and assuring the quality of environmental data and promoting other intergovernmental interface opportunities. Additionally, staff will provide technical assistance to participating laboratories to foster improved performance levels and meet Departmental expectations for quality data.

3.3.3 Increase Laboratory Participation

Strategies will continue to be developed to increase participation by domestic and international laboratories through attendance at conferences and workshops, presentations, and development of professional papers for journals.

3.3.4 External Outreach

Opportunities to offer technical assistance to other national and international organizations will be identified. This will be promoted through participation in conferences, workshops, meetings, etc., and by providing presentations, reviews, and updates on RESL programs to other federal, national and international programs to extend the understanding and importance of performance testing for laboratory analyses.

Photo 3.5 – Chemist Analyzing MAPEP PT Sample for Nickel-63

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Appendix A
FY09 Analytical Services Program Annual Workshop

The Analytical Services Program annual workshop (ASP 2009) was held September 14-17, 2009 as a primary means to share information, provide training and obtain feedback from Program and audited facility personnel. The workshop atmosphere allowed a free and open exchange between ASP components; senior DOE management; DOE site participants; analytical laboratory representatives; treatment, storage and disposal facility personnel; and other governmental agencies (i.e., the Department of Defense, the Environmental Protection Agency, etc.). The meeting was attended by over 140 individuals and provided significant input from all participants for overall Program improvements.

The keynote speaker at the meeting was Raymond Furstenau (Deputy Manager for Nuclear Energy at the Idaho Operations Office). Session presentations were made by DOECAP, MAPEP, and SPADAT representatives and participants regarding individual site Program status, DOE site challenges and environmental actions, successful environmental projects, and audited facility improvements and progress. This year's meeting featured half-day workshop training sessions focused on consolidated audit program materials, OUO policies, point-of-contact responsibilities, training guidance, effective auditing, report writing, and process document updates.

Working sessions included continuing resolution of QSAS technical issues, laboratory and TSDF checklist comments, the FY10 DOECAP audit schedule, and feedback on DOECAP operations and implementation. Consistent with previous meetings, the program included presentations from audited laboratory and TSDF senior management, project managers using VSP tools, EPA representatives from the Office of the Inspector General and the Office of the Science Advisor, and participants from the US Navy Laboratory Quality & Accreditation Office.

Workshop Award Presentations

Glenn Joseph Pardue, Jr.
DOECAP

James R. Dahlgran
MAPEP

John Wilson
SPADAT

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Appendix B

FY09 DOECAP AUDITED LABORATORIES	
AAL – Assaigai Analytical Laboratories, Inc., Albuquerque, NM	ARS - American Radiation Services, Inc., Port Allen, LA
BCL - BC Laboratories, Inc., Bakersfield, CA	CAL - Caltest Analytical Laboratory, Napa, CA
CAI - CEBAM Analytical, Inc., Seattle, WA	DCS - DataChem Laboratories, Inc., Salt Lake City, UT
DFL - Davis and Floyd, Inc., Greenwood, SC	EMAX - EMAX Laboratories, Inc., Torrance, CA
ESD – Oak Ridge National Laboratory Environmental Sciences Division, Oak Ridge, TN	ESO - Eberline Services, Inc., Oak Ridge, TN
ESR - Eberline Services, Inc., Richmond, CA	GEL - GEL Laboratories, LLC, Charleston, SC
GPA – GPL Alabama Laboratory, Montgomery, AL	GPL – GPL Laboratory, Frederick, MD
GPT – GPL Tennessee Laboratory, Johnson City, TN	LLI - Lionville Laboratory, Inc., Lionville, PA
MCL - Materials and Chemistry Laboratory, Oak Ridge, TN	ORISE – Oak Ridge Institute for Science and Education, Oak Ridge, TN (Initial Audit then a follow-up Surveillance)
PAL - USEC Paducah Analytical Laboratory, Paducah, KY	PAR - Paragon Analytics, Inc, Fort Collins, CO
PORTS - USEC Portsmouth Analytical Laboratory, Piketon, OH	RMAL – Radioactive Material Analysis Laboratory ORNL, Oak Ridge, TN
RACL – Radioisotope and Analytical Chemistry Laboratory, BWXT, Lynchburg, VA	S&ME, Inc., Knoxville, TN (Continuing Qualification Audit then Closure Audit)
SEI - Shaw Environmental and Infrastructure, Oak Ridge, TN	SES – Shealy Environmental Services, Inc., Cayce, SC
SRI - Southwest Research Institute, San Antonio, TX	TAA – Test America, Inc., Arvada, CO
TAR – Test America, Inc., Richland, WA	TAS – Test America, Inc. - St. Louis, Earth City, MO
TAK – Test America, Inc., Knoxville, TN	XEN – Xenco Laboratories, Norcross GA (Closure Audit)

FY09 DOECAP AUDITED TSDFs	
ARU – Clean Harbors Aragonite, Aragonite, UT	DSSI - Diversified Scientific Services, Inc., Kingston, TN
ELD – Clean Harbors El Dorado, El Dorado, AR	EST - Energy Solutions, LLC, Oak Ridge, TN
ESU – Energy Solutions of Utah, Clive, Utah	M&EC - Materials and Energy Corporation, Oak Ridge, TN
PFF- Perma-Fix of Florida, Gainesville, FL	PFN – Perma-Fix Northwest, Richland, WA
WCS - Waste Control Specialists, LLC, Andrews, TX	

Appendix C

MAPEP Series 21 Laboratories, 2009

Lab Name (Domestic Laboratories)	City	State
Alabama Department of Environmental Management	Montgomery	AL
USAFSAM/OEHHL	Brooks City-Base	TX
Argonne National Laboratory/Analytical Chemistry Lab.	Argonne	IL
Argonne National Laboratory	Argonne	IL
ALS Laboratory Group, Environmental Division	Fort Collins	CO
Idaho National Laboratory	Idaho Falls	ID
American Radiation Services Inc.	Port Allen	LA
CH2M Hill Applied Science Laboratory	Corvallis	OR
B&W Y-12, Analytical Chemistry Organization Laboratory	Oak Ridge	TN
BC Laboratories, Inc	Bakersfield	CA
Northeast Laboratory Services, Inc.	Waterville	ME
Caltest Analytical Laboratory	Napa	CA
California Department of Public Health	Richmond	CA
Colorado Dept. of Public Health and Environment	Denver	CO
Lawrence Livermore National Laboratory - EMRL	Livermore	CA
222-S Laboratory	Richland	WA
Carlsbad Environmental Monitoring and Research Center	Carlsbad	NM
TestAmerica Denver	Arvada	CO
Davis & Floyd, Inc.	Greenwood	SC
Department of Environmental Health & Safety	Raleigh	NC
DLE Associates	Hercules	CA
S&S Onsite Analytical	Findlay	OH
B&W Pantex - D&RMG	Amarillo	TX
EMAX Laboratories, Inc	Torrance	CA
U. S. EPA Office of Radiation and Indoor Air	Las Vegas	NV
Lawrence Livermore National Laboratory ERAD	Livermore	CA
Washington State Public Health Laboratories	Shoreline	WA

Lab Name (Domestic Laboratories)	City	State
Environmental Radiation Laboratory	Atlanta	GA
Region 5 EQC Tritium Lab	Aiken	SC
ETTP	Oak Ridge	TN
EnergySolutions, LLC	Clive	UT
Florida Dept of Health Environmental Laboratory	Orlando	FL
Florida Dept. of Health, Mobile Environmental Radiological Lab	Orlando	FL
Fernald Project	Harrison	OH
Fermi National Accelerator Laboratory (FermiLab)	Batavia	IL
Lawrence Livermore Laboratory	Livermore	CA
GEL Laboratories, LLC	Charleston	SC
Georgia Power Company Environmental Laboratory	Smyrna	GA
GPL Laboratories, LLLP	Frederick	MD
Hazards Control Analytical Lab	Livermore	CA
Hall Environmental Analysis Laboratory	Albuquerque	NM
SC Dept. Health & Environmental Control Radiological Lab.	Columbia	SC
Washington Closure Hanford	Richland	WA
Oak Ridge National Laboratory-Internal Dosimetry Group	Oak Ridge	TN
ISU - Department of Physics/Health Physics/EAL	Pocatello	ID
Jefferson Laboratory	Newport News	VA
Kansas Dept. of Health & Environment	Topeka	KS
Kennedy Space Center, HP Laboratory	Kennedy Space Center	FL
Los Alamos National Laboratory	Los Alamos	NM
Lawrence Berkeley National Laboratory	Berkeley	CA
Lawrence Livermore National Laboratory	Livermore	CA
ICP Analytical Services Laboratories	Idaho Falls	ID
Idaho National Lab ATR Complex Radioanalytical Laboratory	Scoville	ID
USEC, Inc.	Piketon	OH
United States Enrichment Corporation	Paducah	KY
Radioactive Material Analysis Laboratory	Oak Ridge	TN
MDPH-Radiation Control Program	Jamaica Plain	MA

Lab Name (Domestic Laboratories)	City	State
PIKA International	McClellan	CA
National Air and Radiation Environmental Laboratory	Montgomery	AL
B&W Tech. Services-Radioisotope & Analytical Chemistry Lab.	Lynchburg	VA
New Jersey Dept. of Health & Senior Services, PHEL, ECLS	Trenton	NJ
Assaigai Analytical Laboratories, Inc.	Albuquerque	NM
Nuclear Technology Services, Inc.	Roswell	GA
Life Science Laboratories, Inc.	East Syracuse	NY
Ohio Department of Health Laboratory	Reynoldsburg	OH
ORISE/IEAV	Oak Ridge	TN
Outreach Technologies, Inc.	Broken Arrow	OK
NASA Plum Brook Reactor Facility Lab	Sandusky	OH
Environmental Science Lab PNNL/ESL	Richland	WA
TestAmerica St. Louis	Earth City	MO
TestAmerica Knoxville	Knoxville	TN
TestAmerica Richland	Richland	WA
WRPS RadCon Program Count Room	Richland	WA
RSA Laboratories, Inc.	Hebron	CT
Savannah River National Laboratory/SRNS	Aiken	SC
GPL Laboratories Alabama, LLC	Montgomery	AL
SRS Environmental Monitoring Laboratory	Aiken	SC
SLAC DOE National Accelerator Laboratory	Menlo Park	CA
Scientific Laboratory Division	Albuquerque	NM
Southwest Research Institute	San Antonio	TX
Sandia National Lab, Radiation Protection Sample Diagnostics	Albuquerque	NM
Texas Department of State Health Services Laboratory	Austin	TX
Teledyne Brown Engineering - Environmental Services	Knoxville	TN
Environmental, Inc., Midwest Lab	Northbrook	IL
Eberline Services Oak Ridge Laboratory	Oak Ridge	TN
Eberline Analytical Corp. Richmond CA Lab	Richmond	CA

Lab Name (Domestic Laboratories)	City	State
FUSRAP	Berkeley	MO
UniTech-235	Barnwell	SC
UNLV Radioanalytical Services Laboratory	Las Vegas	NV
UniTech Services Group	Springfield	MA
Lionville Laboratory	Exton	PA
Waste Sampling and Characterization Facility	Richland	WA
Pace Analytical Services, Pittsburgh	Greensburg	PA
WI, DPH, Radiation Protection Section	Madison	WI
WIPP Laboratories	Carlsbad	NM
Wisconsin State Laboratory of Hygiene	Madison	WI
WVDP Environmental Laboratory	West Valley	NY
West Valley Process Chemistry	West Valley	NY
WVDP Radiation Protection Lab	West Valley	NY
Durateck, Inc. - Bear Creek Lab	Oak Ridge	TN
Pacific Northwest National Laboratory	Richland	WA
AREVA NP Environmental Laboratory	Westboro	MA
US Army Yuma Proving Ground / Material Analysis Lab	Yuma	AZ

Lab Name (International Laboratories)	City	Country
Radiation Protection Bureau ERHD NMS	Ottawa	Ontario
Ministry Of Health,Radiation Protection Department Lab	Sharq	Kuwait
Foods and Water Laboratories Center	Muscat	Oman
International Atomic Energy Agency	Seibersdorf	Austria
Radiation Measurements Laboratory	Amman	Jordan
Chemical Analysis Laboratory	AL-Jaubaiha	Jordan
Laboratori de Radiologia Ambiental-Universitat de Barcelona	Barcelona	Spain
Lancaster Environment Centre	Lancaster	UK
National Radiation Laboratory	Christchurch	New Zealand
Royal Scientific Society - Radiation Measurements Lab	Al-Jubaiha	Jordan
Radiation Protection Service	Weston	Ontario
Instituto de Radioprotecao e Dosimetria - IRD/CNEN	Rio de Janeiro	Brazil
Soreq NRC	Yavne	Israel
Qatar University- Nuclear Physics Lab	Doha	Qatar
National Center for Energy, Science and Nuclear Techniques	Rabat	Morocco
Veterinary Laboratories Agency	Surrey	UK
Westlakes Science and Technology Park	Cumbria	UK