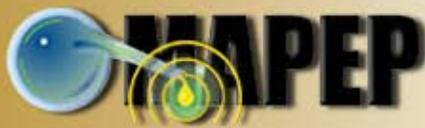




U.S. DEPARTMENT OF
ENERGY



Analytical Services Program

Fiscal Year 2012 Report

U.S. Department of Energy
Office of Health, Safety and Security



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Acronyms

A2LA	American Association for Laboratory Accreditation
ASP	Analytical Services Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DHS	Department of Homeland Security
DoD	Department of Defense
DOE	Department of Energy
DOECAP	Department of Energy Consolidated Audit Program
EDS	Electronic Data System
EPA	Environmental Protection Agency
FY	fiscal year
HSS	Office of Health, Safety and Security
ISO	International Organization for Standardization
LLNL	Lawrence Livermore National Laboratory
LOC	Letter of Concern
MAPEP	Mixed Analyte Performance Evaluation Program
NIST	National Institute of Standards and Technology
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
PNNL	Pacific Northwest National Laboratory
POC	point of contact
PT	performance testing
QA	quality assurance
QSAS	<i>Quality Systems for Analytical Services</i>
QSM	<i>Quality Systems Manual</i>
RESL	Radiological and Environmental Sciences Laboratory
SPADAT	System Planning and Data Assessment Tools and Training
TNI	The National Environmental Laboratory Accreditation Conference Institute
TSDF	treatment, storage, and disposal facility
UMTRCA	Uranium Mill Tailings Radiation Control Act
U.S.	United States
VSP	Visual Sample Plan

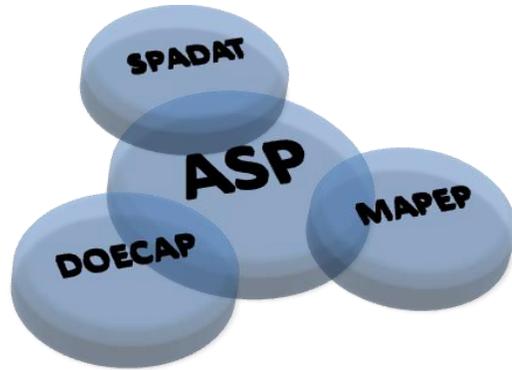


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Executive Summary

This report provides an overview of the United States (U.S.) Department of Energy (DOE) Analytical Services Program (ASP) activities for fiscal year (FY) 2012. The ASP is managed by the Office of Health, Safety and Security (HSS), Office of Sustainable Environmental Stewardship. The component elements of the ASP are as follows:



- Department of Energy Consolidated Audit Program (DOECAP)
- Systematic Planning and Data Assessment Tools and Training (SPADAT) Program
- Mixed Analyte Performance Evaluation Program (MAPEP)

These auditing, planning, and performance testing activities are key vehicles for assuring high-quality, reliable environmental data is available for decision making to support ongoing, critical Departmental operations, such as environmental remediation and long-term legacy management surveillance. In addition, the ASP contributes to the assurance that the Department’s radiological and hazardous waste streams are properly accounted for, treated, and disposed in a compliant manner.

Department of Energy Consolidated Audit Program (DOECAP)

DOECAP is an auditing program of subcontractor analytical environmental laboratories and commercial waste treatment, storage, and disposal facilities (TSDFs). Annual reviews of non-DOE TSDFs contracted to manage DOE’s radiological waste are required by DOE Order (See Appendix B: “Excerpts from DOE Order 435.1, *Radioactive Waste Management*, and DOE Manual 435.1-1”). These auditing activities relative to commercial laboratories and radiological waste vendors are also consistent with DOE Order 414.1D, *Quality Assurance*. DOECAP promotes and encourages laboratory and TSDF improvements, including efforts to correct, document, and close previously identified findings; implement proactive corrective actions; strengthen Quality Assurance programs; and increase focus toward meeting program requirements. The need for an estimated 90 additional independent field audits was eliminated by conducting consolidated reviews and resulted in an estimated annual cost savings to the Department in excess of \$3.6 million, along with additional savings to the audited laboratories and waste facilities.

In FY 2012, a total of 31 DOECAP audits were conducted at analytical environmental laboratories and commercial waste facilities. DOECAP validated closures of over 93% of all open findings and documented improved performance by the laboratories and waste facilities.

In conjunction with these audit activities, DOECAP promoted increased program participation and site awareness, as well as fostering managerial understanding of the risks and liabilities associated with laboratory and TSDF contracts. More than 120 volunteer DOE federal and contractor personnel have become DOECAP-qualified auditors after undergoing a rigorous training program. As a spin-off benefit, the cadre of volunteer auditors from throughout the DOE complex has also provided improved auditing capability and experience at their individual, onsite facilities and established an open forum for discussion and problem solving that fosters improved field-related activities.



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DOECAP continued its active involvement with national standards development programs to promote DOE's missions and interests, and it provided beneficial contributions to DOE field sites. For example, DOECAP is working with the U.S. Department of Defense (DoD) to integrate the laboratory auditing requirements of both organizations and to actively improve laboratory performance levels.

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

Before environmental data is gathered to support DOE site decisions, systematic planning should be employed to ensure that data of the right type, quantity, and quality is collected to meet confidence requirements. The SPADAT Visual Sampling Plan (VSP) is a software tool that supports the development of optimal sampling plans based on statistical sampling theory. VSP also supports the statistical analysis of sample results to reach confident decisions. Virtually all DOE sites have facilities and operations that utilize VSP to improve the quality, defensibility, and cost effectiveness of their sample-supported decisions on key environmental and cleanup projects, site closures, legacy management sites, and regulatory issues. These efforts support DOE's goals to reduce workplace exposure and protect the public and the environment. The SPADAT Program provides tools, guidance, and training in support of the following major DOE field activities:

- Optimization of sampling frequency and locations
- Characterization and remediation planning and assessment
- Effluent, environmental, and process monitoring
- Spatial mapping and temporal assessments
- Sampling and visualization within buildings

In FY 2012, DOE support provided VSP methods, tools, and training to support outdoor radiological surveys, beryllium and radiological contamination evaluations within buildings, monitoring and assessing performance of groundwater remediation technologies, and waste characterization. Continuing advances were made during FY 2012 to enhance and extend VSP's capabilities for sampling irregularly shaped volumes such as piles and ponds, conducting spatial analyses and producing spatial contamination maps, and simultaneously analyzing multiple spatial layers.

DOE leveraged financial investments made by DoD, the Environmental Protection Agency, Department of Homeland Security, Centers for Disease Control, and the United Kingdom Atomic Weapons Establishment to develop the VSP software for a variety of uses. Several VSP additions supported by other agencies are also directly applicable to and meet DOE's site sampling objectives.

Mixed Analyte Performance Evaluation Program (MAPEP)

MAPEP is a set of performance testing (PT) standards designed to evaluate the quality of analytical facilities performing environmental measurements. All laboratories that perform environmental analytical measurements in support of DOE's activities are required to participate in MAPEP. In addition to laboratories supporting DOE's environmental cleanup mission, other MAPEP participants include national laboratories monitoring for environmental contaminants; other federal, state, university, and commercial laboratories; and international laboratories supporting radiological cross-calibration within the Middle East in cooperation with the U.S. Department of State, the International Atomic Energy Agency, and Nuclear Test Ban Treaty participants.



In FY 2012, MAPEP distributed PT standards to more than 100 domestic laboratories and over 30 foreign laboratories, resulting in over 20,000 analyses being reported and evaluated. MAPEP enhancements in the past year included improved performance of participant laboratories for measuring antimony in soil and iodine-129 in water, a reduction in the number of requests for remedial MAPEP PT standards related to consecutive failed test analysis, and continued PT for specialized tests. MAPEP helped to assure field managers that the analytical environmental data for their sites was reliable and defensible, thereby gaining a strong sense of confidence in the overall data quality.

The DOE Office of Nuclear Energy provides programmatic funding to the Radiological and Environmental Sciences Laboratory (RESL), which prepares and distributes the PT samples and evaluates the reported results. The HSS program administrator provides implementation, guidance, and interface with DOECAP. Through RESL, MAPEP expanded its program scope to support federal, state, university, commercial, and international laboratories involved with homeland security, public defense, environmental protection, nuclear waste, and worker protection programs. The RESL programs adhere to high quality standards, as verified by accreditation from the American Association of Laboratory Accreditation for the International Organization for Standardization (ISO) 17025 for laboratory quality systems, ISO 17043 for PT providers, and ISO Guide 34 for certified reference material producers. No other federal laboratory in the U.S. has received all three of these accreditations.



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1.0 Analytical Services Program (ASP)

This report provides an overview of the United States (U.S) Department of Energy (DOE) Analytical Services Program (ASP) activities for fiscal year (FY) 2012. The ASP is managed by the Office of Health, Safety and Security (HSS), Office of Sustainable Environmental Stewardship. The component elements of the ASP are as follows:

- Department of Energy Consolidated Audit Program (DOECAP)
- Systematic Planning and Data Assessment Tools and Training (SPADAT) Program
- Mixed Analyte Performance Evaluation Program (MAPEP)

These auditing, planning, and performance testing (PT) activities are key vehicles for assuring high-quality, reliable environmental data is available for decision making to support critical, ongoing Departmental operations, such as environmental remediation, cleanup projects, and long-term legacy management surveillance. In addition, the ASP assures that the Department's radiological and hazardous waste streams are properly accounted for, treated, and disposed in a compliant manner.

2.0 Department of Energy Consolidated Audit Program (DOECAP)

DOECAP implements annual performance qualification audits of environmental analytical laboratories and commercial waste treatment, storage, and disposal facilities (TSDFs) to support complex-wide DOE mission-critical activities. It was formulated in 2000 in response to the DOE Office of the Inspector General and General Accounting Office reports citing inefficiency, redundancy, and ineffectiveness regarding previous audits conducted by the Department. DOECAP has been successful in reducing Departmental risks in a cost-efficient manner. DOECAP integrates a multisite participation program; standardizes audit criteria, processes, and administration; establishes a cadre of technically competent and trained auditors; establishes a uniform system to track and document completion of corrective actions; provides a mechanism to disseminate information and lessons learned; and reduces audit redundancy.

DOECAP actively contributes to the development of national standards. DOE and the Department of Defense (DoD) have worked together to implement joint documentation such as the merger of the DOE *Quality Systems for Analytical Services (QSAS)* document with the DoD *Quality Systems Manual (QSM)*. This new document, which includes the current revision of The National Environmental Laboratory Accreditation Conference Institute (TNI) standard, utilizes national standards as the basis to implement DOE-specific audits.

DOECAP achieved a cost savings for the Department, which is estimated at \$3.6 million for FY 2012, through the elimination of approximately 90 independent audits that would otherwise have been performed by DOE field elements pursuant to DOE Order 435.1 *Radioactive Waste Management*, for the TSDF facilities and the QSAS requirements for laboratory facilities.

During FY 2012, DOE's subcontracted analytical laboratories and TSDFs continued to offer critical services to support the Department's missions. These analytical laboratories provided high-quality, defensible environmental data and services used by DOE sites in support of environmental remediation, site environmental monitoring, and waste management activities. The TSDFs are

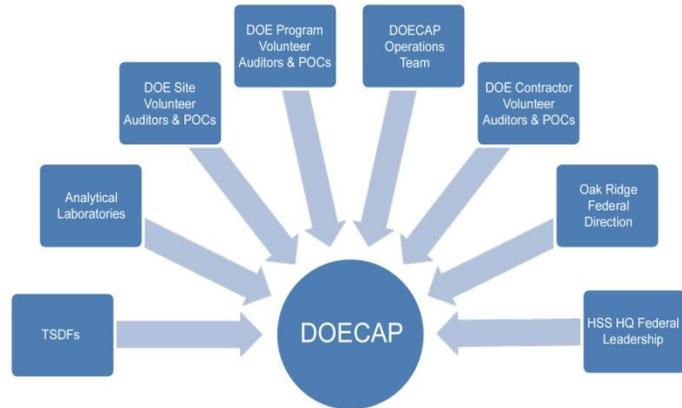


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responsible for proper treatment and disposal of the government’s radiological and nonradiological hazardous waste materials. Annual reviews of non-DOE TSDFs contracted to manage DOE radiological waste are required by DOE Order. (See Appendix B, “Excerpts from DOE Order 435.1, *Radioactive Waste Management*, and DOE Manual 435.1-1”). These auditing activities relative to commercial laboratories and radiological waste vendors are also consistent with the independent assessment expectation in DOE Order 414.1D, *Quality Assurance*. The DOECAP annual audits of laboratories and TSDFs provide DOE environmental and waste managers confidence that the services are compliant with DOE’s contractual agreement stipulations and conform to federal, state, and local requirements.

DOECAP is an integrated voluntary participation effort that requires contributions from many field elements and program offices. DOECAP is administered and implemented by the DOECAP Operations Team, which is responsible for coordinating audit schedules and audit team members.

The participating organizations provide DOECAP with lead auditors, auditors, and points of contact (POCs). This voluntary participation continues to be vital to DOECAP’s success and viability. Additional information is available on the DOECAP Electronic Data System (EDS) website at <https://doecap.oro.doe.gov>.



2.1 Program Achievements and Benefits

Annual audits continue to motivate laboratories and TSDFs to maintain awareness and enhance their compliance with DOE contractual requirements; improve their efforts to meet federal, state, and local regulations; maintain consistency with programmatic requirements; ensure environmental data quality; and competently treat and dispose of DOE radiological and nonradiological hazardous waste.

2.1.1 Achievements in Fiscal Year 2012

During FY 2012, DOECAP initiated and accomplished multiple activities that contributed to the overall success of DOE’s programs and projects. Examples include:

- Increased the number of qualified laboratory and TSDF auditors and lead auditors. The total number of laboratory auditors increased from 56 to 57, including 1 new lead auditor. DOECAP added auditors during the year even though a number of participants were lost due to retirement and work assignment changes. The TSDF auditors increased from 61 to 65, also with 1 new lead auditor.
- Increased field participation and awareness of the benefits that DOECAP provides to the DOE sites. The program’s regular communications with field managers—including reports, memoranda, and in-person meetings—helped foster site management understanding of the risks and liabilities for contracted

laboratories and TSDFs that are associated with the deficiencies identified during DOECAP audits.

- In cooperation with its DoD counterparts, continued integration of the DOE QSAS laboratory requirements with the DoD QSM. The DOECAP Operations Team took a leading role in developing the laboratory requirements for radiochemical analyses. It is anticipated that this effort will unify DOE and DoD laboratory auditing expectations and requirements, as well as providing cross-Departmental efficiencies and overall improved consistency.
- Issued interim findings in a proactive manner to document unacceptable performance identified during periods between audits. This often occurs during the analytical data review and PT evaluation processes. This efficiency benefits the DOECAP community, and should continue to be promoted and expanded.
- Conducted a successful workshop for the DOE ASP in September 2012. To foster program improvement, this workshop provided training opportunities for auditors and POCs and direct, interactive communication with laboratory, TSDF, DOE, and contractor personnel. More than 125 professionals attended this workshop, in person and via webinar, from throughout the DOE complex, as well as intergovernmental federal representatives from DoD, regulators from the Environmental Protection Agency (EPA), and representatives from state regulatory agencies. For the first time, the ASP workshop offered interested parties the opportunity to participate in activities via a webinar connection. Providing webinar capabilities supports the Department's commitment to reduce the Scope 3 indirect greenhouse emissions that result from employee travel. By providing remote accessibility to the September 2012 ASP Workshop in Idaho Falls, approximately 25 attendees were able to fully participate while saving both travel costs and emissions. The workshop focused on training sessions related to policy and procedural updates, audit checklist conformance, and audited facility and DOE site lessons learned.

2.1.2 Program Benefits to DOE

During FY 2012, DOECAP provided numerous benefits in cost savings, improvements in laboratory and TSDF performance, and quality of the audits performed.

- DOECAP saved the Department \$3.6 million through the elimination of approximately 90 independent audits by DOE field element sites as required by DOE Order 435.1 for the TSDF facilities and the QSAS requirements for laboratory facilities.
- DOECAP, in coordination with HSS management, initiated and conducted meetings with select field office managers and personnel to promote the values, benefits, and cost savings of the program and to increase DOE field auditor participation. Meetings were held with personnel from the Oak Ridge Office, National Nuclear Security Administration (NNSA), NNSA Production Office, Richland Operations Office, Office of River Protection, Livermore



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Site Office, and the Idaho Operations Office. The benefits of these meetings included an increased site awareness and/or understanding of the risks/liabilities of using contracted laboratories and TSDFs, an increased commitment for auditor participation based on a fair share contribution for site volume of use of specific audited facilities, and the opportunity to explain the overall field cost savings through DOECAP participation. Through site visits, DOECAP receives DOE field manager support for the program, and the field managers can be assured of the known, acceptable quality of environmental data and the regulatory compliance of waste disposition with DOE field contracts.

- Audit quality and consistency of audit reports improved as a result of drawing from a large, highly qualified pool of technical auditors and subject matter experts from across the DOE complex and from using standardized DOECAP processes (e.g., checklists).
- Analytical laboratory performance and data quality improved as evidenced by a decrease in the number of data quality findings. This improvement was a direct result of the resolution of audit findings through the implementation of the DOECAP corrective action process and causal analysis.
- Safety in handling of DOE environmental samples and waste has increased facility safety awareness through verification of facility compliance with applicable standards and regulations, including conduct of DOECAP regulatory agency reviews as part of TSDF audits.

2.2 Fiscal Year 2012 DOECAP Activities

2.2.1 Audit Performance

In FY 2012, a total of 31 DOECAP audits were conducted: 23 at environmental analytical laboratories and 8 at commercial TSDFs accepting DOE mixed and low-level radioactive waste and chemical waste. Figure 1.1 depicts the approximate locations of the various audited facilities.

DOECAP laboratory audits were conducted by teams filling a total of 135 audit positions, provided by 15 DOE sites, for a total of over 350 auditor-days and over 50 auditor-in-training-days on site at the audited laboratories. The eight DOECAP TSDF audits were conducted by teams comprising a total of 71 audit positions, provided by 19 different DOE sites, for a total of 186 auditor-days and 25 auditor-in-training-days on site at the audited TSDFs. A complete list of laboratories and TSDFs audited by DOECAP in FY 2012 is provided in Appendix A.

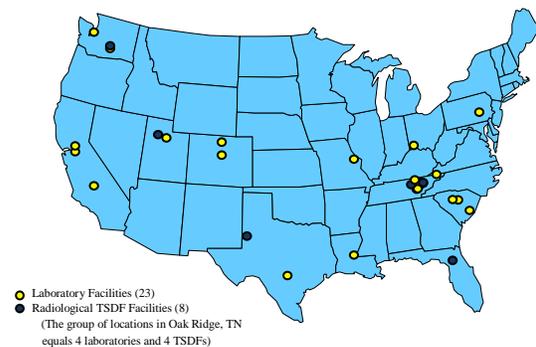


Figure 2.1– Fiscal Year 2012 DOECAP Evaluated Laboratories and TSDFs



A total of 156 laboratory audit findings were issued, including a total of four Priority I findings. Three Priority I findings were related to multiple PT failures for the same analyte on sequential rounds of testing, one of which has been adequately addressed and closed. One other Priority I finding was issued during an audit for insufficient training of critical personnel. During the course of the TSDF audits, no Priority I findings were identified, but 35 Priority II findings were issued. The FY 2012 audit cycle was also able to document closure of 94% of previously issued DOECAP laboratory findings and 91% of previously issued TSDF findings. All active facilities in DOECAP have demonstrated acceptable performance and have quality systems to support DOE’s site activities and needs.

2.2.2 Auditor Qualification and Training

Prospective DOECAP auditors and lead auditors are recommended for qualification by DOE sites in a particular audit discipline or disciplines. DOECAP Procedure AD-1, *DOECAP Policies and Practices*, establishes the formal requirements for auditor qualification documentation, evaluation, and approval. Continuing auditor qualifications are maintained by completing at least one DOECAP audit every two years and completing the required annual online reading and training. DOECAP successfully trained auditors and lead auditors during FY 2012 to maintain and minimally increase the auditor pool and to offset auditor losses due to retirements and job changes.

As illustrated in Table 2.1, the qualified DOECAP laboratory and TSDF auditor base had a small increase

	Laboratory	TSDF
Lead Auditors Start of FY 2012	11	11
Lead Auditors Ending FY 2012	12	12
Auditors Start of FY 2012	56	61
Auditors Ending FY 2012	57	65

Table 2.1 – Fiscal Year 2012 DOECAP Lead Auditor

during FY 2012. Sites are encouraged to submit prospective auditors for qualification in all audit disciplines. As of the end of FY 2012, the specific laboratory audit disciplines that require additional qualified auditors are Hazardous and Radioactive Materials Management and Data Quality for Radiochemistry positions. The specific TSDF audit disciplines that require additional qualified auditors include Sampling and Analytical Data Quality and Radiological Control.

2.2.3 Program Participation and Support

DOECAP is based on the premise that DOE sites will provide qualified auditors and the DOECAP Operations Team will coordinate these resources to organize complex-wide assessment teams to execute combined laboratory and TSDF audits. This overall consolidation of audits lowers the cost to any given site, as well as to the Department. DOECAP’s success has been enhanced by field sites designating POCs who are actively promoting and supporting DOECAP-related needs and submitting technically qualified personnel for participation on audits.

Declining site budgets have impacted DOECAP participation to a certain degree. To ensure DOECAP’s continuing sustainability and success, all sites need to maintain or



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increase their volunteer auditor contributions on a fair-share basis commensurate with contractual agreements related to analytical and waste services.

DOECAP continues to promote participation throughout the DOE complex and cooperative efforts with POCs and auditors. Based on this participation, DOECAP filled 91% of the laboratory audit positions and 95% of the TSDF audit positions during the FY 2012 audit cycle. Table 2.2 identifies the DOE entities that participated in DOECAP during FY 2012.

Brookhaven National Laboratory and the Brookhaven Site Office	Nevada National Security Site and the Nevada Site Office
Oak Ridge Environmental Management Program/ Oak Ridge Office	Oak Ridge National Laboratory and the Oak Ridge National Laboratory Site Office
Environmental Management Consolidated Business Center	Office of Legacy Management Department of Energy Headquarters
Environmental Management Department of Energy Headquarters	Office of Environmental Management Program at the Hanford Site and the Richland Operations Office, and the Office of River Protection
Health, Safety and Security Department of Energy Headquarters	Pacific Northwest National Laboratory and the Pacific Northwest Site Office
Idaho National Laboratory and the Idaho Operations Office	Pantex Site and the Pantex Site Office
Lawrence Berkeley National Laboratory and the Berkeley Site Office	Sandia National Laboratories and the NNSA Albuquerque Complex
Lawrence Livermore National Laboratory and the Livermore Site Office	Savannah River Site and the Savannah River Operations Office
Portsmouth/Paducah Sites and the Portsmouth/Paducah Project Office	Thomas Jefferson National Accelerator Facility and the Thomas Jefferson Site Office
Los Alamos National Laboratory and the Los Alamos Site Office	Y-12 National Security Site and the NNSA Production Office

Table 2.2 – Active Fiscal Year 2012 DOECAP Participants

2.2.4 Program National and International Interactions

DOECAP increased its interactions within DOE and with other governmental agencies. Representatives participated in the 2012 ASP Workshop and the activities to promote the cooperation and sharing of lessons learned between various organizations. Interactions and influences included:

- DOECAP representatives attend TNI meetings, the DoD Environmental Monitoring and Data Quality Workshop, the Radiobioassay and Radiochemical Measurements Conference, and the National Environmental Measurements Conference. This participation helps to foster DOECAP improvements, promote DOE’s missions and interests in development of national consensus laboratory standards, share lessons learned, and clarify the challenges and issues associated with analytical laboratories and waste operations.
- Members of the DOECAP Operations Team serve on the TNI PT Executive Committee, the PT Expert Committee, and the Radiochemistry Standard Workgroup. The ASP Manager is on the TNI Board of Directors as an ex-officio member and on the TNI Laboratory Accreditation System Executive Committee. These interactions have successfully promoted Departmental

auditing and PT policies and procedures into national consensus standards (e.g., TNI, *Management and Technical Requirements for Laboratories Performing Environmental Analysis*, Module 1 PT), including implementation of biannual PT, inclusion of causal analyses into corrective action response, and sharing auditor resources and report information.

2.2.5 Program Challenges

The key challenges to achieving DOECAP's continuing viability and sustainability during the coming years will include initiatives to:

- Promote DOECAP participation throughout the DOE complex and encourage increased complex-wide involvement to staff all disciplines with qualified auditors for the number of audits being performed. Increase DOE line management and field resources by enlisting individuals as DOE site POCs who will actively promote DOECAP and educate each site regarding the benefits and importance of the program and the need to adequately support the projected program activities.
- Maintain DOECAP's strength at a time of declining budgets at the administrative and field operational levels.
- Obtain accurate information regarding laboratory and TSDF contracts and usage from the various DOE sites in order to appropriately prioritize the audit schedules.

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

Nearly every major DOE site, laboratory, and project office (Hanford Site, Lawrence Livermore National Laboratory [LLNL], Los Alamos National Laboratory, Sandia National Laboratories, Idaho National Laboratory, Paducah Site, Portsmouth Site, Oak Ridge Reservation, Savannah River Site, Brookhaven National Laboratory, Argonne National Laboratory, Lawrence Berkeley National Laboratory, Grand Junction Project Office) employs SPADAT Program tools on a variety of projects to support key risk management decisions for environmental and facility operations. The systematic planning approaches and tools facilitate optimal data acquisition and uncertainty management. The SPADAT Visual Sample Plan (VSP) protects against erroneous decisions such as cleaning up a clean site or not cleaning up a contaminated site. Employing this regulator accepted systematic planning, sampling design, and statistical analysis VSP tool provides DOE decision makers with greater confidence that the right sample data is collected the first time, resulting in significant cost and time savings and in streamlined regulator acceptance. Through SPADAT, DOE supports the development of data quality objectives; provides training to facilitate better, faster, and cheaper approaches to meet regulatory requirements; and minimizes data gathering and assessment burdens.

3.1 Program Achievements

Data collection costs and time can be significant, particularly if not approached correctly. DOE sites must collect data through sampling to support decisions for numerous applications.



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Optimizing sample collection strategies by using the VSP modules provides key information required to assess uncertainties and impacts on Departmental decisions for management and/or disposition of radiological and nonradiological hazardous materials. This SPADAT Program has demonstrated for several years that improvements in sampling approaches and tools can provide tremendous cost savings, improve decision defensibility, and streamline regulator acceptance. At the request of field users during FY 2012, several methods and tools were added to VSP, along with many enhancements that provide the DOE users with approaches that more fully meet their application needs. Two of the new sampling and analysis methods added in FY 2012 were sampling of irregularly shaped 3-D volumes such as piles and ponds and new spatial interpolation mapping options. Figure 3.1 illustrates the use of VSP to show sampling locations in a 3-D volumetric space.

To ensure ease of use, the SPADAT VSP tool is freely distributed via the web and targeted towards the non-statistician. In FY 2012, other capabilities were added to facilitate visualization and communication of sampling locations to the sampling teams and those overseeing sampling approaches. Hands-on training sessions offered in FY 2012 provided DOE managers, contractors, and regulators with the know-how to properly use the VSP software.

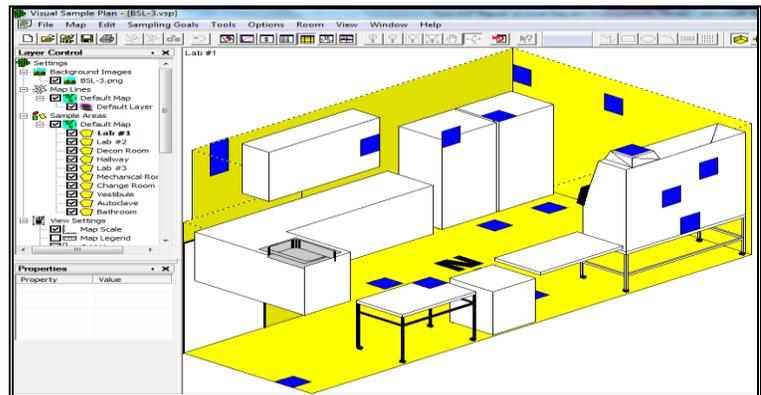


Figure 3.1 – Illustration of Sampling Using VSP Within a Typical Laboratory Space

3.1.1 Benefit and Value to DOE

Without correct representative data, decision reliability will diminish. The SPADAT tools provide DOE sites with technically defensible methods for determining the required number and location of samples to support sound decision making. They also provide statistically valid data analysis capabilities that quantify confidence levels and support uncertainty analyses. Many DOE applications have documented significant cost and time savings using VSP. Moreover, because VSP development has been sponsored in part by the EPA, streamlined regulator acceptance is achieved. VSP helps communicate results in an easily visualized form to key decision makers.

DOE has also been able to leverage significant VSP funding investments by the EPA, DoD, Department of Homeland Security (DHS), Centers for Disease Control, and United Kingdom Atomic Weapons Establishment to minimize its own expenditure contributions. Likewise, those agencies also benefit from the DOE investment. The following VSP additions and enhancements supported by these other agencies have direct application and benefit at DOE sites:

- Stairway and platform representation and sampling supported by DHS (see Figure 3.2)
- DHS-sponsored discovery sampling methods that ensure a high probability of discovering contamination if it is present
- Radiological transect sampling that leverages the DoD-sponsored methods
- Development of case studies for VSP training purposes supported by the Nuclear Regulatory Commission (NRC)
- Stratified sampling of various surfaces within a building sponsored by DHS

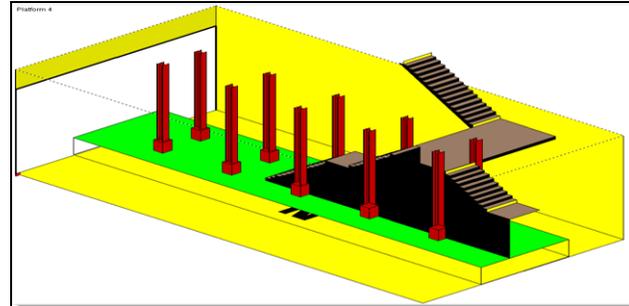


Figure 3.2 – Basement Representation with Stairways and Platforms

3.1.2 Example Applications and Benefits

Each year, DOE VSP users give presentations at the annual DOE ASP Workshop documenting their VSP applications. At the FY 2012 ASP Workshop, applications were presented that included:

Legacy Management:

- Identifying sampling locations for vegetation surveys and ground-truthing hyperspectral surveys

Hanford Site:

- Historical Orchards Suspected of Lead Arsenate Contamination
- Radiological Posting of Lands
- Sludge Depth Measurements in the 105KW Basin and Pits

Uranium Mill Tailings Radiation Control Act (UMTRCA) Sites:

- Temporal Redundancy Tests at the UMTRCA site in Shiprock, New Mexico
- Well Trend Tests at Six UMTRCA Sites in Colorado and Wyoming.
- Analyte Correlation Evaluations at the UMTRCA site in Shiprock, New Mexico

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA):

- Trend Tests at the CERCLA Sites in Fernald, Ohio; Monticello, Utah; and Weldon Spring, Missouri

Similar VSP Program applications have been implemented by most of the DOE sites, and many of them have been featured at previous ASP workshops. In previous



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workshops, we have focused on other DOE sites such as Oak Ridge, Paducah, Portsmouth, LLNL, etc., as well as international applications (e.g., Canada and the United Kingdom).

Similar VSP applications have been implemented by most of the DOE sites. Based on feedback from DOE-affiliated VSP users, field managers, trainees, and regulators, the goals of cost savings, streamlined acceptance, defensibility, and time reductions are being achieved across the DOE complex through use of the SPADAT Program tools.

3.2 Fiscal Year 2012 SPADAT Activities

3.2.1 New VSP Developments

The VSP Program software is constantly being upgraded (in accordance with Pacific Northwest National Laboratory [PNNL] software quality assurance [QA] requirements) with new features and statistical methods. As these are added, a new version is periodically released. In October 2012, VSP version 6.3 was released. This release included the following major additions and improvements:

- Pile and Pond Sampling (Irregularly shaped 3-D sampling)
- Nearest Neighbor Spatial Mapping
- Least Squared Distance Spatial Mapping
- Added ability to automatically create user-defined sample parameters during data import
- Added room transparency in 3D view
- Added loading/saving of 3D elevation surfaces
- Support for multiple raster data sets with accompanying layer controls

The VSP software is available without cost on the PNNL website, <http://vsp.pnl.gov>, along with the user manual and technical documents that provide detailed background on the statistical methodologies. Some of the new VSP developments and major accomplishments in FY 2012 are outlined and illustrated in the following paragraphs.

Multiple Raster Data Sets with Layer Controls

With the addition of multiple image and map layers needed to manage several possible spatial analyses, a new raster control system was developed. Each layer can be separately displayed and controlled. This allows the user to compare and contrast spatial analyses and to control import and export of these layers.

Piles and Ponds Sampling

DOE VSP users requested the addition of sampling either the surface of or within an irregularly shaped 3-D object such as a soil pile or a pond (see Figure 3.3 on the following page). This new addition to VSP allows application of a variety of decision rules and sample design objectives for these types of volumes. Visualization of the volumes, sample locations, and sample results provide the user with greater flexibility and understanding while maintaining the data quality objectives.

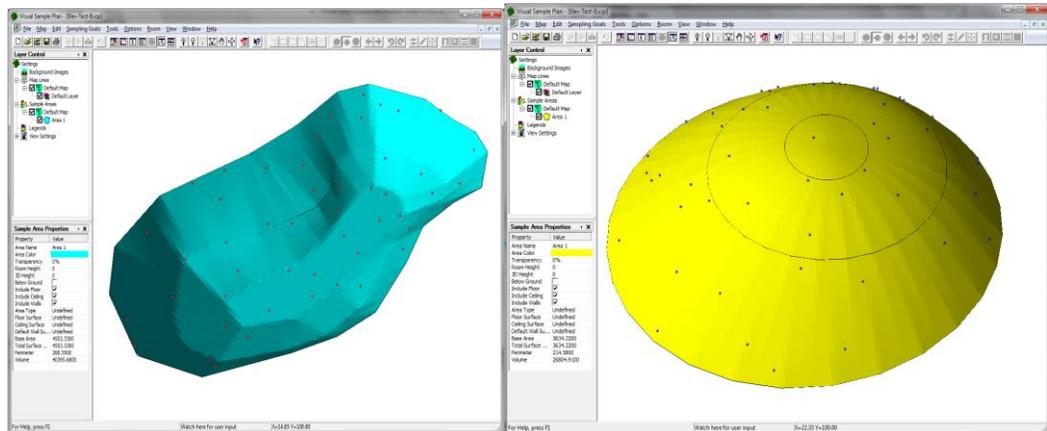


Figure 3.3 – 3-D Piles and Pond Sampling

Nongeostatistical Interpolated Spatial Maps

The geostatistical interpolation methods for spatial mapping involve many parameter inputs. Without some training, it is easy to produce meaningless maps that provide a false sense of understanding and confidence. DOE users requested that additional spatial mapping functions be added to allow for the performance of quick, less precise spatial interpolations. Two new spatial mapping methods were added in FY 2012. These include Nearest Neighbor and Least Squares Distance approaches.

A comparison of the results from the three spatial interpolation mapping algorithms applied on historical data from the Hanford Site wells is shown in Figure 3.4. With these new spatial interpolation methods in VSP, the DOE analyst can quickly explore the spatial distribution of contaminants of concern without employing the sophisticated geostatistical kriging method. Although not as accurate as the geostatistical method and void of statistical confidence/uncertainty estimation, the nearest neighbor and least squares distance spatial evaluations provide a quick view of spatial contamination.

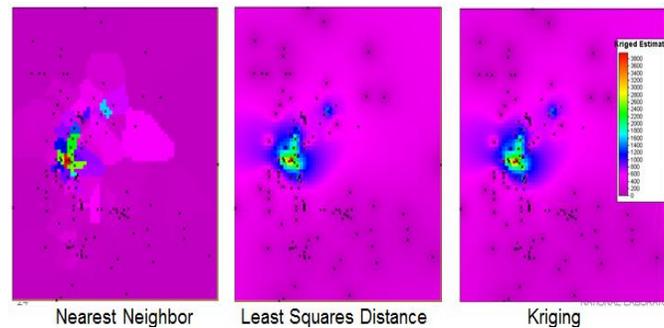


Figure 3.4 – Comparison of Spatially Interpolated Map Using Three Algorithms in VSP

3.2.2 Training at DOE Sites

Limited funding reduced the number of VSP courses offered in FY 2012, but the demand for these courses remains high. The objective of the VSP training is to get the tools into the hands of DOE site practitioners and ensure that they are sufficiently



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trained to maximize benefits and protect against misuse. Although the amount of material contained within each course continues to expand, the new features and enhancements allow class members to proceed at a much faster rate, and the course length does not need to expand. Because other agencies also sponsor VSP courses, maintenance and updating of training material is usually leveraged off other agency course investments. These courses are cost shared with the benefitting DOE site or another government agency. As shown in Photo 3.1, the hands-on VSP course provides the participants an opportunity to work through over 40 case studies using various VSP modules and gives them experience in manipulating and visualizing results.



Photo 3.1 – VSP Class Working Through Case Studies

The VSP Program training courses offered at DOE sites in FY 2012 included courses at Portsmouth, Ohio, in conjunction with the University of Ohio and at Richland, Washington, primarily for the CH2M Hill Plateau Remediation Company contractor (funded independently). Each of these courses was filled to capacity, and people were turned away from some of the training sessions due to limited seating. The courses involve not only DOE managers, staff, and contractors but also state and EPA regulators. Due to training participation of regulators, the proposed sampling plans and formulation of data quality objectives are more readily accepted and quickly approved. This cooperation between DOE field site personnel and state/federal regulators via the training forum has realized a cross-savings in the time spent negotiating the sampling strategy and data quality objectives while simultaneously meeting the goals and expectations for field sampling. The course evaluations continue to be extremely positive, with many participants stating this has been the best, most useful training they have received in recent time.

4.0 Mixed Analyte Performance Evaluation Program (MAPEP)

MAPEP provides critical QA testing for laboratory analytical services. MAPEP's mission is to provide DOE and all stakeholders with the highest quality data on laboratory performance. Radiological and nonradiological (organic and inorganic) constituents are evaluated by performing semiannual PT of onsite DOE laboratories, commercial laboratories who support DOE, other federal laboratories, state laboratories, and international laboratories.



Photo 4.1 – Proficiency Testing Standards

4.1 Standard Distribution Nationally and Internationally

Twice a year, MAPEP distributes nine standard PT sample types in four matrices: mixed-analyte soil, organics in soil, mixed-analyte water, semivolatile organics in water, iodine-129 in water, gross alpha/beta water, radiological analyte vegetation, radiological analyte air filters, and gross alpha/beta air filters. Laboratories are evaluated according to criteria described in the MAPEP Handbook, found online 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.

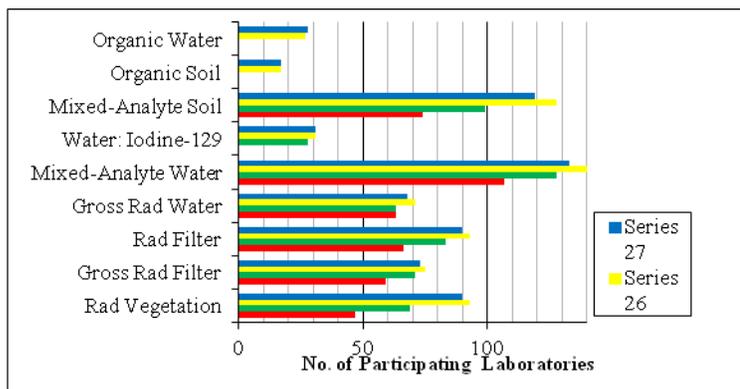


Figure 4.1 – Historical Graph of Standards Distributed to Participating Laboratories, MAPEP Series 24 through Series 27

Auditors from DOECAP incorporate MAPEP PT result evaluations when conducting laboratory audits. The total PT distribution for Series 26 and 27 by MAPEP in FY 2012 was 1285 standards to over 100 laboratories worldwide. The participating laboratories performed and reported over 23,000 analytical results through the MAPEP secure website. In support of improved laboratory performance levels and reporting of accurate environmental data, MAPEP continued to offer open participation for all laboratories performing radiological analyses and possessing an NRC radiological license.

Participation included 35 international laboratories that support radiological cross-calibration with Middle Eastern and North African laboratories in coordination with the U.S. Department of State, the International Atomic Energy Agency, Nuclear Test Ban Treaty countries, and laboratories monitoring Chernobyl. Figure 4.1 illustrates the number of PT standards distributed to all participating laboratories from MAPEP Series 24 through Series 27 by standard matrix.

4.2 Benefit and Value to DOE

MAPEP challenges analytical laboratories supporting DOE and other stakeholder missions by testing whether analytes in environmental standards can be correctly identified and whether the specific concentration or activity level can be accurately analyzed and reported. The Radiological and Environmental Sciences Laboratory (RESL) is the only laboratory PT program that targets the performance of analytical laboratories based on low-level mixed-analytes in real-world environmental sample matrices. MAPEP participants can effectively demonstrate their proficiency in radiological, stable inorganic, and organic analyses from single-blind PT standards traceable to the National Institute of Standards and Technology (NIST) supported by RESL’s accreditations to international standards. MAPEP is performance-based and does not specify the methodology to be used for the various sample analyses. MAPEP also provides an open forum in which analytical deficiencies and areas for



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improvement can be identified, technical assistance can be requested from MAPEP chemists, and various methodologies can be compared.

MAPEP performs semiannual testing. Laboratories are challenged to properly perform and report their results with a frequency that requires their complete attention throughout the year. Laboratories are tested for all aspects of analytical results, including sample receipt protocol, proper method analysis, data reporting, and data evaluation. Participating laboratories have dramatically improved the “Acceptable” results for their analyses over the years. Difficult analysis of radiological, stable inorganic and organic analytes that can harm the environment, cause health effects to the public, and indicate nuclear activities are more accurately determined by laboratories that participate in MAPEP. Consistent participation by



Photo 4.2 – Analyzing MAPEP Proficiency Testing Standards

laboratories who report semiannually allows MAPEP to trend individual laboratory performance for stakeholders. The laboratory data is available for stakeholders to review on MAPEP’s secure access website. MAPEP continues to challenge participating laboratories with unique, new, and improved PT not offered by other PT programs.

MAPEP supports DOE and other national stakeholders. MAPEP provides assurance of the quality and accuracy of the analytical data provided to the DOE Office of Environmental Management, other DOE

offices, and other stakeholders to support decision making. These decisions include cleanup programs under CERCLA, the Resource Conservation and Recovery Act, and other critical stakeholder programs.

Other programs, such as the Office of Legacy Management, must monitor environmental samples for residual analytes. The analytes must be reported accurately when present near method detection limits for these sites. MAPEP includes special tests, such as false positives and sensitivity tests at or near the detection limits to evaluate laboratories’ performance close to detection limits. These special tests are especially crucial for the long-term monitoring of remediated sites. The radiological analyte activities at these sites are continually monitored for any increases that would indicate a breach of radioactive containment. The specialized tests included in MAPEP’s test sessions are:

- False Positive Testing.
- Sensitivity/False Negative Testing.
- Unique Isotopic Ratios.
- Varying matrices and concentrations.
- Natural matrices (soil, surface/groundwater).

4.4 MAPEP Proficiency Testing Identifies Quality Concerns

Laboratories participating in the MAPEP are continually reviewed and evaluated for their historical performance. Performance is evaluated over the last three test sessions and within each test session for each standard matrix. Beginning in September 2011 with Series 24,

MAPEP started issuing “Not Acceptable” performance for analytes that were not reported in that series but were reported in previous series. This practice was instituted because certain laboratories were not reporting analytes to avoid “Not Acceptable” performance when they suspected a sensitivity test was being evaluated. If an analytical data quality problem is identified, RESL issues a Letter of Concern (LOC) to help participants identify, investigate, and resolve potential quality issues.

MAPEP issued more than 600 LOCs over the past three test sessions to multiple laboratories for PT failures on multiple matrices. The majority of concerns issued were to state and national laboratories, including DOE onsite analytical laboratories.

As part of the DOECAP/MAPEP interactive cooperation, when a DOECAP audited laboratory fails PTs for the same analyte on sequential rounds of testing, a Priority I Finding is issued and immediate corrective actions are required. MAPEP plays a crucial role in identifying analytical problems that are otherwise difficult to recognize and assists laboratories in correcting issues before they become a liability to DOE. A memorandum detailing the criteria used for issuing an LOC can also be found at <http://www.inl.gov/resl/mapep>.

4.3 Improved Performance of MAPEP Laboratories

Laboratories participating in MAPEP continue to demonstrate improved performance results for analytes. As an example of improved performance results, graphs for iodine-129 in water and antimony in soil are included in Figures 4.2 and 4.3. Both figures show the improved performance of the laboratories participating in MAPEP.

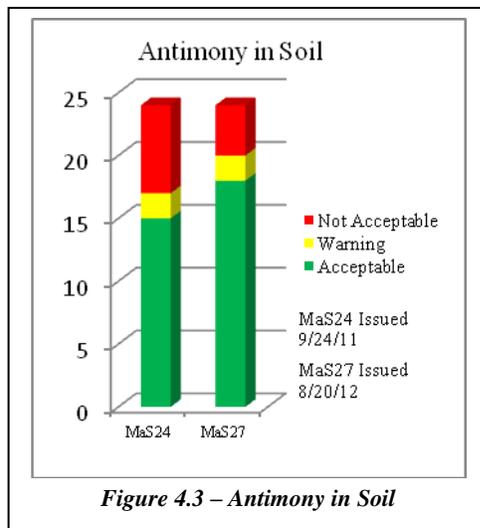


Figure 4.3 – Antimony in Soil

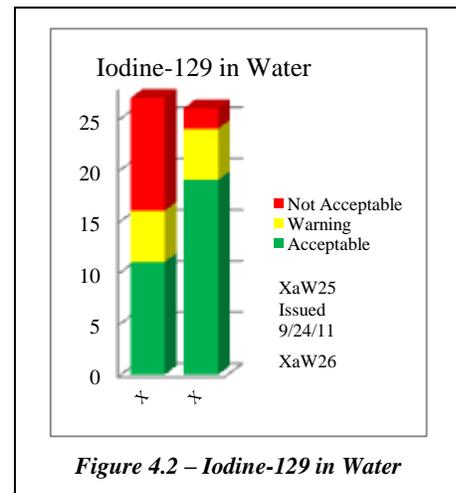


Figure 4.2 – Iodine-129 in Water



4.5 Program Updates

Export Control Agreement Impacts Laboratory Participation in Fiscal Year 2012

Early in 2012, MAPEP initiated an Export Control Agreement requirement on the MAPEP website. Prior to receiving any MAPEP standards, all potential participants were required to log in to the MAPEP system and agree to a re-export statement outlining the sample recipients' responsibilities regarding U.S. export regulations.

Starting early in July, participants were emailed at least three times over the month attempting to inform them of the new MAPEP participation requirement. After multiple email notifications over 2 months, 127 out of 145 potential participants responded and completed the re-export agreement. Overall, MAPEP had a slight decrease in laboratory participation due to Export Control Agreements not being acknowledged by participants in time for series distribution.



Photo 4.3 – Preparing MAPEP Proficiency Testing Standards for International Laboratories

MAPEP Remedial Standards Policy

MAPEP and DOECAP continue to proactively work together to resolve poor laboratory performance. RESL has issued a policy that addresses how laboratories can request remedial MAPEP standards between designated test sessions. Laboratories that have been issued Priority I findings by DOECAP for poor performance in MAPEP validate their laboratory-implemented corrective actions by passing a similar remedial PT test and confirming the problem has been resolved.

RESL Maintained Accreditations to International Standards

RESL maintained its accreditations for International Organization for Standardization (ISO) Standard 17025, *General Requirements for the Competency of Testing and Calibration Laboratories*; ISO Standard 17043, *Conformity Assessment – General Requirements for Proficiency Testing*; and ISO Guide 34 *General Requirements for the Competence of Reference Material Producers*, as verified by the independent American Association for Laboratory Accreditation (A2LA) in 2012. RESL is the only laboratory in the U.S. that holds all three ISO accreditations for extensive radiological, stable inorganic and organic analytes in complex matrices. The RESL accreditation certificates with associated scopes are available on the A2LA website, www.a2la.org, under certificate numbers 2377.01, 2377.02, and 2377.03.

Traceability of RESL to the National Institute of Standards & Technology

RESL currently is recognized as a reference laboratory to NIST and is designated by HSS as the only DOE reference laboratory for environmental analyses. RESL maintains direct radiological traceability to NIST through an Interagency Agreement. The NIST/RESL Radiological Traceability Program 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 RESL scientists' ability both to prepare test materials of known radionuclide activities and to correctly analyze test materials of unknown activities.

Program Promotion/Technical Assistance

MAPEP continues to explore opportunities to promote the program and to demonstrate its relevance to present and future needs of the DOE complex. Opportunities to offer technical assistance to national and international organizations have been and are continuing to be identified. MAPEP continues to provide technical assistance to participating laboratories, which fosters improved performance levels and assisting in meeting Departmental expectations for data quality.

Participation in conferences, workshops, and meetings promotes the importance of laboratory PT analyses, and the presentations, reviews, and updates on MAPEP extend understanding of PT. RESL's staff held a MAPEP Workshop at the 2012 Radiobioassay & Radiochemical Measurements Conference. The workshop was an interactive forum for participants' feedback, and it was well attended, with good customer feedback and discussion. In addition, a tour of the RESL laboratory was provided to the attendees at the 2012 ASP Workshop.



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Appendix A

Fiscal Year 2012 DOECAP-Audited Laboratories	
ACO - B&W Y-12 Analytical Chemistry Organization, Oak Ridge, Tennessee	ALSU - ALS Laboratory Group, Salt Lake City, Utah
ALSC - ALS Laboratory Group, Fort Collins, Colorado	ARS - American Radiation Services, Inc., Port Allen, Louisiana
BCL - BC Laboratories, Inc., Bakersfield, California	CAL - Caltest Analytical Laboratory, Napa, California
CAI - CEBAM Analytical, Inc., Bothell, Washington	ALSO - ALS Laboratory Group, Cincinnati, Ohio
ESO - Eberline Services, Inc., Oak Ridge, Tennessee	ESR - Eberline Services, Inc., Richmond, California
GEL - GEL Laboratories, LLC, Charleston, South Carolina	LLI - Lionville Laboratory, Inc., Exton, Pennsylvania
MBT - Microbac Laboratories, Johnson City, Tennessee	MCL - Materials and Chemistry Laboratory, Oak Ridge, Tennessee
ORISE - Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee	TAR - TestAmerica, Inc., Richland, Washington
SRI - Southwest Research Institute, San Antonio, Texas	TAK - TestAmerica, Inc., Knoxville, Tennessee
SES - Shealy Environmental Services, Inc., Cayce, South Carolina	TAS - TestAmerica, Inc., Earth City, Missouri
SCL - Shealy Consulting, LLC, Lexington, South Carolina	CLS - Center for Laboratory Sciences, Pasco, Washington
TAA - TestAmerica, Inc., Arvada, Colorado	

Fiscal Year 2012 DOECAP-Audited TSDFs	
WCS - Waste Control Specialists, LLC, Andrews, Texas	PFN - Perma-Fix Environmental Services, Richland, Washington
DSSI - Diversified Scientific Services, Inc., Kingston, Tennessee	PFF- Perma-Fix Environmental Services, Gainesville, Florida
EST - EnergySolutions, LLC, Oak Ridge, Tennessee	ESU - EnergySolutions, LLC, Clive, Utah
IMP - IMPACT Services, Inc. Oak Ridge, Tennessee	MEC - Materials and Energy Corporation, Oak Ridge, Tennessee



Appendix B

Excerpts from DOE Order 435.1 and DOE Manual 435.1-1

DOE Order 435.1, *Radioactive Waste Management*, Requirement 4:

- 4c. All radioactive waste shall be managed in accordance with the requirements in DOE M 435.1-1, *Radioactive Waste Management Manual*.

DOE Manual 435.1-1, *Radioactive Waste Management Manual*, Chapter I, Requirement 1.F:

1.F(4) Approval of Exemptions for Use of Non-DOE Facilities.

DOE waste shall be treated, stored, and in the case of low-level waste, disposed of at the site where the waste is generated, if practical; or at another DOE facility. If DOE capabilities are not practical or cost effective, exemptions may be approved to allow use of non-DOE facilities for the storage, treatment, or disposal of DOE radioactive waste based on the following requirements:

- (a) Such non-DOE facilities shall:
1. Comply with applicable Federal, State, and local requirements;
 2. Have the necessary permit(s), license(s), and approval(s) for the specific waste(s); and
 3. Be determined by the Field Element Manager to be acceptable based on a review conducted annually by DOE.
- (b) Exemptions for the use of non-DOE facilities shall be documented to be cost effective and in the best interest of DOE, including consideration of alternatives for on-site disposal, an alternative DOE site, and available non-DOE facilities; consideration of life-cycle cost and potential liability; and protection of public health and the environment.