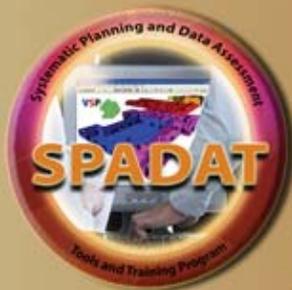




U.S. DEPARTMENT OF
ENERGY



Analytical Services Program

Program Description

March 2016

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



DOE Analytical Services Program Description

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ACRONYMS

ANSI	American National Standards Institute
ASP	Analytical Services Program
ASQ	American Society for Quality
AU	Office of Environment, Health, Safety and Security
COMPASS	Computerization of MARSSIM for Planning and Assessing Site Surveys
Department	U.S. Department of Energy
DOE	U.S. Department of Energy
DOECAP	U.S. Department of Energy Consolidated Audit Program
DQO	Data Quality Objective
EDS	Electronic Data System
EM	Office of Environmental Management
EPA	U.S. Environmental Protection Agency
ESU	EnergySolutions, LLC in Clive, Utah
FY	Fiscal Year
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
MAPEP	Mixed Analyte Performance Evaluation Program
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
NELAC	National Environmental Laboratory Accreditation Conference
NNSA	National Nuclear Security Administration
NRC	U.S. Nuclear Regulatory Commission
PNNL	Pacific Northwest National Laboratory
POC	Point of Contact
Program	U.S. Department of Energy Consolidated Audit Program
PT	Proficiency Testing
QSM	Quality Systems Manual
RAMP	Radiation Protection Computer Code Analysis and Maintenance Program
RESL	Radiological and Environmental Sciences Laboratory
RMCC	Radiation Measurements Cross-Calibration (Project)
TNI	The NELAC Institute
TSDF	Treatment, Storage, and Disposal Facility
U.S.	United States
VSP	Visual Sample Plan

1.0 INTRODUCTION

This program description provides an overview of the Analytical Services Program (ASP) activities for the United States (U.S.) Department of Energy (DOE or Department), including the National Nuclear Security Administration (NNSA). The Office of Environment, Health, Safety and Security (AU), Office of Sustainable Environmental Stewardship, manages the ASP, which is composed of the elements listed below. The term *DOE managers*, as used in this document, refers to managers at all levels in the Department from the Program Offices to the field elements that depend on the services provided by the ASP’s component programs.



- ◆ **U.S. Department of Energy Consolidated Audit Program (DOECAP or Program):**
Ensures that DOE managers receive reliable, high-quality analytical laboratory data for environmental decision-making and that DOE’s radiological and hazardous waste streams which are dispositioned to commercial waste treatment, storage, and disposal facilities (TSDFs) are properly accounted for, treated, and disposed of in compliance with the applicable requirements.
- ◆ **Mixed Analyte Performance Evaluation Program (MAPEP):**
Provides cost-effective environmental proficiency testing (PT) samples to commercial and government-owned/contractor-operated laboratories and evaluates the laboratories’ performance so that DOE managers can have confidence in the analytical data.
- ◆ **Systematic Planning and Data Assessment Tools Program – Visual Sample Plan (VSP):**
Promotes development of sampling plans that identify the optimum locations to collect samples, determine the number of samples needed, and increase the cost-effectiveness of sampling plan development and implementation.

The auditing, PT, and sample planning activities are essential to mission-critical DOE operations, such as ongoing environmental monitoring, environmental remediation, and long-term legacy management and surveillance. The ASP’s component programs reduce DOE’s risks and liabilities by providing quality environmental data as the basis for sound decision-making and ensuring compliant disposition of waste. Appendix A provides excerpts of the requirements in the DOE directives that are directly applicable to the Department’s use of commercial environmental analytical laboratories and waste management TSDFs (i.e., DOE Order 435.1, *Radioactive Waste Management*; DOE Manual 435.1-1, *Radioactive Waste Management Manual*; and DOE Order 414.1D, *Quality Assurance*).

2.0 U.S. DEPARTMENT OF ENERGY CONSOLIDATED AUDIT PROGRAM (DOECAP)

2.1 DOECAP OVERVIEW

DOECAP has a clearly defined mission to improve the quality of environmental and industrial hygiene data provided to DOE by commercial laboratories and to ensure compliant waste management services are provided by commercial vendors. This mission is particularly important given the amount of money that DOE spends each year on these services. For example, DOE’s spending for analytical laboratory and TSDF services was estimated at \$69 million for Fiscal Year (FY) 2015 and \$70.5 million for FY 2016. Thirty-five DOE Program Offices and site/field offices regularly

<p>\$70.5 Million Estimated Spending in FY 2016:</p> <ul style="list-style-type: none"> ◆ TSDFs: \$41.8 million ◆ Laboratories: \$28.7 million



participate in DOECAP, and they are listed in Appendix B. Figure 1 illustrates the components that comprise DOECAP, each of which is vital to the success of the Program.

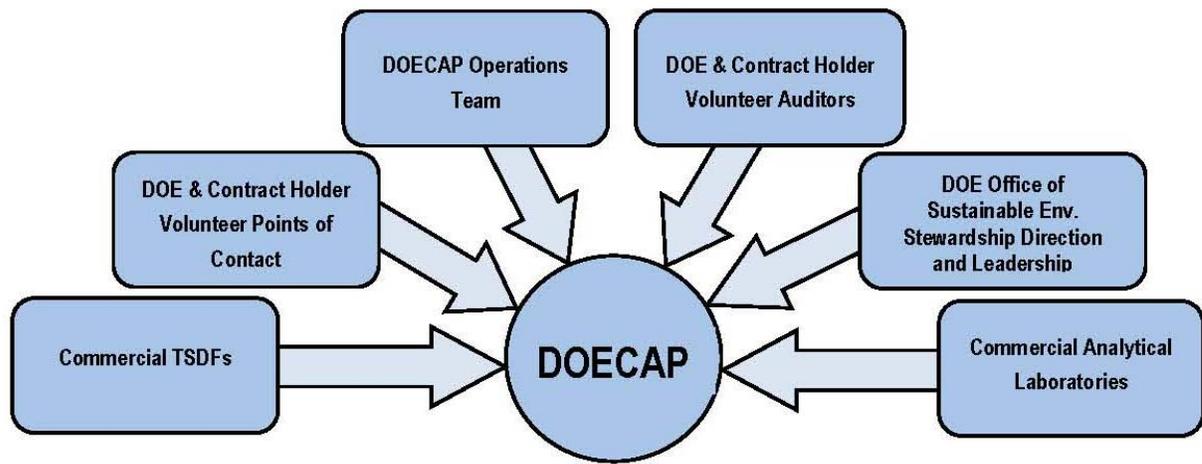


Figure 1. DOECAP Components

2.2 DOECAP AUDITS

2.2.1 Types of Audits

- ◆ **Initial and Continuing Audits:** Laboratories and TSDFs are selected for DOECAP audits based on the facility having multiple DOE contracts (i.e., multiple DOE users) and the amount of money that DOE is spending (or intends to spend) at the facility. In addition, the ASP Manager will consider adding a facility to the DOECAP audit list if specifically requested to do so by a DOE field element manager. Once a facility is added to the audit list, it is audited on a regular basis as long as it continues to hold multiple DOE contracts and DOE continues to spend a significant amount of money for the facility’s services.

The objective of an initial or continuing laboratory audit is to assess the laboratory’s ability to produce data of acceptable, documented quality through analytical operations that follow approved, technically sound methods and to handle DOE samples and analysis-derived waste in a manner that is protective of human health and the environment. The objective of an initial or continuing TSDF audit is to assess the TSDF’s management systems and operational activities and to verify the TSDF’s ability to meet the applicable requirements for storing, handling, transporting, processing, and final disposition of DOE waste and material. The continuing laboratory and TSDF audits also assess the facilities’ implementation of an effective corrective action plan process.

- ◆ **Phased Audits:** In 2014, DOECAP initiated a voluntary phased audit approach for TSDFs. The intent of this change was to: (1) take advantage of the savings from reduced auditor travel costs and (2) use the operational efficiencies gained from this approach to increase the number of facilities that DOECAP audits each year. The phased audit approach is designed to prepare facilities that consistently perform well on DOECAP audits for an audit schedule that alternates a full DOECAP audit one year with a desktop audit the next year as long as the facility maintains good performance. DOECAP considers good performance to include a

robust self-assessment program and a mature issues management program, which are demonstrated when the facility (a) incorporates the DOECAP audit checklist lines of inquiry into its operational activities and its assessment, audit, and surveillance programs and (b) implements meaningful corrective actions that address the root cause(s) and extent of condition associated with findings. A facility's performance on DOECAP audits determines its progress from one phase to the next. DOECAP expanded the phased audit approach to include laboratories in FY 2016.

In FY 2014, EnergySolutions, LLC in Clive, Utah, (ESU) was the first facility to volunteer to participate in a phased audit, and the ESU Phase I audit was a successful effort. During FY 2015, ESU completed a Phase II audit, and DOECAP plans to perform a desktop audit of ESU in FY 2016. Three other TSDFs volunteered in FY 2015 and participated in Phase I audits.

- ◆ **Surveillance Audits:** A surveillance audit is a limited-scope audit conducted prior to the next scheduled DOECAP audit. For example, in FY 2014, DOECAP conducted a laboratory surveillance audit to verify closure of previous DOECAP audit findings so that the Lawrence Livermore National Laboratory could award a contract to that laboratory. In FY 2015, DOECAP conducted a TSDF surveillance audit to verify closure of a Priority I finding.
- ◆ **Closure Audits:** There are two types of closure audits: (1) an audit conducted when a facility goes out of business and (2) an audit conducted when DOE ends its contract(s) with a facility, although the facility continues to provide services to other, non-DOE clients. The laboratory closure audits are conducted to ensure that the laboratory has appropriately transferred archived records and disposed of any remaining DOE samples and derived waste. The TSDF closure audits are conducted to ensure the TSDF has properly disposed of all DOE waste that was shipped to the facility and to ensure appropriate transfer of the records associated with disposal of DOE's waste and material.

2.2.2 DOECAP Audit Checklists

DOECAP has developed the laboratory and TSDF audit checklists below. The checklists are based on the applicable requirements from federal regulations and national consensus standards. The audit checklists are revised each year, as needed, to incorporate new and revised regulations and consensus standards. The revised checklists are provided to the auditor cadres for review before being finalized. As the audit cycle progresses, the auditors provide suggested changes to improve the usability of the checklists and to identify newly revised consensus standards.

Laboratory Audit Checklists

- | | |
|---|---|
| ◆ Checklist 1, <i>Quality Assurance Management Systems and General Laboratory Practices</i> | ◆ Checklist 6, <i>Hazardous and Radioactive Materials Management</i> |
| ◆ Checklist 2, <i>Data Quality for Organic Analyses</i> | ◆ Checklist 8, <i>Data Quality for Special Biological Analyses - Aquatic Toxicity</i> |



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- ◆ Checklist 3, *Data Quality for Inorganic Analyses*
- ◆ Checklist 4, *Data Quality for Radiochemistry Analyses*
- ◆ Checklist 5, *Laboratory Information Management Systems/Electronic Data Management*
- ◆ Checklist 9, *Data Quality for Nondestructive Assay*
- ◆ Checklist 10, *Laboratory Closure*

TSDF Audit Checklists

- ◆ Checklist 1, *Quality Assurance*
- ◆ Checklist 2, *Sampling and Analytical Data Quality*
- ◆ Checklist 3, *Waste Operations*
- ◆ Checklist 4, *Environmental Compliance and Permitting*
- ◆ Checklist 5, *Radiological Control*
- ◆ Checklist 6, *Industrial and Chemical Safety*
- ◆ Checklist 7, *Transportation Management*
- ◆ Checklist 8, *Agency Review*

2.2.3 DOECAP Laboratory and TSDF Auditor Cadres

DOECAP's success depends on each of the participants (DOE Program offices, site/field offices, and contractors) providing a fair share of auditor resources to conduct the audits. Serving on DOECAP audits benefits the auditors and their employers by enhancing the auditors' skills (e.g., conducting audits, completing audit checklists, and reviewing corrective actions for adequacy) and providing them with valuable experience that can be put to use at their home sites.

Maintaining the staffing level of the DOECAP auditor cadres is one of the Program's major challenges. The number of qualified auditors varies from year to year and typically ranges between 50 to 60 individuals for laboratory audits and 50 to 75 individuals for TSDF audits. Each year, DOECAP must identify new auditors among the Program participants to stay ahead of losses due to retirement and job changes.

2.2.4 National Consensus Standards Development and Revision

All of the DOECAP audit checklists include requirements from national consensus standards. For that reason, DOECAP supports development of practical, cost-effective national consensus standards that are consistent with federal policy and meet the needs of DOE and other U.S. users. The DOECAP Operations Team members and the ASP Manager routinely participate in committees sponsored by The National Environmental Laboratory Accreditation Conference (NELAC) Institute (TNI) to revise the TNI standards that are of interest to DOE and which apply to DOECAP-audited laboratories, including:

- ◆ EL-V1-2012, *Quality Systems for Radiochemical Testing*, Module 6
- ◆ EL-V3-2011, *General Requirements for Environmental Proficiency Test Providers*

- ◆ EL-V4-2009, *General Requirements for an Accreditation of Environmental Proficiency Test Providers*

The ASP Manager is a member of the TNI Laboratory Accreditation System Executive Committee and an ex-officio member of the TNI Board of Directors. The ASP Manager and the DOECAP Operations have successfully promoted DOE’s auditing and PT policies for inclusion in TNI standards (e.g., TNI EL-VI-2009, Volume 1, *Management and Technical Requirements for Laboratories Performing Environmental Analysis*, Module 1, “Proficiency Testing”), as well as promoting implementation of biannual proficiency evaluations for laboratories versus annual evaluations, promoting the requirement for laboratories to perform causal analysis as part of the facility’s corrective action response to findings, and providing guidance for development of limit of quantitation and limit of detection requirements.

2.3 DOECAP PUBLIC-ACCESS AND RECORDS MANAGEMENT WEBSITES

2.3.1 DOECAP Public Access Website

The DOECAP External Website (http://www.p2s.com/?page_id=1526) provides access to Program documents that can be made publicly available, such as the joint U.S. Department of Defense/DOE *Consolidated Quality Systems Manual (QSM) for Environmental Laboratories*, blank DOECAP audit checklists, and other Program documents.

2.3.2 SharePoint Electronic Data System (EDS)

The EDS is available to DOECAP participants via the Internet, and it provides DOECAP’s document control and records archive capabilities. The Operations Team posts DOECAP audit reports and corrective action plans in EDS, and these documents are classified as Official Use Only. DOE employees and DOE contractor personnel must formally request access to EDS and receive authorization from the DOE Office of Science Information Technology organization.

2.4 BENEFITS FROM PARTICIPATING IN DOECAP

Table 1 lists the benefits that DOECAP provides to the Program participants, which are discussed in the following subsections.

Table 1. Benefits from DOECAP

◆ Improved audit efficiency	◆ Reduced cost for audits
◆ Enhanced audit quality	◆ Improved data quality
◆ Improved communication	◆ Shared lessons learned
◆ DOE directives compliance	◆ Improved auditor skills
◆ Decreased risks and liabilities for DOE	◆ Increased worker safety at audited facilities



2.4.1 Improved Audit Efficiency and Reduced Costs for Audits

Before DOECAP was implemented, each DOE site had to staff its own audit teams and send them out to conduct every required audit. This resulted in up to *23 audit teams visiting a single laboratory* and *20 audit teams visiting a single TSDF* each year across the DOE Complex. The teams would perform the necessary oversight reviews to assure that DOE was receiving high-quality analytical laboratory data and compliant waste management services.

Instead of 43 reviews and 43 reports, DOECAP provides a single team, a single review, and a single report for each site annually. The DOE site managers, DOE contractors, and DOECAP points of contact (POC) receive their facility's final audit report. Streamlining the review and audit process by eliminating more than 170 redundant audits, generates \$7.2 million in cost savings to DOE Program Offices / sites. Additional cost savings are realized in time and expense associated with hosting such a large number of audit teams.

2.4.2 Enhanced Audit Quality

DOECAP provides a consistently high level of audit quality by using:

- ◆ DOECAP-trained and qualified audit teams
- ◆ Standardized audit checklists
- ◆ A well-established, formalized audit process
- ◆ A centralized, dedicated computer system for records (SharePoint EDS)
- ◆ Centralized support functions that are provided by the DOECAP Operations Team, including the following:
 - ✓ Scheduling and staffing the audits
 - ✓ Obtaining document packages from the audited facilities so that the auditors can review the documents and prepare prior to the start of each audit
 - ✓ Providing a standardized audit report format and technical/editorial support for the reports
 - ✓ Distributing the final audit reports after they are approved by the ASP Manager
 - ✓ Tracking the audit findings to closure
 - ✓ Qualifying and training auditor and lead auditor candidates

2.4.3 Improved Laboratory Data Quality and Decreased TSDF Risks for DOE

DOECAP's laboratory and TSDF audits provide DOE managers with mission-critical information about the risks and liabilities associated with contracted facilities' services.

- ◆ **Laboratory Analytical Data Quality:** Some of the risks and liabilities associated with poor laboratory data quality are the loss of public trust and credibility, noncompliance with regulatory and permit requirements, failure to meet milestones/goals for site cleanup, and the potential for litigation that could drive up DOE's costs and delay project schedules. In addition, poor quality laboratory data could cause DOE to issue inaccurate or biased environmental reports because those reports were based on flawed data. DOECAP laboratory audits include the primary analytical services that are provided to DOE (e.g., organic, inorganic, and/or radiochemical analyses). In addition, the audit team reviews the status of the laboratory's liability insurance and its coverage for unexpected facility closure.

- ◆ **TSDF Risk Management:** Some of the risks associated with the use of inadequate, noncompliant waste vendors are: (1) the potential for increased risk of radiological or other hazardous exposures to the TSDF's personnel and the nearby public, (2) the loss of public trust for using a TSDF that failed to manage waste in compliance with its permits, and (3) increased liability for the Department due to using an uninsured waste vendor that abruptly goes out of business. Therefore, DOECAP TSDF audits include a review of the facility's industrial and chemical safety programs, the radiation protection program (where applicable), waste operations, and transportation operations. The audits include interviews with regulators and a review of the regulators' files to identify any issues or concerns about the TSDF's compliance with its permits. The audit team also reviews the status of the TSDF's liability insurance and its coverage for unexpected facility closure.

2.4.4 Increased Worker Safety at DOECAP-Audited Laboratories and TSDFs

Auditing the worker safety programs at DOE's contracted laboratories and TSDFs helps reduce DOE's potential liability and risk of litigation, especially for those activities associated with environmental analysis and disposition of hazardous and radioactive waste and material. DOECAP laboratory audits include the use of an audit checklist that is specific to laboratory hazardous and radiological materials management programs, which helps ensure the safety and health of the personnel working at the audited facility. DOECAP TSDF audits include the use of an audit checklist that is specific to the industrial and chemical safety programs, and for TSDFs that manage DOE's radioactive waste, DOECAP uses an audit checklist that is specific to the radiation protection program.

2.4.5 Improved Communication and Shared Lessons Learned Among DOECAP Participants

DOECAP Conference Calls

DOECAP has established laboratory and TSDF POCs at the various Program Offices, site/field offices, and contractors across the DOE Complex. These POCs participate in conference calls every other week that are held by the DOECAP Operations Team. These calls are used to update DOECAP participants on the results from recently completed audits, the schedule for upcoming audits, etc. DOECAP auditors are also invited to participate in these calls.



When significant findings (i.e., Priority I findings) are identified that might severely impact DOE's operations, the ASP Manager notifies the POCs so that the contract holders for the affected laboratory or TSDF can take appropriate action. Sharing the DOECAP audit findings and lessons learned with the Program participants allows information identified at one DOE site to be applied to similar activities at other sites, including the on-site laboratories and waste management programs. The conference calls promote participation in the Program and assist in identifying auditors to serve on upcoming DOECAP audits.

Annual ASP Workshop

The DOE AU Office of Sustainable Environmental Stewardship sponsors the annual ASP Workshop to foster continuous improvement and communication, which includes sharing lessons learned providing feedback on the ASP. The ASP Workshop agenda includes presentations on the most common DOECAP laboratory and TSDF findings, MAPEP PT results and trends, and VSP field applications. In addition, there is usually intergovernmental participation from other agencies, such as the U.S. Department of Defense, the U.S. Environmental Protection Agency (EPA), the U.S. Department of Homeland Security, etc. The DOECAP Operations Team provides training sessions for lead auditors and auditors.

The ASP Workshop is held in September each year, and approximately 100 individuals attend from across the DOE Complex and from the DOECAP-audited laboratories and TSDFs. The DOECAP Operations Team strives to select venues that will provide easy access and reasonable travel costs from across the U.S.

2.4.6 Compliance with DOE Directive Requirements

Certain DOE directive requirements are directly applicable to the Department's use of commercial environmental analytical laboratories and waste management TSDFs. Appendix A provides excerpts from these directives.

- ◆ **Radiological TSDF Audits:** DOE Manual 435.1-1, *Radioactive Waste Management Manual*, requires DOE field managers to approve the use of non-DOE facilities for radiological waste management, and to review the TSDF's performance annually. DOECAP's TSDF audits assess the TSDF's management systems and operational activities to verify its ability to meet the regulatory and DOE applicable requirements.
- ◆ **Laboratory and Nonradiological TSDF Audits:** DOE Order 414.1D, *Quality Assurance*, requires DOE to: (1) achieve a high level of quality for all work based on thorough, rigorous assessments and effective corrective actions and (2) evaluate subcontractor, vendor, and supplier activities to ensure they meet the applicable quality assurance requirements. DOECAP audits are a cost-effective means that DOE field managers can use to meet these requirements.

2.4.7 Improved Auditor Skills

By participating in audits of commercial facilities, DOECAP auditors have opportunities to enhance their capabilities and auditing skills (e.g., interviewing, identifying deficiencies, report writing). This valuable experience is then put to use for the auditors' employers to improve on-site environmental monitoring and

surveillance audits, environmental management system audits, integrated safety management verifications, self-assessments, etc. A number of DOE sites have adopted DOECAP's audit checklists and/or report templates and modified them for their own use. In addition, DOECAP participants become part of knowledge pool that all of them can draw on to help solve problems, located needed resources, and share lessons learned.

3.0 MAPEP

3.1 MAPEP OVERVIEW

MAPEP is a PT program for environmental analytical laboratories that provide services to DOE, and it is managed by the DOE Radiological and Environmental Sciences Laboratory (RESL). The DOE Office of Nuclear Energy provides programmatic funding and oversight for RESL's operations. AU provides technical guidance and assistance on MAPEP implementation matters.

RESL provides MAPEP PT samples in four media (water, soil, air filters, and vegetation), and the samples contain radionuclides, organics, and/or inorganics traceable to the U.S. National Institute of Standards and Technology. Twice a year, RESL distributes MAPEP PT samples. The laboratories have 60 days to analyze the samples and provide their results to RESL. Approximately one month later, RESL posts the results on the secure MAPEP website. RESL's independence from the laboratories ensures a fair evaluation of the PT results. In addition, RESL monitors the types of analyses performed by the participating laboratories and varies the formulation of the MAPEP PT samples accordingly.

Thanks to DOE's sponsorship of MAPEP, RESL is able to provide PT samples and analyze performance for the participating laboratories free of charge. About 140 laboratories have participated in MAPEP testing with about 65% U.S. analytical laboratories and 35% international laboratories. The U.S. laboratories directly or indirectly support DOE's missions and/or interests or other agency missions. International participation in MAPEP supports the U.S. Government's relationships with other nations via scientific exchange and improved analytical measurements.

3.2 RESL'S ACCREDITATIONS

RESL is accredited by the American National Standards Institute – American Society for Quality (ANSI-ASQ) National Accreditation Board as a PT provider and as a certified reference material provider:

- ◆ International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) 17025:2005, *General Requirements for the Competence of Testing and Calibration Laboratories*
- ◆ ISO/IEC 17043:2010, *Proficiency Testing Provider Accreditation Program*
- ◆ ISO Guide 34:2009, *General Requirements for the Competence of Reference Material Producers*



3.3 BENEFITS FROM PARTICIPATING IN MAPEP

3.3.1 PT Samples with Mixed Analytes in Real-World Sample Matrices

MAPEP is the only PT program that provides mixed analytes in real-world sample matrices. Commercial PT samples are used to test the laboratories' analytical proficiencies within very narrow bounds. For instance, commercial PT samples are frequently provided with only a specified group of analytes in a solution that has been diluted into deionized or distilled water or has been spiked onto clean sand. The commercial PT samples do not contain multiple analytes in the same sample like MAPEP samples, nor do they contain materials that interfere with the analysis, as is common in real-world environmental samples.

3.3.2 Improved Reliability and Credibility of Analytical Results Used for DOE's Environmental Management Decisions

MAPEP's primary objective is to foster the reliability and credibility of the analytical results used in DOE's decision-making processes, particularly with regard to decisions regarding the Department's radiological protection programs, environmental remediation and monitoring programs, and long-term stewardship surveillances. MAPEP PT samples test the laboratories' entire analytical process, and RESL evaluates the laboratories' performance with regard to:

- ◆ Analytical measurement accuracy
- ◆ Identification of false positives
- ◆ Measurement sensitivity/failure to detect
- ◆ Dissolution of the chemical forms of the analyte
- ◆ Analysis of the analyte in the presence of chemical interferences

RESL evaluates the laboratories' performance according to the criteria in the *Handbook for the Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP)*, which is available at <http://www.id.energy.gov/resl/mapep/handbookv15.pdf>.

The RESL staff provides a full performance evaluation for each MAPEP PT series directly to DOE Headquarters, DOE field elements, and the DOECAP Operations Team. The reports describe the participating laboratories' performance, point out marginal or poor performance, and delineate those laboratories that did not report results. RESL also provides information regarding the laboratories' PT performance issues during the MAPEP portion of the DOECAP laboratory conference calls.

3.3.3 Improved Laboratory Performance

One of the RESL staff’s favorite sayings is “Participation improves performance,” and a look at the MAPEP results illustrates their point. RESL includes a new test with each MAPEP series. Some of the laboratories have difficulty with the new challenge, but as shown by the results discussed below, the laboratories rally, ask for technical assistance from RESL when they need it, and improve their performance in subsequent MAPEP PT series.

Iodine-129 in Water: Figure 2 illustrates the MAPEP participating laboratories’ progress over time in tests for iodine-129. Starting with MAPEP Series 25, RESL began including a PT sample for determination of iodine-129 in water. Many of the laboratories initially had difficulty with this test, but by MAPEP Series 28, most of the laboratories had significantly improved their performance.

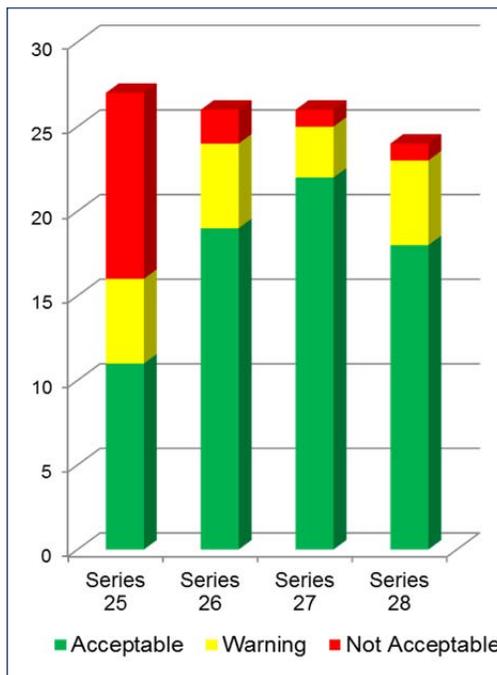


Figure 2. Laboratories’ Performance for Determination of Iodine-129 in Water for MAPEP Series 25–28

False Positive Tests: RESL has been including false positive tests in the MAPEP PT series for several years. Figure 3 illustrates the improvement in the laboratories’ performance between MAPEP Series 31 and Series 32 with regard to the false positive test for antimony in water.

3.3.4 Access to Reports and Laboratory Results via the MAPEP Website

RESL maintains both publicly accessible and secure MAPEP websites. The public MAPEP website is located at <http://www.id.energy.gov/resl/mapep/map.ep.html> and the secure, password-protected website is located at <https://mapep.inl.gov>.

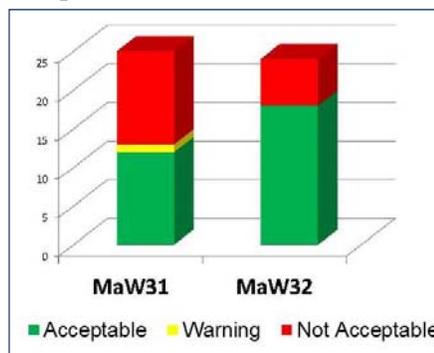


Figure 3. Summary of the MAPEP Series 31 and 32 Results of False Positive Tests for Antimony in Water

The laboratories use the secure MAPEP website to report their analytical results, view their individual performance reports, and trend historical performance by analyte. Stakeholders such as the DOE Program Offices, site/field offices, regulators, DOECAP auditors, and the DOECAP Operations Team also receive access to the secure MAPEP website. This access



allows them to view the laboratories' performance data and to run queries for historical trending by analyte and/or matrix.

3.4 MAPEP'S LINK TO DOECAP

When RESL posts the results for a MAPEP test series, the performance of the DOECAP-audited laboratories is reviewed. These laboratories comprise approximately one-third of the U.S. laboratories that participate in MAPEP. If RESL's performance evaluation identifies a laboratory's PT results as "Not Acceptable" for two or more consecutive PT rounds (single or multiple analytes), DOECAP issues an interim Priority I or Priority II finding to that laboratory. The priority level of the finding depends on the severity of the problem. In response to a DOECAP finding, the laboratory is required to develop a corrective action plan, which is tracked to closure. The DOECAP Operations Team is authorized to ask RESL to issue remedial MAPEP PT samples to DOECAP-audited laboratories as part of the corrective action implementation process.

3.5 INTERNATIONAL PARTICIPATION IN MAPEP

There is a continuing concern in the Middle East and North Africa about improving the radiological and inorganic analytical capabilities of the region's laboratories. Iran recently brought a nuclear power plant on line, and several other countries in this region are in the planning stages or are actively developing nuclear power reactors and/or research reactors. Thus, there is a strong need for reliable, defensible baseline radiological data, as well as data on inorganic contaminants, such as metals, that could enter the food chain. MAPEP offers a credible means for international laboratories to test and measure their skill at analyzing environmental pollutants, which will give the laboratories (and their clients) greater confidence in the quality of their environmental data quality and data trending.



The Radiation Measurements Cross-Calibration Project (RMCC), which is coordinated by the Middle East Scientific Institute for Security in Amman, Jordan, strives to improve performance and develop standards for laboratory analytical measurement capabilities. The RMCC Project encourages all of the nations that join it to stress participation in MAPEP to their laboratories as a way to improve performance. The U.S. participates in the RMCC Project via sponsorship from the NNSA's Office of International Nuclear Safeguards and Engagement Program. The funding enables the participation of the ASP Manager and subject matter experts from Sandia National Laboratories.

The RMCC Project conducts annual workshops to provide training on relevant topics, such as laboratory management, quality assurance, radiochemistry, mass spectrometry, and gamma spectroscopy. An ASP representative attends the workshops, and the presentations focus on improving analytical laboratory data quality. The presentations include a discussion of recent MAPEP PT results and the most common DOECAP laboratory audit findings, since the laboratories in the RMCC Project's member nations may have similar applications. The ASP also provides the DOECAP laboratory audit checklists and the ASP annual reports for inclusion on the RMCC Project's website at <http://rmccnetwork.net/en>.

4.0 VSP

4.1 INTRODUCTION

The Pacific Northwest National Laboratory (PNNL) manages VSP for DOE. Sampling occurs on all DOE sites for a variety of purposes, and the VSP software developed by the DOE Systematic Planning and Data Assessment Tools Program is an easy-to-use tool that supports development of defensible sampling plans based on statistical sampling theory and data quality objectives (DQO). VSP couples site, building, and sample location graphics with optimal sampling design and statistical analysis strategies to help users ensure that they collect the right type, quantity, and quality of data. VSP also provides statistical analysis of the results to support confident decision-making. VSP's applications include the following:



- ◆ Decontamination and decommissioning, environmental characterization, and remediation
- ◆ Environmental monitoring and stewardship, including long-term legacy and groundwater monitoring
- ◆ Response to and recovery from an indoor or outdoor chemical/biological/ radiological terrorist event
- ◆ Sampling plans for items, buildings, soil, groundwater, sediment, surface water, and subsurface layers
- ◆ Identification, delineation, and footprint reduction of high-contamination regions through transect sampling (e.g., unexploded ordnance sites and radiological contamination sites)

4.2 BENEFITS FROM USING VSP

4.2.1 VSP is Free and Easy to Use

VSP is available for free download at <http://vsp.pnnl.gov>. This program is easy to use, and it is highly visual. VSP will run on any personal computer that has a Microsoft Windows operating system (XP, Vista, Windows 7, Windows 8, and Windows 10). VSP is primarily designed to be easy for users that do not have expertise in statistics.

The VSP website provides information about the VSP modules, as well as links to other sites that provide software for use in contaminated site cleanup. Online help and technical documentation on the statistical methods are available. Users can download the VSP user's guide by individual chapter or as a complete file at <http://vsp.pnnl.gov/docs/PNNL-23211.pdf>.

4.2.2 VSP's Real-time, Cost-Benefit Tradeoff Information Can Decrease Sampling and Analytical Costs

VSP provides users with real-time, cost-benefit tradeoff evaluations based on the projected number of samples, total sampling costs, and sampling locations, which allows users to select the option that provides just enough sampling to obtain a defensible answer. Users can create sampling plans that fill in gaps for sites where samples have been taken in the past.



4.2.3 VSP Contains Features to Assist *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) Users

Most DOE sites implement MARSSIM radiological characterization procedures to verify site cleanups or conditions. Version 7.4 of VSP, integrated the Computerization of MARSSIM for Planning and Assessing Site Surveys (COMPASS) software, which facilitates the use of MARSSIM procedures. The software was developed by the Oak Ridge Institute for Science and Education. The COMPASS features in VSP include: (1) gross activity calculations, (2) elevated measurement comparison, (3) individual radionuclide or series selection and (4) support for building surfaces and surface soil. Users can download the COMPASS software at:

<http://www.marssim.com/Tools.htm>

Figure 4 provides examples of VSP's room and furniture design features. The MARSSIM guidance stipulates that the maximum surface area is based on class. For example, Class 1 areas within buildings are equal to or less than 100 square meters. To further assist MARSSIM users, PNNL also added sample area/room partitioning based on size. This VSP feature can automatically partition rooms or sample areas based on either maximum size or minimum number of partitions, and the user can specify the angle of division and shape of the partitions.



Figure 4. Example of VSP's Room Design Feature

4.2.4 VSP Can Streamline Sampling Plan Acceptance by Regulatory Agencies

VSP implements DQO process for sample collection and decision-making, which is part of the reason that VSP is so well accepted by regulators. The DQO process enables VSP users to achieve the desired risk limit at a minimum cost.

To defend a sampling plan to a regulator concerned about safety or to a citizens' group concerned about saving taxpayer dollars requires balancing cost and risk. In this context, "defensible" means that sufficient samples are taken in an unbiased way so that DOE can make a decision, obtain a sufficiently precise estimate of a key statistic, or declare an area free of contamination with a stated level of confidence. VSP has achieved wide acceptance from regulatory agencies, and its use is often recommended for minimizing cost and sampling requirements while maximizing the available information. Examples of regulatory agencies that recommend VSP are as follows:

- ◆ **EPA:** The EPA webpage titled, "Resources for Planning New Data Collections" at <http://www2.epa.gov/quality/resources-planning-new-data-collections> includes a section on, "Software for Estimating Sample Sizes and Locations" that lists VSP and states VSP is a simple, defensible tool for defining an optimal,

technically defensible sampling scheme for site characterization. VSP is applicable for any two-dimensional sampling plan including surface soil, building surfaces, water bodies, or other similar applications.

◆ **U.S. Nuclear Regulatory Commission (NRC):**

- ✓ A publicly available, internal NRC memorandum from the Director, Division of Systems Analysis, Office of Nuclear Regulatory Research, dated June 6, 2014, states: “VSP is used by NRC staff, Agreement States, licensees, and contractors to ensure confident statistically defensible decisions at a variety of facilities. The code has been successfully developed and maintained by PNNL for use by the NRC and its contractors for many years.” This memorandum can be viewed or downloaded at <http://pbadupws.nrc.gov/docs/ML1415/ML14154A402.pdf>.
- ✓ On October 24, 2014, the NRC Executive Director for Operations issued SECY-14-0117, *The Radiation Protection Computer Code Analysis and Maintenance Program* (RAMP), which describes the NRC’s integrated plan for developing, maintaining, and distributing the NRC’s radiation protection, dose assessment, and emergency response computer codes. VSP is one of the codes recommended by RAMP, which can be viewed or downloaded at <http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2014/2014-0117scy.pdf>.

4.3 VSP TRAINING AND SOCIAL MEDIA SITES

4.3.1 VSP Training is Offered in the Classroom and via YouTube

The VSP website provides information about upcoming VSP training courses. PNNL posts step-by-step VSP training videos on YouTube. For example, PNNL posted 19 VSP instructional videos on YouTube during FY 2015.

4.3.2 VSP’s Social Media Sites

VSP joined social media during FY 2015 when PNNL set up VSP pages on YouTube, LinkedIn, and Facebook. As noted above, VSP provides training videos on YouTube, and the VSP LinkedIn and Facebook pages enable users to easily obtain information about upcoming enhancements and new modules, provide feedback, and ask questions.



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APPENDIX A
EXCERPTS FROM DOE ORDER 435.1, DOE MANUAL 435.1-1,
AND DOE ORDER 414.1D

DOE Order 435.1, Radioactive Waste Management	
Paragraph 4a	“DOE radioactive waste management activities shall be systematically planned, documented, executed, and evaluated.”
Paragraph 4c	“All radioactive waste shall be managed in accordance with the requirements in DOE M 435.1-1, <i>Radioactive Waste Management Manual</i> .”
DOE Manual 435.1-1, Radioactive Waste Management Manual, Chapter I	
Paragraph 2F(4)	<p><u>Approval of Exemptions for Use of Non-DOE Facilities</u>: “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:</p> <p>(a) Such non-DOE facilities shall:</p> <ol style="list-style-type: none"> 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. <p>(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.”</p>
DOE Order 414.1D, Quality Assurance	
Paragraph 1a	“To ensure that Department of Energy (DOE), including National Nuclear Security Administration (NNSA), products and services meet or exceed customers’ requirements and expectations.”
Paragraph 1b(3)	“To achieve quality for all work based upon the following principles: Performance and quality improvement require thorough, rigorous assessments and effective corrective actions.”
Paragraph 3b	“Except for the equivalencies and exemptions in paragraph 3.c., this CRD must be included in contracts for the management or operation of a DOE-owned or –leased facility (i.e., those contracts that include the clause at 48 C.F.R. (DEAR) 970.5204-2, laws, regulations and DOE directives) that require or involve responsibility for work that affects or may affect DOE sites, facilities, programs or activities (including work that may take place outside the physical boundaries of a DOE facility, such as design or analytical services). For all other contracts involving or requiring this type of work, the applicable requirements set forth in the CRD must be included in the contract terms and conditions.”
Attachment 1, Paragraph 2e	<u>Contractor Requirements Document</u> : “For subcontractor, vendor, and supplier activities that are not governed by the contractor’s DOE-approved QAP, evaluate their program to ensure they meet applicable QA requirements.”



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**APPENDIX B
DOE PROGRAMS AND SITES THAT REGULARLY
PARTICIPATE IN DOECAP**

Headquarters Program Offices	
Office of Environment, Health, Safety and Security (AU)	Office of Energy Efficiency and Renewable Energy
Office of Environmental Management (EM)	National Nuclear Security Administration (NNSA)
Office of Fossil Energy	Office of Nuclear Energy
Office of Legacy Management	Office of Science
Field and Site Offices	
Argonne National Laboratory Argonne Site Office	Brookhaven National Laboratory Brookhaven Site Office
Fermi National Accelerator Laboratory Fermi Site Office	Hanford Site Office of River Protection
Hanford Site Richland Operations Office	Idaho National Laboratory Idaho Operations Office
Lawrence Berkeley National Laboratory Berkeley Site Office	Lawrence Livermore National Laboratory Livermore Field Office
Los Alamos National Laboratory NNSA Los Alamos Field Office	Los Alamos National Laboratory EM Los Alamos Site Office
National Renewable Energy Laboratory Golden Field Office	Nevada National Security Site Nevada Field Office
Oak Ridge National Laboratory Oak Ridge National Laboratory Site Office	Oak Ridge Reservation Oak Ridge EM
Oak Ridge Office Integrated Support Center	Pacific Northwest National Laboratory Pacific Northwest Site Office
Paducah Site Portsmouth/Paducah Project Office	Pantex Plant NNSA Production Office
Portsmouth Site Portsmouth/Paducah Project Office	Sandia National Laboratories Sandia Field Office
Savannah River Site Savannah River Operations Office	Separations Process Research Unit EM Consolidated Business Center
SLAC National Accelerator Laboratory SLAC Site Office	Thomas Jefferson National Accelerator Facility, Thomas Jefferson Site Office
Transuranic Waste Processing Center Oak Ridge EM	West Valley Demonstration Project EM Consolidated Business Center
Y-12 National Security Complex NNSA Production Office	



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