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FINAL SAMPLING AND ANALYSIS PLAN NAS BRUNSWICK ME
10/01/2014
TETRA TECH EC INC

**SAP Worksheet #1 – Title and Approval Page**

# FINAL

# SAMPLING AND ANALYSIS PLAN
## (Field Sampling Plan and Quality Assurance Project Plan)
## October 2014

**RADIOLOGICAL REMEDIATION/ASSESSMENT**
**FORMER NAVAL AIR STATION BRUNSWICK**
**CUMBERLAND COUNTY, MAINE**

**Prepared for:**
Department of the Navy
Naval Facilities Engineering Command, Atlantic
9742 Maryland Avenue
Norfolk, VA 23511-3095

and

Base Realignment and Closure
Program Management Office, Northeast
4911 South Broad Street
Philadelphia, PA 19112-1303

**Prepared by:**
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**Prepared under:**
Contract No. N62470-13-D-8007
DCN: 4659-WE09-14-0489
CTO No. WE09

Review Signature: ______________________ 10/02/14
Greg Joyce — Date
TtEC Quality Control Program Manager

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# EXECUTIVE SUMMARY

Tetra Tech EC, Inc. (TtEC) has prepared this Sampling and Analysis Plan (SAP) to provide guidance on sampling, analysis, and quality control (QC) in support of radiological survey and remediation activities at former Naval Air Station (NAS) Brunswick for the United States Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Atlantic under a Remedial Action Contract, N62470-13-D-8007, Contract Task Order (CTO) WE09. The quality assurance (QA)/QC elements in this SAP were prepared in accordance with the U.S. Environmental Protection Agency (EPA) Uniform Federal Policy for Quality Assurance Project Plans (EPA 2005) and Requirements for Quality Assurance Project Plans, EPA QA/R-5, QAMS (EPA 2006a) to ensure that all data collected are precise, accurate, representative, complete, and comparable to meet their intended use.

During this CTO, TtEC will perform a variety of project tasks at various sites at NAS Brunswick, which involve radiological, munitions, and other environmental related investigation and remediation tasks. This SAP will only discuss sites associated with radiological remediation activities. Some of these sites may also have munitions or chemical remediation activities associated with them, but the sampling and analysis requirements for munitions and/or chemical constituents will be discussed in a separate SAP. The intent of this SAP is to be a stand-alone document that will be used to describe sampling and analysis requirements associated with radiological remediation.

## BACKGROUND

NAS Brunswick is located in Cumberland County, Maine approximately 25 miles north of Portland and 31 miles south of Augusta, Maine (Figure 2-1). The Main Station lies between the Androscoggin River to the north and Casco Bay to the south and at one time encompassed approximately 3,200 acres. NAS Brunswick was officially closed in 2011 in accordance with 2005 Base Realignment and Closure Act. As of December 2013, approximately 80 percent of the property has been transferred out of Navy control. All sites being addressed in this SAP (Figure 2-2) are currently on Navy-owned property. NAS Brunswick no longer maintains a security presence, but has a Caretaker Site Office (CSO) presence through designation of a Caretaker Site Officer.

The Historical Radiological Assessment (HRA) was revised in 2013 and finalized in March 2014. Sites described in SAP Worksheet #10 that are listed as radiologically impacted sites in the HRA, as well as several other areas identified in the Site Management Plan (ECC 2008) will require further radiological surveys as well as some degree of radiological materials removal to be performed. The radiological work elements for the radiologically impacted sites in the HRA are addressed in the Basewide Radiological Management Plan (TtEC 2014) as well as the individual Task-Specific Plans (TSPs)/Work Plans (as appropriate) that will be prepared for each site. Each TSP/Work Plan will identify the type (scoping/characterization) and what class of survey to be performed, survey boundaries, scanning methodologies and sampling frequencies for each of the radionuclides of concern (ROCs).

## REGULATORY OVERSIGHT

Environmental investigation and remediation activities are being conducted at NAS Brunswick under the Department of Defense (DoD) Installation Restoration (IR) Program in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act and the National Oil and Hazardous Substances Pollution Contingency Plan. Under Executive Order 12580, the Navy is the lead agency responsible for implementation of the IR Program and any removal actions. EPA Region I is the lead regulatory agency. The State of Maine Bureau of Remediation and Waste Management Department of Enviromental Protection will provide additional state regulatory oversight.

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Figure 2-1 Site Location Map

Figure 2-2 NAS Brunswick Sites Location Map

## APPENDICES

Appendix A TtEC Standard Operating Procedures
Appendix B Laboratory DoD ELAP Accreditation

# Abbreviations and Acronyms

| | |
|---|---|
| %D | percent difference |
| %R | percent recovery |
| μg/kg | micrograms per kilogram |
| μg/L | micrograms per liter |
| AA | atomic absorption |
| Bi-214 | bismuth-214 |
| BRAC | Base Realignment and Closure |
| CA | corrective action |
| CAS | Chemical Abstracts Service |
| CCV | continuing calibration verification |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| $cm^2$ | square centimeter |
| COC | chain-of-custody |
| Co-60 | cobalt-60 |
| Cs-137 | cesium-137 |
| CSO | Caretaker Site Office |
| CTO | Contract Task Order |
| DCN | Document Control Number |
| DoD | Department of Defense |
| dpm | disintegrations per minute |
| DQA | data quality assessment |
| DQO | Data Quality Objective |
| DRMO | Defense Reutilization and Marketing Office |
| EDD | electronic data deliverable |
| ELAP | Environmental Laboratory Accreditation Program |
| EPA | U.S. Environmental Protection Agency |
| FCR | Field Change Request |
| FSS | Final Status Survey |
| g | gram |
| ICAL | initial calibration |
| ICV | initial calibration verification |
| IR | Installation Restoration |
| keV | kiloelectron volt |

## Abbreviations and Acronyms
(Continued)

| | |
|---|---|
| L | liter |
| LCS | laboratory control sample |
| LCSD | laboratory control sample duplicate |
| LLRW | low-level radioactive waste |
| $LNO_2$ | nitrolinoleic acid |
| MARSSIM | Multi-Agency Radiation Survey and Site Investigation Manual |
| MDA | minimum detectable activity |
| mg/kg | milligrams per kilogram |
| mL | milliliter |
| mm | millimeter |
| N/A | not applicable |
| Navy | United States Department of the Navy |
| NEDD | Navy Electronic Data Deliverable |
| NIRIS | Naval Installation Restoration Information Solution |
| NIST | National Institute of Standards and Technology |
| OOS | out of service |
| oz | ounce |
| PARCC | precision, accuracy, representativeness, completeness, and comparability |
| pCi/g | picocuries per gram |
| pCi/L | picocuries per liter |
| PDF | portable document format |
| PM | Project Manager |
| PMO | Program Management Office |
| PQCM | Project Quality Control Manager |
| QA | quality assurance |
| QAPP | Quality Assurance Project Plan |
| QC | quality control |
| QCPM | Quality Control Program Manager |
| QSM | Quality Systems Manual |
| Ra-226 | radium-226 |
| RASO | Radiological Affairs Support Office |
| RCA | Radiological Control Area |
| RER | relative error ratio |

## Abbreviations and Acronyms
(Continued)

| | |
|---|---|
| RI | remedial investigation |
| RPD | relative percent difference |
| RPM | Remedial Project Manager |
| RSO | Radiation Safety Officer |
| RSOR | Radiation Safety Officer Representative |
| SAP | Sampling and Analysis Plan |
| SDG | sample delivery group |
| SOP | Standard Operating Procedure |
| Sr-90 | strontium-90 |
| TBD | to be determined |
| Th-232 | throium-232 |
| TSP | Task-Specific Plan |
| TtEC | Tetra Tech EC, Inc. |
| U-238 | uranium-238 |
| UFP | Uniform Federal Policy |
| VSP | Visual Sampling Plan |

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## SAP Worksheet #2 – SAP Identifying Information

**Site Name/Number:** Radiological Remediation/Assessment at NAS Brunswick
**Contractor Name:** Tetra Tech EC, Inc. (TtEC)
**Contract Number:** N62470-13-D-8007
**Contract Title:** Remedial Action Contract

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the Uniform Federal Policy for Quality Assurance Project Plans (EPA 2005) and U.S. Environmental Protection Agency (EPA) Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (EPA 2002).

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held.

| **Scoping Session** | **Date** |
|---|---|
| Kick-off meeting with the United States Department of the Navy (Navy) | 9/25/13 |

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

| **Title** | **Date** |
|---|---|
| None | |

6. List organizational partners (stakeholders) and connection with lead organization: EPA Region I, the State of Maine Bureau of Remediation and Waste Management Department of Enviromental Protection, and Radiological Affairs Support Office (RASO) will provide regulatory oversight and guidance.

7. Lead organization: Navy

8. If any required SAP elements or required information is not applicable to the project or is provided elsewhere, then note the omitted SAP elements and provide an explanation for its exclusion below:

   - SAP Worksheet #8 (Special Personnel Training Requirements Table) is not applicable for this project as there are no special training requirements associated with sampling.
   - SAP Worksheet #13 (Secondary Data Criteria and Limitations Table) is not applicable for this project as secondary data evaluation is not required.

SAP elements and required information that are not applicable to the project are noted below. An explanation is provided above and in the appropriate SAP worksheet(s), as necessary.

## SAP Worksheet #2 – SAP Identifying Information (Continued)

| UFP-QAPP Worksheet # | Required Information | Crosswalk to Related Information |
|---|---|---|
| **A. Project Management** | | |
| *Documentation* | | |
| **1** | Title and Approval Page | |
| **2** | Table of Contents<br>SAP Identifying Information | |
| **3** | Distribution List | |
| **4** | Project Personnel Sign-Off Sheet | |
| *Project Organization* | | |
| **5** | Project Organizational Chart | |
| **6** | Communication Pathways | |
| **7** | Personnel Responsibilities and Qualifications Table | |
| **8** | Special Personnel Training Requirements Table | Not applicable |
| *Project Planning/Problem Definition* | | |
| **9** | Project Planning Session Documentation (including Data Needs tables)<br>Project Scoping Session Participants Sheet | |
| **10** | Problem Definition, Site History, and Background<br>Site Maps (historical and present) | |
| **11** | Site-Specific Project Quality Objectives | |
| **12** | Measurement Performance Criteria Table for Samples | |
| **13** | Sources of Secondary Data and Information<br>Secondary Data Criteria and Limitations Table | Not applicable |
| **14** | Summary of Project Tasks | |
| **15** | Reference Limits and Evaluation Table | |
| **16** | Project Schedule/Timeline Table | |
| **B. Measurement Data Acquisition** | | |
| *Sampling Tasks* | | |
| **17** | Sampling Design and Rationale | |
| **18** | Sampling Locations and Methods/ SOP Requirements Table<br>Sampling Location Map(s) | |
| **19** | Analytical Methods/SOP Requirements Table | |
| **20** | Field Quality Control Sample Summary Table | |
| **21** | Project Sampling SOP References Table | |
| **22** | Field Equipment Calibration, Maintenance, Testing, and Inspection Table | |
| *Analytical Tasks* | | |
| **23** | Analytical SOPs<br>Analytical SOP References Table | |
| **24** | Analytical Instrument Calibration Table | |

## SAP Worksheet #2 – SAP Identifying Information (Continued)

| UFP-QAPP Worksheet # | Required Information | Crosswalk to Related Information |
|---|---|---|
| **25** | Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table | |
| *Sample Collection* | | |
| **26** | Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal<br>Sample Handling Flow Diagram | |
| **27** | Sample Custody Requirements, Procedures/SOPs Sample Container Identification<br>Example Chain-of-Custody Form and Seal | |
| *Quality Control Samples* | | |
| **28** | QC Samples Table<br>Screening/Confirmatory Analysis Decision Tree | |
| *Data Management Tasks* | | |
| **29** | Project Documents and Records Table | |
| **30** | Analytical Services Table<br>Analytical and Data Management SOPs | |
| **C. Assessment Oversight** | | |
| **31** | Planned Project Assessments Table<br>Audit Checklists | |
| **32** | Assessment Findings and Corrective Action Responses Table | |
| **33** | QA Management Reports Table | |
| **D. Data Review** | | |
| **34** | Verification (Step I) Process Table | |
| **35** | Validation (Steps IIa and IIb) Process Table | |
| **36** | Validation (Steps IIa and IIb) Summary Table | |
| **37** | Usability Assessment | |

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## SAP Worksheet #3 – Distribution List

The following distribution list represents the recipients of the final version of this SAP.

| Name of SAP Recipients | Title/Role | Organization | Telephone Number | Mailing and E-mail Address |
|---|---|---|---|---|
| Mr. Todd Bober | Remedial Project Manager (RPM) | Base Realignment and Closure (BRAC) Program Management Office (PMO) Northeast | (215) 897-4911 | 4911 South Broad Street<br>Philadelphia, PA 19112<br>todd.bober@navy.mil |
| Mr. Matthew Slack | Radiological Environmental Protection Manager | RASO | (757) 887-4212 | NAVSEA DET RASO<br>160 Main Road<br>Yorktown, VA 23691<br>matthew.slack@navy.mil |
| Ms. Vanessa Good | Administrative Record Manager | Tetra Tech, Inc. | (412) 921-7090 | Attention: NAVFAC ERP Documents<br>Foster Plaza Bldg. 7<br>661 Andersen Drive<br>Pittsburgh, PA 15220<br>vanessa.good@tetratech.com |
| Mr. Bob LeClerc | Caretakers Site Office (CSO) | Installation Representative/CSO | (207) 406-2290 | 119 Purinton Road, Building 53<br>Brunswick, ME 04011<br>robert.leclerc@navy.mil |
| Mr. Joe Gallant | Construction Phase Navy Technical Representative (NTR) | NAVFAC PWD Maine Portsmouith Naval Shipyard | (207) 438-2990 | Buidling 65, Floor 2<br>Portsmouth, NH 03804-5000<br>joseph.gallant@navy.mil |
| Mr. Steve Levesque | N/A | Midcoast Redevelopment Reuse Authority (MRRA) | (207) 798-6512 | MRRA<br>4 Admiral Fitch Ave.<br>Brunswick, ME 04011<br>stevel@mrra.us |
| Mr. Mike Daly | RPM | EPA Region I | (617) 918-1386 | OSSR07-3<br>5 Post Office Square, Suite 100<br>Boston, MA 02109-3912<br>daly.mike@epa.gov |
| Mr. Iver Mcleod | State of Maine Environmental Representative | Bureau of Remediation and Waste Management Department of Enviromental Protection | (207) 287-7713 | 17 State House Station<br>Augusta, ME 04011<br>iver.j.mcleod@maine.gov |

## SAP Worksheet #3 – Distribution List (Continued)

| Name of SAP Recipients | Title/Role | Organization | Telephone Number | Mailing and E-mail Address |
|---|---|---|---|---|
| Mr. Derek Pinkham | Project Manager (PM) | TtEC | (215) 702-4070 | 820 Town Center Drive, Suite 100<br>Langhorne, PA 19047-174<br>derek.pinkham@tetratech.com |
| Mr. Erik Abkemeier | Radiation Safety Officer (RSO) | TtEC | (757) 944-0921 | 5250 Challedon Drive<br>Virginia Beach, VA 23462<br>erik.abkemeier@tetratech.com |
| Mr. Chuck Taylor | Radiation Safety Officer Representative (RSOR) | TtEC | (707) 287-0798 | 20 Katahdin Drive<br>Brunswick, ME 04011<br>chuck.taylor@tetratech.com |
| Mr. Greg Joyce | Quality Control Program Manager (QCPM) | TtEC | (360) 780-0371 | 1230 Columbia Street, Suite 750<br>San Diego, CA 92101<br>greg.joyce@tetratech.com |
| Mr. Chris Hanif | Project Quality Control Manager (PQCM) | TtEC | (510) 967-1710 | 20 Katahdin Drive<br>Brunswick, ME 04011<br>chris.hanif@tetratech.com |
| Ms. Lisa Bienkowski | Program Chemist | TtEC | (949) 809-5028 | 17885 Von Karman Avenue,<br>Suite 500<br>Irvine, CA 92614<br>lisa.bienkowski@tetratech.com |
| Ms. Sabina Sudoko | Project Chemist | TtEC | (949) 809-5022 | 17885 Von Karman Avenue,<br>Suite 500<br>Irvine, CA 92614<br>sabina.sudoko@tetratech.com |
| Ms. Erika Gish | Laboratory Project Manager | TestAmerica | (314) 298-8566 | 13715 Rider Trail North<br>Earth City, MO 63045<br>erika.gish@testamericainc.com |

## SAP Worksheet #4 – Project Personnel Sign-Off Sheet

The key personnel listed below will read the final version of this SAP. Their signature and date will be filled in below and included in the project file.

| Name | Organization/Title/Role | Signature/E-mail Receipt | SAP Section Reviewed | Date SAP Read |
|---|---|---|---|---|
| Mr. Derek Pinkham | TtEC/PM | | Entire document | |
| Mr. Chuck Taylor | TtEC/RSOR | | Entire document | |
| Mr. Chris Hanif | TtEC/PQCM | | Entire document | |
| Ms. Sabina Sudoko | TtEC/Project Chemist | | Entire document | |
| Ms. Erika Gish | TestAmerica/Laboratory Project Manager | | Entire document | |
| TBD [a] | TtEC/Field Crews | | Entire document | |

***Notes:***

[a] Field crews include multiple persons and vary from project to project. Therefore, persons identified by the project quality control manager (PQCM) will read the SAP and sign this worksheet as required.

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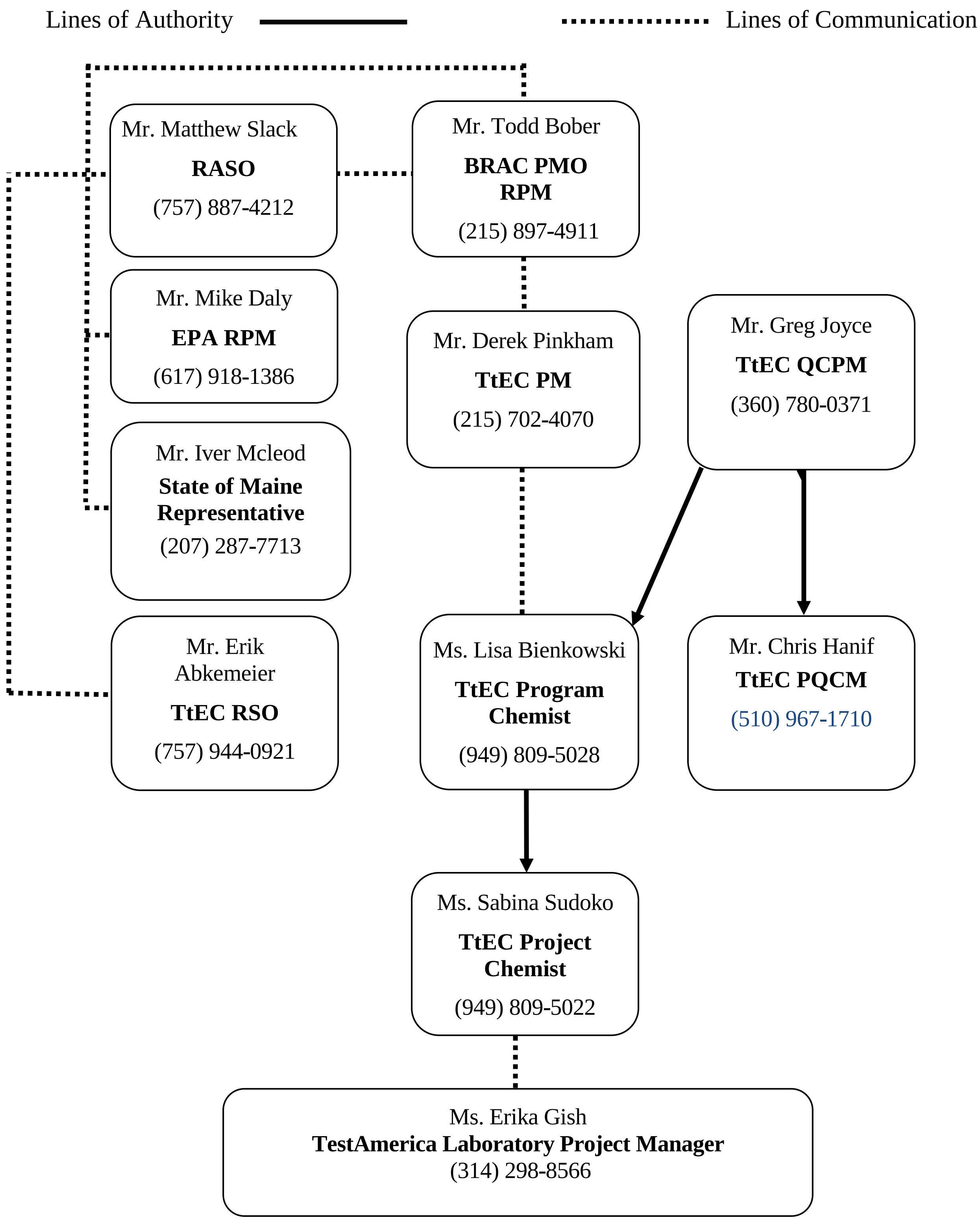
## SAP Worksheet #5 – Project Organizational Chart



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## SAP Worksheet #6 – Communication Pathways

| Communication Drivers | Responsible Affiliation | Name | Phone Number | Procedure |
|---|---|---|---|---|
| Point of contact for significant changes or corrective actions | BRAC PMO RPM | Mr. Todd Bober | (215) 897-4911 | If significant changes or corrective actions occur during the project, the RPM will notify the regulators involved in this project. |
| SAP review and radiological concurrence | RASO | Mr. Matthew Slack | (757) 887-4212 | The RASO will review and concur with the SAP as related to the radiological aspects of NAS Brunswick. |
| Point of contact for contractor quality issues | TtEC QCPM | Mr. Greg Joyce | (360) 780-0371 | The QCPM is responsible for overseeing program quality control (QC), including construction and analytical data acquisition. The QCPM has the authority to suspend project activities if quality standards are not maintained. |
| Project management | TtEC PM | Mr. Derek Pinkham | (215) 702-4070 | If changes are necessary, the PM is responsible for communicating the changes via phone and/or e-mail to the project staff and is authorized to stop work, if necessary. |
| SAP review | TtEC QCPM | Mr. Greg Joyce | (360) 780-0371 | The SAP will be written by the Program Chemist and reviewed by the QCPM prior to submittal to the Navy for review. |
| Notification of nonusable analytical results | TtEC Program Chemist | Ms. Lisa Bienkowski | (949) 809-5028 | If significant problems are identified by the laboratory or the project team that impact the usability of the data (i.e., the data are rejected or data quality objectives are not met), the Program Chemist will notify the TtEC PM. The PM will notify the BRAC PMO RPM. |
| Coordination of laboratory supplies for field sampling activities | TtEC Project Chemist | Ms. Sabina Sudoko | (949) 809-5022 | The Project Chemist will contact the laboratory to provide all necessary sample containers and appropriate shipping materials (such as coolers and bubble wrap) to be delivered on-site prior to commencement of field sampling activities and throughout the course of the project. |

## SAP Worksheet #6 – Communication Pathways (Continued)

| Communication Drivers | Responsible Affiliation | Name | Phone Number | Procedure |
|---|---|---|---|---|
| Reporting laboratory data quality issues or analytical corrective actions | TestAmerica Laboratory Project Manager | Ms. Erika Gish | (314) 298-8566 | All data quality issues will be reported in writing to the Project Chemist and Program Chemist within 24 hours. Any corrective actions will be documented and verified by the Program Chemist who will notify in writing the QCPM and PM. The PM will notify the BRAC PMO RPM. |
| Field corrective actions | TtEC PQCM | Mr. Chris Hanif | (510) 967-1710 | All field corrective actions will be documented in writing by the PQCM who will notify in writing the QCPM, RSO, and PM. The PM will notify the BRAC PMO RPM and RASO. |
| Release of analytical results | TtEC Project Chemist | Ms. Sabina Sudoko | (949) 809-5022 | The Project Chemist will review analytical results to verify that the requirements in this SAP have been met prior to releasing the data to the project team for evaluation. |
| Review of radiological data and concurrence on radiological actions | RASO | Mr. Matthew Slack | (757) 887-4212 | The RASO will review all appropriate radiological data provided by the RSO (or designee) and will provide concurrence with actions proposed. |
| SAP procedure revision during field activities | TtEC Program Chemist | Ms. Lisa Bienkowski | (949) 809-5028 | The Program Chemist (or designee) will prepare a Field Change Request for any changes in sampling or analytical procedures that occur due to conditions in the field. |
| SAP addendums | TtEC Program Chemist | Ms. Lisa Bienkowski | (949) 809-5028 | Significant changes to the SAP such as additional scope of work that is not covered in this SAP may require that the Program Chemist prepare an addendum to this SAP. |

## SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

| Name | Title/Role | Organizational Affiliation | Responsibilities |
|---|---|---|---|
| Mr. Todd Bober | RPM | BRAC PMO | • Performing project management for the Navy<br>• Ensuring that the project scope of work requirements are fulfilled<br>• Overseeing the project cost and schedule<br>• Providing formal technical direction to the TtEC project team, as needed<br>• Acting as lead interface with agencies |
| Mr. Derek Pinkham | PM | TtEC | • Coordinating work activities of subcontractors and TtEC personnel, and ensuring that all personnel adhere to the administrative and technical requirements of the project<br>• Monitoring and reporting the progress of work, and ensuring that the project deliverables are completed on time and within project budget<br>• Monitoring the budget and schedule, and notifying the BRAC PMO RPM of any changes that may require administrative actions<br>• Ensuring adherence to the quality requirements of the contract, project scope of work, and the QC plans<br>• Ensuring that all work meets the requirements of the technical specifications and complies with applicable codes and regulations<br>• Ensuring that all work activities are conducted in a safe manner in accordance with the Site-Specific Safety and Health Plan, United States Army Corps of Engineers' Safety and Health Requirements (Engineer Manual 385-1-1), and all applicable Occupational Safety and Health Administration regulations<br>• Serving as the primary contact between the Navy and TtEC for actions and information related to the work and including appropriate TtEC technical personnel in the decision-making<br>• Coordinating satisfactory resolution and completion of evaluation and acceptance report for nonconformance reports<br>• Suspending project activities if standards are not maintained |

## SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

| Name | Title/Role | Organizational Affiliation | Responsibilities |
|---|---|---|---|
| Mr. Matthew Slack | Radiological Environmental Protection Manager | RASO | • Reviewing radiological laboratory data on a routine basis<br>• Reviewing and approving all radiological management plans and final reports<br>• Providing review and concurrence on data for proposed radiological actions<br>• Ensuring that all necessary sample results are provided and are consistent with proposed radiological actions<br>• Comparing radiological data with the requirements of the Work Plan, Task-specific Plans, and SAP to ensure that all proper conditions have been met to implement the action requested |
| Mr. Erik Abkemeier | RSO | TtEC | • Overseeing overall radiological operations and documentation for the project<br>• Supporting projects as the technical lead for radiological data collection and analysis<br>• Ensuring that RSOR and field sampling personnel have adequate training in radiological sample collection<br>• Receiving and reviewing radiological data from the Project Chemist to ensure the data quality objectives have been met<br>• Reviewing and evaluating scan survey data and requiring additional scan data, as necessary<br>The RSO (or designee) will also perform the following:<br>• Concurring on the identification of elevated areas for collection of biased samples and the locations of systematic samples including plotting of those samples on maps<br>• Overseeing the preparation of a remediation plan and the performance of remediation activities (including evaluating biased sampling data) when sampling activities indicate the presence of radioactive materials at levels above the release criteria<br>• Recommending radiological activities to the RASO for concurrence including additional sampling<br>• Identifying samples for the Project Chemist that need to be forwarded to TestAmerica laboratory for additional radiological testing |

## SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

| Name | Title/Role | Organizational Affiliation | Responsibilities |
|---|---|---|---|
| Mr. Chuck Taylor | RSOR | TtEC | • Supervising day-to-day radiological operations<br>• Ensure site activities are in compliance with Nuclear Regulatory Commission Radioactive Materials License (RML) No. 29-31396-01 or Maine Agreement State RML, as applicable.<br>• Overseeing performance of radiological static surveys |
| Mr. Greg Joyce | QCPM | TtEC | • Establishing and maintaining the Quality Program<br>• Overseeing program QC, including construction and analytical data acquisition<br>• Working directly with the PM and the Navy to ensure implementation of the program QC Plans<br>• Acting as a focal point for coordination for quality matters across all projects and resolving quality issues<br>• Suspending project activities if quality standards are not maintained<br>• Interfacing with the Navy on quality-related items<br>• Conducting field QC audits to ensure project plans are being followed<br>• Performing reviews of audit and surveillance reports conducted by others<br>• Approving any FCRs and reviewing the SAP and any addendums to the SAP |
| Ms. Lisa Bienkowski | Program Chemist | TtEC | • Developing the SAP and any addendums to the SAP<br>• Implementing contract requirements for data collection<br>• Supporting projects as the technical lead for data collection and analysis<br>• Evaluating and selecting qualified laboratories<br>• Providing oversight of the laboratories with regards to deliverable requirements and monitoring performance of the laboratories<br>• Overseeing preparation of the Navy Electronic Data Deliverable (NEDD) deliverable for analytical results for upload to the Naval Installation Restoration Information Solution (NIRIS) website<br>• Coordinating submittal of hardcopy analytical data packages with Navy Administrative Record |

## SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

| Name | Title/Role | Organizational Affiliation | Responsibilities |
|---|---|---|---|
| Ms. Sabina Sudoko | Project Chemist | TtEC | • Tracking samples sent to laboratory to ensure laboratory receipt of samples and proper login of samples for analysis<br>• Tracking receipt of analytical results<br>• Reviewing analytical results against requirements in this SAP prior to distribution to the project team<br>• Coordinating upload of electronic data to database |
| Ms. Erika Gish | Laboratory Project Manager | TestAmerica | • Coordinating with the Project Chemist regarding sample receipt and discrepancies<br>• Ensuring samples are logged in according to the chain-of-custody (COC)<br>• Checking that analytical results are produced in accordance with this SAP and providing those results to the Project Chemist at the expected turnaround time<br>• Ensuring that analytical data packages and electronic deliverable requirements are in accordance with SAP Worksheet #29 |

## SAP Worksheet #8 – Special Personnel Training Requirements Table

| Project Function | Specialized Training By Title or Description of Course | Training Provider | Training Date | Personnel / Groups Receiving Training | Personnel Titles / Organizational Affiliation | Location of Training Records / Certificates |
|---|---|---|---|---|---|---|
| Radiation Awareness | General employee radiological training | RSO or designee | Prior to start of field work | All on-site personnel | All on-site personnel/TtEC | TtEC Project File |

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## SAP Worksheet #9 – Project Scoping Session Participants Sheet

<table>
<tr><td colspan="3">Project Name: Radiological Remediation/Assessment<br>Projected Date(s) of Sampling: 2014 through 2016<br>Project Manager: Mr. Derek Pinkham</td><td colspan="2">Site Name: NAS Brunswick<br>Site Location: Cumberland County, Maine</td></tr>
<tr><td colspan="5">Date of Session: September 25, 2013<br>Scoping Session Purpose: Kick-off meeting to discuss scope of project with Navy. The purpose of this meeting was to develop a mutual understanding of the work to be performed and the planning documents to be developed and submitted.</td></tr>
<tr><th>Name</th><th>Title</th><th>Affiliation</th><th>Phone #</th><th>E-mail Address</th></tr>
<tr><td>Mr. Todd Bober</td><td>RPM</td><td>BRAC PMO</td><td>(215) 897-4911</td><td>todd.bober@navy.mil</td></tr>
<tr><td>Mr. Derek Pinkham</td><td>Project Manger</td><td>TtEC</td><td>(215) 702-4070</td><td>derek.pinkham@tetratech.com</td></tr>
</table>

Detailed meeting minutes are available in the TtEC project file.

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## SAP Worksheet #10 – Problem Definition

The main problem defined for this project is: Based on the Historical Radiological Assessment (HRA), the Navy has determined that various sites require radiological characterization, remediation, and a Final Status Survey (FSS) to achieve regulatory free release of the site or a restricted release of the site. Therefore, the Navy has initiated survey and remedial actions for the removal and disposal of radiologically contaminated soil, asphalt and concrete surfaces, and building materials as applicable to protect the public health and welfare and the environment from actual or potential releases of radiological contamination. These survey and remedial actions will substantially eliminate the potential threat posed by future migration and/or off-site releases of radiologically contaminated material potentially present at the various sites into the surrounding environment.

### BACKGROUND AND SCOPE

NAS Brunswick is located in Cumberland County, Maine approximately 25 miles north of Portland and 31 miles south of Augusta, Maine (Figure 2-1). The Main Station lies between the Androscoggin River to the north and Casco Bay to the south and at one time encompassed approximately 3,200 acres. NAS Brunswick was officially closed in 2011 in accordance with 2005 Base Realignment and Closure Act. As of December 2013, approximately 80 percent of the property has been transferred out of Navy control. All sites being addressed in this SAP (Figure 2-2) are currently on Navy-owned property.

The HRA was revised in 2013 and finalized in March 2014. Sites described below that are listed as radiologically impacted sites in the HRA, as well as several other areas identified in the Site Management Plan (ECC 2008) will require further radiological surveys as well as some degree of radiological materials removal to be performed. A brief description of the sites is provided below.

### Quarry Area of Concern

The Quarry Area of Concern is located southwest of the runways at the western boundary and the debris area is approximately four acres in size (Figure 2-2); the entire site is limited to an area delineated by fencing and is approximately 7 acres in size. Site investigations have discovered significant amounts of debris (partially buried scrap metal, tires, and concrete) at the site including munitions. It is suspected that the area was used as a dump site. During the site inspection performed in 2008, a rocket motor tail fin assembly was discovered on the surface of the Quarry Area of Concern. In 2009, the Naval Ordnance Safety and Security Activity (NOSSA) made a determination that there was at least a medium likelihood of encountering munitions-related items in the subsurface. Based on this determination, the Navy has included this area in the Military Munitions Response Program. A surface clearance of the site (within the fenced area) has already been performed. Part of this site was also used for permitted petroleum sludge spreading/treatment in accordance with State of Maine requirements. Investigations accomplished to date have uncovered numerous Munitions and Explosives of Concern (MEC) items and debris. Chemical contaminants at this site include low-level exceedances of screening criteria for semivolatile organics, primarily polynuclear aromatic hydrocarbons (PAHs), and diesel range organics that were detected in shallow subsurface and surface soil samples during the 2011 investigation performed by Tetra Tech NUS. During that investigation, low-level and

## SAP Worksheet #10 – Problem Definition (Continued)

sporadic exceedances of volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), target analyte metals, and pesticides were detected in the soil at the Quarry Area of Concern. The site is also designated as a radiologically impacted site in the HRA, and the ROCs for the site are cesium-137 (Cs-137), radium-226 (Ra-226), strontium-90 (Sr-90), and uranium-238 (U-238). The goal is to free release as much of the Quarry Area of Concern as possible and minimize the size of the restricted release area (approximately 140 feet x 80 feet to be developed as an on-site waste consolidation area) requiring land use controls.

At this site, TtEC will perform the following tasks:

**Delineation Work:**

1. Prepare Work Plan for delineation of extent of debris present.
2. Establish radiologically controlled area (RCA).
3. Establish appropriate backgrounds.
4. Establish debris screening area and debris stockpile area.
5. Complete clearing and grubbing of test pit/boring locations if not coincidental with anomaly locations
6. Conduct geophysical surveys of test pit/boring locations (if not coincidental with anomaly locations) to determine extent of debris up to 4 feet below ground surface (bgs). (Power/utilities are underground within the Quarry Area of Concern.)
7. Provide radiological support to other contractor performing MEC anomaly removals. Initial survey will be Class 3. If contamination is found, TtEC will perform survey per TSP based on characterization data. All excavations during the intrusive investigation will be completed in 12-inch lifts and radiological scans will be performed on the newly exposed surfaces after each lift, and on the final excavated surface. Geophysical scans will be performed by contractor performing the anomaly removals. Radiologically scanned soil will be stockpiled next to excavation. Soil samples will be collected and analyzed as described in Worksheet #17. Upon completion of investigation, the excavation will be backfilled with any removed material that is not low level radioactive waste (LLRW). Any LLRW will be transferred to the Navy's LLRW waste contractor for disposal.
8. Radiologically survey all recovered debris associated with the anomaly/munition removals for free release and stockpile on site until it can be placed in the future on-site waste consolidation area or off-site disposal if LLRW. Scrap metal will be recycled off-site to the maximum extent practicable.
9. Dig test pits and advance soil borings to delineate horizontal and vertical extents of debris; soil to be radiologically scanned in the same manner as described in step #7 above. However, in addition to performing radiological scans, geophysical detector scans will also be performed. Removed material to be returned to test pit/boring location if non-LLRW.

## SAP Worksheet #10 – Problem Definition (Continued)

10. Once the Quarry Area of Concern within fence line has been cleared of anomalies/munitions (up to 4 feet bgs), establish the lateral and vertical extent of the radiological investigation area, which will be based on the lateral and vertical extent of the waste debris that is present.
11. Prepare an Action Memorandum and Work Plan for completing the debris removal, radiological investigation, and on-site waste consolidation.
12. Prepare a TSP for the site (scoping/characterization, RASS, and FSS)

**<u>Final Radiological Survey, Debris Consolidation, and Cover Placement Work:</u>**

1. Establish RCA.
2. Establish appropriate backgrounds.
3. Establish debris screening area and debris stockpile area.
4. Complete clearing and grubbing of site.
5. Perform geophysical survey, if there are areas that have not been previously surveyed.
6. Conduct the radiological survey of the investigation area and waste consolidation areas.
7. Radiologically survey all recovered debris associated with the debris removal for free release and stockpile on site until can be placed in the future on-site waste consolidation area or off-site disposal if LLRW. Scrap metal that has been radiologically free released surveyed as material and equipment (M&E) will be recycled off-site to the maximum extent practicable.
8. Stockpile the radiologically scanned soil generated during the debris removal and sample as needed (as described in Worksheet #17) to determine if soils are suitable for use as backfill or fill material over the consolidated waste area or for off-site disposal if LLRW or hazardous/“Special Waste”. The non-LLRW soil suitable for use as backfill or fill material will be stockpiled on site until it can be placed in the future on-site waste consolidation area. Any soil that exceeds any cleanup levels will be disposed at an appropriate disposal facility.
9. Once the Quarry Area of Concern has been cleared of the debris (up to 4 feet bgs) perform radiological survey per TSP.
10. Once the area is radiologically cleared (or if agreed with Navy that the area will be included in the on-site waste consolidation area and remain as a “restricted release area”), place radiologically cleared debris in established location (with Navy concurrence) within excavated area (approximately 140 feet x 80 feet in size) and then place reuseable radiologically cleared excavated soil on top of debris; grade area outside of waste consolidation area; place 4 inch layer of topsoil (approximately 3,727 cubic yards) over the complete fenced in 7 acre area (waste consolidation area and perimeter area) and hydroseed and water for up to two events as needed.
11. Prepare an FSS and/or Restricted Release Report.
12. Prepare a Remedial Action Completion Report (RACR).

## SAP Worksheet #10 – Problem Definition (Continued)

### IR Site 7 Old Acid/Caustic Pit

IR Site 7 is a flat, open clearing that is approximately 1.4 acres in size located in the northeast portion of NAS Brunswick (Figure 2-2). The site is believed to have been used historically for disposal of non-radiological hazardous liquids (acidic and caustic liquids, transformer oils, solvents, and miscellaneous liquids) and was used more recently by the Defense Reutilization and Marketing Office (DRMO) facility as an outdoor storage and equipment laydown area between 1964 and 1974. The site was remediated in 2002 and approximately 400 cubic yards of soil was removed (one third was disposed of off-site and the remainder was spread across the remainder of the site in six inch lifts). Cadmium-contaminated soils (ranging from 2.5 to 16.3 milligrams per kilogram [mg/kg]) still exist in several areas. The soils also contain elevated levels of manganese. The site has shallow groundwater depth (4 to 7 feet). Groundwater is also contaminated with cadmium ranging from 1 to 50 micrograms per liter (µg/L). The site is currently being managed by the Navy to control exposures to contaminants from soil and groundwater. IR Site 7 is also designated as a radiologically impacted site in the HRA and the ROCs include cobalt-60 (Co-60), Cs-137, Ra-226, Sr-90, thorium-232 (Th-232), U-238, and tritium. The goals are to free release the site and to remove the cadmium-contaminated soil to eliminate the cadmium source of groundwater contamination.

At this site, TtEC will perform the following tasks:

1. Develop Work Plan to remove remaining cadmium contaminated soil and place under IR Sites 1 and 3 landfill cap (to be extended to accommodate this soil) and restore site. The Work Plan will include a SAP that discusses the sampling and analysis for the chemical (cadmium) contamination.
2. Prepare a TSP that details the radiological surveys and sampling activities to be performed.
3. Establish RCA.
4. Establish appropriate backgrounds.
5. Complete clearing (mowing) as required; field activities to be performed concurrently with IR Sites 1 and 3 activities.
6. Complete gamma walk-over survey of site prior to start of activities.
7. Upgrade haul road.
8. The boundaries of the cadmium contaminated soils will be based on existing sample data; no additional chemical soil sampling required. 1,200 cubic yards of low-level cadmium contaminated soil to be removed from 2 locations (one area estimated to be 4,805 square feet in size at an average depth of 5 feet and the other area is 1,700 square feet in size at an average depth of 3 feet).
9. Radiologically survey and remediate as described in the TSP the ground surface prior to excavation actitivites for low-level cadmium contaminated soil. Radiologically impacted soil will be transferred to the Navy’s LLRW waste contractor for disposal.

## SAP Worksheet #10 – Problem Definition (Continued)

10. Excavate the low-level cadmium contaminated soils from the 2 locations. Excavations will be completed in 12-inch lifts and radiological scans will be performed on the newly exposed surfaces after each lift. Additonal radiological sampling and remediation will be performed as described in the TSP based on the scan and soil sample data. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
11. Perform radiological survey of the final excavated area and remediate as necessary. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
12. Backfill and restore site (estimate 800 cubic yards of material and hydroseed);
13. Prepare a FSS report for site.
14. Prepare a RACR which will include IR Sites 1 and 3 activities.

### IR Site 9 Neptune Drive Disposal Area

IR Site 9 is a partially remediated waste disposal area occupying approximately 20 acres in the central portion of NAS Brunswick (Figure 2-2). The site contains waste incinerator ash. Wastes reportedly dumped at this location include solvents that were burned on the ground, paint sludge, and wastes from the metal shop. Previous remedial actions for non-radiological contamination removed approximately 50,000 tons of contaminated soil. Clean fill was used to create a temporary cap (polyethylene liner, fill, and vegetation) over most of the remediated areas. However, remediation did not address waste material located under the roads or around the utilities and site investigations have confirmed that the boundary of the disposal area is larger than previously remediated though the extents are not fully known. Based on the existing test pit and soil boring data, the ash/waste material is spread across the remaining 16 acres of the site at an average depth of 3.5 feet. The waste is shallow around the asphalt paving and utilities based on existing soil boring data. Accessible areas shall be radiologically surveyed and data utilized to evaluate the restricted release of the area. Based on recent data gap investigations, the soils at various depths may contain low level concentrations of metals such as arsenic (up to 19.9 mg/kg) and chromium (up to 35.5 mg/kg) as well as PAHs, including carcinogenic PAHs such as benzo(a)anthracene (up to 19.9 mg/kg), benzo(a)pyrene (up to 15.8 mg/kg), benzo(b)fluoranthene (up to 21.2 mg/kg) and low levels of other PAHs above EPA regional screening levels. In addition, low-level VOCs such as tetrachloroethene may be present in some soil as a recent field screening using a photoionization detector (PID) detected up to 19.5 parts per million (ppm) during data gap sampling. Land use restrictions are currently being implemented. IR Site 9 is designated as a radiologically impacted site in the HRA and the ROCs include Co-60, Cs-137, Ra-226, Th-232, U-238, and tritium. The goals for this site are to determine the extent of ash present to allow Navy to establish land controls and to free release as much of the area as possible.

At this site, TtEC will perform the following tasks:

1. Prepare a TSP that details the radiological surveys, sampling, and test pit activities to be performed.

## SAP Worksheet #10 – Problem Definition (Continued)

2. Establish RCA.
3. Establish appropriate backgrounds.
4. Conduct clearing and grubbing.
5. Complete gamma walk-over survey of site prior to start of activities.
6. Perform test pitting in the perimeter area to delineate the horizontal extent of the waste/ash remaining around the perimeter of the site. Excavations will be completed in 12-inch lifts and radiological scans will be performed on the newly exposed surfaces after each lift. Additonal radiological sampling and remediation will be performed as needed based on the scan and soil sample data. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
7. Once extent of waste ash is determined, perform radiological survey over the complete disposal area (capped and perimeter areas) and remediate as necessary. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
8. Backfill test pits with excavated material, if not LLRW.
9. Prepare Final Status Survey (FSS) report.

### IR Sites 1 and 3 Hazardous Waste Burial Area

IR Site 1 (Orion Street Landfill) and IR Site 3 (Hazardous Waste Burial Area) are co-located in the central portion of NAS Brunswick. IR Sites 1 and 3 are located immediately north of Building 642 (Figure 2-2) and is approximately 10 acres in size and contains an estimated 300,000 cubic yards of waste. Prior disposal included domestic waste and hazardous materials (such as aircraft parts and construction debris as well as asbestos-containing materials [ACM]). The landfill also was used for disposal of waste oil, solvents, pesticides, herbicides, petroleum products, paints, and other various chemicals. Solvents were detected in soil jar headspace PID readings from waste zones within the landfill from 0.5 to 90 ppm. PAHs, the pesticide dieldrin, PCBs, dioxin, arsenic, and cadmium were also detected at levels above EPA risk based cleanup levels. The landfill has a RCRA multilayer cap in place, which was constructed in 1995. The cap shall be expanded by approximately 0.5 acre and the IR Site 7 soil placed under the cap. It is not anticipated that soils in the waste zone will be encountered during this work and that the new landfill cover will be able to be tied into the existing landfill cover. IR Sites 1 and 3 is designated as a radiologically impacted site in the HRA and the ROCs include Co-60, Cs-137, Ra-226, Sr-90, Th-232, U-238, and tritium. The goals for this site are to extend the exsiting RCRA cap 0.5 acre to accommodate the 1,200 cubic yards of cadmium contaminated soil from IR Site 7 and achieve restricted release.

At this site, TtEC will perform the following tasks:

1. Develop Action Memorandum.
2. Develop Execution Plan/Work Plan that also incorporates IR Site 7 activities including design to expand the existing RCRA cap.

## SAP Worksheet #10 – Problem Definition (Continued)

3. Prepare a TSP that details the radiological surveys and sampling activities to be performed.
4. Establish RCA.
5. Complete gamma walk-over survey prior to start of activities.
6. Complete clearing and grubbing.
7. Perform geophysical survey.
8. Perform radiological survey and and remediate as necessary to obtain free release of the main cap area (10 acres) per TSP. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
9. Conduct a radiological survey of the area adjacent to the southern edge of the landfill to be opened to allow for expansion of landfill (area closest to Building 642).
10. Expose the radiologically cleared southern edge of existing liner system (cap).
11. Prepare subgrade for landfill extension.
12. Perform radiological survey to obtain free release of the prepared subgrade per TSP. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
13. Perform expansion of landfill (i.e., extend design of landfill bottom an additional 0.5 acre).
14. Place soil from IR Site 7 on top of landfill extension and stabilize with cementious material to minimize leaching potential of cadmium.
15. Once all of IR Site 7 soil has been placed, extend RCRA cap over the soil and place 1,210 tons of material to raise grade of landfill to design specs.
16. Install new fencing.
17. Perform hydooseeding/site restoration as required.
18. Prepare FSS and/or Restricted Release Report.
19. Prepare Completion Report for RCRA cap.

### Undocumented Former Orion Street Disposal Area

The Undocumented former Orion Street disposal area site is located at the corner of Orion Street and Merriconeag Drive (Figure 2-2). The exact size of the site is currently not known, but is estimated to be 106,400 square feet in size. The area was identified as an open disposal area where the Ground Electronics Division alledgely disposed of defective electronics components, including electron tubes. The site is designated as a radiologically impacted site in the HRA and the ROCs for the site include Co-60, Ra-226, Sr-90, and Th-232. No information was provided that documents any chemical contaminants of concern at this site. The site is currently a vacant lot used for athletic activities. The goal is to obtain free release of this site.

At this site, TtEC will perform the following tasks:

## SAP Worksheet #10 – Problem Definition (Continued)

1. Prepare a TSP that details the radiological surveys and sampling activities to be performed.
2. Complete clearing (mowing) as required.
3. Complete gamma walk-over survey of site prior to start of activities.
4. Complete the radiological survey and remediate as necessary. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
5. Backfill and restore site (top soil / general backfill and reseed) if required.
6. Prepare FSS report.

### DRMO Site

The DRMO Site (Site 13) consists of Building 584 (approximately 7,200 square feet) and the adjacent DRMO yard south of Building 584 and Site 4 (Figure 2-2). The yard is an approximate 84,000 square foot asphalt paved surface adjacent to Building 584. The eastern portion of the Building 584 was built on top of the acid/caustic pit which is part of Site 4. The DRMO Site is designated as a radiologically impacted site in the HRA and the ROCs include Co-60, Cs-137, Ra-226, Sr-90, Th-232, U-238, and tritium. The site information does not indicate that any chemical contamination is present. The goals for this site are to achieve free release of the DRMO yard and Building 584.

At this site, TtEC will perform the following tasks:

1. Prepare a TSP of the yard area and a separate TSP for Building 584, which will detail the radiological survey and sampling activities to be performed.
2. The survey approach of the yard area includes:
   a. Establish RCA
   b. Conduct a gamma survey of the existing asphalt surface and identify (and remove) any elevated areas. Asphalt with elevated readings will be stockpiled pending survey and results of the underlying soil per the TSP.
   c. Once survey is complete, the asphalt shall be removed in 50 foot by 50 foot grids, each pile will be staged on liner material and given a unique identification.
   d. The final disposition of the asphalt will depend on the soil survey and sampling results.
   e. Complete radiological survey of the soil surface and remediate as necessary. Radiologically impacted soil and associated asphalt to be transferred to the Navy's LLRW waste contractor for disposal.
   f. Non-impacted asphalt to be disposed of/recycled off-site.
   g. Sampling for chemical contamination will be accomplished if soils appeared to be impacted from previous historic operations. This chemical sampling will be described in a separate SAP.

## SAP Worksheet #10 – Problem Definition (Continued)

h. Backfill and restore the site, including a layer of asphalt pavement.

i. Prepare FSS report.

3. The survey approach for Building 584 includes:

   a. Obtain storage containers for storing building equipment / work with CSO to locate another building for temporary storage of equipment to allow performance of the survey activities.

   b. Establish RCA.

   c. Perform M&E survey of equipment to be removed/relocated. Any LLRW to be transferred to the Navy's LLRW waste contractor for disposal.

   d. Remove applicable building materials to get down to surface of when contamination could have occurred. Perform M&E survey on removed building materials. Any LLRW to be transferred to the Navy's LLRW waste contractor for disposal. Radiologically cleared debris to be disposed as construction debris.

   e. Perform a radiological survey and sampling of building.

   f. Return removed equipment to another warehouse or Building 584 based on direction from Navy.

   g. Prepare FSS report.

### IR Site 2/Orion Street Landfill (South)

IR Site 2 is located in the vicinity of the southern extent of the main runways within the restricted weapons compound area (Figure 2-2). The site is approximately 3 acres and was previously used as the primary landfill for the base between 1945 and 1955 for disposal of domestic waste, hazardous materials, aircraft parts, and construction debris. All prior boring log soil samples had levels of contaminants (VOCs, PAHs, metals, and pesticides) that were below EPA risk based cleanup levels. A portion of this site has been capped with 15 inches of topsoil. Reportedly, wastes were incinerated on-site and buried in a two-acre pit (formerly a borrow pit). IR Site 2 is designated as a radiologically impacted site in the HRA, and the ROC for the site is Ra-226. The goals for this site are to further characterize the lateral extent of contamination and minimize the restricted release area.

For this site, TtEC will perform the following tasks:

1. Develop Work Plan to characterize the horizontal and vertical extent of waste material present north of the cap area.
2. Prepare TSP that details the radiological surveys and sampling to be performed.
3. Establish RCA.
4. Conduct clearing and grubbing of the uncapped area (approximately 1 acre in size).
5. Complete walk-over gamma survey of site prior to conducting characterization activities.
6. Perform geophysical survey of uncapped area.

## SAP Worksheet #10 – Problem Definition (Continued)

7. Complete the radiological survey and remediate as necessary in the uncapped area per the TSP. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
8. Grade uncapped area and place 2,000 cubic yards of soil cover over graded area followed by placement of a non-woven geotextile liner.
9. Perform clearing and grubbing of the existing soil cap area (approximately 2 acres in size).
10. Complete the radiological survey and remediate as necessary in the existing capped area. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
11. Backfill and restore the existing capped areas, as needed.
12. Prepare FSS report.
13. Prepare a Post-Construction Summary Report.

### Building 9 MWR CPO Wardroom/VPU/Electronics and Ordnance Shop

Building 9 (Figure 2-2) is approximately 8,888 square feet in size and was constructed in 1943. The building had several uses, including a laundry facility, electronics and ordnance shop (1950s to 1960s), Patrol Squadron Special Unit (VPU) (1970s to 1980s), and the Morale, Welfare, and Recreation CPO Wardroom from 2006 to 2011. A radiological survey was completed that identified radiological contamination was present in the building. Building 9 is designated as a radiologically impacted site in the HRA, and the ROCs include Cs-137, Ra-226, Th-232, U-238, and tritium. The goal is to achieve free release of the building.

At this site, TtEC will perform the following tasks:

1. Prepare TSP that details the remediation and radiological surveys and sampling to be performed.
2. Remediate the one area of known contamination. Radiologically impacted debris to be transferred to the Navy's LLRW waste contractor for disposal.
3. Complete radiological surveys, sampling, and remediation as required to achieve free release.
4. Prepare FSS report.

### IR Site 6 Sandy Road Rubble and Asbestos Disposal Site

IR Site 6 is bordered by Sandy Road to the southeast and by a stream behind Building 516 to the north and is approximately 1 acre in size (Figure 2-2). At this site, a small depression was reportedly used for general disposal of construction debris, aircraft parts, and other non-putrescible wastes until the late 1970s. A 1995 Record of Decision states that approximately 8,800 cubic yards of construction debris and asbestos material would be excavated from IR Sites 5 and 6. Although a 2008 Site Management Plan states that the remediation of IR Site 6 was completed in 1993, the same plan states that remedial measures for IR Sites 1 and 3 were not

## SAP Worksheet #10 – Problem Definition (Continued)

initiated until 1995. Therefore, a date is not known for the completion of this remediation. IR Site 6 is designated as a radiologically impacted site in the HRA, and the ROCs are Co-60, Cs-137, Ra-226, Th-232, Sr-90, U-238, and tritium. There are no reported chemical contaminants of concern, though waste is known to be present. The goals for this site are to confirm that the construction debris and asbestsos material has been removed and to obtain free release.

At this site, TtEC will perform the following tasks:

1. Prepare a TSP that details the radiological surveys, sampling, and test pit activities to be performed.
2. Establish RCA.
3. Complete clearing and grubbing as required.
4. Complete gamma walk-over survey of the site prior to start of activities.
5. Complete the radiological surveys, sampling, and remediation as necessary. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal.
6. Perform test pitting in various locaitons of the site to confirm waste material has been removed. Excavations will be completed in 12-inch lifts and radiological scans will be performed on the newly exposed surfaces after each lift. Additonal radiological sampling and remediation will be performed as needed based on the scan and soil sample data. Radiologically impacted soil will be transferred to the Navy's LLRW waste contractor for disposal
7. Backfill test pits with removed material (if non-LLRW) and hydroseed.
8. Prepare FSS report.

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## SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements

The Data Quality Objectives (DQOs) specify project objectives, data collection boundaries and limitations, the most appropriate type of data to collect, and the level of acceptable decision error. The quality and quantity of data required to implement environmental removal actions are also defined.

The DQOs, as defined through the seven-step process (EPA 2006b), are as follows:

### 1. State the problem

The main problem defined for this project is: Based on the HRA, the Navy has determined that various sites require radiological characterization, remediation, and a Scoping or Final Status Survey (FSS) to achieve regulatory free release of the site or a restricted release of the site, or verify that the area is not radiologically impacted. Therefore, the Navy has initiated survey and remedial actions for the removal and disposal of radiologically contaminated soil, asphalt and concrete surfaces, and building materials as applicable to protect the public health and welfare and the environment from actual or potential releases of radiological contamination. These survey and remedial actions will substantially eliminate the potential threat posed by future migration and/or off-site releases of radiologically contaminated material potentially present at the various sites into the surrounding environment.

### 2. Identify the goal of the study

TtEC will develop a TSP for each site that identifies the type of survey required and potential remedial actions necessary to ensure that residual radioactivity is below the release criteria.

1. For a scoping survey, the decision is, “Does the survey information defined in the TSP identify ROCs and assess general levels and extent of contamination?”
2. For a characterization survey, the decision is, “Does the survey information defined in the TSP identify the nature and extent of the ROC contamination that may lead to remediation?”
3. For a remedial action support survey, the decision is, “Does the remedial action support survey indicate that the remediation is complete as defined in the TSP?”
4. For an FSS, the decision is, “Does the data from the FSS demonstrate compliance with the ROC release criteria and provide for a decision to free release the site?”

### 3. Identify information inputs

Inputs for the survey of the site will vary depending on the specific survey requirements detailed in the TSP. Typically, the following data will be collected:

1. Identification of a representative reference background area
2. Gamma scan survey readings
3. Alpha/beta scan survey readings
4. Biased and systematic static alpha , beta, and gamma static measurements

## SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

5. Biased and systematic solid or swipe measurements
6. Exposure rate scan measurements

In addition:

For a scoping survey, additional inputs to the decision are the information based on previous surveys and radiological survey data collected during the implementation phase.

For a characterization survey, additional inputs are again the information based on the previous surveys and the radiological survey data collected during the implementation phase.

For a remedial action support survey, additional inputs are the results of previous surveys and the specific remediation plans.

For an FSS, additional inputs are the radiological survey results and the ROC release criteria.

### 4. Define the boundaries of the study

Field activities may be affected by seasonal (snow or rainy) variations. Study boundaries for the soil, asphalt and concrete surfaces, and building materials as applicable will depend on the survey performed and will be presented, on a case-by-case basis, in the TSP. The maximum surface area for a Class 1 outdoor survey unit is 2,000 square meters. The maximum surface area for a Class 1 indoor survey unit is 100 square meters. The maximum surface area for Class 2 outdoor survey unit is 5,000 square meters. The maximum surface area for a Class 2 indoor survey unit is 1,000 square meters.

### 5. Develop the analytic approach

1. For a scoping survey, the decision rule is, “If the survey results identify ROCs and assess general levels and extent of contamination as defined in the TSP, then design and perform an optimized characterization survey. Otherwise, prepare an FSS report.”
2. For a characterization survey, the decision rule is, “If the survey results identify the nature and extent of the ROC contamination that requires remediation as defined in the TSP, then design and perform an optimized remedial action survey. Otherwise, prepare an FSS report.”
3. For a remedial action support survey, the decision rule is, “If the survey results indicate that the remediation is complete as defined in the TSP, then design and perform an optimized FSS. Otherwise, reevaluate the remedial alternative and continue remediation, as necessary.”

## SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

4. For an FSS, the decision rule is, "If the data from the FSS demonstrates compliance with the ROC release criteria and provides for a decision to free release the site, then document the results in the FSS report. Otherwise, evaluate whether additional assessment and/or remediation are necessary."

### 6. Specify performance or acceptance criteria

In evaluating the results (unless otherwise indicated in the TSP), Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (DoD et al. 2000) Scenario A will be applied. In Scenario A, the null hypothesis ($H_o$) is tested to verify whether residual contamination exceeds the release criterion; also, the alternative hypothesis ($H_a$) is tested to determine whether the residual contamination meets the release criterion. A 95 percent confidence level for detecting radioactivity above the release criteria will be assumed with Type I and II errors limited to 5 percent, except when double sampling is used with RASO's concurrence. Then the Type I error rate will be set to a maximum of 2.5 percent. With RASO concurrence, Scenario B will be applied. In scenario B, the null hypothesis ($H_o$) is tested to verify the net median concentration of radioactivity in the survey unit is less than the Lower Bound of the Gray Region, and, therefore the eadioactivity in the survey unit is indistinguishable from background.

Actions to minimize decision errors will be instituted during the data collection phase of the radiological survey. Qualified radiation survey personnel will perform the surveys and record the data. Automated recording of survey data will be used where possible to minimize errors. Data transcribing is the second phase where errors may arise. To avoid data errors for manual surveys, experienced personnel will record and transcribe data.

The ongoing evaluation of survey results from gamma scans and analytical results will provide a final check for errors which, if detected, can be corrected. The Radiation Safety Officer (RSO) (or designee), who is not involved in the direct data collection process, will review and evaluate the survey data. This ongoing review and evaluation will ensure an independent review for consistency of all survey data collected.

Field crews will review this SAP prior to collection of samples and sign off on SAP Worksheet #4. Sampling and analytical performance or acceptance criteria are specified in SAP Worksheets #12, 15, and 28.

### 7. Develop the plan for obtaining data

Radioactive source readings will be used to check instruments for consistency prior to use in each daily shift. The instrument will be used only after readings are compared and agree within +/- 20 percent of predetermined responses. The Radiation Safety Officer Representative (RSOR) will review the information each day to verify that equipment is operating satisfactorily. MARSSIM (DoD et al. 2000) guidelines will then be used to conduct surveys and determine the appropriate number of samples to be collected in each survey unit. The data collecting design alternatives may change slightly if assumptions are reviewed based on conditions in the field

## SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

being different than the furnished information derived from historical research and current knowledge. Sampling design and rationale are detailed in SAP Worksheet #17.

The following types of analytical data will be generated during this project:

- **Swipe sample data:** Swipe samples will be collected from the asphalt, concrete, and building material surfaces as applicable as described in the TSP and analyzed for gross alpha/gross beta to determine the amount of removable contamination. Swipe sample data will be used along with radiological survey data of these surfaces to determine whether remediation is required and as part of the remedial action support surveys to evaluate the effectiveness of the remediation.
- **Radiological screening data:** Soil samples will be collected from the soil surfaces as described in the TSP and analyzed for ROCs to determine the extent of radiological contamination and as part of the remedial action support surveys to evaluate the effectiveness of the remediation. When samples are initially analyzed by gamma spectroscopy, the data will be considered screening data because: 1) the samples will be analyzed using the 186.2 kiloelectron-volt (keV) Ra-226 gamma energy peak, which is difficult to definitively separate from the Uranium-235 (U-235) 185.7 keV gamma energy peak but is used for expedited analysis; 2) it will be used to make decisions on whether or not remediation is required, and if required, to make decisions on whether further remediation is required after initial remediation. The laboratory performing this initial gamma spectroscopy analysis (TestAmerica) will only produce EPA Level II-equivalent data package for this type of sample analysis. This data will not be utilized for FSS data, only for initial screening purposes.
- **Radiological definitive data:** Once the soil gamma spectroscopy screening data represent sample results that are below the release criteria, definitive gamma spectroscopy sample results (i.e., results that are legally defensible as well as suitable for final decision-making) will be produced either by: 1) reanalyzing the samples by gamma spectroscopy after an in-growth period (so Ra-226 daughter products can approach secular equilibrium) by using the 609 keV bismuth-214 (Bi-214) gamma energy peak to quantify Ra-226 results; or 2) recalculating the screening data using a Bi-214 in-growth correction factor. Once the reanalyzed or recalculated results are below the release criteria, those results will be considered definitive gamma spectroscopy data such that the data represent a final decision that the material is not contaminated and no further remediation is required. TestAmerica will produce an EPA Level IV-equivalent data package for this type of analyses. In addition to gamma spectroscopy analysis, Sr-90, U-238, and tritium analyses may be required depending upon the site-specific ROCs as detailed in SAP Worksheet #18. These analyses do not have a screening procedure but are just analyzed as definitive data analyses. Sr-90, U-238, and tritium analyses will be performed by TestAmerica who will produce an EPA Level IV-equivalent data package for these analyses.

## SAP Worksheet #12 – Measurement Performance Criteria Table for Samples

| QC Sample | Analytical Group | Frequency | Data Quality Indicators | Measurement Performance Criteria | QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A) |
|---|---|---|---|---|---|
| Field Duplicate | Gamma isotopes | 1 per 20 samples | Precision | Relative percent difference (RPD) ≤50% when detected concentrations >5x MDA | S&A |

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## SAP Worksheet #13 – Secondary Data Criteria and Limitations Table

For this project, secondary data are not applicable.

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## SAP Worksheet #14 – Summary of Project Tasks

### PROJECT TASKS

Tasks applicable to each site are detailed in SAP Worksheet #10. A summary of radiological activities performed by TtEC for this project may include the following:

- Preparation of TSPs
- Preparatory activities and meetings
- Preconstruction environmental surveying (Site reconnaissance and existing survey/ Environmental Conditions Report)
- Clearing vegetation
- Conducting geophysical surveys
- Radiological surveying and sampling
- Remediation of radiologically contaminated soil, asphalt, concrete, and building material surfaces as applicable
- Conducting FSSs of ground surface (soil, asphalt, and concrete)
- Conducting FSS within buildings
- Site restoration which may include backfill placement or geotextile liners
- Non-LLRW waste characterization, transport, and disposal
- Transfer of LLRW to the Navy's LLRW waste contractor for disposal
- Surveying and decontamination of equipment
- Sampling of backfill material
- Preparation of an FSS report

Sampling design and rationale are detailed in SAP Worksheet #17. Sample collection and data management procedures are described in this worksheet (SAP Worksheet #14).

### SAMPLE COLLECTION PROCEDURES

The following sections provide the sampling procedures for collection of samples associated with survey and remedial activities for this project. All samples will be labeled, documented, and packaged according to procedures in SAP Worksheets #27 and 29.

#### *Radiological Surveys*

Surveys will be conducted in accordance with Standard Operating Procedures (SOPs) discussed in SAP Worksheet #21 and included in Appendix A. Swipe samples will be screened using a Ludlum 2929 or 3030 scaler with a Ludlum 43-10-1 detector (or equivalent). Data are reported in units of disintegrations per minute (dpm) per 100 square centimeters ($cm^2$).

#### *Soil/Swipe Sampling*

## SAP Worksheet #14 – Summary of Project Tasks (Continued)

Soil/swipe samples will be collected in accordance with the SOP listed in SAP Worksheet #21 and included in Appendix A.

## DATA MANAGEMENT PROCEDURES

Field surveying data, logbooks, and COC records will be maintained in the TtEC project file. The field crews will e-mail a copy of the COC records to the TtEC Project Chemist the day any samples are collected and shipped to the laboratory. The Project Chemist will maintain a copy of the COC record until submitted to the Navy Administrative Record along with the hardcopy packages as described in SAP Worksheet #29.

For gamma spectroscopy analysis, TestAmerica will provide screening analytical results as an Microsoft Excel file and as a portable document format (PDF) file (as detailed in SAP Worksheet #29) to the Project Chemist for review prior to release of the results to the RSO and project team. When sample results are identified by the RSO (or designee) as representing definitive data (as described in SAP Worksheet #11 Step 7), the Project Chemist will be notified if TestAmerica should re-analyze those samples after 21 day in-growth to produce a definitive data deliverable as described in SAP Worksheet #29. After Project Chemist review, the definitive data will be provided to the RSO and project team.

Sr-90, U-238, and tritium analyses will also be performed by TestAmerica who will in turn e-mail analytical results within the turnaround time to the Project Chemist. This submittal will include analytical results and basic QC results (method blanks, laboratory control sample [LCS], and laboratory duplicate as applicable). The Project Chemist will review prior to distribution to the RSO and project team. Following this submittal, TestAmerica will submit deliverables as described in SAP Worksheet #29.

Information from the COC records for samples analyzed by TestAmerica will be uploaded into a database. TestAmerica will provide electronic data deliverables (EDD) in order to upload analytical results into the database. The EDD will be checked for required values and project-specific requirements. Any discrepancies in the EDD will be corrected by the laboratory. The database will be backed up on electronic media or an independent server.

Survey data will be recorded by on-site personnel for all samples locations. Horizontal control information for upload into the database will be captured in the State Plane Coordinate System in feet and vertical control standards will be in mean sea level. The analytical results and survey data from survey units for elevated readings that required further remediation and for FSS samples will be submitted to the NIRIS website.

## SAP Worksheet #15 – Reference Limits and Evaluation Table

**Matrix:** Soil

**Analytical Group:** Gamma Isotopes (TestAmerica)

| Analyte | CAS Number | Project Action Limit (pCi/g) | Project Action Limit Reference | Project MDA (pCi/g) | Laboratory-specific MDA [a] (pCi/g) |
|---|---|---|---|---|---|
| Bismuth-214 | 14733-03-0 | Not applicable [b] | Not applicable [b] | Not applicable [b] | Not applicable [b] |
| Cesium-137 | 10045-97-3 | 6.6 above background [c] | Release criteria [c] | 0.66 | 0.66 |
| Cobalt-60 | 10198-40-0 | 2.28 above background [c] | Release criteria [c] | 0.2 | 0.2 |
| Lead-214 | 15067-28-4 | Not applicable [b] | Not applicable [b] | Not applicable [b] | Not applicable [b] |
| Potassium-40 | 13966-00-2 | Not applicable [b] | Not applicable [b] | Not applicable [b] | Not applicable [b] |
| Radium-226 | 13982-63-3 | 1.0 above background [c] | Release criteria [c] | 0.2 | 0.2 |
| Thorium-232 | 7440-29-1 | 0.66 above background [c] | Release criteria [c] | 0.5 | 0.5 |
| Uranium-235 | 15117-96-1 | Not applicable [b] | Not applicable [b] | Not applicable [b] | Not applicable [b] |

When a rapid turnaround time is required for samples collected for gamma spectroscopy and the samples have not undergone a prescribed in-growth period, Ra-226 will be reported based on the 186 keV Ra-226 gamma energy peak. These results will be considered screening data. For in-growth samples or samples that are recounted based on an in-growth correction factor (definitive data), Ra-226 will be reported based on the 609 keV Bi-214 gamma energy peak.

## SAP Worksheet #15 – Reference Limits and Evaluation Table (Continued)

**Matrix:** Soil
**Analytical Group:** Sr-90 (TestAmerica)

| Analyte | CAS Number | Project Action Limit (pCi/g) | Project Action Limit Reference | Project MDA (pCi/g) | Laboratory-specific MDA [a] (pCi/g) |
|---|---|---|---|---|---|
| Total Strontium | 7440-24-6 | 1.02 above background [c] | Release criteria [c] | 0.5 | 0.5 |
| Strontium-90 | 10098-97-2 | 1.02 above background [c] | Release criteria [c] | 0.5 | 0.5 |

Total strontium analysis can be performed first by the laboratory if a quick turnaround time for results is needed. If the total strontium result is less than the release criterion, Sr-90 specific analysis is not required. However, if the total strontium result is above the release criterion, then Sr-90 specific analysis will be performed.

## SAP Worksheet #15 – Reference Limits and Evaluation Table (Continued)

**Matrix:** Soil

**Analytical Group:** U-238 (TestAmerica)

| Analyte | CAS Number | Project Action Limit (pCi/g) | Project Action Limit Reference | Project MDA (pCi/g) | Laboratory-specific MDA [a] (pCi/g) |
|---|---|---|---|---|---|
| Uranium-238 | 7440-61-1 | 8.4 above background [c] | Release criteria [c] | 0.5 | 0.5 |

U-235 and Th-232 may also be analyzed by alpha spectroscopy along with U-238, but will only be performed if verification of gamma spectroscopy U-235 and Th-232 results are needed at the direction of the RSO in conjunction with RASO.

## SAP Worksheet #15 – Reference Limits and Evaluation Table (Continued)

**Matrix:** Soil
**Analytical Group:** Tritium (TestAmerica)

| Analyte | CAS Number | Project Action Limit (pCi/g) | Project Action Limit Reference | Project MDA (pCi/g) | Laboratory-specific MDA [a] (pCi/g) |
|---|---|---|---|---|---|
| Tritium | 10028-17-8 | 66 above background | Release criteria [c] | 1 | 1 |

## SAP Worksheet #15 – Reference Limits and Evaluation Table (Continued)

***Notes:***

Soil analytical results will be reported as dry-weight corrected. Non-detected results will be reported by the laboratory with a "U" qualifier.

[a] Minimum Detected Activities (MDAs) are being used in place of limits of quantitation, limits of detection, and detection limits for radiochemistry analyses. MDAs are calculated on a per sample per analysis basis and take into account instrument background, sample size, and count time. Therefore, any MDA values listed in this worksheet for the radiological analyses is the minimum MDA value that the laboratory will achieve. However, laboratory reports will list the actual MDA value calculated for each isotope.

[b] Gamma isotopes associated with Ra-226 or other naturally occurring radioactive material (potassium-40 and uranium-235) are reported at the request of RASO even though release criteria have not been established.

[c] Soil release criteria listed are limits based on the Nuclear Regulatory Commision document NUREG-1757, Considated Decommissioning Guidance (NRC 2006) whose limits are deemed in compliance with the 25 mrem/y unrestricted dose limit in 10CFR20.1402. These values were developed by scaling the NUREG-1757 values to 15 mrem/y unrestricted dose. The criterion listed is that value above background for those radionuclides found in background soils.

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## SAP Worksheet #16 – Project Schedule/Timeline Table

The project schedule will be included in each site-specific TSP.

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## SAP Worksheet #17 – Sampling Design and Rationale

The following sections provide a rationale for types of sampling that may be performed for this project.

### REFERENCE BACKGROUND AREA SAMPLING

A mean background level will be determined by performing measurements at systematic locations within a designated background area. The number of soil samples will be calculated by MARSSIM (DoD et al. 2000) (and concurred with by RASO) to determine the appropriate number of samples. These samples will be collected in the background area at systematic locations as determined by Visual Sampling Plan (VSP) software. TestAmerica will analyze the samples for gamma spectroscopy (after in-growth) to establish mean background area levels for Cs-137, Co-60, Ra-226, Th-232 and U-235. TestAmerica will also analyze the samples for Sr-90, U-238, and tritium as required.

### SURFACE SURVEY AND SAMPLING FOR OUTDOOR AREAS

Outdoor areas include any areas outside of buildings which include surface soil, excavations, asphalt, or concrete. Per MARSSIM, surface surveys will be conducted in these areas by dividing the site into Class 1 survey units not to exceed 2,000 square meters in size; Class 2 survey units not to exceed 10,000 square meters in size, and Class 3 survey units have no size limitations. The exact number of survey units will be specified in the site-specific TSP. The survey units will be divided based on the soil, asphalt, and concrete surface materials present at the site.

Initially, all of the Class 1 surfaces will undergo a 100 percent gamma surface scan with TtEC's RASO-approved vehicle towed array system and/or a Ludlum Model 2350-1 data logger equipped with a Ludlum Model 44-10 2-inch by 2-inch sodium iodide detector (or equivalent). Additionally, concrete surface Class 1 survey units will receive a 100 percent alpha/beta scan using a Ludlum Model 2360 meter equipped with a Ludlum Model 43-37 gas flow proportional detector (or equivalent). Systematic sampling of these ground surfaces will then be based on a random start point and sample spacing using Equation 4-1 from the Basewide Radiological Management Plan (TtEC 2014) or using the most current version of VSP software with a triangular grid pattern. Unless specifically calculated in a TSP or by MARSSIM (DoD et al. 2000) to determine the appropriate number of samples in concurrence with RASO, 20 systematic samples will be collected per each survey unit. Based on the scan data, biased samples will also be collected at each area exceeding 3 sigma of the survey unit. Class 2 surfaces will undergo 50 percent surface scans. Class 3 surveys will be based on professional judgment as described in each site-specific TSP.

At each biased or systematic sample location, a static reading will be collected. For the asphalt and concrete survey units, swipe samples will also be collected, if required, as described in the applicable TSP. For the soil survey units, a soil sample will be collected and analyzed for site-specific ROCs as described in SAP Worksheet #18.

Any concrete surface areas exceeding the surface release criteria of 20 dpm/100 $cm^2$ removal contamination and 100 dpm/100 $cm^2$ fixed contamination or 200 dpm/100 $cm^2$ removable

## SAP Worksheet #17 – Sampling Design and Rationale (Continued)

contamination and 1,000 dpm/100 $cm^2$ fixed contamination for gross alpha/gross beta, respectively, will be remediated and transferred to the Navy's LLRW waste contractor for disposal as directed by the RASO. Any analytical results will accompany the transfer of the LLRW materials. After remediation, surveys of the remediated areas, including swipe samples for loose surface contamination, will be conducted to verify that the contaminated area(s) were successfully remediated.

Any soil with results above the release criteria listed in SAP Worksheet #15 will be characterized (by the collection of samples to bound the contaminated area) and then removed and transferred to the Navy's LLRW waste contractor for disposal as directed by the RASO. Any analytical results will accompany the transfer of the LLRW materials. The process of evaluating results, collecting characterization or systematic samples, and removing contaminated material will continue as an iterative process until a set of systematic sample results indicates the soil survey unit is below the release criteria.

### SURFACE SURVEY AND SAMPLING FOR INDOOR AREAS

Surface surveys will be conducted in buildings by dividing the site into Class 1 survey units not to exceed 100 square meters in size; Class 2 survey units not to exceed 1,000 square meters in size; and Class 3 survey units have no size limitations. The exact number of survey units will be specified in the site-specific TSP. The survey units will be divided based on the surface materials present in the building.

Initially, all of the Class 1 surfaces will undergo a 100 percent gamma surface scan with a Ludlum Model 2350-1 data logger equipped with a Ludlum Model 44-10 2-inch by 2-inch sodium iodide detector (or equivalent). Additionally, the Class 1 survey units will receive a 100 percent alpha/beta scan using a Ludlum Model 2360 meter equipped with a Ludlum Model 43-37, 47-37-1, or 43-68 gas flow proportional detector (or equivalent). Systematic static measurements of the ground surfaces will then be collected using a Ludlum Model 2360 datalogger with a 43-68 detector (or equivalent) based on a random start point and sample spacing using Equation 4-1 from the Basewide Radiological Management Plan (TtEC 2014) or using the most current version of VSP software with a triangular grid pattern. The number of static measurements will be specifically calculated by MARSSIM (DoD et al. 2000) to determine the appropriate number of samples in concurrence with RASO. Based on the scan data, biased systematic static measurements will also be collected at each area exceeding 3 sigma of the survey unit. At each biased and systematic location, swipe samples will also be collected. Class 2 surfaces will undergo a 50 percent surface scan.

Any surface areas exceeding the surface release criteria of 20 dpm/100 $cm^2$ removal contamination and 100 dpm/100 $cm^2$ fixed contamination or 200 dpm/100 $cm^2$ removable contamination and 1,000 dpm/100 $cm^2$ fixed contamination for gross alpha/gross beta, respectively, will be remediated and transferred to the Navy's LLRW waste contractor for disposal as directed by the RASO. After remediation, surveys of the remediated areas, including swipe samples for loose contamination, will be conducted to verify that the contaminated area(s) were successfully remediated.

## SAP Worksheet #17 – Sampling Design and Rationale (Continued)

## EXCAVATED SOIL SURVEYING AND SAMPLING

Excavated soil will be surveyed at the site during the excavation process or transported to an area along with excavated debris that is to be surveyed for radiological contamination. Final disposition of the soil will be one of the following:

- Any soil exceeding any ROC release criterion will be transferred to the Navy's LLRW waste contractor for disposal.
- Any soil associated with radiologically contaminated debris items as identified during the survey process will be transferred to the Navy's LLRW waste contractor for disposal.
- Any soil that has been free released or associated with items that have been radiologically free released will be either returned to the site, disposed of at another location at NAS Brunswick, disposed of off-site, or reused on site based on the Work Plan and TSP requirements. For material to be reused on site, this material will be accumulated in 100 cubic yard piles and four samples from each pile will be collected and composited to be analyzed for the site-specific ROCs for potential reuse as backfill of the site. If all analytical results from the pile meet the ROC release criteria, then soil may be reused at the site pending RASO concurrence and any further characterization for any chemical contaminants of concern at the site.

## BACKFILL SOIL SAMPLING

If additional soil from off-site sources is needed for backfill at any of the sites, then the soil will be sampled to ensure the soil meets the radiological release criteria. One soil sample per 1,000 cubic yards of soil per source will be collected and analyzed for gamma isotopes, Sr-90, U-238, and tritium and evaluated against the criteria listed in Worksheet #15. If the soil is going to be used at a site that contained chemical contamination, then that soil will also be sampled for chemical contaminants of concern that will be detailed in another SAP.

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## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

The following tables provided information for the reference background area sampling and for sampling at each of the sites.

### REFERENCE BACKGROUND AREA

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Reference background area / See SAP Worksheet #27 for Sample ID | Soil | Surface | Gamma Isotopes [a] (which includes Co-60, Cs-137, Ra-226, and Th-232), Sr-90, U-238, and Tritium. | See Worksheet #17 | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

## QUARRY AREA OF CONCERN: ROCs are Cs-137, Ra-226, Sr-90, and U-238.

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Biased and Systematic Samples / See SAP Worksheet #27 for Sample ID | Soil | TBD [b] | Gamma Isotopes [a] (which includes Cs-137 and Ra-226)<br><br>10 percent of samples analyzed for gamma isotope definitive analysis will be randomly selected for analysis of additional ROCs for this site which include Sr-90 and U-238. | See Worksheet #17 | SOP-006 |
| Excavated Soil Samples for Potential Reuse / See SAP Worksheet #27 for Sample ID | Soil | Random | Gamma Isotopes [a] (which includes Cs-137 and Ra-226), Sr-90 and U-238. | One soil sample will be collected from a minimum of four areas for each 100 cubic yards of soil; those samples will be composited into one sample for laboratory analysis. | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

## IR SITE 7 OLD ACID/CAUSTIC PIT: ROCs are Co-60, Cs-137, Ra-226, Th-232, Sr-90, U-238, and Tritium.

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Biased and Systematic Samples / See SAP Worksheet #27 for Sample ID | Soil | TBD [b] | Gamma Isotopes [a] (which includes Co-60, Cs-137, Ra-226, and Th-232)<br><br>10 percent of samples analyzed for gamma isotope definitive analysis will be randomly selected for analysis of additional ROCs for this site which include Sr-90, U-238, and Tritium. | See Worksheet #17 | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

## IR SITE 9 NEPTUNE DRIVE DISPOSAL AREA: ROCs are Co-60, Cs-137, Ra-226, Th-232, U-238, and Tritium.

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Biased and Systematic Samples / See SAP Worksheet #27 for Sample ID | Soil | TBD [b] | Gamma Isotopes [a] (which includes Th-232)<br><br>10 percent of samples analyzed for gamma isotope definitive analysis will be randomly selected for analysis of additional ROCs for this site which include Sr-90, U-238, and Tritium. | See Worksheet #17 | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

## IR SITES 1 AND 3 HAZARDOUS WASTE BURIAL AREA: ROCs are Co-60, Cs-137, Ra-226, Th-232, Sr-90, U-238, and Tritium.

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Biased and Systematic Samples / See SAP Worksheet #27 for Sample ID | Soil | TBD [b] | Gamma Isotopes [a] (which includes Co-60, Cs-137, Ra-226, and Th-232)<br><br>10 percent of samples analyzed for gamma isotope definitive analysis will be randomly selected for analysis of additional ROCs for this site which include Sr-90, U-238, and Tritium. | See Worksheet #17 | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

## UNDOCUMENTED FORMER ORION STREET DISPOSAL AREA: ROCs are Co-60, Ra-226, Th-232, and Sr-90.

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Biased and Systematic Samples / See SAP Worksheet #27 for Sample ID | Soil | TBD [b] | Gamma Isotopes [a] (which covers Co-60, Ra-226, and Th-232)<br><br>10 percent of samples analyzed for gamma isotope definitive analysis will be randomly selected for analysis of additional ROCs for this site which include Sr-90. | See Worksheet #17 | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

## DRMO SITE: ROCs are Co-60, Cs-137, Ra-226, Th-232, Sr-90, U-238, and Tritium.

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Asphalt and concrete surfaces / See SAP Worksheet #27 for Sample ID | Swipe | Not applicable [c] | Gross Alpha/Gross Beta | See Worksheet #17 | SOP-001 |
| Building surfaces / See SAP Worksheet #27 for Sample ID | Swipe | Not applicable [c] | Gross Alpha/Gross Beta | See Worksheet #17 | SOP-001 |
| Biased and Systematic Samples / See SAP Worksheet #27 for Sample ID | Soil | TBD [b] | Gamma Isotopes [a] (which includes Co-60, Cs-137, Ra-226, and Th-232)<br><br>10 percent of samples analyzed for gamma isotope definitive analysis will be randomly selected for analysis of additional ROCs for this site which include Sr-90, U-238, and Tritium. | See Worksheet #17 | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

## IR SITE 2/ORION STREET LANDFILL (SOUTH): ROC is Ra-226.

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Biased and Systematic Samples / See SAP Worksheet #27 for Sample ID | Soil | TBD [b] | Gamma Isotopes [a] (which includes Ra-226) | See Worksheet #17 | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

**BUILDING 9 MWR CPO WARDROOM/VPU/ELECTRONICS AND ORDNANACE SHOP: ROCs are Cs-137, Ra-226, Th-232, U-238, and Tritium.**

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Building surfaces / See SAP Worksheet #27 for Sample ID | Swipe | Not applicable [c] | Gross Alpha/Gross Beta | See Worksheet #17 | SOP-001 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

### IR SITE 6 SANDY RUBBLE AND ASBESTOS DISPOSAL SITE: ROCs are Co-60, Cs-137, Ra-226, Th-232, Sr-90, Tritium, and U-238.

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Biased and Systematic Samples / See SAP Worksheet #27 for Sample ID | Soil | TBD [b] | Gamma Isotopes [a] (which includes Co-60, Cs-137, Ra-226, and Th-232)<br><br>10 percent of samples analyzed for gamma isotope definitive analysis will be randomly selected for analysis of additional ROCs for this site which include Sr-90, Tritium, and U-238. | See Worksheet #17 | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

## BACKFILL SOIL (OFF-SITE SOURCE)

| Sampling Location/ ID Number | Matrix | Depth (feet) | Analytical Group | Number of Samples | Sampling SOP Reference |
|---|---|---|---|---|---|
| Backfill soil / See SAP Worksheet #27 for Sample ID | Soil | Not applicable | Gamma Isotopes<br>Sr-90<br>U-238<br>Tritium | See Worksheet #17 | SOP-006 |

## SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

***Notes:***

TestAmerica will initially analyze all excavated soil samples (biased, characterization, or systematic) by gamma spectroscopy. Once the systematic samples are classified as FSS samples, TestAmerica will either: 1) analyze those samples again by gamma spectroscopy after an in-growth period and based on the 609 keV Bi-214 gamma energy peak or, 2) recalculate the sample results in FSS format by applying an appropriate in-growth correction factor to determine Ra-226 concentration based on the Bi-214 concentration. (An in-growth period is defined as the period after Bi-214 approaches secular equilibrium with Ra-226, which is typically 21 calendar days, and thus the Ra-226 result will be reported based on the Bi-214 result, taking into account this time to achieve secular equilibrium.) In addition, 10 percent of the final FSS samples will be randomly chosen for total strontium or Sr-90, Isotopic Uranium for U-238 and liquid scintillation counting for H-3 analysis to be performed by TestAmerica (depending on the site). The final analytical results will be used to determine that results from the soil are below release criteria.

[a] Gamma spectroscopy analysis using the Ra-226 186.2 keV gamma energy peak as a screening method can be used for all soil samples initially. However, reference background area samples and FSS samples will also be analyzed after a 21-day in-growth period to produce definitive data.

[b] The depth cannot be determined until the remediation has been completed.

[c] Swipes samples are not collected at depths but collected on surfaces. Therefore, depth is not applicable.

## SAP Worksheet #19 – Analytical SOP Requirements Table

| Matrix | Analytical Group | Analytical and Preparation Method/SOP Reference | Containers | Sample Volume | Preservation Requirements (chemical, temperature, light protected) | Maximum Holding Time (preparation/analysis) |
|---|---|---|---|---|---|---|
| Soil | Gamma Isotopes (TestAmerica) Screening/Definitive | EPA 901.1 or DOE EML HASL 300 Method GA-01-R/ ST-RD-0102 | Gallon size resealable plastic bag | ~ 1,000 g | None | Not applicable |
| Soil | Sr-90 (TestAmerica) | EPA 905.0 or 905/ ST-RD-0403 | Gallon size resealable plastic bag | ~ 300 g | None | Not applicable |
| Soil | U-238 (TestAmerica) | DOE HASL A-01-R/ ST-RD-0210 | Gallon size resealable plastic bag | ~ 300 g | None | Not applicable |
| Soil | Tritium (TestAmerica) | EPA 906.0/ ST-RD-0302 | Gallon size resealable plastic bag | ~ 300 g | None | Not applicable |

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## SAP Worksheet #20 – Field Quality Control Sample Summary Table

| Matrix | Analytical Group | No. of Sampling Locations | No. of Field Duplicates | No. of MS/MSDs [b] | No. of Source Blanks [b] | No. of Equipment Blanks [b] | No. of VOA Trip Blanks [b] | Total No. of Samples to Lab |
|---|---|---|---|---|---|---|---|---|
| Soil | Gamma Isotopes | TBD [a] | 1 per 20 samples | Not applicable | Not applicable | Not applicable | Not applicable | TBD [a] |

***Notes:***

[a] Number of sampling locations will be deteremined in the field as described in Worksheet #17.

[b] Matrix spike (MS)/matrix spike duplicates (MSDs) are not applicable to radiological analyses because radiological methods do not require MS/MSDs since it is not possible to spike a sample with a radiological isotope. In addition, source and equipment blanks are not required since samples are collected with disposable equipment. Trip blanks are only applicable to volatile analysis and not radiological analyses.

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## SAP Worksheet #21 – Project Sampling SOP References Table

| Reference Number | Title, Revision Date and/or Number | Originating Organization of Sampling SOP | Equipment Type | Modified for Project Work? (Y/N) | Comments |
|---|---|---|---|---|---|
| SOP-001 | Radiation and Contamination Surveys, Revision 0, 11/9/12 | TtEC | See SOP attached in Appendix A | N | None |
| SOP-006 | Sampling Procedures for Radiological Surveys, Revision 0, 11/9/12 | TtEC | See SOP attached in Appendix A | N | None |

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## SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table

| Field Equipment | Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference | Comments |
|---|---|---|---|---|---|---|---|
| Ludlum Mod 3 or 12 Meter w/ 44-9 detector (or equivalent); Ludlum Model 19 (or equivalent); Ludlum 2350-1 w/ 44-10 detector (or equivalent); Ludlum 2360 w/ 43-68 detector (or equivalent); Ludlum 2360 w/ 43-89 detector (or equivalent); Eberline Model RO-20 (or equivalent); GR 135 Exploranium (or equivalent); Ludlum Model 177 w/ HP-210 detector (or equivalent) | 1. Calibrate at laboratory featuring NIST traceable standards<br>2. Operational checks and verifications | 1. Annually<br>2. Daily | 1. Pass/fail<br>2. +/- 20% of baseline response criteria | 1. If recalibration fails, then instrument combo is retained/exchanged by instrument vendor.<br>2. If checks and verifications fail, then instrument combo is placed OOS/returned to instrument vendor for repair/exchange. Subsequently, data collected with instrument since previous QC check will be reviewed. | Site Instrument Mechanic or Radiological Control Technician under direction of Project Supervisor (with oversight from project/ license RSO) | SOP-002 (as provided in Appendix A in this SAP) | None |

## SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table (Continued)

| Field Equipment | Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference | Comments |
|---|---|---|---|---|---|---|---|
| F&J High/Lo Vol Air Sampler (or equivalent | 1. Calibrate at laboratory featuring manufacturer air flow acceptance standards and equipment<br>2. Operational checks and verifications | 1. Annually<br>2. Daily | Pass/fail | If checks and verifications fail, then instrument combo is placed OOS/returned to instrument vendor for repair/ exchange. | Site Instrument Mechanic or Radiological Control Technician under direction of Project Supervisor (with oversight from project/ license RSO) | SOP-002 (as provided in Appendix A in this SAP) | None |

## SAP Worksheet #23 – Analytical SOP References Table

| Lab SOP Number [a] | Title, Revision Date, and/or Number | Definitive or Screening Data | Matrix and Analytical Group | Instrument | Organization Performing Analysis | Modified for Project Work? (Y/N) |
|---|---|---|---|---|---|---|
| ST-RD-0102 | Gammavision Analysis, Revision 12, 04/16/14 | Screening/ Definitive | Soil<br>Gamma Isotopes | Geranium Spectroscopy System | TestAmerica | N |
| ST-RD-0403 | Low Background Gas Flow Proportional Counting System Analysis<br>Revision 14, 09/12/13 | Definitive | Soil<br>Sr-90 | Gas Flow Proportional Counter | TestAmerica | N |
| ST-RD-0210 | Alpha Spectroscopy Analysis<br>Revision 11, 08/21/13 | Definitive | Soil<br>U-238 | Alpha Spectrometer | TestAmerica | N |
| ST-RD-0302 | Liquid Scintillation Counter Analysis<br>Revision 14, 05/08/13 | Definitive | Soil<br>Tritium | Liquid Scintillation Counter | TestAmerica | N |

***Notes:***
[a] Analytical SOP revision number and date listed are current as of the date this SAP was published.

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## SAP Worksheet #24 – Analytical Instrument Calibration Table

| Instrument | Calibration Procedure | Frequency of Calibration | Acceptance Criteria | Corrective Action (CA) | Person Responsible for CA | SOP Reference |
|---|---|---|---|---|---|---|
| Geranium Spectroscopy System | • Energy calibration<br>• Efficiency calibration | Major changes to the system or when the continuing calibration criteria cannot be met. | Per Sections 10.1.1.5 and 10.1.2.5 of the SOP. | • Recalibration<br>• Instrument maintenance<br>• Notify laboratory manager | TestAmerica Group Leader | ST-RD-0102 |
| Gas Flow Proportional Counter | • Plateau generation and/or verification<br>• Discriminator setting<br>• Initial long background count<br>• Mass attenuated efficiency calibration<br>• Eight source dual/single calibration curves | Annual | • Plot efficiencies vs. masses<br>• Calculate equation of curve – degree ≤3<br>• Remove outliers >15% deviation from theoretical values but not more than 20% of total points<br>• Calculate coefficient of determination (R^2). R^2 must be ≥0.9<br>• Verify calibration with second source standard count – must be within 30 percent of true value and mean across all detectors <10% | • Recalibrate<br>• Instrument maintenance<br>• Consult with Technical Director | TestAmerica Group Leader | ST-RD-0403 |

## SAP Worksheet #24 – Analytical Instrument Calibration Table (Continued)

| Instrument | Calibration Procedure | Frequency of Calibration | Acceptance Criteria | Corrective Action (CA) | Person Responsible for CA | SOP Reference |
|---|---|---|---|---|---|---|
| Alpha Spectrometer | 1. Energy calibration<br>2. Efficiency calibration and background check<br>3. Subtraction spectrum<br>4. Pulser check | 1. Monthly<br>2. Monthly<br>3. Monthly<br>4. Daily | 1. Three isotopes in 3–6 MeV range all within ± 40 keV of expected value<br>2. >20%<br>3. Ultra Low Level: < 2 CPM<br>Low Level: < 2–4 CPM<br>Routine Level: < 4–10 CPM<br>High Level: < 10–20 CPM<br>4. Pulser energy, peak centroid, peak resolution, peak area, calibration | • Recalibrate<br>• Instrument maintenance<br>• Consult with Technical Director<br>• If background check is > 20 CPM, then detector requires maintenance | TestAmerica Group Leader | ST-RD-0210 |
| Liquid Scintillation Counter | 1. Statistical baseline for C-14 and H-3 backgrounds and efficiencies<br>2. Check of C-14 and H-3 backgrounds and efficiencies<br>3. Quench curve for specific nuclide | 1. Startup or long-term use<br>2. Daily<br>3. Annual | 1. Developed with statistical limits at time of startup<br>2. Within 3 sigma of baseline established at startup or when re-established<br>3. Second source verification ± 10% of true value | • Recalibrate<br>• Instrument maintenance<br>• Consult with Technical Director | TestAmerica Group Leader | ST-RD-0302 |

## SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

| Instrument Equipment | Maintenance Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference |
|---|---|---|---|---|---|---|---|---|
| Geranium Spectroscopy System | Clean cave; fill $LNO_2$ | Physical check | Physical check | Weekly | Acceptable background | • Recalibrate<br>• Instrument maintenance<br>• Consult laboratory manager | TestAmerica Group Leader/Analyst | ST-RD-0102 |
| | Background check/Check deviation | Physical check | Physical check | Prior to use and at minimum daily | Within 3 sigma of measured population | • Recalibrate<br>• Instrument maintenance<br>• Consult laboratory manager | TestAmerica Group Leader/Analyst | ST-RD-0102 |
| | Source check/Check deviation | Physical check | Physical check | Prior to use and at minimum daily | Within 3 sigma of measured population | • Recalibrate<br>• Instrument maintenance<br>• Consult laboratory manager | TestAmerica Group Leader/Analyst | ST-RD-0102 |
| Gas Flow Proportional Counter | 1. Clean instrument<br>2. Inspect windows<br>3. QA check | 1. Physical check<br>2. Physical check<br>3. Background and source count | 1. Physical check<br>2. Physical check<br>3. Check deviation | 1. Daily<br>2. High counts and/or background<br>3. Daily | 1. None applicable<br>2. No physical defects<br>3. Within ± 3 percent of 20 day population | • Recalibrate<br>• Instrument maintenance<br>• Consult with Technical Director | TestAmerica Group Leader/Analyst | ST-RD-0403 |
| Alpha Spectrometer | Clean planchette holders | Physical check | Physical check | Monthly | Acceptable background and calibration efficiencies | • Recalibrate<br>• Instrument maintenance<br>• Consult with Technical Director | TestAmerica Group Leader/Analyst | ST-RD-0210 |

## SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

| Instrument Equipment | Maintenance Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference |
|---|---|---|---|---|---|---|---|---|
| Liquid Scintillation Counter | 1. QA check<br>2. Clean dust and debris from sample deck<br>3. Photon multiplier tubes cleaned by manufacturer | 1. Background and efficiency verification for C-14 and H-3<br>2. Physical check<br>3. Physical check | 1. Review of daily control data<br>2. Physical check<br>3. Physical check | 1. Daily<br>2. Monthly<br>3. Semi-annual or annual | For all three maintenance activities: within 3 sigma of established baselines and stable baselines for C-14 and H-3 efficiencies | • Recalibrate<br>• Instrument maintenance<br>• Consult with Technical Director | TestAmerica Group Leader/Analyst | ST-RD-0302 |

## SAP Worksheet #26 – Sample Handling System

### Sample Handling System

| |
|---|
| **SAMPLE COLLECTION, PACKAGING, AND SHIPMENT** |
| Sample Collection (Personnel/Organization): Sampler/TtEC |
| Sample Packaging (Personnel/Organization): Sampler/TtEC |
| Coordination of Shipment (Personnel/Organization): Sampler/TtEC |
| Type of Shipment/Carrier: Commercial carrier |
| **SAMPLE RECEIPT AND ANALYSIS** |
| Sample Receipt (Personnel/Organization): Sample Custodian/TestAmerica |
| Sample Custody and Storage (Personnel/Organization): Sample Custodian/TestAmerica |
| Sample Preparation (Personnel/Organization): Sample preparation personnel/TestAmerica |
| Sample Determinative Analysis (Personnel/Organization): Analyst/ TestAmerica |
| **SAMPLE ARCHIVING** |
| Field Sample Storage (No. of days from sample collection): Samples may be requested to be returned to project site for archival by TtEC. |
| Sample Extract/Digestate Storage (No. of days from extraction/digestion): Not applicable for radiological analyses |
| Biological Sample Storage (No. of days from sample collection): Not applicable to this project |
| **SAMPLE DISPOSAL/ARCHIVE** |
| Personnel/Organization: Sample Custodian/TestAmerica |
| Number of Days from Analysis: Samples may be requested to be returned to project site for archival by TtEC. |

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## SAP Worksheet #27 – Sample Custody Requirements Table

An overriding consideration for data resulting from laboratory analyses is the ability to demonstrate that the data are legally defensible, i.e., that the samples were obtained from the locations stated and that they reached the laboratory without alteration. To accomplish this, evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal will be documented through the COC record. A sample is considered to be in custody if the following conditions have been observed:

- In actual possession or in view of the person who collected the samples
- Locked in a secure area
- Placed in an area restricted to authorized personnel

The COC record lists each sample and the individuals performing the sample collection, shipment, and receipt. The COC record will be the controlling document to ensure that the sample custody is maintained. Each time the sample custody is transferred, the former custodian will sign the COC on the _Relinquished By_ line, and the new custodian will sign the COC on the _Received By_ line. The date, time, and project or company affiliation will accompany each signature. When a commercial carrier is used to ship samples to the laboratory, the waybill number and carrier name (i.e., FedEx or UPS) will be recorded on the COC. The shipping container will be secured with two custody seals, thereby allowing for custody to be maintained by the shipping personnel until receipt by the laboratory.

Sample custody will be the responsibility of sampling personnel from the time of sample collection until the samples are accepted by the laboratory. Thereafter, the laboratory performing the analysis will maintain custody. The sample custodian will sign the COC, inventory each shipment, and note any discrepancies on the sample login form. The laboratory will immediately notify the TtEC Project Chemist of any discrepancies. The laboratory will have a system for tracking samples consistent with the Quality Systems Manual (QSM) (DoD 2010). Radiological soil samples submitted to TestAmerica may also be returned to NAS Brunswick for archiving and disposition at the request of TtEC.

In addition to providing a custody exchange record for the samples, the COC record serves as a formal request for sample analyses. The COC records will be completed, signed, and distributed as follows:

- The original copy sent to the laboratory along with the samples
- A copy retained on-site for inclusion in the project files
- A copy e-mailed to the Project Chemist on a daily basis to allow tracking of samples sent to the laboratory to confirm laboratory receipt of samples

### *SAMPLE NUMBERING*

The sample number will be recorded in the field logbook, on the labels, and on the COC record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification

## SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

number. Samples will be uniquely designated using a numbering system that identifies the CTO number, location/type of sample, and a sequential number as follows:

- Reference Area: **WW-XXXX-RAUU-VVV**, where:

  WW – CTO number, i.e. 09
  XXXX – abbreviation for worksite
  RA – indicates that the sample is a "reference area" sample
  UU – two-character consecutive sample number indicating reference area number (starting with 01)
  VVV – three-character consecutive sample number starting with 001 (number of samples collected from each reference area)

- Imported Soil (off-site source): **WW-XXXX-IFUU-VVV**, where:

  WW – CTO number, i.e. 09
  XXXX – abbreviation for worksite
  IF – indicated "Imported Fill" soil sample from an off-site source
  UU – two-character consecutive sample number indicating pile number (starting with 01)
  VVV – three-character consecutive sample number starting with 001 (number of samples collected from each pile number)

- Anomalous Soil Investigation: **WW-XXXX-YYYYSUUULZZ-VVV**, where:

  WW – CTO number, i.e. 09
  XXXX – abbreviation for worksite
  YYYY – abbreviation for site area location
  SU – indicates that the sample is from a "survey unit"
  UU – survey unit number
  L – indicates which anomaly location within the survey unit, the sample is from
  ZZ – location number
  VVV – three-character consecutive sample number starting with 001 (number of samples collected from each sampled location)

- Building or Site Survey Unit: **WW-YYYY-SUUU-TVVV-ZZ**, where:

  WW – CTO number, i.e. 09
  YYYY – abbreviation for building or site area location
  SU – indicates that the sample is from a "survey unit"
  UU – survey unit number
  T – single-character identifier that represents sample collection location (C=ceiling, F=floor or ground surface, R=roof, W=wall)
  VVV – three-character consecutive sample number for this survey unit (starting with 001)
  ZZ – two-character consecutive sample number starting with 01 (to be used if additional samples are collected from the same location)

## SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

- Soil Pit Unit Excavated/In-Situ: **WW-PYY-TUUUU-VV**, where:

  WW – CTO number, i.e. 09
  P – indicates soil pit
  YY – soil pit unit number
  T – single-character identifier that represents sample collection location (E=excavated soil, S=In-Situ soil)
  UUUU – four-character consecutive sample number indicating soil testing unit number (starting with 0001)
  VV – two-character consecutive sample number starting with 01 (to be used if additional samples are collected from the same location)

- Ancillary Sample (off-site source): **WW-AUUUU-VVV**, where:

  WW – CTO number, i.e. 09
  A – indicates that the sample is ancillary and not associated with another identified sample category
  UUUU – abbreviation for specific sample collection area
  VVV – three-character consecutive sample number for this ancillary grouping (starting with 001)

### *SAMPLE PACKAGING*

Samples to be transported to the laboratory will be shipped in boxes or coolers. Glass containers will be wrapped in bubble wrap to protect from breakage during transport. The COC record will include the air bill number for the commercial carrier (FedEx or UPS), and the “Received By” box will be labeled with the commercial carrier’s name. The COC record will be sealed in a double-resealable plastic bag and then taped to the inside of the sample cooler lid. The cooler will be taped shut with strapping tape. Two custody seals will be taped across the cooler lid: one seal in the front and one seal in the back. Clear tape will be applied to the custody seals to prevent accidental breakage during shipment. The pouch for the air bill will be placed on the cooler and secured with clear tape. The air bill will be completed and placed in the pouch. If multiple coolers are being shipped, the original air bill will be placed on the cooler with the COC record, and copies of the air bill will be placed on the other coolers. The number of packages should be included on each air bill (1 of 2, 2 of 2). Saturday deliveries, if required, should be coordinated with the laboratory in advance via the TtEC Project Chemist, and field sampling personnel or their designee must ensure that Saturday delivery stickers are placed on each cooler by the commercial carrier.

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## SAP Worksheet #28 – Laboratory QC Samples Table

**Matrix:** Soil
**Analytical Group:** Gamma Isotopes
**Analytical Method/SOP Reference**: EPA 901.1 or DOE EML HASL 300 Method GA-01-R / ST-RD-0102

| QC Sample | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Background Sample | Daily | Absolute value < MDA | [a] | TestAmerica Analyst | Accuracy | Absolute value < MDA |
| LCS | Weekly<br><br>Weekly and may be performed 1 per preparatory batch (defined as ≤ 20 samples) for FSS samples | Gamma source check ± 20% of known activity<br><br>Cs-137: 87-120%<br>Co-60: 87-115% | [b] | TestAmerica Analyst | Accuracy | Gamma source check ± 20% of known activity<br><br>Cs-137: 87-120%<br>Co-60: 87-115% |
| Sample Duplicate | 1 per preparatory batch (defined as ≤ 20 samples) | RPD ≤40% or RER ≤1 | [c] | TestAmerica Analyst | Precision | RPD ≤40% or RER ≤1 |

## SAP Worksheet #28 – Laboratory QC Samples Table (Continued)

**Matrix:** Soil
**Analytical Group:** Sr-90
**Analytical Method/SOP Reference**: EPA 905.0 or 905 / ST-RD-0403

| QC Sample | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | 1 per preparatory batch (defined as ≤ 20 samples) | Analytes < MDA | [a] | TestAmerica Analyst | Accuracy | Analytes < MDA |
| LCS and/or LCSD | 1 per preparatory batch (defined as ≤ 20 samples) | 88–136%<br>RPD ≤40% and/or RER ≤1 | [b] | TestAmerica Analyst | Accuracy | 88–136%<br>RPD ≤40% and/or RER ≤1 |
| Sample Duplicate | 1 per preparatory batch (defined as ≤ 20 samples) | RPD ≤40% and/or RER ≤1 | [c] | TestAmerica Analyst | Accuracy | RPD ≤40% and/or RER ≤1 |
| Tracers | Per sample, blank, LCS, LCSD, duplicate | Sr and/or Y tracers: 40–110% | [d] | TestAmerica Analyst | Accuracy | Sr and/or Y tracers: 40–110% |

## SAP Worksheet #28 – Laboratory QC Samples Table (Continued)

**Matrix:** Soil
**Analytical Group:** U-238
**Analytical Method/SOP Reference**: DOE HASL A-01-R / ST-RD-0210

| QC Sample | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | 1 per preparatory batch (defined as ≤ 20 samples) | Analytes < MDA | [a] | TestAmerica Analyst | Accuracy | Analytes < MDA |
| LCS and/or LCSD | 1 per preparatory batch (defined as ≤ 20 samples) | 70–130%<br>RPD ≤40% and/or RER ≤1 | [b] | TestAmerica Analyst | Accuracy | 70–130%<br>RPD ≤40% and/or RER ≤1 |
| Sample Duplicate | 1 per preparatory batch (defined as ≤ 20 samples) | RPD ≤40% and/or RER ≤1 | [c] | TestAmerica Analyst | Accuracy | RPD ≤40% and/or RER ≤1 |
| Tracer | Per sample, blank, LCS, LCSD, duplicate | 30–110% | [d] | TestAmerica Analyst | Accuracy | 30–110% |

## SAP Worksheet #28 – Laboratory QC Samples Table (Continued)

**Matrix:** Soil
**Analytical Group:** Tritium
**Analytical Method/SOP Reference**: EPA 906.0 / ST-RD-0302

| QC Sample | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | 1 per preparatory batch (defined as ≤ 20 samples) | Analytes < MDA | [a] | TestAmerica Analyst | Accuracy | Analytes < MDA |
| LCS and/or LCSD | 1 per preparatory batch (defined as ≤ 20 samples) | 78–122%<br>RPD ≤40% and/or RER ≤1 | [b] | TestAmerica Analyst | Accuracy | 78–122%<br>RPD ≤40% and/or RER ≤1 |
| Sample Duplicate | 1 per preparatory batch (defined as ≤ 20 samples) | RPD ≤40% and/or RER ≤1 | [c] | TestAmerica Analyst | Accuracy | RPD ≤40% and/or RER ≤1 |

## SAP Worksheet #28 – Laboratory QC Samples Table (Continued)

***Notes:***

[a] Any sample associated with a background sample or method blank that fails the criteria checks will be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results will be reported with appropriate data qualifying codes.

[b] Reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.

[c] Reprep and reanalyze the sample and duplicate in the associated preparatory batch for failed analytes if sufficient sample material is available and the sample is homogeneous. If RPD/RER still out of range, report as matrix interference confirmed and write a nonconformance. If reanalysis is in range, re-extract samples in batch.

[d] The data will be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.

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## SAP Worksheet #29 – Project Documents and Records Table

| Document | Where Maintained |
|---|---|
| SAP | TtEC project file; Navy Administrative Record |
| Field logbook | TtEC project file |
| Field forms | TtEC project file |
| COC | TtEC project file; TestAmerica |
| Shipping records | TtEC project file |
| Field surveillance reports | TtEC project file |
| Field Change Requests | TtEC project file |
| TestAmerica laboratory data package (EPA Level IV-equivalent) | TtEC project file and TestAmerica; project file copy will subsequently be sent to Navy Administrative Record |

Field documentation associated with sampling activities includes field logbooks, sample labels, COCs, sample shipping records, field surveillance reports, and Field Change Request (FCR) forms. In addition, laboratory documentation will be generated during this project. These types are described in the following sections.

### Field Logbook

A permanently bound field logbook with consecutively numbered pages, used for sampling activities only, will be assigned to this project. The logbooks will be numbered sequentially on the cover by the Project Quality Control Manager (PQCM) and that number will be entered into a logsheet maintained by the PQCM. All entries will be recorded in indelible black or blue ink. At the end of each work day, the logbook pages will be signed by the responsible sampler, and any unused portions of the logbook pages will be crossed out, signed, and dated. If it is necessary to transfer the logbook to another person, the person relinquishing the logbook will sign and date the last page used, and the person receiving the logbook will sign and date the next page to be used. At a minimum, the logbook will contain the following information:

- Project name and site location
- Date and time
- Personnel in attendance
- General weather information
- Work performed
- Field observations
- Sampling performed, including specifics such as location, type of sample, type of analyses, and sample identification

## SAP Worksheet #29 – Project Documents and Records Table (Continued)

- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments
- Descriptions of deviations from this SAP
- Problems encountered and corrective action taken
- Identification of field QC samples
- QC activities
- Verbal or written instructions
- Any other events that may affect the samples

### Sample Labels

For gamma isotope sample collection for TestAmerica, a resealable plastic bag will be used to collect soil samples. Two sample labels will be computer generated at the time the COC is prepared. One label will be affixed to the resealable plastic bag and the second will be affixed to the prepared tuna can used for sample processing. (If not computer generated, labels will then be hand-written using indelible black or blue ink.) The label will contain the following:

- Sample identification number
- Sample collection date (month/day/year)
- Time of collection (24-hour clock) from the start of sampling
- Sampler's initials
- Sample weight (data completed by laboratory)

If containers are too small to fit the entire above-listed sample information (like for swipe samples), at a minimum the container will be labeled with the sample identification number.

### Chain-of-Custody

COC information is described in SAP Worksheet #27.

### Sample Shipping Records

Samples will be shipped via commercial carrier to the laboratory. The COC will be packaged within the cooler, and the sender's copy of the air bill will serve as custody documentation and will be maintained on-site in the project file. Sample shipping procedures are detailed in SAP Worksheet #27.

## SAP Worksheet #29 – Project Documents and Records Table (Continued)

### Field Surveillance Reports

Field surveillances will be performed in accordance with the three phases of inspection as required by the QC Program. A Preparatory Inspection will be performed by the PQCM prior to the first sampling activities. This will include a general orientation for health and safety. An Initial Inspection will be conducted at the beginning of field sampling activities for this project. Daily field inspections and subsequent surveillances will be performed at the discretion of the PQCM or the QCPM throughout the duration of the project. The PQCM will use the Initial Inspection Checklist during inspection.

### Field Change Request

An FCR will be prepared by the Program Chemist, or a designee, if a change to the SAP occurs during sampling or analysis activities. These changes will be minor and not result in a change in scope and/or DQOs for this project. The FCR must be approved prior to field implementation. Major changes to the work scope affecting the original DQOs may require preparation of a SAP Addendum.

### Laboratory Documentation

Samples will be assigned into a sample delivery group (SDG) number for every batch of 20 samples or less based on as received on a daily basis by the laboratory. Initial analytical results that are e-mailed to the TtEC Project Chemist for review will be submitted by the laboratory as follows:

- COC
- Case narrative
- Sample results
- Method blank results
- Laboratory control sample (LCS) results
- Laboratory duplicate results

The following documentation is maintained by TestAmerica and is available for review, as required:

- Energy control check standard daily for each detector

TestAmerica will then produce a final EPA Level IV-equivalent data package in PDF format that will be sent to the TtEC Project Chemist. The package will be page numbered, and contain the following information:

- Cover page (with laboratory name, address, phone number, contact person, and SDG number, as well as the project name and project number)
- Table of contents
- Case narrative including resolution of all corrective actions and nonconformance

## SAP Worksheet #29 – Project Documents and Records Table (Continued)

- Sample management records, including a copy of the COC record, shipping documents as applicable, and laboratory sample receipt forms
- Cross-reference table for sample IDs versus laboratory IDs
- Analytical results and quality assurance/QC information as follows:
  - Radiological raw data sequence
    a. Sample results forms, including method blanks
    b. Sample raw data
    c. QC summaries
    d. Initial calibration (ICAL)
    e. Calibration checks, including all related continuing calibration verifications (CCVs)
    f. Instrument run log
    g. Sample preparation log

All relevant laboratory raw data and documentation including, but not limited to, logbook, data sheets, electronic files, and reports, will be maintained by the laboratory for at least 5 years. TtEC must be notified 30 days before disposal of any relevant records.

An EDD will also be submitted to the TtEC Project Chemist in automated data review format. Both the EDDs and the hardcopy data package will present results to at least three significant figures. Results for QC analyses (method blanks, LCS, and duplicates) will be reported up to three significant figures.

When revisions to data packages are required, the revised pages will be stamped with the notation “amended or revised report” and have the same page numbering system as the original pages. If the revisions affect the EDDs, the revised EDD will then be sent along with the revised hardcopy pages to the TtEC Project Chemist.

## SAP Worksheet #30 – Analytical Services Table

| Matrix | Analytical Group | Sampling Locations/ ID Number | Analytical Method | Data Package Turnaround Time | Laboratory/ Organization (contact information) | Backup Laboratory/ Organization (contact information) |
|---|---|---|---|---|---|---|
| Soil | All | All | • EPA 901.1 MOD<br>• EPA 905.0/905<br>• DOE HASL A-01-R<br>• EPA 906.0 | 10-30 business days | TestAmerica<br>Contact: Erika Gish<br>13715 Rider Trail North<br>Earth City, MO 63045<br>(314) 298-8566 | TBD |

TestAmerica has been selected to analyze samples for this project, and they have successfully completed the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) certification, as provided in Appendix B, for the matrices and methods listed in SAP Worksheet #23 and will maintain current status throughout the duration of this project. The laboratory is capable of providing the project QC and data deliverables required by this SAP and the QSM for Environmental Laboratories (DoD 2010). Currently, the State of Maine Division of Environmental Health does not certify laboratories for radiological methods. TestAmerica sent confirmation email from the State to TtEC's Program Chemist confirming this.

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## SAP Worksheet #31 – Planned Project Assessments Table

| Assessment Type | Frequency | Internal or External | Organization Performing Assessment | Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation) | Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation) | Person(s) Responsible for Identifying and Implementing Corrective Actions (Title and Organizational Affiliation) | Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (Title and Organizational Affiliation) |
|---|---|---|---|---|---|---|---|
| Field Sampling Surveillance | At a minimum, once at the beginning, once during, and once toward the end of the project | Internal | TtEC | PQCM, TtEC | Project Manager, TtEC | Project Manager, TtEC | Project Manager and QCPM, TtEC |
| Management Review | Once during the project duration | Internal | TtEC | QCPM, TtEC | Project Manager, TtEC | Project Manager, TtEC | PQCM, TtEC |

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## SAP Worksheet #32 – Assessment Findings and Corrective Action Responses

| Assessment Type | Nature of Deficiencies Documentation | Individual(s) Notified of Findings (Title and Organizational Affiliation) | Time Frame of Notification | Nature of Corrective Action Response Documentation | Individual(s) Receiving Corrective Action Response (Title and Organizational Affiliation) | Time Frame for Response |
|---|---|---|---|---|---|---|
| Field Sampling Surveillance | Surveillance Report | Project Manager, TtEC | 7 days after completion of the inspection | Corrective Action Report | Project Manager and QCPM, TtEC | 5 days after notification |
| Management Review | Surveillance Report | Project Manager, TtEC | 7 days after completion of the inspection | Corrective Action Report | Project Manager, TtEC | 14 days after notification |

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## SAP Worksheet #33 – QA Management Reports Table

| Type of Report | Frequency (daily, weekly monthly, quarterly, annually, etc.) | Projected Delivery Date(s) | Person(s) Responsible for Report Preparation (Title and Organizational Affiliation) | Report Recipient(s) (Title and Organizational Affiliation) |
|---|---|---|---|---|
| Field Sampling Surveillance Report | Once at the beginning, once during, and once towards the end of field sampling activities | Determined during the project | PQCM, TtEC | Project Manager and QCPM, TtEC |
| Management Review Report | Once after management review is completed | Determined during the project | QCPM, TtEC | Project Manager and Program Manager, TtEC |

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## SAP Worksheet #34 – Verification (Step I) Process Table

| Verification Input | Description | Internal/ External | Responsible for Verification (Title and Organizational Affiliation) |
|---|---|---|---|
| Field logbook | Field logbooks will be reviewed weekly and verified for information accuracy and completeness. The inspection will be documented in daily QC reports. | I | PQCM, TtEC |
| COC records | COC records will be reviewed daily upon their completion and verified for completeness. | I | PQCM, TtEC<br>Project Chemist, TtEC |
| Sample receipt | The Project Chemist will verify receipt of samples by the laboratory. | I | Project Chemist, TtEC |
| Sample logins | Sample login information will be reviewed and verified for accuracy and completeness in accordance with the requirements in this SAP. | E | Laboratory Project Manager, TestAmerica |
| Laboratory analytical results prior to release | Laboratory analytical results will be reviewed to verify that the requirements in this SAP have been met. Prior to release, results will be verified as follows: | E | Laboratory Project Manager, TestAmerica |
| | All analytical results (100 percent) comply with the method- and project-specific requirements and any deviations or failure to meet criteria is documented for the project file. | E | Analyst, TestAmerica |
| | All manual entries (100 percent) are free of transcription errors and manual calculations are accurate; computer calculations are spot-checked to verify program validity; results reported are compliant with method- and project-specific QC requirements; raw data and supporting materials are complete; spectral assignments are confirmed; descriptions of deviations from method or project requirements are documented; significant figures and rounding have been appropriately used; reported values include dilution factors; and results are reasonable. | E | Peer Analyst, TestAmerica |
| | Analytical results reported are compliant with method- and project-specific QC requirements; the reported information is complete; the information in the report narrative is complete and accurate; and results are reasonable. | E | Supervisor, TestAmerica |
| | Analytical results reported are compliant with method- and project-specific QC; analytical methods are performed in compliance with approved SOPs. This review may be conducted after release of results since reviews are done only on 10 percent of the results. | E | Laboratory Project Manager, TestAmerica |

## SAP Worksheet #34 – Verification (Step I) Process Table (Continued)

| Verification Input | Description | Internal/ External | Responsible for Verification (Title and Organizational Affiliation) |
|---|---|---|---|
| Laboratory analytical results due at turnaround time listed on COC | Laboratory analytical results will be verified for having been obtained following the protocols in this SAP and being of sufficient quality to satisfy DQOs. | I | Project Chemist, TtEC |
| Laboratory data packages | Screening data reports and EPA Level IV-equivalent laboratory data packages will be verified by the laboratory performing the work for completeness and technical accuracy prior to submittal in accordance with requirements described in SAP Worksheet #29. | E<br><br>I | Laboratory Project Manager, TestAmerica<br><br>Project Chemist, TtEC |
| Field and electronic data | One hundred percent of manual entries will be reviewed against the hardcopy information and 10 percent of electronic uploads will be checked against the hardcopy. | I | Project Chemist, TtEC |

## SAP Worksheet #35 – Validation (Steps IIa and IIb) Process Table

| Step IIa/IIb | Validation Input | Description | Responsible for Validation (Title and Organizational Affiliation) |
|---|---|---|---|
| IIa | Sample Collection | Ensure that the sampling procedures described in this SAP were used to collect samples and that any deviations to those procedures were documented in a FCR. | PQCM, TtEC<br>Project Chemist, TtEC |
| IIa | Sample Handling | Ensure that the procedures described in this SAP for sample handling, packaging, and transport to the laboratory were followed. | PQCM, TtEC<br>Project Chemist, TtEC |
| IIa | Sample Documentation | Ensure that the COC procedures described in this SAP were followed for sample collection and that logbooks or field forms were completed as required. | PQCM, TtEC<br>Project Chemist, TtEC |
| IIa | Analytical Procedures | Ensure that the analytical methods and deliverable requirements described in this SAP were followed including holding times, analyte lists, and QC criteria. | Laboratory Project Manager, TestAmerica |
| IIa | Laboratory data reports | Data reports will be validated by the laboratory performing the work for technical accuracy and requirements listed in SAP Worksheet #29 prior to submittal. | Laboratory Project Manager, TestAmerica |
| IIb | Sampling Procedures | Review of sampling procedures to appropriately document if any deviations occurred and if corrective action is required. | PQCM, TtEC |
| IIb | Analytical Procedures | Review of analytical procedures to appropriately document if any deviations occurred and if corrective action is required. | Project Chemist, TtEC |
| IIb | Project quantitation imits goals and Laboratory QC Criteria | Ensure project quantitation limits and laboratory QC criteria were followed and any deviations documented. | Project Chemist, TtEC |

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## SAP Worksheet #36 – Analytical Data Validation (Steps IIa and IIb) Summary Table

| Step IIa/IIb | Matrix | Analytical Group | Validation Criteria | Data Validator (Title and Organizational Affiliation) |
|---|---|---|---|---|
| IIa | All | All | In accordance with laboratory SOPs listed in SAP Worksheet #23 | Project Chemist, TtEC |
| IIb | All | All | In accordance with DoD QSM | Project Chemist, TtEC |

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## SAP Worksheet #37 – Usability Assessment

After the analytical results have been reviewed, verified, and validated in accordance with SAP Worksheets #34 through 36, a data quality assessment (DQA) report may be prepared to assess data quality and usability. The DQA will include review of the following:

- Sample collection and analytical methods to verify that these were performed as discussed in SAP Worksheets #14 and 17
- Project-specific MDAs as listed in SAP Worksheet #15 to verify that project-specific remedial goals were met
- DQOs to determine whether they have been achieved by the data collected
- Project-specific data quality indicators for precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters as discussed below

Analytical DQOs as assessed through the PARCC parameters are as follows:

### Precision

Precision is the measure of the reproducibility of a set of replicate results or the agreement among repeat observations made under the same conditions. Analytical precision is the measurement of the variability associated with duplicate or replicate analyses. As applicable, field duplicate, sample duplicate, and laboratory control sample duplicate (LCSD) samples will be used to assess field and analytical precision. The precision measurement will be determined using the relative percent difference (RPD) or relative error ratio (RER) between the duplicate sample results as follows:

$$RPD = 100 \times 2 \times (\text{result - duplicate result})/(\text{result + duplicate result})$$

$$RER = (\text{result activity – duplicate activity})/(\text{sample uncertainty + duplicate uncertainty})$$
using 2 sigma propagated uncertainty

As applicable, the RPD or RER limits for laboratory duplicates and LCSD are presented in SAP Worksheet #28.

### Accuracy

Accuracy is defined as the nearness of a result or the mean of a set of results to the true or accepted value. Analytical accuracy is measured by comparing the percent recovery (%R) of analytes spiked into a sample against a control limit. Spiked samples include LCS or LCSD analyzed for every batch of up to 20 samples and serve as a measure of analytical accuracy. Surrogate standards, as applicable, are added to all samples, blanks, LCS, or LCSD and evaluate the method's accuracy and help to determine matrix interferences. %R is calculated as follows:

$$\%R = 100 \times (\text{spiked sample result - unspiked sample result})/\text{amount of spike added}$$

As applicable, the laboratory will review the spiked sample and surrogate recoveries for each analysis to ensure that the %R lies within the control limits listed in SAP Worksheet #28.

## SAP Worksheet #37 – Usability Assessment (Continued)

### Representativeness

Unlike precision and accuracy, which can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. It is a qualitative parameter that depends on proper design of the sampling program.

Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to the procedures in this SAP. Errors in sample collection, packaging, preservation, or COC procedures may result in samples being judged non-representative and may form a basis for rejecting the data.

### Completeness

Completeness is the percentage of measurements made that is judged to be valid. The completeness goal is to generate a sufficient amount of valid data to meet project needs. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with a rejected (R) flag. The requirement of completeness is 95 percent for samples and is determined using the following equation:

$$\% \text{ completeness} = 100 \times (\text{number of valid analyte results}/\text{number of possible results})$$

### Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another, whether it was generated by a single laboratory or during interlaboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical results.

Sample collection and handling procedures will adhere to EPA-approved protocols. Laboratory procedures will follow standard analytical protocols, use standard units and standardized report formats, follow the calculations as referenced in approved analytical methods, and use a standard statistical approach for QC measurements.

# REFERENCES

AEC (Atomic Energy Commission). 1974. Regulatory Guide 1.86. Termination of Operating Licenses for Nuclear Reactors. June.

DoD (Department of Defense). 2010. Quality Systems Manual for Environmental Laboratories. Version 4.2. October.

DoD, Department of Energy, Nuclear Regulatory Commission, and U.S. Environmental Protection Agency. 2000. Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575. August.

EPA (U.S. Environmental Protection Agency). 2000. Radionuclides Notice of Data Availability Technical Support Document. Targeting and Analysis Branch, Standards and Risk Management Division, Office of Groundwater and Drinking Water, EPA. March.

——————. 2002. Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS. December.

——————. 2005. Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP). March.

——————. 2006a. EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, QAMS. May.

——————. 2006b. Guidance on Systematic Planning using the Data Quality Objectives Process, EPA QA/G-4, QAMS. February.

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# FIGURES

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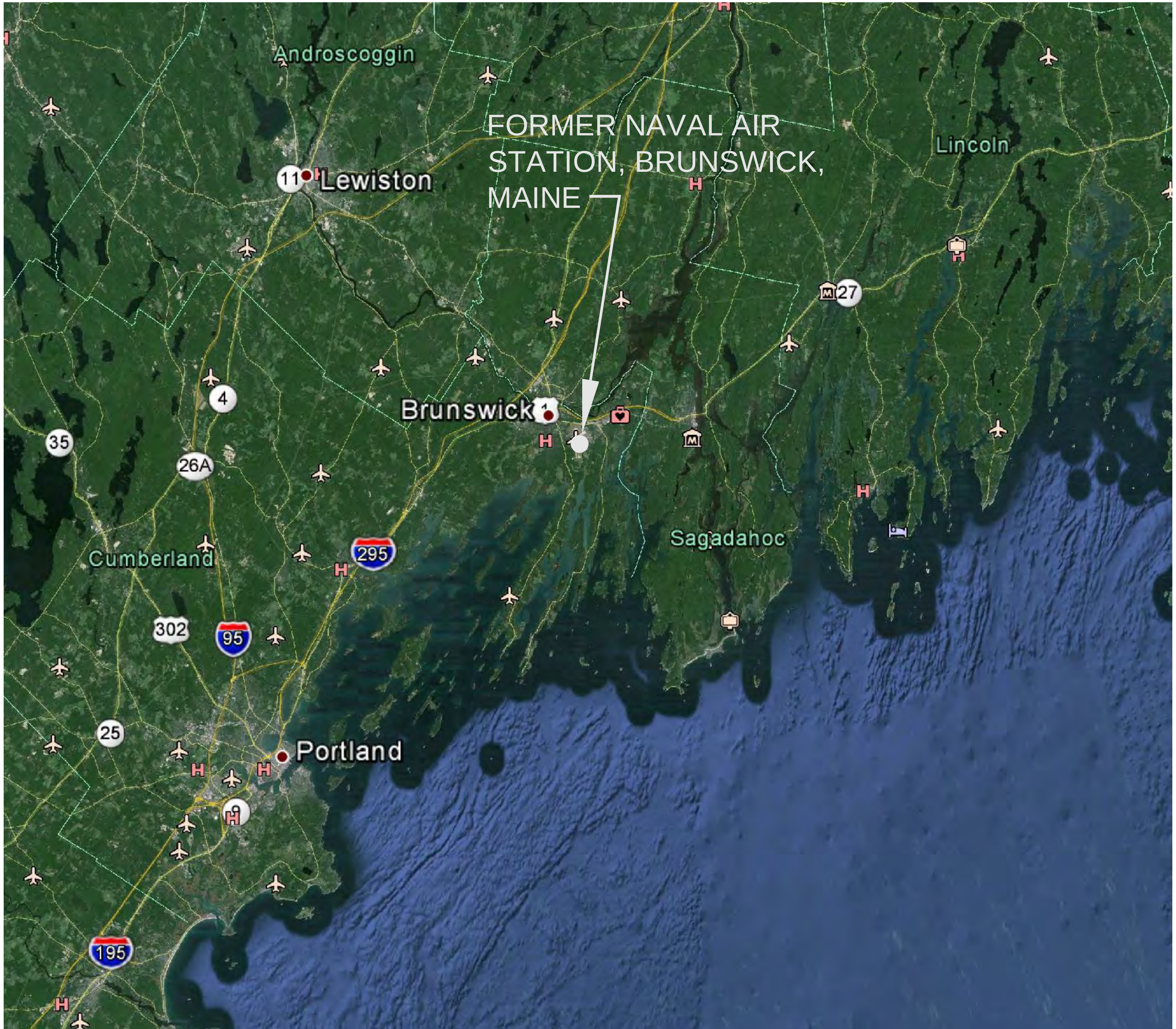


FORMER NAVAL AIR STATION, BRUNSWICK, MAINE

KEYPLAN

SAMPLING AND ANALYSIS PLAN

FIGURE 2-1

SITE LOCATION MAP

FORMER NAVAL AIR STATION, BRUNSWICK, MAINE

REVISION: –
AUTHOR: A.CRABTREE
PROJECT NO:
FILE: SEE BELOW

TETRA TECH EC, INC.

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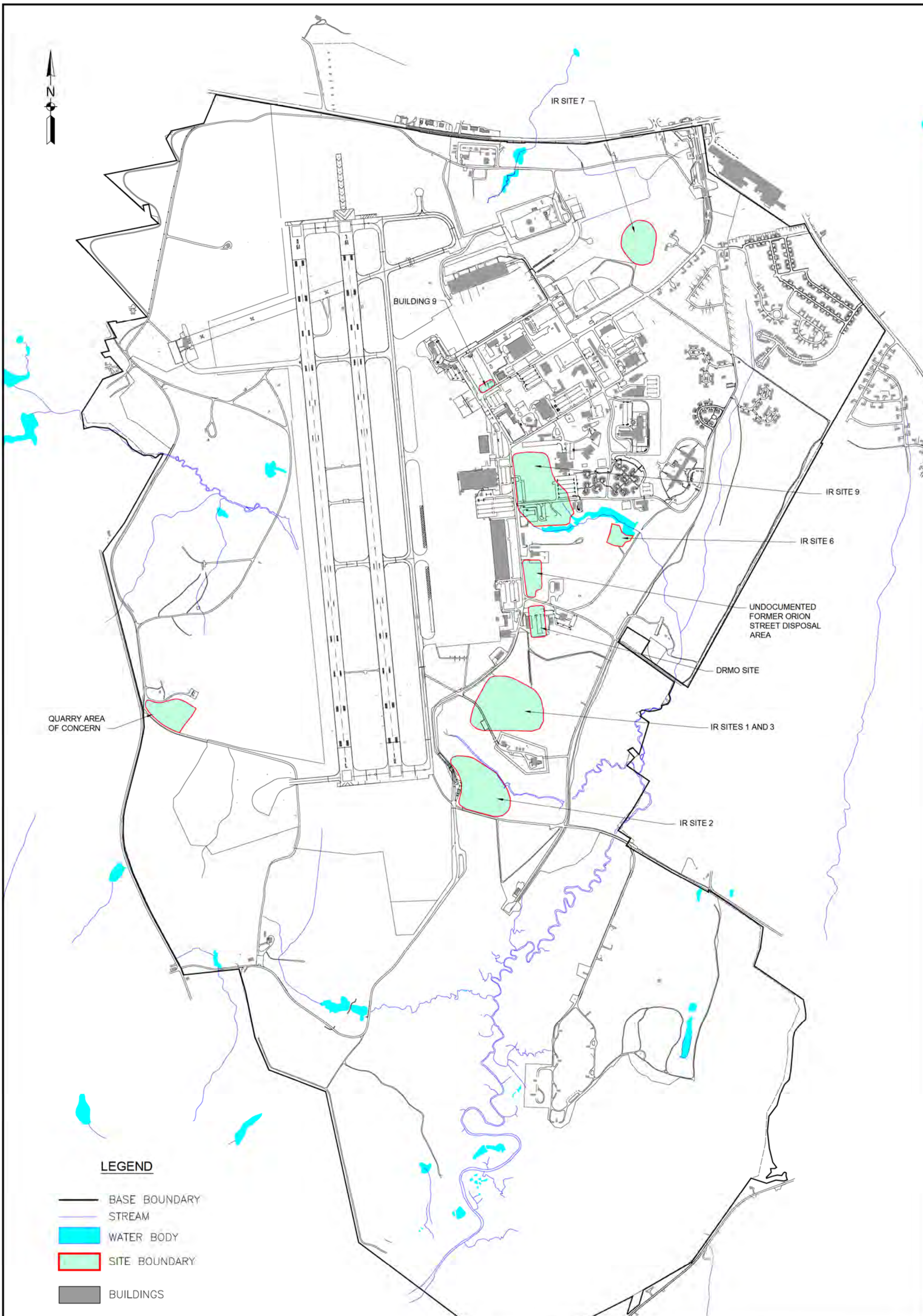


SAMPLING AND ANALYSIS PLAN

FIGURE 2-2

NAS BRUNSWICK SITES LOCATION MAP

FORMER NAVAL AIR STATION, BRUNSWICK, MAINE

REVISION: —
AUTHOR: A.CRABTREE
PROJECT NO:
FILE: SEE BELOW

TETRA TECH EC, INC.

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# APPENDIX A

# TtEC STANDARD OPERATING PROCEDURES

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# Standard Operating Procedure

## RADIATION AND CONTAMINATION SURVEYS

## SOP-001

## Revision 1

Approved By:

Erik Abkemeier, CHP, PE, CSP, CHMM
Corporate Health Physics Manager

8/19/2014
Date

## REVISION HISTORY

| *Revision (Date)* | *Rev. No* | *Prepared By* | *Description of Changes* | *Affected Pages* |
|---|---|---|---|---|
| 11/9/12 | 0 | E. Abkemeier | Original | All |
| 8/19/14 | 1 | E. Abkemeier | Clarification for alpha scanning, efficiencies, static counts | 8-10 |
| | | | | |
| | | | | |

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## 1.0 PURPOSE

The purpose of this procedure is to specify methods and requirements for radiological surveys, and to provide documentation of acquired data.

Adherence to this procedure will provide reasonable assurance that the surveys performed have reproducible results. This guidance for control of radiation exposures provided in this procedure is in accordance with the as low as reasonably achievable (ALARA) philosophy.

## 2.0 SCOPE

This procedure shall be implemented by Tetra Tech EC, Inc. (TtEC) staff and subcontractor personnel when conducting radiation or contamination surveys.

## 3.0 DEFINITIONS AND ABBREVIATIONS

**Activity** – The rate of disintegration (transformation) or decay of radioactive material. The units of activity for the purpose of this procedure are disintegrations per minute (dpm) for loose and fixed surface contamination, picocuries per gram (pCi/g) for soil, or microcuries per milliliter (μCi/mL) for airborne contamination.

**Contamination** – Deposition of radioactive material in any place is not desired. Contamination may be due to the presence of alpha particle, beta particle, or gamma-ray-emitting radionuclides.

**Exposure/Dose Rate** – The amount of radiation (exposure or dose) delivered at a given point per unit time. Typical units for exposure are microroentgen per hour (microR/hr) while typical units for dose are micro Rem per hour (microRem/hr).

**Fixed Contamination** – Radioactive contamination that is not readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk swipe, or masslin.

**Minimum Detectable Activity (MDA)** – For purposes of this procedure, MDA for removable radioactive contamination is defined as the smallest amount of sample activity that will yield a net count with a 95 percent confidence level based upon the background count rate of the laboratory counting instrument used.

**Minimum Detectable Concentration (MDC)** – For purposes of this procedure, MDC is the *a priori* activity level that a specific instrument and technique can be expected to detect 95 percent of the time for portable survey instruments.

**Removable Surface Contamination** – Radioactive contamination that is readily removed from a surface by applying light-to-moderate pressure when wiping with a paper or cloth disk swipe, or masslin.

## 4.0 PROCEDURE DETAILS

### 4.1 General

Radiation surveys are performed to identify radiation areas, measure the exposure and or dose rate, and assess the intensity and shape of those areas to determine control requirements at the worksite.

Contamination surveys are conducted to detect loose surface contamination and fixed contamination. Loose surface contamination is normally detected indirectly by a swipe sample or wipe performed on the item or surface of interest. Fixed contamination levels are measured directly.

Survey results, locations, and any unusual conditions shall be documented and described on survey forms like Attachments 1 and 2, Radiation/Contamination Survey Form, and Radiation/Contamination Survey Supplement, respectively.

When performing surveys, express readings as the actual observed number. Do not report "<MDA" or "<Bkg." When background corrections are made, results may be expressed as negative numbers as applicable.

Field backgrounds will be checked and MDC calculations verified each work day.

#### 4.1.1 Discussion

Radiation and contamination surveys shall be performed on an as-needed basis. The need for performing a survey is identified by, but not limited to, the following conditions:

- A condition exists where radiological data are needed.
- An investigation is required due to abnormal conditions or indications.
- An ongoing job requires a survey to update radiological postings.
- A routine survey is required to meet TtEC's Nuclear Regulatory Commission Radioactive Materials License or Agreement State Radioactive Materials License.
- As required to support Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM; NUREG-1575) based survey activities.

#### 4.1.2 Planning and Prerequisites

Instruments used to perform radiation and contamination surveys shall be operated in accordance with their operation procedure. Steps to be completed during the planning phase include the following:

- Obtain appropriate survey instruments and prepare the instruments for use.
- Obtain the necessary forms, swipes, and applicable protective clothing that will be used during the survey.

Prior to entering an area to perform a survey, each radiation detection instrument shall be:

- Checked to make sure battery is charged.
- Checked for obvious physical damage.
- Quantitatively response-checked daily, prior to use.

- Checked to ensure that the instrument calibration is current.

If any of the above conditions are unsatisfactory, the instrument shall be tagged “out of service” and not used.

## 4.2 Procedure Process

### 4.2.1 Exposure/Dose Rate Surveys

Always survey a sufficient number of locations to determine the average and maximum general area and contact radiation levels.

A Ludlum Model-19, Bicron MicroREM, or equivalent meter, should be used for performing exposure or dose rate surveys for radiation. The instrument should be operated in accordance with the manufacturer-supplied operations manual and any applicable requirements from work-specific documents. Care should be taken to ensure that the instrument has been allowed to stabilize between individual measurements.

When performing general area exposure/dose rate surveys, the Radiological Control Technician (RCT) should:

- Attempt to determine the source of radiation fields.
- Record the highest level as the general area exposure/dose rate.
- Perform contact exposure/dose rate measurements with the detector within 1 inch of the surface to be surveyed.
- Perform surveys at approximately 1 meter (waist level) from the surface to establish posting requirements for the area.
- Verify the exposure/dose rates of known elevated exposure/dose rate locations.

### 4.2.2 Removable Contamination Surveys

#### 4.2.2.1 Removable Contamination Swipe

The following guidance shall be used unless an approved site-specific survey/work instruction directs otherwise.

#### 4.2.2.2 Swipe Surveys

1. Label or number swipes, as necessary, to identify each swipe.
2. Wipe the swipes over approximately 100 square centimeters ($cm^2$) (16 square inches) of the surface to be sampled.
3. Apply moderate pressure.
4. Exercise care on rough surfaces so as not to tear the swipes.
5. Exercise care on wet surfaces so as not to degrade the swipes. Ensure that surfaces are not submerged in water and that cloth swipes, or similar, are used on wet/damp surfaces.

When surveying an area:

1. Obtain swipes from sample points, which are representative of the average and maximum contamination levels in the area, as identified during preliminary surveys. These areas could include:
    a. Areas of high traffic
    b. On and under benches or tables
    c. Beneath piping and components
    d. On accessible wall surfaces
    e. On piping and significant components
    f. Near drains, sumps, and low spots
2. Swipe floor and component surfaces which display evidence of (potentially) contaminated water leakage.
3. Ensure that contamination is not spread to clean areas when obtaining swipes.

When surveying equipment:

1. Obtain swipes on exposed surfaces.
2. Obtain swipes in cracks or crevices where contamination may have settled.
3. Obtain swipes on openings to internal surfaces.
4. Handle swipes in a manner that will prevent cross-contamination.

#### 4.2.2.3 Counting Swipes

A Ludlum Model-2929 scaler with a Model 43-10-1 ZnS(Ag) scintillation probe (or equivalent) or Protean Alpha/Beta Gas Flow Proportional Counter (or equivalent) may be used.

1. Count the swipes in accordance with the operating procedure for the instrument.
2. Record swipe results in dpm/100 $cm^2$.
3. Store/archive used swipes as radioactive material until disposal is approved by the Radiological Affairs Support Office (RASO).

#### 4.2.2.4 Removable Contamination Surveys Using Large-area Wipes (LAWs)

Large-area contamination surveys using LAWs are appropriate for monitoring the radiological cleanliness of non-contaminated areas or equipment, to track area decontamination progress, or for initially verifying that surfaces are free from contamination.

There are no specific requirements concerning the amount of area to be wiped when performing LAWs. The area wiped should be determined based on the use of the survey data and the dust loading of the LAW material.

#### 4.2.2.5 Performing LAWs

Use masslin, oil-impregnated cloths, or equivalent media to perform LAWs. Select an appropriate collection material and method based upon the survey conditions such as wet surfaces, rough surfaces, heavily soiled areas, and oily and greasy surfaces.

1. Label or number the cloths, as necessary, to assist in determining the location of the sample.
2. Determine the size of the area to be sampled based on the survey requirements.
3. Wipe the collection media over the surface using moderate pressure by hand, with a masslin mop, or other approved techniques.

4.2.2.6 Evaluating LAWs

1. Allow wet LAW to dry prior to counting.
2. Scan the LAW with an appropriate field instrument (Ludlum Model-2360 meter with a 43-89 probe, or equivalent), in an area with a low background.
3. Hold the detector within a quarter inch of the swipe and move the detector over the swipe at a maximum rate of 1 inch per second.
4. If any indication of an increased count rate is noted, pause to allow the meter reading to stabilize.
5. If the swipe reading is indistinguishable from background, consider the surveyed surface to be free from contamination. If the LAW reading is greater, conduct further surveys to isolate the boundaries of the contamination.

4.2.3 Surveys for Fixed Alpha/Beta Contamination

Fixed contamination surveys are used to obtain indications of fixed contamination levels on surface areas, pieces of equipment, or tools for characterization and/or release surveys. Fixed contamination surveys are also performed to assess if residual contamination is present greater than the release criteria for the radionuclide(s) of concern.

A Ludlum Model-2360 datalogger with a 43-68 gas flow proportional detector or 43-89 scintillation detector, or equivalent, should be used for performing fixed contamination surveys for alpha and beta contamination. For large area surveys of alpha and beta contamination, a Ludlum Model-2360 datalogger with a 43-37 series detector, or equivalent, should be used. Note that this includes use of the Area Radiation Monitoring Instrument (ARMI).

4.2.3.1 Scans

1. When surveying for fixed alpha/beta contamination, the probe should be held within a quarter inch or less from the surface being surveyed. The movement rate of the detector probe should be 4 centimeters per second or slower, unless specified otherwise by a work plan, task-specific plan, or other authorized document for a specific survey. Note that alpha surveys involve listening and monitoring for 1 or more counts over a specified time interval when using a 43-68 detector, or equivalent, or 2 or more counts over a specified time interval when using a 43-37 detector, or equivalent, unless specified otherwise by a work plan, task-specific plan, or other authorized document for a specific survey. **This time interval must be programmed into the Ludlum Model 2360 datalogger per the operator's manual prior to commencing surveying.** Follow up investigations will consist of pausing over the area registering the counts. If the counts are duplicated or exceeded, a two minute static count with a Ludlum Model 43-68 detector, or equivalent, is necessary for verification of potential fixed contamination.

2. When performing direct scan surveys of objects, surfaces, materials, equipment, etc., static measurements should be performed frequently to ensure the detection of residual activity.
3. Whenever practical, 100 percent of accessible areas being surveyed should be direct-scan surveyed, unless the applicable work planning document indicates otherwise.
4. Scan ranges are documented as the range from the lowest measurement to the highest measurement observed.

4.2.3.2 Static

1. Count time for conducting static measurements will be dependent upon the isotope of concern and the MDA for the instrument being used.
2. Static measurements should be performed as required by a work-specific document, or frequently enough to ensure the detection of residual activity. A typical static count time for alpha-emitting radionuclides is 2 minutes to ensure an acceptable MDA is achieved. Note that the desired MDA to be achieved is typically 50% of the applicable release criterion to be achieved, but the MDA to be achieved shall not exceed 90% of the release criterion to be achieved unless specified otherwise by a work plan, task-specific plan, or other authorized document for a specific survey. For example, for an alpha release criterion of 100 dpm/100 cm$^2$, a target MDA is 50 dpm/100 cm$^2$, but 90 dpm/100 cm$^2$ is acceptable.
3. When taking a static measurement for fixed alpha/beta contamination, the probe should be held within a quarter inch or less from the surface being surveyed.
4. Results should be reported in units of net counts per minute (cpm) above background or dpm/100 cm$^2$.

The following formula should be used for converting direct probe readings in cpm to dpm/100 cm$^2$:

$$A_S = \frac{R_{S+B} - R_B}{\varepsilon_i \varepsilon_s \frac{W_A}{100\,\text{cm}^2}}$$

where

$A_S$ = total surface activity (dpm/100 cm$^2$)
$R_{S+B}$ = the gross count rate of the measurement in cpm
$R_B$ = the background count rate in cpm
$\varepsilon_i$ = the instrument efficiency (counts per particle)
$\varepsilon_s$ = the contaminated surface efficiency (particles per disintegration)
$W_A$ = the physical area of the detector window (cm$^2$)

In the absence of experimentally determined surface efficiencies, ISO-7503-1 and NUREG-1507 provide conservative recommendations for surface efficiencies. ISO-7503-1 recommends a surface efficiency of 0.25 for alpha emitters. ISO-7503-1 recommends a surface efficiency of 0.25 for beta emitters with maximum energies between 0.15 and 0.4 MeV, and 0.5 for beta emitters with maximum energies exceeding 0.4 MeV .NUREG-1507 provides surface efficiencies based on studies performed primarily at Oak Ridge Institute for Science and Education.

#### 4.2.4 Gamma Surveys

A Ludlum Model-2350-1 meter with a 44-10 probe, or equivalent, should be used for gamma radiation surveys. For large areas, a RASO-approved vehicle towed array system may be used in accordance with *SOP 013, Vehicle Towed Array*.

##### 4.2.4.1 Scans

1. Set the audio response switch to the “on” position.
2. If a single detector is used, traverse a path at a maximum speed of approximately 0.5 meters per second and slowly move the detector assembly in a serpentine (S-shaped) pattern, while maintaining the detector approximately 10 centimeters (cm) (4 inches) from the area being surveyed.
3. If a detector array is used, it will be pushed or pulled in a straight line with the detector centers positioned approximately 30 cm apart.
4. Scan ranges should be recorded from the lowest reading to the highest reading noted.
5. If data logging is being performed, the scan data will be collected at the time interval necessary to obtain the measurements required for the survey.
6. Locations of radiation levels greater than 3 standard deviations above the mean background shall be marked and identified for further investigations. Alternatively, with RASO approval, locations of radiation levels exceeding 3 standard deviations above the mean value of the survey unit shall be marked for further investigations.
7. Measurement results are recorded in cpm.

##### 4.2.4.2 Static

1. Static gamma measurements require positioning the detector assembly approximately 10 cm (4 inches) above the surface and completing a stationary 60-second survey.
2. Static measurements should be performed as required in the applicable work planning document, or frequently enough to ensure the detection of residual activity.
3. Record results in cpm.

## 5.0 RECORDS

Radiation/Contamination Survey Form

Radiation/Contamination Survey Supplement

## 6.0 REFERENCES

| ***Number*** | ***Title*** |
|---|---|
| NUREG-1575 | Multi-Agency Radiation Survey and Site Investigation Manual |

## 7.0 ATTACHMENTS

Forms provided in this section illustrate the minimum requirements for their respective subject matter. Alternative documents or electronic data logging may be used providing the information is presented in a clear and concise manner and the content meets or exceeds the information required to complete these documents.

Attachment 1, Radiation/Contamination Survey Form

Attachment 2, Radiation/Contamination Survey Supplement

## ATTACHMENT 1 – RADIATION/CONTAMINATION SURVEY FORM

| DATE: TIME: | INSTRUMENTATION USED | | | | | |
|---|---|---|---|---|---|---|
| SURVEY NUMBER: | **Model Inst/Det.** | **Serial Number** | **Calibration Due Date** | **% Efficiency** | **MDC/MDA ($dpm/100cm^2$)** | **Background ($dpm/100cm^2$)** |
| LOCATION: | | | | | | |
| SURVEYOR: | | | | | | |
| REVIEWED BY: | | | | | | |
| RSOR: | | | | | | |

Isotopes of Concern:

Description or drawing:

Routine (Daily / Weekly / Monthly) ☐ Non-routine ☐

All radiation readings in μr/hr unless otherwise noted.
(#)….denotes swipe location or fixed α/β readings.
#…….denotes G/A radiation readings.
# / #…denotes contact / 1 meter radiation readings.
*………denotes highest radiation reading on contact.
Δ……...denotes static location.

## ATTACHMENT 2 - RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER:

SURVEYOR: LOCATION:

| Location | Exposure Rate (μR/hr) | | Fixed + Removable | | | Removable | | Comments |
|---|---|---|---|---|---|---|---|---|
| | Contact | 1 Meter | Gamma (cpm) | Alpha dpm/probe | Beta/Gamma dpm/probe | Alpha $dpm/100cm^2$ | Beta/Gamma $dpm/100cm^2$ | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
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| 25 | | | | | | | | |

| Reviewer | Date/Time: | RSOR | Date/Time: |
|---|---|---|---|
| | | | |

# Standard Operating Procedure

## PREPARATION OF PORTABLE RADIATION AND CONTAMINATION SURVEY METERS AND INSTRUMENTS FOR FIELD USE

## SOP-002

## Revision 1

Approved By:

| | |
|---|---|
| Erik Abkemeier, CHP, PE, CSP, CHMM<br>Corporate Health Physics Manager | 8/19/2014<br>Date |

## REVISION HISTORY

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| 11/9/12 | 0 | E. Abkemeier | Original | All |
| 8/19/14 | 1 | E. Abkemeier | Clarifications | 4, 5, 6, 9 |
| | | | | |
| | | | | |

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## 1.0 PURPOSE

This procedure is used to specify the general requirements for preparing portable radiation and contamination survey meters and instruments for use at field locations. The procedures presented below will be supplemented by the specific instrument operation manuals, Tetra Tech EC, Inc. (TtEC)-approved subcontractor procedures, and specific work documents (i.e., Task-specific Plans (TSPs), work instructions, and other Work Plan documents).

## 2.0 SCOPE

This procedure will be used by TtEC personnel and its subcontractors for preparation of portable radiation and contamination survey meters and instruments used on site. This procedure is intended to provide general instructions for preparing radiation and contamination survey meters and instruments for field operations. Development of specific procedures for the implementation of the requirements of this procedure is the responsibility of the end users.

In certain instances the requirements of this procedure may need to be added to or modified for specific field operations. Additional requirements and guidance for these cases will be provided in work-specific documents (e.g., Time Critical Removal Action Work Plan, etc.), will be subject to the same review process as this document, and will have precedence over the guidelines in this document as appropriate.

## 3.0 DEFINITIONS AND ABBREVIATIONS

**Acceptance Range** – A range of values that describes an acceptable instrument check result. An acceptance range is typically determined by adding ± 20 percent or ± 2σ to the expected value.

**Calibration Sticker** – A label affixed to a properly calibrated instrument. The calibration sticker may be applied by the calibration facility or the end user. The calibration sticker should indicate the date through which the calibration is valid.

**Chi-Square Test** – A probability density function that gives the distribution of the sum of the squares of a number of independent random variables, each with a normal distribution with zero mean and unit variance, that has the property that the sum of two or more random variables with such a distribution also has one, and that is widely used in testing statistical hypotheses, especially about the theoretical and observed values of a quantity and about population variances and standard deviations. This test is used to evaluate the operation of an instrument, generally upon return from calibration.

**Check Log** – A form, or series of forms, used to document that an instrument was checked prior to usage in the field. Check logs can consist of multiple pages and must contain at least one page identifying the instrument. At least one page must also specify the parameters (source, geometry, etc.) used for the daily check. Space shall be provided to document the daily tests in the log. The log should be designed so as to clearly associate the required verifications with the signature or initials of the individual performing the check and date of each check.

**Instrument Efficiency** – A measure of the response (counts) obtained with a particular instrument when exposed to a known fluence of radioactive particles. Instrument efficiency has units of counts per disintegration though are typically recorded as a unitless value.

# 4.0 PROCEDURE DETAILS

## 4.1 Calibration

Instrument calibrations shall be performed using measuring and test equipment and National Institute of Standards and Technology (NIST) traceable sources. Calibrations will be performed at an accredited calibration laboratory. Calibration will be performed in accordance with the equipment manufacturers' manuals or a subcontractor's TtEC-approved procedure. Properly calibrated instruments shall be marked with a calibration sticker and include an accompanying calibration certificate.

Calibration shall be performed annually (± 15 days) or on a schedule consistent with the manufacturer's recommendation if more restrictive. The routine frequency may be extended by up to one additional month with written approval of the Radiation Safety Officer Representative (RSOR), or designee. However, the frequency of calibration may not be extended when instruments are being used for surveys of record (i.e., Final Status Surveys, Characterization Surveys, etc.) In addition to the routine frequency of performance, calibration shall be performed under the following conditions:

- Prior to placing a new instrument into service.
- After any major repair or alteration to the instrument or detector.

## 4.2 General Considerations

Upon receipt of survey equipment from an offsite vendor, and prior to shipment to an offsite vendor, the survey equipment shall be surveyed for alpha/beta fixed and loose contamination in accordance with *SOP 003, Release of Materials and Equipment from Radiologically Controlled Areas*. If any contamination limits are exceeded, notify the RSOR immediately.

Determination of instrument background, chi-square testing and instrument efficiency should be conducted in a controlled environment. This typically will consist of a secured office or lab area located in a non-impacted area and which is known to be free of contamination. Testing jigs or apparatus may be employed as necessary to ensure that consistent, reproducible geometries are used, particularly during repeated measurements.

In the event that any instrument and detector combination fails a chi-square test or daily operation check or has exceeded its annual calibration date without RSOR approval, the instrument shall be put in an "out of service" condition by placing an "out of service" tag or equivalent on the instrument and detector combination, and securing in a separate area such that the instrument and detector combination cannot be issued for use. The RSOR and any Radiological Control Technicians (RCTs) and their respective supervision shall be notified immediately when any survey instrumentation has been placed "out of service".

Any instrument and detector combinations that have not had a daily operation check performed because daily plans do not include their use shall be secured in an area to prevent their use until operation checks have been performed.

Table 4-1 gives suggested geometries to use for the most common instrument types to be used. Alternate geometries can be used provided that they are more appropriate for the intended usage of the instrument.

## 4.3 Determination of Instrument Background

The determination of an instrument specific background is an optional procedure which may be employed at the discretion of the RSOR. There is no regulatory requirement that necessitates the determination of background for each instrument. However, instruments used for documenting scoping, characterization and final status surveys should have a background determined annually, at a minimum. Instrument background determination is typically performed in a controlled environment and usually consists of a series of repeated background measurements that are statistically analyzed to obtain an expected range of valid background values. The established instrument background range can be used as a means of performing daily operation checks.

Instrument background determinations, when necessary, are considered valid for as long as the instrument has been properly maintained per the requirements of this procedure. If instrument backgrounds are required, a new background determination should be performed following each calibration.

**TABLE 4-1**

**SUGGESTED GEOMETRIES FOR BACKGROUND MEASUREMENTS AND SOURCE CHECKS**

| Measurement | Instrument/Detector Combinations | Probe Location |
|---|---|---|
| Exposure/Dose Rate | Ludlum Model 19, RO-20, Bicron MicroREM, or equivalent meter with integral tissue equivalent plastic or sodium iodide (NaI) 1"x1" detector | contact[a] |
| Gamma | Ludlum Model 2221, 2350-1 or 2360 portable survey meter or equivalent with a Ludlum Model 44-10, FIDLER or equivalent detector | 4 inches above ground surface/source |
| Beta/Gamma | Ludlum Model 2360 portable survey meter or equivalent with a Ludlum Model 43-37, 43-68, 43-89 or equivalent detector; Ludlum Model 3 portable survey meter with a Ludlum Model 44-9 G-M probe or equivalent | ¼ inch above ground surface/source |
| Alpha/Beta | Ludlum 2360 portable survey meter or equivalent with a Ludlum 43-37, 43-68, 43-89 or equivalent detector | ¼ inch from surface/source |

***Notes:***

[a] Field readings with exposure/dose rate instruments are conducted at 1 meter; background determination, chi-square test and operational checks are typically performed at a more convenient distance. Geometry should be documented as appropriate on the relevant data forms and logs.

When required, background determinations will be documented on Attachment A or equivalent as specified in the work-specific procedures. The form should include the following information at a minimum:

- Identification information (i.e., model and serial numbers) for the instrument and detector
- Conditions used for determination (geometry, radiation type, operating voltage, etc.)
- Date and time of determination
- Identification and signature, or initials, of technician
- Identification and signature of reviewer

The end result of a background determination should be to obtain an acceptance range for subsequent background checks.

### 4.4 Chi-Square Test

When chi-square tests are required by work-specific documents, this procedure shall be followed; however, any specific instructions for chi-square testing in governing work specific documents shall have precedence. When required, chi-square tests shall be performed annually (± 15 days), following calibration, or if there is reason to suspect that the instrument calibration may no longer be valid (i.e., inability to obtain a valid range of chi-square values). Chi square testing is not required to be performed on exposure rate instruments (e.g., Ludlum Model 19 or RO-20) or personnel contamination “frisking” instrument/detector combinations (e.g., Ludlum Model 3 or 177 with 44-9) unless specified in work-specific documents.

Chi-square tests shall be performed with sources with isotopic content appropriate to the detector being evaluated and the anticipated contaminants in the survey area. The source should be of sufficient activity to yield a counting rate of 1,000 to 50,000 counts per minute (cpm). The source should not exceed 50,000 cpm.

When required, chi-square tests should be documented in Attachment B or equivalent, or as specified in the work-specific documents. The form should include the following information at a minimum:

- Identification information (i.e., model and serial numbers) for the instrument and detector
- Conditions used for the test (geometry, radiation type, operating voltage, etc.)
- Source ID number
- Date and time of determination
- Identification and signature, or initials, of technician
- Identification and signature of reviewer

The chi-square test procedure will produce a chi-squared value ($\chi^2$), which should be between 10.11 and 30.14 for a test using 20 counts. Failure to obtain a chi-squared value in this range indicates a problem with either the instrument or the methodology used to perform the chi-square test and requires further investigation. The RSOR should be notified of the failure to assist in planning a course of action. In cases of chi-square testing for large area gas proportional detectors, such as the Ludlum 43-37 series detectors, the initial recommendation is to increase the number of measurements from 20 to 30 (or more), and use the table to determine the chi-square acceptable values. For instance, for 30 measurements, the $\chi^2$ value must be between 18.5 and 43.8 in order to acceptably pass the chi-squared test.

**Table 1.** Critical values for the chi-square and reduced chi-square statistics for different $\nu$ values. The critical values correspond to $\alpha = 0.10$ for a two-tail test, or $\alpha = 0.05$ for a one-tail test. The relative variance (RV) and coefficient of variation (CV) for the chi-square statistic are given also.

| $\nu$ | RV | CV (%) | $\chi^2$-LOW | $\chi^2$-HIGH | ($\chi^2$-LOW)/$\nu$ | ($\chi^2$-HIGH)/$\nu$ |
|---|---|---|---|---|---|---|
| 30 | $6.67 \times 10^{-2}$ | 25.8 | 18.5 | 43.8 | 0.617 | 1.46 |
| 35 | $5.71 \times 10^{-2}$ | 23.9 | 22.5 | 49.8 | 0.642 | 1.42 |
| 40 | $5.00 \times 10^{-2}$ | 22.4 | 26.5 | 55.8 | 0.663 | 1.40 |
| 45 | $4.44 \times 10^{-2}$ | 21.1 | 30.6 | 61.7 | 0.680 | 1.37 |
| 50 | $4.00 \times 10^{-2}$ | 20.0 | 34.8 | 67.5 | 0.696 | 1.35 |
| 60 | $3.33 \times 10^{-2}$ | 18.3 | 43.2 | 79.1 | 0.720 | 1.32 |
| 70 | $2.86 \times 10^{-2}$ | 16.9 | 51.7 | 90.5 | 0.739 | 1.29 |
| 80 | $2.50 \times 10^{-2}$ | 15.8 | 60.4 | 102 | 0.755 | 1.27 |
| 90 | $2.22 \times 10^{-2}$ | 14.9 | 69.1 | 113 | 0.768 | 1.26 |
| 100 | $2.00 \times 10^{-2}$ | 14.1 | 77.9 | 124 | 0.779 | 1.24 |
| $10^3$ | $2.00 \times 10^{-3}$ | 4.47 | 928 | 1,075 | 0.928 | 1.075 |
| $10^4$ | $2.00 \times 10^{-4}$ | 1.41 | 9,768 | 10,234 | 0.9768 | 1.0234 |
| $10^5$ | $2.00 \times 10^{-5}$ | 0.447 | 99,266 | 100,737 | 0.99266 | 1.00737 |
| $10^6$ | $2.00 \times 10^{-6}$ | 0.141 | 997,675 | 1,002,327 | 0.997675 | 1.002327 |

For further troubleshooting, consult "Basic Applications of the Chi-Square Statistic Using Counting Data" from the October 1999, Volume 77, Number 4 from the Health Physics Society Journal.

### 4.5 Instrument Efficiency for Portable Instruments

The instrument efficiency ($\varepsilon_i$) is the ratio between the net count rate (in cpm) of the instrument and the surface emission rate of the efficiency check source for a specified geometry. The surface emission rate is the 2π particle fluence that is affected by both the attenuation and backscatter of the radiation emitted from the efficiency check source.

The following equation is used to calculate the instrument efficiency in counts per particle:

$$\varepsilon_i = \frac{R_{S+B} - R_B}{q_{2\pi}\left(W_A / S_A\right)}$$

Where,

$E_i$ = the instrument efficiency (counts per disintegration)
$R_{S+B}$ = the gross count rate of the efficiency check source, measured in cpm
$R_B$ = the background count rate in cpm
$q_{2\pi}$ = the 2 π surface emission rate of the calibration source (NIST traceable)
$W_A$ = the active area of the probe window in square centimeters (cm$^2$)
$S_A$ = the area of the source in cm$^2$

***Note***: This equation assumes that the dimensions of the efficiency check source are sufficient to cover the window of the instrument detector. If the dimensions of the efficiency check source are smaller than the detector's window, set $W_A$ equal to the dimensions of the efficiency source (i.e., set the quotient of $W_A$ and $S_A$ equal to 1).

Instrument efficiency shall be determined for all instruments and radiation and contamination survey meters that are to be used for alpha and beta surveys prior to use for field operations. Instrument efficiency is dependent upon energy of the incident radiation. Multiple energy-specific instrument efficiencies may be determined when isotopes with significantly varying energies are analyzed.

The equipment manufacturer's procedures shall be followed to determine the instrument efficiency for those instruments for which it is required. In instances where governing work-specific documents specify a means or expanded scope of inclusion for instrument efficiency determination, they shall have precedence.

All instrument efficiency determinations should be documented on an approved subcontractor form, or as specified in the work-specific documents. The form should include the following information at a minimum:

- Identification information (i.e., model and serial numbers) for the instrument and detector
- Conditions used for determination (geometry, radiation type, operating voltage, etc.)
- Source-specific information (ID number, surface emission rate, area)
- Detector window area
- Date and time of determination
- Identification and signature, or initials, of technician
- Identification and signature of reviewer (typically the RSOR)

The resulting efficiency should be reported in units of counts per disintegration.

### 4.6 Operation Check

An operation check for each instrument should be performed at the beginning of each workday that a particular instrument is used. The operations check should include the following checks at a minimum:

- Check that instrument calibration is still valid (date on sticker not yet passed)
- Check the instrument (including the detector) for physical defects (knobs, displays, cables, connectors, Mylar windows, dented/damaged enclosure, etc.)
- Check of instrument battery (per manufacturers' instructions)
- Source check (should give consistently reproducible results with same source)

Instructions for performing operation checks for specific instruments and detectors are included in Attachment C of this procedure. Failure of any of the above checks shall result in the instrument being removed from active service until the condition can be addressed. The RSOR should be notified of any instrument failing an operations check for reasons other than failure of a battery check. In cases of battery check failure, the battery should be replaced and the check repeated.

The specified checks should each be performed every day and documented. A separate check log shall be maintained for each instrument type. The check log shall contain the following information at a minimum:

- Identification information (i.e., model and serial numbers) for the instrument and detector
- Conditions used for the check (geometry, radiation type, etc.)
- Source ID number
- Source check readings in appropriate measurements
- Verification of current calibration
- Verification of physical condition
- Verification of battery check
- Verification that source check observation is within the acceptance range
- Date of operational check
- Signature or initials of technician
- Identification and signature of reviewer

Of the required information given above, only the verifications, date and signature or initials need to be completed on a daily basis. The remaining information can be completed once and kept in the check log with the additional pages for daily checks, provided that none of the information changes. If the information changes, then a new check log should be started.

A sticker annotating that daily operation checks have been completed satisfactorily shall be affixed to each instrument. The sticker shall contain the following information at a minimum:

- Initials of technician
- Date of operational check

### 4.7 Maintenance

Instruments shall be stored in areas which prevent damage by movement, accumulation of moisture or dust. Detector covers shall be used for storage when practical.

Instrument maintenance (except external adjustments and cable or Mylar window replacements) shall be performed by the manufacturer or an approved vendor.

## 5.0 RECORDS

Records that result from this procedure may include forms that document background determinations, chi-square tests, instrument efficiency, instrument calibration and check logs. Record forms shall be obtained from the attachments of this procedure or equivalent electronic versions or as specified in work-specific procedures.

## 6.0 REFERENCES

None.

## 7.0 ATTACHMENTS

Attachment A, Instrument/Detector Background Form

Attachment B, Chi Square Form

Attachment C, Instrument and Detector Operational Check Procedures

Instrument/Detector Background Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Instrument Model: | | | | | Instrument Serial No. | | |
| Cal due date | | | | | Data Type | | |
| Detector Model: | | | | | Detector Serial No.: | | |
| Today's Date: | | | | | Data Collected by: | | |

| Count Number | Background |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |
| 14 | |
| 15 | |
| 16 | |
| 17 | |
| 18 | |
| 19 | |
| 20 | |
| Total | |
| Mean Count: | |
| Standard Deviation: | |
| Mean + 3 σ Value: | |

Comments:

| | |
|---|---|
| Mean +20% | |
| Mean -20% | |

| | |
|---|---|
| Calculations Completed by: | Date: |
| Reviewed by: | Date: |

Attachment A

Chi Square Form

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Instrument Model: | | | | Instrument Serial No. | | | |
| | | | | | | | |
| Cal due date | | | | Data Type | | | $C_B$ |
| | | | | | | | |
| Detector Model: | | | | Detector Serial No.: | | | |
| | | | | | | | |
| Today's Date: | | | | Data Collected by: | | | |
| Source ID: | Activity | dpm | | | | | |
| Radionuclide: | CPM | CPM | | | | | |
| Count Number Background | (Gross) $C_G$ | (Net) $C_I$ | | $(C_I - \bar{c})$ | $(C_I - \bar{c})^2$ | +20%<br>-20% | |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
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| 15 | | | | | | | |
| 16 | | | | | | | |
| 17 | | | | | | | |
| 18 | | | | | | | |
| 19 | | | | | | | |
| 20 | | | | | | | |
| Total | | | | SUM | | $\Sigma(C_I - c)^2$ | |
| Mean Count: $\bar{c}$ | | | | | | | |
| Chi Squared Value ($C^2$): | | 10.11 - 30.14 | Standard Deviation: | | | | |
| + 2 σ Value: | - 2 σ Value: | | | | | | |
| Calculations Completed by: | | | | | | Date: | |
| Reviewed by: | | | | | | Date: | |

Performed By *(Print)*: ____________________________

Signature: __________________________________

**Daily QC Worksheet**
**2350-1 Countrate Meters**

Date: ____________ Time: __________

| Instrument Model # | Data # | Instrument Serial # | Probe | Probe Serial # | Calibration Due Date | Battery Check | Calibration Check | Condition | Physical Damage | Background Readings (CPM) | Background QC Limits (CPM) | Instrument Readings (Net CPM) | Source QC Limits (CPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| **Source Information:** | **Isotope** | **ID** | **Half-life** | **Activity** | **Creation Day** |
| **Source Information:** | **Isotope** | **ID** | **Half-life** | **Activity** | **Creation Day** |

Note_____________________________________________________________________________________________

Reviewed By: ______________________________ Date: ______________

Performed By *(Print)* : ___________________________

Signature: __________________________________

# Daily QC Worksheet
## Countrate Friskers

Date: _____________ Time: ___________

| Instrument Model # | Data # | Instrument Serial # | Probe | Probe Serial # | Calibration Due Date | Battery Check | Calibration Check | Condition | Physical Damage | Background Reading (CPM) | Background QC Limits (CPM) | Source Reading (Net CPM) | Source QC Limits (CPM) |
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| Source Information: | Isotope | ID | Half-life | Activity | Creation Day |
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Note_________________________________________________________________________________________________________________

Reviewed By: ________________________________ Date: _______________

Performed By *(Print)* : ____________________________

Signature: _________________________________

**Daily QC Worksheet**
**Model RO-20 Meters**

Date: _____________ Time: ___________

| Instrument Model # | Data # | Instrument Serial # | Calibration Due Date | Battery Check | Calibration Check | Condition | Physical Damage | Background Reading | Background QC Limits | Source Reading (Net) | Source QC Limits |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| **Source Information:** | **Isotope** | **ID** | **Half Life** | **Activity** | **Creation Day** |
| **Source Information:** | **Isotope** | **ID** | **Half Life** | **Activity** | **Creation Day** |

Note________________________________________________________________________________________________________________

Reviewed By: ________________________________ Date: ______________

Performed By *(Print)* : ____________________________

Signature: _________________________________

# Daily QC Worksheet
## Model 19 Micro-R Meters

Date: _____________ Time: ___________

| Instrument Model # | Data # | Instrument Serial # | Calibration Due Date | Battery Check | Calibration Check | Condition | Physical Damage | Background Reading | Background QC Limits | Source Reading (Net) | Source QC Limits |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| **Source Information:** | **Isotope** | **ID** | **Half Life** | **Activity** | **Creation Day** |
| **Source Information:** | **Isotope** | **ID** | **Half Life** | **Activity** | **Creation Day** |

Note_____________________________________________________________________________________________________

Reviewed By: ________________________________ Date: ______________

Performed By *(Print)* : ___________________________

Signature: _________________________________

# Daily QC Worksheet
## 2360 Countrate Meters

Date: ____________ Time: __________

| Instrument Model # | Data # | Instrument Serial # | Probe | Probe Serial # | Calibration Due Date | Battery Check | Calibration Check | Condition | Physical Damage | Background Readings | Background QC Limits (CPM) | Instrument Readings (Net CPM) | Source QC Limits (CPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| | | | | | | | | | | | | Section 2: α β | α β |
| | | | | | | | | | | | | Section 3: α β | α β |
| | | | | | | | | | | | | Section 4: α β | α β |
| | | | | | | | | | | α β | | Section 1: α β | α β |
| | | | | | | | | | | | | Section 2: α β | α β |
| | | | | | | | | | | | | Section 3: α β | α β |
| | | | | | | | | | | | | Section 4: α β | α β |

*These meters are paired with floor monitoring detectors and require a four-part source check.

| Source Information: | Isotope | ID | Half-life | Activity | Creation Day |
|---|---|---|---|---|---|
| **Source Information:** | **Isotope** | **ID** | **Half-life** | **Activity** | **Creation Day** |

Note___________________________________________________________________________________________________

Reviewed By: ______________________________ Date: _____________

Performed By *(Print)*: ___________________________

Signature: ___________________________________

# Daily QC Worksheet
## Friskers

Date: _____________ Time: ___________

| Instrument Model # | Data # | Instrument Serial # | Probe | Probe Serial # | Calibration Due Date | Battery Check | Calibration Check | Condition | Physical Damage | Background Reading | Background QC Limits | Source Reading (Net CPM) | Source QC Limits (CPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
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| **Source Information:** | Isotope | ID | Half-life | Activity | Creation Day |
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Note_______________________________________________________________________________________________________________

Reviewed By: ________________________________ Date: _______________

# Standard Operating Procedure

## SAMPLING PROCEDURES
## FOR RADIOLOGICAL SURVEYS

## SOP-006

## Revision 1

Approved By:

8/18/2014

Erik Abkemeier, CHP, PE, CSP, CHMM | Date
Corporate Health Physics Manager

## REVISION HISTORY

| *Revision (Date)* | *Rev. No* | *Prepared By* | *Description of Changes* | *Affected Pages* |
|---|---|---|---|---|
| 11/9/12 | 0 | E. Abkemeier | Original | All |
| 08/18/14 | 1 | E. Abkemeier | Clarifications | 5, 7 |
| | | | | |
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## 1.0 PURPOSE

This procedure will be used by Tetra Tech EC, Inc. (TtEC) personnel and its subcontractors to perform swipe sampling and sampling of various types of media including soil and water.

## 2.0 SCOPE

This procedure shall be implemented by TtEC staff and subcontractor personnel when collecting samples on field projects related to radiological surveys.

## 3.0 DEFINITIONS AND ABBREVIATIONS

**Swipe Samples** – Swipe samples are materials, which after being wiped over a surface, are analyzed to determine the presence of removable radioactivity on the surface area that was wiped.

**Soil Samples** – Soil samples are defined as soil collected for analytical purposes. Soil samples will be collected from the top 15 centimeters (cm) (6 inches) of the surface, unless otherwise noted in the applicable work-planning document [e.g. a Task-specific Plan (TSP), Work Instruction or Work Plan].

**Sediment Samples** – Sediment samples are defined as a collection of clay, silt, sand, and/or gravel deposited by water, wind, or glaciers used for analytical purposes.

**Solid Material Samples** – Solid material samples are defined as pieces of concrete, brick, porcelain, wood, or any other hard material collected for analytical purposes from buildings or surrounding areas. The samples could include accumulations from ventilation systems or drain systems.

**Liquid Samples** – Liquid samples are defined as liquid collected for analytical purposes from sinks, drain piping, sewer systems, rinsate, groundwater, leachate, liquid investigation-derived waste, and low-point accumulation areas inside of buildings, sumps, and excavation pits.

## 4.0 SAMPLING PROCEDURE DETAILS

### 4.1 General Procedures

Field instruments used for measurements required by this procedure shall be function checked daily with NIST traceable standards and verified to have current calibration.

Anytime this procedure is in effect, the Radiation Safety Officer Representative (RSOR) (or qualified designee) should ensure, by periodic personal observation, that samples are appropriately collected and controlled.

Surface scan surveys are to be performed at each location before initiating sampling. This will identify the presence of gross contamination, which will require that samples and equipment be treated as radioactive, and handled in accordance with applicable license requirements. Samples will be recorded on chain-of-custody (COC) documentation.

### 4.2 Sampling Procedure Process

Sample activities will be recorded in the field logbook as directed by the applicable Sampling and Analysis Plan (SAP).

#### 4.2.1 Swipe Sampling

Swipe samples will be obtained in accordance with SOP 001, *Radiation and Contamination Surveys*. Swipe samples will be documented in a logbook as applicable. Sample COC records shall be completed in accordance with the applicable SAP.

#### 4.2.2 Soil Sampling

Because standard surface soil contamination criteria for radionuclides are applicable to the average concentration in *the upper 15 cm (6 inches) of soil*, the sampling protocol described here is based on obtaining a sample of this upper 15 cm (6 inches). Special situations, such as sampling at depths greater than 15 cm (6 inches), evaluating trends or airborne deposition, determining near-surface contamination profiles, and measuring non-radiological contaminants, may require special sampling procedures. These special situations will be evaluated and incorporated into work plans or task-specific plans(TSPs) as the need arises.

Samples will be collected with a hand-auger, hollow-stem auger, split-spoon sampler, disposable scoop, or equivalent. The soil removed for sampling must be sufficient to yield a sample of sufficient volume for the sample container being used. Soil samples will be collected and handled as follows:

1. Loosen the soil at the selected sampling location to a depth of approximately 15 cm (6 inches), using a clean trowel or other digging instrument. In rocky terrain, a pick axe or mechanical means such as a Hilti gun may be used to remove soil for sampling. If an excavator is used due to health and safety reasons, extreme care should be used to ensure that the soil collected is from the upper com (6 inches) of the original surface.
2. Remove large rocks, vegetation and foreign objects. In some cases, however, these objects may be the source of the contamination and may be collected as separate samples for characterization.
3. Place as much soil as practical into a 250-milliliter (mL)-wide mouth plastic bottle, plastic 500-mL Marinelli container, plastic ziplok bag, or other suitable collection device. Approximately 1000 grams may be necessary for soil with significant moisture (approximately 3 “tuna cans” full). Note that if a “split sample” is necessary for a regulatory agency to perform confirmatory analysis, collection of up to 2000 grams of soil will be necessary. Ensure that the material collected is from the upper 15 cm (6 inches) of soil. Note that this may require digging a hole wider, as opposed to deeper.
4. Tape the cap of the container in place or seal the ziplock plastic bag.
5. Label the sample container in accordance with the applicable SAP.
6. Document all samples collected in the sample logbook as applicable. Sample COC records shall be completed in accordance with the applicable SAP.

7. Transport samples in a project vehicle to the on-site laboratory for analysis as soon as possible after sample collection. Sample packaging and shipment procedures for transporting samples to an off-site laboratory are described in Section 4.3 of this procedure.
8. Clean or decontaminated tools will be used at each sampling location. Sampling tools will be decontaminated as described in the applicable SAP.
9. Nitrile gloves shall be changed between sampling evolutions to avoid cross contamination.

#### 4.2.3 Sediment Sampling

Several methods are available to collect sediment samples. The tools used will be appropriate to the circumstances and may include use of trowels, augers, or other hand tools. Sediment sampling will be conducted as follows:

1. A hand-auger, trowel or similar device will be used to access each sampling location. The sample collection tool will be selected based on physical limitations accessing the sample location.
2. Place as much material as practical into a 250-mL-wide mouth plastic bottle, plastic 500-mL Marinelli container, plastic ziplok bag or other suitable container.
3. Follow steps 4 through 9 of Section 4.2.2 to complete sample collection.

#### 4.2.4 Solid Material Sampling

Several methods are available to collect solid material samples. To collect samples, solid materials may need to be broken into smaller pieces. Solid materials will be collected as follows:

1. Break up the material into small enough pieces to fill a 250-mL-wide mouth plastic bottle, plastic 500-mL Marinelli container, plastic ziplok bag or other suitable container. A pick axe or mechanical means such as a Hilti gun may be used to remove solid material for sampling. At no time shall an excavator be used to collect samples.
2. Follow steps 4 through 9 of Section 4.2.2 to complete sample collection.

##### 4.2.4.1 **Pipe and Drain Line Sampling**

Pipe and drain line sampling is conducted to assess residual radioactivity that may be inside of drain lines or materials within sanitary sewer and storm drain systems.

1. Since the type of material found inside drain lines varies, there is no specific method identified to collect these samples. Samples may be collected using a plumber’s snake, swabs, scraper, trowel, etc.
2. Place as much material as practical into a 250-mL-wide mouth plastic bottle, plastic 500-mL Marinelli container, plastic ziplok bag or other suitable container.
3. Follow steps 4 through 9 of Section 4.2.2 to complete sample collection.

#### 4.2.4.2 **Ventilation Sampling**

Ventilation sampling will be performed to identify if the system is impacted and assess the residual radioactivity that may be present.

1. If visible dust is present inside the ventilation system, use a masslin cloth to accumulate the material into a pile. (If no visible dust is present, collect a swipe sample as discussed in SOP 001, *Radiation and Contamination Surveys*.)
2. Using a flat utensil such as a piece of paper or scraper carefully place as much material as possible into a 250-mL-wide mouth plastic bottle, plastic 500-mL Marinelli container, plastic ziplok bag or other suitable container.
3. Follow steps 4 through 9 of Section 4.2.2 to complete sample collection.

### 4.2.5 Water Sampling

Water samples will be collected as follows:

1. Collect water using any of the following sampling equipment: disposable bailer, pump, coliwassa-type tube sampler, or equivalent. Care will be taken to avoid collection of bottom sediment or vegetation.
2. Fill completely a 250-mL-wide mouth plastic bottle, plastic 500-mL Marinelli container or two liter plastic bottles.
3. Follow steps 4 through 9A of Section 4.2.2 to complete sample collection.

### 4.3 Sample Packaging and Transport

Samples will be delivered for analysis to the laboratory via a box, cooler, or similar container (ice is not required if only radiological analysis will be performed), along with the COC documentation completed as described in the applicable SAP.

The applicable SAP may require samples to be sent to an off-site laboratory for analysis, (e.g., total strontium, isotopic uranium, isotopic plutonium). Samples designated for transport off-site will be packaged in accordance with applicable Department of Transportation (DOT) and International Air Transport Association (IATA) procedures. At a minimum, sample containers will be placed in a box, cooler, or similar container for shipment and packaged with bubble wrap or other materials, as necessary, to prevent container breakage. Prepared packages will be surveyed prior to shipment using an appropriate exposure rate meter in accordance with SOP 001, Radiation and Contamination Surveys.

## 5.0 RECORDS

Sample collection records will include field logbooks and COC documentation. These records will be completed and maintained in accordance with the SAP.

## 6.0 REFERENCES

| ***Number*** | ***Title*** |
|---|---|
| SOP 001 | Radiation and Contamination Surveys |

## 7.0 ATTACHMENTS

None.

# APPENDIX B

# LABORATORY DOD ELAP ACCREDITATION

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LABORATORY
ACCREDITATION
BUREAU®

# Certificate of Accreditation

**ISO/IEC 17025:2005** **Certificate Number L2305**

## TestAmerica Laboratories

St. Louis Facility
13715 Rider Trail North
Earth City Missouri 63045

**has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).***

**The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).**

**Accreditation valid through: January 10, 2016**

**R. Douglas Leonard, Jr., President, COO**
**Laboratory Accreditation Bureau**
**Presented the 31st of May 2013**

*See the laboratory's Scope of Accreditation for details of accredited parameters
**Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

LABORATORY ACCREDITATION BUREAU

Certificate # L2305

# Scope of Accreditation For TestAmerica Laboratories

St. Louis Facility
13715 Rider Trail North
Earth City, Missouri 63045
Marti Ward
314-298-8566

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.2) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to TestAmerica Laboratories, Inc. to perform the following tests:

Accreditation granted through: **January 10, 2016**

**Testing - Environmental**

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| ICP-AES | EPA 6010C | Aluminum |
| ICP-AES | EPA 6010C | Antimony |
| ICP-AES | EPA 6010C | Arsenic |
| ICP-AES | EPA 6010C | Barium |
| ICP-AES | EPA 6010C | Beryllium |
| ICP-AES | EPA 6010C | Bismuth |
| ICP-AES | EPA 6010C | Boron |
| ICP-AES | EPA 6010C | Cadmium |
| ICP-AES | EPA 6010C | Calcium |
| ICP-AES | EPA 6010C | Chromium |
| ICP-AES | EPA 6010C | Cobalt |
| ICP-AES | EPA 6010C | Copper |
| ICP-AES | EPA 6010C | Iron |
| ICP-AES | EPA 6010C | Lead |
| ICP-AES | EPA 6010C | Lithium |
| ICP-AES | EPA 6010C | Magnesium |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| ICP-AES | EPA 6010C | Manganese |
| ICP-AES | EPA 6010C | Molybdenum |
| ICP-AES | EPA 6010C | Nickel |
| ICP-AES | EPA 6010C | Phosphorus |
| ICP-AES | EPA 6010C | Potassium |
| ICP-AES | EPA 6010C | Selenium |
| ICP-AES | EPA 6010C | Silicon |
| ICP-AES | EPA 6010C | Silver |
| ICP-AES | EPA 6010C | Sodium |
| ICP-AES | EPA 6010C | Strontium |
| ICP-AES | EPA 6010C | Sulfur |
| ICP-AES | EPA 6010C | Thallium |
| ICP-AES | EPA 6010C | Thorium |
| ICP-AES | EPA 6010C | Tin |
| ICP-AES | EPA 6010C | Titanium |
| ICP-AES | EPA 6010C | Uranium |
| ICP-AES | EPA 6010C | Vanadium |
| ICP-AES | EPA 6010C | Zinc |
| GC/MS | EPA 8260C | Acetone |
| GC/MS | EPA 8260C | Acetonitrile |
| GC/MS | EPA 8260C | Acrolein |
| GC/MS | EPA 8260C | Acrylonitrile |
| GC/MS | EPA 8260C | Benzene |
| GC/MS | EPA 8260C | Benzyl chloride |
| GC/MS | EPA 8260C | Bromobenzene |
| GC/MS | EPA 8260C | Bromochloromethane |
| GC/MS | EPA 8260C | Bromodichloromethane |
| GC/MS | EPA 8260C | Bromoform |
| GC/MS | EPA 8260C | Bromomethane |
| GC/MS | EPA 8260C | n-Butanol |
| GC/MS | EPA 8260C | 2-Butanone |
| GC/MS | EPA 8260C | n-Butylbenzene |
| GC/MS | EPA 8260C | sec-Butylbenzene |
| GC/MS | EPA 8260C | tert-Butylbenzene |
| GC/MS | EPA 8260C | Carbon disulfide |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8260C | Carbon tetrachloride |
| GC/MS | EPA 8260C | Chlorobenzene |
| GC/MS | EPA 8260C | Chlorobromomethane |
| GC/MS | EPA 8260C | 2-Chloro-1,3-butadiene |
| GC/MS | EPA 8260C | Chlorodibromomethane |
| GC/MS | EPA 8260C | Dibromochloromethane |
| GC/MS | EPA 8260C | Chloroethane |
| GC/MS | EPA 8260C | 2-Chloroethyl vinyl ether |
| GC/MS | EPA 8260C | Chloroform |
| GC/MS | EPA 8260C | Chloromethane |
| GC/MS | EPA 8260C | Allyl chloride |
| GC/MS | EPA 8260C | 2-Chlorotoluene |
| GC/MS | EPA 8260C | 4-Chlorotoluene |
| GC/MS | EPA 8260C | Cyclohexane |
| GC/MS | EPA 8260C | Cyclohexanone |
| GC/MS | EPA 8260C | 1,2-Dibromo-3-chloropropane |
| GC/MS | EPA 8260C | 1,2-Dibromoethane |
| GC/MS | EPA 8260C | Dibromomethane |
| GC/MS | EPA 8260C | 1,2-Dichlorobenzene |
| GC/MS | EPA 8260C | 1,3-Dichlorobenzene |
| GC/MS | EPA 8260C | 1,4-Dichlorobenzene |
| GC/MS | EPA 8260C | trans-1,4-Dichloro-2-butene |
| GC/MS | EPA 8260C | Dichlorodifluoromethane |
| GC/MS | EPA 8260C | 1,1-Dichloroethane |
| GC/MS | EPA 8260C | 1,2-Dichloroethane |
| GC/MS | EPA 8260C | cis-1,2-Dichloroethene |
| GC/MS | EPA 8260C | trans-1,2-Dichloroethene |
| GC/MS | EPA 8260C | 1,1-Dichloroethene |
| GC/MS | EPA 8260C | 1,2-Dichloroethene (total) |
| GC/MS | EPA 8260C | 1,2-Dichloropropane |
| GC/MS | EPA 8260C | 1,3-Dichloropropane |
| GC/MS | EPA 8260C | 2,2-Dichloropropane |
| GC/MS | EPA 8260C | cis-1,3-Dichloropropene |
| GC/MS | EPA 8260C | trans-1,3-Dichloropropene |
| GC/MS | EPA 8260C | 1,1-Dichloropropene |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8260C | 1,2-Dichloro-1,1,2,2-tetrafluoroethane |
| GC/MS | EPA 8260C | Dimethyl disulfide |
| GC/MS | EPA 8260C | 1,4-Dioxane |
| GC/MS | EPA 8260C | Ethyl acetate |
| GC/MS | EPA 8260C | Ethylbenzene |
| GC/MS | EPA 8260C | Ethyl ether |
| GC/MS | EPA 8260C | Diethyl ether |
| GC/MS | EPA 8260C | Ethyl methacrylate |
| GC/MS | EPA 8260C | Freon 113 |
| GC/MS | EPA 8260C | Hexachlorobutadiene |
| GC/MS | EPA 8260C | n-Hexane |
| GC/MS | EPA 8260C | 2-Hexanone |
| GC/MS | EPA 8260C | Iodomethane |
| GC/MS | EPA 8260C | Isobutanol |
| GC/MS | EPA 8260C | Isopropylbenzene |
| GC/MS | EPA 8260C | p-Isopropyltoluene |
| GC/MS | EPA 8260C | Methacrylonitrile |
| GC/MS | EPA 8260C | Methyl acetate |
| GC/MS | EPA 8260C | Methyl butyl ketone |
| GC/MS | EPA 8260C | Methylcyclohexane |
| GC/MS | EPA 8260C | Dichloromethane |
| GC/MS | EPA 8260C | Methylene chloride |
| GC/MS | EPA 8260C | Methyl methacrylate |
| GC/MS | EPA 8260C | 4-Methyl-2-pentanone |
| GC/MS | EPA 8260C | MTBE |
| GC/MS | EPA 8260C | Naphthalene |
| GC/MS | EPA 8260C | 2-Nitropropane |
| GC/MS | EPA 8260C | Nonanal |
| GC/MS | EPA 8260C | Pentachloroethane |
| GC/MS | EPA 8260C | Propionitrile |
| GC/MS | EPA 8260C | n-Propylbenzene |
| GC/MS | EPA 8260C | Styrene |
| GC/MS | EPA 8260C | 1,1,1,2-Tetrachloroethane |
| GC/MS | EPA 8260C | 1,1,2,2-Tetrachloroethane |
| GC/MS | EPA 8260C | Tetrachloroethene |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8260C | Tetrahydrofuran |
| GC/MS | EPA 8260C | Toluene |
| GC/MS | EPA 8260C | 1,3,5-Trichlorobenzene |
| GC/MS | EPA 8260C | 1,2,3-Trichlorobenzene |
| GC/MS | EPA 8260C | 1,2,4-Trichlorobenzene |
| GC/MS | EPA 8260C | 1,1,1-Trichloroethane |
| GC/MS | EPA 8260C | 1,1,2-Trichloroethane |
| GC/MS | EPA 8260C | Trichloroethene |
| GC/MS | EPA 8260C | Trichlorofluoromethane |
| GC/MS | EPA 8260C | 1,2,3-Trichloropropane |
| GC/MS | EPA 8260C | 1,1,2-Trichloro-1,2,2-trifluoroethane |
| GC/MS | EPA 8260C | Trichlorotrifluoroethane |
| GC/MS | EPA 8260C | 1,2,4-Trimethylbenzene |
| GC/MS | EPA 8260C | 1,3,5-Trimethylbenzene |
| GC/MS | EPA 8260C | Vinyl acetate |
| GC/MS | EPA 8260C | Vinyl chloride |
| GC/MS | EPA 8260C | m-Xylene & p-Xylene |
| GC/MS | EPA 8260C | o-Xylene |
| GC/MS | EPA 8260C | Xylenes (total) |
| GC/MS SIM | EPA 8260 SIM | 1,4-Dioxane |
| GC/MS | EPA 624 | Acetone |
| GC/MS | EPA 624 | Acetonitrile |
| GC/MS | EPA 624 | Acrolein |
| GC/MS | EPA 624 | Acrylonitrile |
| GC/MS | EPA 624 | Benzene |
| GC/MS | EPA 624 | Benzyl chloride |
| GC/MS | EPA 624 | Bromobenzene |
| GC/MS | EPA 624 | Bromochloromethane |
| GC/MS | EPA 624 | Bromodichloromethane |
| GC/MS | EPA 624 | Bromoform |
| GC/MS | EPA 624 | Bromomethane |
| GC/MS | EPA 624 | n-Butanol |
| GC/MS | EPA 624 | 2-Butanone |
| GC/MS | EPA 624 | n-Butylbenzene |
| GC/MS | EPA 624 | sec-Butylbenzene |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 624 | tert-Butylbenzene |
| GC/MS | EPA 624 | Carbon disulfide |
| GC/MS | EPA 624 | Carbon tetrachloride |
| GC/MS | EPA 624 | Chlorobenzene |
| GC/MS | EPA 624 | Chlorobromomethane |
| GC/MS | EPA 624 | 2-Chloro-1,3-butadiene |
| GC/MS | EPA 624 | Chlorodibromomethane |
| GC/MS | EPA 624 | Dibromochloromethane |
| GC/MS | EPA 624 | Chloroethane |
| GC/MS | EPA 624 | 2-Chloroethyl vinyl ether |
| GC/MS | EPA 624 | Chloroform |
| GC/MS | EPA 624 | Chloromethane |
| GC/MS | EPA 624 | Allyl chloride |
| GC/MS | EPA 624 | 2-Chlorotoluene |
| GC/MS | EPA 624 | 4-Chlorotoluene |
| GC/MS | EPA 624 | Cyclohexane |
| GC/MS | EPA 624 | Cyclohexanone |
| GC/MS | EPA 624 | 1,2-Dibromo-3-chloropropane |
| GC/MS | EPA 624 | 1,2-Dibromoethane |
| GC/MS | EPA 624 | Dibromomethane |
| GC/MS | EPA 624 | 1,2-Dichlorobenzene |
| GC/MS | EPA 624 | 1,3-Dichlorobenzene |
| GC/MS | EPA 624 | 1,4-Dichlorobenzene |
| GC/MS | EPA 624 | trans-1,4-Dichloro-2-butene |
| GC/MS | EPA 624 | Dichlorodifluoromethane |
| GC/MS | EPA 624 | 1,1-Dichloroethane |
| GC/MS | EPA 624 | 1,2-Dichloroethane |
| GC/MS | EPA 624 | cis-1,2-Dichloroethene |
| GC/MS | EPA 624 | trans-1,2-Dichloroethene |
| GC/MS | EPA 624 | 1,1-Dichloroethene |
| GC/MS | EPA 624 | 1,2-Dichloroethene (total) |
| GC/MS | EPA 624 | 1,2-Dichloropropane |
| GC/MS | EPA 624 | 1,3-Dichloropropane |
| GC/MS | EPA 624 | 2,2-Dichloropropane |
| GC/MS | EPA 624 | cis-1,3-Dichloropropene |

**Non-Potable Water**

| Technology | Method | Analyte |
|---|---|---|
| GC/MS | EPA 624 | trans-1,3-Dichloropropene |
| GC/MS | EPA 624 | 1,1-Dichloropropene |
| GC/MS | EPA 624 | 1,2-Dichloro-1,1,2,2-tetrafluoroethane |
| GC/MS | EPA 624 | Dimethyl disulfide |
| GC/MS | EPA 624 | 1,4-Dioxane |
| GC/MS | EPA 624 | Ethyl acetate |
| GC/MS | EPA 624 | Ethylbenzene |
| GC/MS | EPA 624 | Ethyl ether |
| GC/MS | EPA 624 | Diethyl ether |
| GC/MS | EPA 624 | Ethyl methacrylate |
| GC/MS | EPA 624 | Freon 113 |
| GC/MS | EPA 624 | Hexachlorobutadiene |
| GC/MS | EPA 624 | n-Hexane |
| GC/MS | EPA 624 | 2-Hexanone |
| GC/MS | EPA 624 | Iodomethane |
| GC/MS | EPA 624 | Isobutanol |
| GC/MS | EPA 624 | Isopropylbenzene |
| GC/MS | EPA 624 | p-Isopropyltoluene |
| GC/MS | EPA 624 | Methacrylonitrile |
| GC/MS | EPA 624 | Methyl acetate |
| GC/MS | EPA 624 | Methyl butyl ketone |
| GC/MS | EPA 624 | Methylcyclohexane |
| GC/MS | EPA 624 | Dichloromethane |
| GC/MS | EPA 624 | Methylene chloride |
| GC/MS | EPA 624 | Methyl methacrylate |
| GC/MS | EPA 624 | 4-Methyl-2-pentanone |
| GC/MS | EPA 624 | MTBE |
| GC/MS | EPA 624 | Naphthalene |
| GC/MS | EPA 624 | 2-Nitropropane |
| GC/MS | EPA 624 | Nonanal |
| GC/MS | EPA 624 | Pentachloroethane |
| GC/MS | EPA 624 | Propionitrile |
| GC/MS | EPA 624 | n-Propylbenzene |
| GC/MS | EPA 624 | Styrene |
| GC/MS | EPA 624 | 1,1,1,2-Tetrachloroethane |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 624 | 1,1,2,2-Tetrachloroethane |
| GC/MS | EPA 624 | Tetrachloroethene |
| GC/MS | EPA 624 | Tetrahydrofuran |
| GC/MS | EPA 624 | Toluene |
| GC/MS | EPA 624 | 1,3,5-Trichlorobenzene |
| GC/MS | EPA 624 | 1,2,3-Trichlorobenzene |
| GC/MS | EPA 624 | 1,2,4-Trichlorobenzene |
| GC/MS | EPA 624 | 1,1,1-Trichloroethane |
| GC/MS | EPA 624 | 1,1,2-Trichloroethane |
| GC/MS | EPA 624 | Trichloroethene |
| GC/MS | EPA 624 | Trichlorofluoromethane |
| GC/MS | EPA 624 | 1,2,3-Trichloropropane |
| GC/MS | EPA 624 | 1,1,2-Trichloro-1,2,2-trifluoroethane |
| GC/MS | EPA 624 | Trichlorotrifluoroethane |
| GC/MS | EPA 624 | 1,2,4-Trimethylbenzene |
| GC/MS | EPA 624 | 1,3,5-Trimethylbenzene |
| GC/MS | EPA 624 | Vinyl acetate |
| GC/MS | EPA 624 | Vinyl chloride |
| GC/MS | EPA 624 | m-Xylene & p-Xylene |
| GC/MS | EPA 624 | o-Xylene |
| GC/MS | EPA 624 | Xylenes (total) |
| GC/MS | EPA 8270D | Acenaphthene |
| GC/MS | EPA 8270D | Acenaphthylene |
| GC/MS | EPA 8270D | Acetophenone |
| GC/MS | EPA 8270D | 2-Acetylaminofluorene |
| GC/MS | EPA 8270D | 4-Aminobiphenyl |
| GC/MS | EPA 8270D | Aniline |
| GC/MS | EPA 8270D | Anthracene |
| GC/MS | EPA 8270D | Aramite (total) |
| GC/MS | EPA 8270D | Atrazine |
| GC/MS | EPA 8270D | Azobenzene |
| GC/MS | EPA 8270D | Benzaldehyde |
| GC/MS | EPA 8270D | Benzidine |
| GC/MS | EPA 8270D | Benzo(a)anthracene |
| GC/MS | EPA 8270D | Benzo(b)fluoranthene |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8270D | Benzo(k)fluoranthene |
| GC/MS | EPA 8270D | Benzoic acid |
| GC/MS | EPA 8270D | Benzo(ghi)perylene |
| GC/MS | EPA 8270D | Benzo(a)pyrene |
| GC/MS | EPA 8270D | Benzyl alcohol |
| GC/MS | EPA 8270D | 1,1'-Biphenyl |
| GC/MS | EPA 8270D | bis(2-Chloroethoxy)methane |
| GC/MS | EPA 8270D | bis(2-Chloroethyl) ether |
| GC/MS | EPA 8270D | bis(2-Chloroisopropyl) ether |
| GC/MS | EPA 8270D | bis(2-Ethylhexyl) phthalate |
| GC/MS | EPA 8270D | 4-Bromophenyl phenyl ether |
| GC/MS | EPA 8270D | n-Butylbenzenesulfonamide |
| GC/MS | EPA 8270D | Butyl benzyl phthalate |
| GC/MS | EPA 8270D | Caprolactam |
| GC/MS | EPA 8270D | Carbazole |
| GC/MS | EPA 8270D | 4-Chloroaniline |
| GC/MS | EPA 8270D | Chlorobenzilate |
| GC/MS | EPA 8270D | p-Chlorobenzilate |
| GC/MS | EPA 8270D | 4-Chloro-3-methylphenol |
| GC/MS | EPA 8270D | 2-Chloronaphthalene |
| GC/MS | EPA 8270D | 2-Chlorophenol |
| GC/MS | EPA 8270D | 4-Chlorophenyl phenyl ether |
| GC/MS | EPA 8270D | Chrysene |
| GC/MS | EPA 8270D | Cresols (total) |
| GC/MS | EPA 8270D | Cyclohexanol |
| GC/MS | EPA 8270D | Diallate |
| GC/MS | EPA 8270D | Dibenz(a,h)anthracene |
| GC/MS | EPA 8270D | Dibenzo(a,h)anthracene |
| GC/MS | EPA 8270D | Dibenzofuran |
| GC/MS | EPA 8270D | Di-n-butyl phthalate |
| GC/MS | EPA 8270D | 1,2-Dichlorobenzene |
| GC/MS | EPA 8270D | 1,3-Dichlorobenzene |
| GC/MS | EPA 8270D | 1,4-Dichlorobenzene |
| GC/MS | EPA 8270D | 3,3'-Dichlorobenzidine |
| GC/MS | EPA 8270D | 2,4-Dichlorophenol |
| GC/MS | EPA 8270D | 2,6-Dichlorophenol |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8270D | Diethyl phthalate |
| GC/MS | EPA 8270D | O,O-Diethyl-O-(2-pyrazinyl) phosphorothioate |
| GC/MS | EPA 8270D | Dimethoate |
| GC/MS | EPA 8270D | p-Dimethylaminoazobenzene |
| GC/MS | EPA 8270D | 7,12-Dimethylbenz(a)anthracene |
| GC/MS | EPA 8270D | 3,3'-Dimethylbenzidine |
| GC/MS | EPA 8270D | Dimethylformamide |
| GC/MS | EPA 8270D | alpha,alpha-Dimethylphenethylamine |
| GC/MS | EPA 8270D | 2,4-Dimethylphenol |
| GC/MS | EPA 8270D | Dimethyl phthalate |
| GC/MS | EPA 8270D | 1,3-Dinitrobenzene |
| GC/MS | EPA 8270D | 1,4-Dinitrobenzene |
| GC/MS | EPA 8270D | 4,6-Dinitro-2-methylphenol |
| GC/MS | EPA 8270D | 2,4-Dinitrophenol |
| GC/MS | EPA 8270D | 2,4-Dinitrotoluene |
| GC/MS | EPA 8270D | 2,6-Dinitrotoluene |
| GC/MS | EPA 8270D | 2-sec-Butyl-4,6-dinitrophenol |
| GC/MS | EPA 8270D | Dinoseb |
| GC/MS | EPA 8270D | Di-n-octyl phthalate |
| GC/MS | EPA 8270D | 1,4-Dioxane |
| GC/MS | EPA 8270D | 1,2-Diphenylhydrazine (as Azobenzene) |
| GC/MS | EPA 8270D | Disulfoton |
| GC/MS | EPA 8270D | Ethyl methacrylate |
| GC/MS | EPA 8270D | Ethyl methanesulfonate |
| GC/MS | EPA 8270D | Famphur |
| GC/MS | EPA 8270D | Fluoranthene |
| GC/MS | EPA 8270D | Fluorene |
| GC/MS | EPA 8270D | Hexachlorobenzene |
| GC/MS | EPA 8270D | Hexachlorobutadiene |
| GC/MS | EPA 8270D | Hexachlorocyclopentadiene |
| GC/MS | EPA 8270D | Hexachloro-1,3-cyclopentadiene |
| GC/MS | EPA 8270D | Hexachloroethane |
| GC/MS | EPA 8270D | Hexachlorophene |
| GC/MS | EPA 8270D | Hexachloropropene |
| GC/MS | EPA 8270D | Indeno(1,2,3-cd)pyrene |
| GC/MS | EPA 8270D | Isodrin |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8270D | Isophorone |
| GC/MS | EPA 8270D | Isosafrole |
| GC/MS | EPA 8270D | Kepone |
| GC/MS | EPA 8270D | Methapyrilene |
| GC/MS | EPA 8270D | 2-Methylbenzenamine |
| GC/MS | EPA 8270D | 3-Methylcholanthrene |
| GC/MS | EPA 8270D | 4,4'-Methylenebis(2-chloroaniline) |
| GC/MS | EPA 8270D | Methyl methacrylate |
| GC/MS | EPA 8270D | Methyl methanesulfonate |
| GC/MS | EPA 8270D | 2-Methylnaphthalene |
| GC/MS | EPA 8270D | Methyl parathion |
| GC/MS | EPA 8270D | 2-Methylphenol |
| GC/MS | EPA 8270D | 3-Methylphenol & 4-Methylphenol |
| GC/MS | EPA 8270D | 2-Methylphenol, 3-methylphenol and 4-methylphenol |
| GC/MS | EPA 8270D | Methylphenols (total) |
| GC/MS | EPA 8270D | Naphthalene |
| GC/MS | EPA 8270D | 1,4-Naphthoquinone |
| GC/MS | EPA 8270D | 1-Naphthylamine |
| GC/MS | EPA 8270D | 2-Naphthylamine |
| GC/MS | EPA 8270D | 2-Nitroaniline |
| GC/MS | EPA 8270D | 3-Nitroaniline |
| GC/MS | EPA 8270D | 4-Nitroaniline |
| GC/MS | EPA 8270D | Nitrobenzene |
| GC/MS | EPA 8270D | 2-Nitrophenol |
| GC/MS | EPA 8270D | 4-Nitrophenol |
| GC/MS | EPA 8270D | 4-Nitroquinoline-1-oxide |
| GC/MS | EPA 8270D | N-Nitrosodi-n-butylamine |
| GC/MS | EPA 8270D | N-Nitrosodiethylamine |
| GC/MS | EPA 8270D | N-Nitrosodimethylamine |
| GC/MS | EPA 8270D | N-Nitrosodiphenylamine |
| GC/MS | EPA 8270D | N-Nitrosodi-n-propylamine |
| GC/MS | EPA 8270D | N-Nitrosomethylethylamine |
| GC/MS | EPA 8270D | N-Nitrosomorpholine |
| GC/MS | EPA 8270D | N-Nitrosopiperidine |
| GC/MS | EPA 8270D | N-Nitrosopyrrolidine |
| GC/MS | EPA 8270D | 5-Nitro-o-toluidine |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8270D | 2,2'-oxybis(1-Chloropropane) |
| GC/MS | EPA 8270D | Parathion |
| GC/MS | EPA 8270D | Pentachlorobenzene |
| GC/MS | EPA 8270D | Pentachloroethane |
| GC/MS | EPA 8270D | Pentachloronitrobenzene |
| GC/MS | EPA 8270D | Pentachlorophenol |
| GC/MS | EPA 8270D | Phenacetin |
| GC/MS | EPA 8270D | Phenanthrene |
| GC/MS | EPA 8270D | Phenol |
| GC/MS | EPA 8270D | p-Phenylene diamine |
| GC/MS | EPA 8270D | Phorate |
| GC/MS | EPA 8270D | 2-Picoline |
| GC/MS | EPA 8270D | Pronamide |
| GC/MS | EPA 8270D | Pyrene |
| GC/MS | EPA 8270D | Pyridine |
| GC/MS | EPA 8270D | Safrole |
| GC/MS | EPA 8270D | Sulfotepp |
| GC/MS | EPA 8270D | 1,2,4,5-Tetrachlorobenzene |
| GC/MS | EPA 8270D | 2,3,4,6-Tetrachlorophenol |
| GC/MS | EPA 8270D | Tetraethyldithiopyrophosphate (Sulfotepp) |
| GC/MS | EPA 8270D | Thionazin |
| GC/MS | EPA 8270D | o-Toluidine |
| GC/MS | EPA 8270D | Tributyl phosphate |
| GC/MS | EPA 8270D | 1,2,4-Trichlorobenzene |
| GC/MS | EPA 8270D | 2,4,5-Trichlorophenol |
| GC/MS | EPA 8270D | 2,4,6-Trichlorophenol |
| GC/MS | EPA 8270D | O,O,O-Triethyl phosphorothioate |
| GC/MS | EPA 8270D | 1,3,5-Trinitrobenzene |
| GC/MS | EPA 8270D | Tris(2-chloroethyl)phosphate |
| GC/MS | EPA 8270D | 1-Methyl naphthalene |
| GC/MS | EPA 625 | Acenaphthene |
| GC/MS | EPA 625 | Acenaphthylene |
| GC/MS | EPA 625 | Acetophenone |
| GC/MS | EPA 625 | 2-Acetylaminofluorene |
| GC/MS | EPA 625 | 4-Aminobiphenyl |
| GC/MS | EPA 625 | Aniline |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 625 | Anthracene |
| GC/MS | EPA 625 | Aramite (total) |
| GC/MS | EPA 625 | Atrazine |
| GC/MS | EPA 625 | Azobenzene |
| GC/MS | EPA 625 | Benzaldehyde |
| GC/MS | EPA 625 | Benzidine |
| GC/MS | EPA 625 | Benzo(a)anthracene |
| GC/MS | EPA 625 | Benzo(b)fluoranthene |
| GC/MS | EPA 625 | Benzo(k)fluoranthene |
| GC/MS | EPA 625 | Benzoic acid |
| GC/MS | EPA 625 | Benzo(ghi)perylene |
| GC/MS | EPA 625 | Benzo(a)pyrene |
| GC/MS | EPA 625 | Benzyl alcohol |
| GC/MS | EPA 625 | 1,1'-Biphenyl |
| GC/MS | EPA 625 | bis(2-Chloroethoxy)methane |
| GC/MS | EPA 625 | bis(2-Chloroethyl) ether |
| GC/MS | EPA 625 | bis(2-Chloroisopropyl) ether |
| GC/MS | EPA 625 | bis(2-Ethylhexyl) phthalate |
| GC/MS | EPA 625 | 4-Bromophenyl phenyl ether |
| GC/MS | EPA 625 | n-Butylbenzenesulfonamide |
| GC/MS | EPA 625 | Butyl benzyl phthalate |
| GC/MS | EPA 625 | Caprolactam |
| GC/MS | EPA 625 | Carbazole |
| GC/MS | EPA 625 | 4-Chloroaniline |
| GC/MS | EPA 625 | Chlorobenzilate |
| GC/MS | EPA 625 | p-Chlorobenzilate |
| GC/MS | EPA 625 | 4-Chloro-3-methylphenol |
| GC/MS | EPA 625 | 2-Chloronaphthalene |
| GC/MS | EPA 625 | 2-Chlorophenol |
| GC/MS | EPA 625 | 4-Chlorophenyl phenyl ether |
| GC/MS | EPA 625 | Chrysene |
| GC/MS | EPA 625 | Cresols (total) |
| GC/MS | EPA 625 | Cyclohexanol |
| GC/MS | EPA 625 | Diallate |
| GC/MS | EPA 625 | Dibenz(a,h)anthracene |
| GC/MS | EPA 625 | Dibenzo(a,h)anthracene |
| GC/MS | EPA 625 | Dibenzofuran |
| GC/MS | EPA 625 | Di-n-butyl phthalate |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 625 | 1,2-Dichlorobenzene |
| GC/MS | EPA 625 | 1,3-Dichlorobenzene |
| GC/MS | EPA 625 | 1,4-Dichlorobenzene |
| GC/MS | EPA 625 | 3,3'-Dichlorobenzidine |
| GC/MS | EPA 625 | 2,4-Dichlorophenol |
| GC/MS | EPA 625 | 2,6-Dichlorophenol |
| GC/MS | EPA 625 | Diethyl phthalate |
| GC/MS | EPA 625 | O,O-Diethyl-O-(2-pyrazinyl) phosphorothioate |
| GC/MS | EPA 625 | Dimethoate |
| GC/MS | EPA 625 | p-Dimethylaminoazobenzene |
| GC/MS | EPA 625 | 7,12-Dimethylbenz(a)anthracene |
| GC/MS | EPA 625 | 3,3'-Dimethylbenzidine |
| GC/MS | EPA 625 | Dimethylformamide |
| GC/MS | EPA 625 | alpha,alpha-Dimethylphenethylamine |
| GC/MS | EPA 625 | 2,4-Dimethylphenol |
| GC/MS | EPA 625 | Dimethyl phthalate |
| GC/MS | EPA 625 | 1,3-Dinitrobenzene |
| GC/MS | EPA 625 | 1,4-Dinitrobenzene |
| GC/MS | EPA 625 | 4,6-Dinitro-2-methylphenol |
| GC/MS | EPA 625 | 2,4-Dinitrophenol |
| GC/MS | EPA 625 | 2,4-Dinitrotoluene |
| GC/MS | EPA 625 | 2,6-Dinitrotoluene |
| GC/MS | EPA 625 | 2-sec-Butyl-4,6-dinitrophenol |
| GC/MS | EPA 625 | Dinoseb |
| GC/MS | EPA 625 | Di-n-octyl phthalate |
| GC/MS | EPA 625 | 1,4-Dioxane |
| GC/MS | EPA 625 | 1,2-Diphenylhydrazine (as Azobenzene) |
| GC/MS | EPA 625 | Disulfoton |
| GC/MS | EPA 625 | Ethyl methacrylate |
| GC/MS | EPA 625 | Ethyl methanesulfonate |
| GC/MS | EPA 625 | Famphur |
| GC/MS | EPA 625 | Fluoranthene |
| GC/MS | EPA 625 | Fluorene |
| GC/MS | EPA 625 | Hexachlorobenzene |
| GC/MS | EPA 625 | Hexachlorobutadiene |
| GC/MS | EPA 625 | Hexachlorocyclopentadiene |
| GC/MS | EPA 625 | Hexachloro-1,3-cyclopentadiene |
| GC/MS | EPA 625 | Hexachloroethane |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 625 | Hexachlorophene |
| GC/MS | EPA 625 | Hexachloropropene |
| GC/MS | EPA 625 | Indeno(1,2,3-cd)pyrene |
| GC/MS | EPA 625 | Isodrin |
| GC/MS | EPA 625 | Isophorone |
| GC/MS | EPA 625 | Isosafrole |
| GC/MS | EPA 625 | Kepone |
| GC/MS | EPA 625 | Methapyrilene |
| GC/MS | EPA 625 | 2-Methylbenzenamine |
| GC/MS | EPA 625 | 3-Methylcholanthrene |
| GC/MS | EPA 625 | 4,4'-Methylenebis(2-chloroaniline) |
| GC/MS | EPA 625 | Methyl methacrylate |
| GC/MS | EPA 625 | Methyl methanesulfonate |
| GC/MS | EPA 625 | 2-Methylnaphthalene |
| GC/MS | EPA 625 | Methyl parathion |
| GC/MS | EPA 625 | 2-Methylphenol |
| GC/MS | EPA 625 | 3-Methylphenol & 4-Methylphenol |
| GC/MS | EPA 625 | 2-Methylphenol, 3-methylphenol and 4-methylphenol |
| GC/MS | EPA 625 | Methylphenols (total) |
| GC/MS | EPA 625 | Naphthalene |
| GC/MS | EPA 625 | 1,4-Naphthoquinone |
| GC/MS | EPA 625 | 1-Naphthylamine |
| GC/MS | EPA 625 | 2-Naphthylamine |
| GC/MS | EPA 625 | 2-Nitroaniline |
| GC/MS | EPA 625 | 3-Nitroaniline |
| GC/MS | EPA 625 | 4-Nitroaniline |
| GC/MS | EPA 625 | Nitrobenzene |
| GC/MS | EPA 625 | 2-Nitrophenol |
| GC/MS | EPA 625 | 4-Nitrophenol |
| GC/MS | EPA 625 | 4-Nitroquinoline-1-oxide |
| GC/MS | EPA 625 | N-Nitrosodi-n-butylamine |
| GC/MS | EPA 625 | N-Nitrosodiethylamine |
| GC/MS | EPA 625 | N-Nitrosodimethylamine |
| GC/MS | EPA 625 | N-Nitrosodiphenylamine |
| GC/MS | EPA 625 | N-Nitrosodi-n-propylamine |
| GC/MS | EPA 625 | N-Nitrosomethylethylamine |
| GC/MS | EPA 625 | N-Nitrosomorpholine |
| GC/MS | EPA 625 | N-Nitrosopiperidine |

**Non-Potable Water**

| Technology | Method | Analyte |
|---|---|---|
| GC/MS | EPA 625 | N-Nitrosopyrrolidine |
| GC/MS | EPA 625 | 5-Nitro-o-toluidine |
| GC/MS | EPA 625 | 2,2'-oxybis(1-Chloropropane) |
| GC/MS | EPA 625 | Parathion |
| GC/MS | EPA 625 | Pentachlorobenzene |
| GC/MS | EPA 625 | Pentachloroethane |
| GC/MS | EPA 625 | Pentachloronitrobenzene |
| GC/MS | EPA 625 | Pentachlorophenol |
| GC/MS | EPA 625 | Phenacetin |
| GC/MS | EPA 625 | Phenanthrene |
| GC/MS | EPA 625 | Phenol |
| GC/MS | EPA 625 | p-Phenylene diamine |
| GC/MS | EPA 625 | Phorate |
| GC/MS | EPA 625 | 2-Picoline |
| GC/MS | EPA 625 | Pronamide |
| GC/MS | EPA 625 | Pyrene |
| GC/MS | EPA 625 | Pyridine |
| GC/MS | EPA 625 | Safrole |
| GC/MS | EPA 625 | Sulfotepp |
| GC/MS | EPA 625 | 1,2,4,5-Tetrachlorobenzene |
| GC/MS | EPA 625 | 2,3,4,6-Tetrachlorophenol |
| GC/MS | EPA 625 | Tetraethyldithiopyrophosphate (Sulfotepp) |
| GC/MS | EPA 625 | Thionazin |
| GC/MS | EPA 625 | o-Toluidine |
| GC/MS | EPA 625 | Tributyl phosphate |
| GC/MS | EPA 625 | 1,2,4-Trichlorobenzene |
| GC/MS | EPA 625 | 2,4,5-Trichlorophenol |
| GC/MS | EPA 625 | 2,4,6-Trichlorophenol |
| GC/MS | EPA 625 | O,O,O-Triethyl phosphorothioate |
| GC/MS | EPA 625 | 1,3,5-Trinitrobenzene |
| GC/MS | EPA 625 | Tris(2-chloroethyl)phosphate |
| GC/MS | EPA 625 | 1-Methyl naphthalene |
| GC-ECD | EPA 8081B | Aldrin |
| GC-ECD | EPA 8081B | alpha-BHC |
| GC-ECD | EPA 8081B | beta-BHC |
| GC-ECD | EPA 8081B | delta-BHC |
| GC-ECD | EPA 8081B | gamma-BHC (Lindane) |
| GC-ECD | EPA 8081B | alpha-Chlordane |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC-ECD | EPA 8081B | gamma-Chlordane |
| GC-ECD | EPA 8081B | Chlordane (technical) |
| GC-ECD | EPA 8081B | 4,4'-DDD |
| GC-ECD | EPA 8081B | 2,4'-DDD |
| GC-ECD | EPA 8081B | 4,4'-DDE |
| GC-ECD | EPA 8081B | 2,4'-DDE |
| GC-ECD | EPA 8081B | 4,4'-DDT |
| GC-ECD | EPA 8081B | 2,4'-DDT |
| GC-ECD | EPA 8081B | Dieldrin |
| GC-ECD | EPA 8081B | Endosulfan I |
| GC-ECD | EPA 8081B | Endosulfan II |
| GC-ECD | EPA 8081B | Endosulfan sulfate |
| GC-ECD | EPA 8081B | Endrin |
| GC-ECD | EPA 8081B | Endrin aldehyde |
| GC-ECD | EPA 8081B | Endrin ketone |
| GC-ECD | EPA 8081B | Heptachlor |
| GC-ECD | EPA 8081B | Heptachlor epoxide |
| GC-ECD | EPA 8081B | Methoxychlor |
| GC-ECD | EPA 8081B | Toxaphene |
| GC-ECD | EPA 608 | Aldrin |
| GC-ECD | EPA 608 | alpha-BHC |
| GC-ECD | EPA 608 | beta-BHC |
| GC-ECD | EPA 608 | delta-BHC |
| GC-ECD | EPA 608 | gamma-BHC (Lindane) |
| GC-ECD | EPA 608 | alpha-Chlordane |
| GC-ECD | EPA 608 | gamma-Chlordane |
| GC-ECD | EPA 608 | Chlordane (technical) |
| GC-ECD | EPA 608 | 4,4'-DDD |
| GC-ECD | EPA 608 | 2,4'-DDD |
| GC-ECD | EPA 608 | 4,4'-DDE |
| GC-ECD | EPA 608 | 2,4'-DDE |
| GC-ECD | EPA 608 | 4,4'-DDT |
| GC-ECD | EPA 608 | 2,4'-DDT |
| GC-ECD | EPA 608 | Dieldrin |
| GC-ECD | EPA 608 | Endosulfan I |
| GC-ECD | EPA 608 | Endosulfan II |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC-ECD | EPA 608 | Endosulfan sulfate |
| GC-ECD | EPA 608 | Endrin |
| GC-ECD | EPA 608 | Endrin aldehyde |
| GC-ECD | EPA 608 | Endrin ketone |
| GC-ECD | EPA 608 | Heptachlor |
| GC-ECD | EPA 608 | Heptachlor epoxide |
| GC-ECD | EPA 608 | Methoxychlor |
| GC-ECD | EPA 608 | Toxaphene |
| GC-ECD | EPA 608 | Aroclor 1016 |
| GC-ECD | EPA 608 | Aroclor 1221 |
| GC-ECD | EPA 608 | Aroclor 1232 |
| GC-ECD | EPA 608 | Aroclor 1242 |
| GC-ECD | EPA 608 | Aroclor 1248 |
| GC-ECD | EPA 608 | Aroclor 1254 |
| GC-ECD | EPA 608 | Aroclor 1260 |
| GC-ECD | EPA 608 | Aroclor 1262 |
| GC-ECD | EPA 608 | Aroclor 1268 |
| GC-ECD | EPA 8082A | Aroclor 1016 |
| GC-ECD | EPA 8082A | Aroclor 1221 |
| GC-ECD | EPA 8082A | Aroclor 1232 |
| GC-ECD | EPA 8082A | Aroclor 1242 |
| GC-ECD | EPA 8082A | Aroclor 1248 |
| GC-ECD | EPA 8082A | Aroclor 1254 |
| GC-ECD | EPA 8082A | Aroclor 1260 |
| GC-ECD | EPA 8082A | Aroclor 1262 |
| GC-ECD | EPA 8082A | Aroclor 1268 |
| GC-ECD | EPA 8151A | 2,4-D |
| GC-ECD | EPA 8151A | Dalapon |
| GC-ECD | EPA 8151A | 2,4-DB |
| GC-ECD | EPA 8151A | Dicamba |
| GC-ECD | EPA 8151A | Dichlorprop |
| GC-ECD | EPA 8151A | Dinoseb |
| GC-ECD | EPA 8151A | MCPA |
| GC-ECD | EPA 8151A | MCPP |
| GC-ECD | EPA 8151A | 4-Nitrophenol |
| GC-ECD | EPA 8151A | Pentachlorophenol |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC-ECD | EPA 8151A | 2,4,5-TP (Silvex) |
| GC-ECD | EPA 8151A | 2,4,5-T |
| GC-FID | RSK-175 | Methane |
| GC-FID | RSK-175 | Ethane |
| GC-FID | RSK-175 | Ethene |
| GC-FID | RSK-175 | Acetylene |
| GC-FID | EPA 8015B | Ethanol |
| GC-FID | EPA 8015B | Methanol |
| GC-FID | EPA 8015B | Ethylene glycol |
| GC-FID | EPA 8015B | Propylene glycol |
| GC-FID | EPA 8015B | Diesel Range Organics |
| GC-FID | EPA 8015B | Motor Oil Range Organics |
| GC-FID | EPA 8015B | TPH (as Diesel) |
| GC-FID | EPA 8015B | Gasoline Range Organics |
| LC/MS/MS | EPA 8321A | 2-Amino-4,6-dinitrotoluene |
| LC/MS/MS | EPA 8321A | 4-Amino-2,6-dinitrotoluene |
| LC/MS/MS | EPA 8321A | 3,5-Dinitroaniline |
| LC/MS/MS | EPA 8321A | 1,3-Dinitrobenzene |
| LC/MS/MS | EPA 8321A | 2,4-Dinitrotoluene |
| LC/MS/MS | EPA 8321A | 2,6-Dinitrotoluene |
| LC/MS/MS | EPA 8321A | DNX |
| LC/MS/MS | EPA 8321A | HMX |
| LC/MS/MS | EPA 8321A | HNAB |
| LC/MS/MS | EPA 8321A | HNS |
| LC/MS/MS | EPA 8321A | MNX |
| LC/MS/MS | EPA 8321A | Nitrobenzene |
| LC/MS/MS | EPA 8321A | Nitroglycerin |
| LC/MS/MS | EPA 8321A | 4-Nitrotoluene |
| LC/MS/MS | EPA 8321A | 3-Nitrotoluene |
| LC/MS/MS | EPA 8321A | 2-Nitrotoluene |
| LC/MS/MS | EPA 8321A | PETN |
| LC/MS/MS | EPA 8321A | RDX |
| LC/MS/MS | EPA 8321A | TATB |
| LC/MS/MS | EPA 8321A | Tetryl |
| LC/MS/MS | EPA 8321A | TNX |
| LC/MS/MS | EPA 8321A | 1,3,5-Trinitrobenzene |

**Non-Potable Water**

| Technology | Method | Analyte |
|---|---|---|
| LC/MS/MS | EPA 8321A | 2,4,6-Trinitrotoluene |
| LC/MS/MS | EPA 8321A | Tris (o-cresyl) Phosphate |
| LC/MS/MS | EPA 8321A | 2,4-diamino-6-nitrotoluene |
| LC/MS/MS | EPA 8321A | 2,6-diamino-4-nitrotoluene |
| HPLC | EPA 8330B | 2-Amino-4,6-dinitrotoluene |
| HPLC | EPA 8330B | 4-Amino-2,6-dinitrotoluene |
| HPLC | EPA 8330B | 1,3-Dinitrobenzene |
| HPLC | EPA 8330B | 2,4-Dinitrotoluene |
| HPLC | EPA 8330B | 2,6-Dinitrotoluene |
| HPLC | EPA 8330B | HMX |
| HPLC | EPA 8330B | HNAB |
| HPLC | EPA 8330B | HNS |
| HPLC | EPA 8330B | Nitrobenzene |
| HPLC | EPA 8330B | Nitroglycerin |
| HPLC | EPA 8330B | 2-Nitrotoluene |
| HPLC | EPA 8330B | 3-Nitrotoluene |
| HPLC | EPA 8330B | 4-Nitrotoluene |
| HPLC | EPA 8330B | PETN |
| HPLC | EPA 8330B | RDX |
| HPLC | EPA 8330B | TATB |
| HPLC | EPA 8330B | Tetryl |
| HPLC | EPA 8330B | MNX |
| HPLC | EPA 8330B | DNX |
| HPLC | EPA 8330B | TNX |
| HPLC | EPA 8330B | 1,3,5-Trinitrobenzene |
| HPLC | EPA 8330B | 2,4,6-Trinitrotoluene |
| HPLC | EPA 8310 | Acenaphthene |
| HPLC | EPA 8310 | Acenaphthylene |
| HPLC | EPA 8310 | Anthracene |
| HPLC | EPA 8310 | Benzo(a)anthracene |
| HPLC | EPA 8310 | Benzo(b)fluoranthene |
| HPLC | EPA 8310 | Benzo(k)fluoranthene |
| HPLC | EPA 8310 | Benzo(ghi)perylene |
| HPLC | EPA 8310 | Benzo(a)pyrene |
| HPLC | EPA 8310 | Chrysene |
| HPLC | EPA 8310 | Dibenz(a,h)anthracene |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| HPLC | EPA 8310 | Fluoranthene |
| HPLC | EPA 8310 | Fluorene |
| HPLC | EPA 8310 | Indeno(1,2,3-cd)pyrene |
| HPLC | EPA 8310 | Naphthalene |
| HPLC | EPA 8310 | Phenanthrene |
| HPLC | EPA 8310 | Pyrene |
| GC/MS SIM | EPA 8270D SIM | Acenaphthene |
| GC/MS SIM | EPA 8270D SIM | Acenaphthylene |
| GC/MS SIM | EPA 8270D SIM | Anthracene |
| GC/MS SIM | EPA 8270D SIM | Benzo(a)anthracene |
| GC/MS SIM | EPA 8270D SIM | Benzo(b)fluoranthene |
| GC/MS SIM | EPA 8270D SIM | Benzo(k)fluoranthene |
| GC/MS SIM | EPA 8270D SIM | Benzo(ghi)perylene |
| GC/MS SIM | EPA 8270D SIM | Benzo(a)pyrene |
| GC/MS SIM | EPA 8270D SIM | Chrysene |
| GC/MS SIM | EPA 8270D SIM | Dibenz(a,h)anthracene |
| GC/MS SIM | EPA 8270D SIM | Fluoranthene |
| GC/MS SIM | EPA 8270D SIM | Fluorene |
| GC/MS SIM | EPA 8270D SIM | Indeno(1,2,3-cd)pyrene |
| GC/MS SIM | EPA 8270D SIM | Naphthalene |
| GC/MS SIM | EPA 8270D SIM | Phenanthrene |
| GC/MS SIM | EPA 8270D SIM | Pyrene |
| LC/MS/MS | EPA 6850 | Perchlorate |
| ICP-MS | EPA 6020A | Aluminum |
| ICP-MS | EPA 6020A | Antimony |
| ICP-MS | EPA 6020A | Arsenic |
| ICP-MS | EPA 6020A | Barium |
| ICP-MS | EPA 6020A | Beryllium |
| ICP-MS | EPA 6020A | Bismuth |
| ICP-MS | EPA 6020A | Boron |
| ICP-MS | EPA 6020A | Cadmium |
| ICP-MS | EPA 6020A | Calcium |
| ICP-MS | EPA 6020A | Cerium |
| ICP-MS | EPA 6020A | Cesium |
| ICP-MS | EPA 6020A | Chromium |
| ICP-MS | EPA 6020A | Cobalt |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| ICP-MS | EPA 6020A | Copper |
| ICP-MS | EPA 6020A | Hafnium |
| ICP-MS | EPA 6020A | Iron |
| ICP-MS | EPA 6020A | Lanthanum |
| ICP-MS | EPA 6020A | Lead |
| ICP-MS | EPA 6020A | Lithium |
| ICP-MS | EPA 6020A | Magnesium |
| ICP-MS | EPA 6020A | Manganese |
| ICP-MS | EPA 6020A | Molybdenum |
| ICP-MS | EPA 6020A | Neodymium |
| ICP-MS | EPA 6020A | Nickel |
| ICP-MS | EPA 6020A | Niobium |
| ICP-MS | EPA 6020A | Palladium |
| ICP-MS | EPA 6020A | Phosphorus |
| ICP-MS | EPA 6020A | Platinum |
| ICP-MS | EPA 6020A | Potassium |
| ICP-MS | EPA 6020A | Praseodymium |
| ICP-MS | EPA 6020A | Rhodium |
| ICP-MS | EPA 6020A | Ruthenium |
| ICP-MS | EPA 6020A | Samarium |
| ICP-MS | EPA 6020A | Selenium |
| ICP-MS | EPA 6020A | Silicon |
| ICP-MS | EPA 6020A | Silver |
| ICP-MS | EPA 6020A | Sodium |
| ICP-MS | EPA 6020A | Strontium |
| ICP-MS | EPA 6020A | Sulfur |
| ICP-MS | EPA 6020A | Tantalum |
| ICP-MS | EPA 6020A | Technetium-99 |
| ICP-MS | EPA 6020A | Tellurium |
| ICP-MS | EPA 6020A | Thallium |
| ICP-MS | EPA 6020A | Thorium |
| ICP-MS | EPA 6020A | Tin |
| ICP-MS | EPA 6020A | Titanium |
| ICP-MS | EPA 6020A | Tungsten |
| ICP-MS | EPA 6020A | Uranium |
| ICP-MS | EPA 6020A | Uranium 233 |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| ICP-MS | EPA 6020A | Uranium 234 |
| ICP-MS | EPA 6020A | Uranium 235 |
| ICP-MS | EPA 6020A | Uranium 236 |
| ICP-MS | EPA 6020A | Uranium 238 |
| ICP-MS | EPA 6020A | Vanadium |
| ICP-MS | EPA 6020A | Yttrium |
| ICP-MS | EPA 6020A | Zinc |
| ICP-MS | EPA 6020A | Zirconium |
| ICP-MS | EPA 200.8 | Aluminum |
| ICP-MS | EPA 200.8 | Antimony |
| ICP-MS | EPA 200.8 | Arsenic |
| ICP-MS | EPA 200.8 | Barium |
| ICP-MS | EPA 200.8 | Beryllium |
| ICP-MS | EPA 200.8 | Bismuth |
| ICP-MS | EPA 200.8 | Boron |
| ICP-MS | EPA 200.8 | Cadmium |
| ICP-MS | EPA 200.8 | Calcium |
| ICP-MS | EPA 200.8 | Cerium |
| ICP-MS | EPA 200.8 | Cesium |
| ICP-MS | EPA 200.8 | Chromium |
| ICP-MS | EPA 200.8 | Cobalt |
| ICP-MS | EPA 200.8 | Copper |
| ICP-MS | EPA 200.8 | Hafnium |
| ICP-MS | EPA 200.8 | Iron |
| ICP-MS | EPA 200.8 | Lanthanum |
| ICP-MS | EPA 200.8 | Lead |
| ICP-MS | EPA 200.8 | Lithium |
| ICP-MS | EPA 200.8 | Magnesium |
| ICP-MS | EPA 200.8 | Manganese |
| ICP-MS | EPA 200.8 | Molybdenum |
| ICP-MS | EPA 200.8 | Neodymium |
| ICP-MS | EPA 200.8 | Nickel |
| ICP-MS | EPA 200.8 | Niobium |
| ICP-MS | EPA 200.8 | Palladium |
| ICP-MS | EPA 200.8 | Phosphorus |
| ICP-MS | EPA 200.8 | Platinum |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| ICP-MS | EPA 200.8 | Potassium |
| ICP-MS | EPA 200.8 | Praseodymium |
| ICP-MS | EPA 200.8 | Rhodium |
| ICP-MS | EPA 200.8 | Ruthenium |
| ICP-MS | EPA 200.8 | Samarium |
| ICP-MS | EPA 200.8 | Selenium |
| ICP-MS | EPA 200.8 | Silicon |
| ICP-MS | EPA 200.8 | Silver |
| ICP-MS | EPA 200.8 | Sodium |
| ICP-MS | EPA 200.8 | Strontium |
| ICP-MS | EPA 200.8 | Sulfur |
| ICP-MS | EPA 200.8 | Tantalum |
| ICP-MS | EPA 200.8 | Tellurium |
| ICP-MS | EPA 200.8 | Thallium |
| ICP-MS | EPA 200.8 | Thorium |
| ICP-MS | EPA 200.8 | Tin |
| ICP-MS | EPA 200.8 | Titanium |
| ICP-MS | EPA 200.8 | Tungsten |
| ICP-MS | EPA 200.8 | Uranium |
| ICP-MS | EPA 200.8 | Vanadium |
| ICP-MS | EPA 200.8 | Yttrium |
| ICP-MS | EPA 200.8 | Zinc |
| ICP-MS | EPA 200.8 | Zirconium |
| ICP-AES | EPA 200.7 | Aluminum |
| ICP-AES | EPA 200.7 | Antimony |
| ICP-AES | EPA 200.7 | Arsenic |
| ICP-AES | EPA 200.7 | Barium |
| ICP-AES | EPA 200.7 | Beryllium |
| ICP-AES | EPA 200.7 | Bismuth |
| ICP-AES | EPA 200.7 | Boron |
| ICP-AES | EPA 200.7 | Cadmium |
| ICP-AES | EPA 200.7 | Calcium |
| ICP-AES | EPA 200.7 | Chromium |
| ICP-AES | EPA 200.7 | Cobalt |
| ICP-AES | EPA 200.7 | Copper |
| ICP-AES | EPA 200.7 | Iron |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| ICP-AES | EPA 200.7 | Lead |
| ICP-AES | EPA 200.7 | Lithium |
| ICP-AES | EPA 200.7 | Magnesium |
| ICP-AES | EPA 200.7 | Manganese |
| ICP-AES | EPA 200.7 | Molybdenum |
| ICP-AES | EPA 200.7 | Nickel |
| ICP-AES | EPA 200.7 | Phosphorus |
| ICP-AES | EPA 200.7 | Potassium |
| ICP-AES | EPA 200.7 | Selenium |
| ICP-AES | EPA 200.7 | Silicon |
| ICP-AES | EPA 200.7 | Silver |
| ICP-AES | EPA 200.7 | Sodium |
| ICP-AES | EPA 200.7 | Strontium |
| ICP-AES | EPA 200.7 | Sulfur |
| ICP-AES | EPA 200.7 | Thallium |
| ICP-AES | EPA 200.7 | Thorium |
| ICP-AES | EPA 200.7 | Tin |
| ICP-AES | EPA 200.7 | Titanium |
| ICP-AES | EPA 200.7 | Uranium |
| ICP-AES | EPA 200.7 | Vanadium |
| ICP-AES | EPA 200.7 | Zinc |
| CVAA | EPA 7470A | Mercury |
| Colormetric | EPA 9010C<br>EPA 9012B | Cyanide |
| Ion Chromatrography | EPA 300.0/9056A | Bromide |
| Ion Chromatrography | EPA 300.0/9056A | Chloride |
| Ion Chromatrography | EPA 300.0/9056A | Fluoride |
| Ion Chromatrography | EPA 300.0/9056A | Nitrate |
| Ion Chromatrography | EPA 300.0/9056A | Nitrite |
| Ion Chromatrography | EPA 300.0/9056A | Sulfate |
| Ion Chromatrography | EPA 300.0/9056A | Ortho-phosph |
| Ion Chromatrography | EPA 300.0/9056A | Iodide |
| Ion Chromatrography | EPA 314.0 | Perchlorate |

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Certificate # L2305

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gravimetric | EPA 2540B<br>EPA 2540C<br>EPA 2540D | Solids |
| Probe | EPA 9040C<br>EPA 9045D<br>EPA 150.1 | pH |
| Titration | SM 2320B<br>EPA 310.1 | Alkalinity |
| Titration | EPA 9030 | Sulfide |
| Penske-Martin | EPA 1010A | Ignitability |
| Colormetric | EPA 353.1 | nitrate/Nitrite |
| Colormetric | EPA 365.2 | Total phosph |
| Colormetric | EPA 350.1 | Ammonia |
| Colormetric | EPA 351.2 | TKN |
| TOC Analyzer | EPA 9060 | TOC |
| Tritrmetric | EPA 9020 | TOX |
| Colormetric | EPA 7196A | Hex Chromium |
| Gravimetric | EPA 1664A | Oil & Grease |
| Gravimetric | EPA 1664A | TPH |
| Probe | EPA 9050A | Conductivity |
| Probe | SM 5210B<br>EPA 405.1 | BOD/CBOD |
| Gas Flow Proportional Counter | EPA 900.0<br>EPA 9310 | gross alpha/beta |
| Gas Flow Proportional Counter | EPA 903.0<br>EPA 9315 | Radium-226 |
| Gas Flow Proportional Counter | EPA 903.0<br>EPA 9315 | total radium |
| Gas Flow Proportional Counter | EPA 904.0<br>EPA 9320 | Radium-228 |
| Gas Flow Proportional Counter | EPA 905.0 / DOE HASL 300 Sr-02 | Strontium-90 |
| Liquid Scintillation Counter | EPA 906.0 | Tritium |
| Liquid Scintillation Counter | Eichrom Technologies TCW01/TCS01 | Tecnetium-99 |
| Liquid Scintillation Counter | EERF C-01-C14 | Carbon-14 |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Gamma Emitters: |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Actinium 227 (assumes equilibrium w/ Th-227) |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Actinium 228 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Americium 241 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Antimony 124 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Antimony 125 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium-137 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium/Lanthanum-140 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium 133 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium 140 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Beryllium 7 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 211 eq Th-227 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 207 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth-210M |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 212 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 214 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Calcium-45 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cerium 141 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cerium 139 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cerium 144 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cesium 134 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cesium 137 |

LABORATORY ACCREDITATION BUREAU



| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 56 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 57 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 58 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 60 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Europium 152 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Europium 154 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Europium 155 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Hafnium 181 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Iodine 131 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Iridium 192 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Iron 59 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lanthanum 140 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 210 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 211 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 212 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 214 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Manganese-56 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Manganese 54 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Mercury 203 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Neptunium 237 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Neptunium 239 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Niobium 83 |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Niobium 94 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Niobium 95 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Potassium 40 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Promethium 144 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Promethium 146 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Promethium 147 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Protactinium 234M |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Protactinium 231 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Protactinium 234 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium (226) |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium 228 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium 223 (assumes equilibrium w/ Th-227) |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium 224 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Ruthenium 106 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Scandium 46 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Sodium 22 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Sodium 24 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Strontium 85 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thallium 208 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 227 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 228 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 230 |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 231 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 232 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 234 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Tin 113 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Uranium 235 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Uranium 238 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Vanadium-48 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Yttrium 88 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Zinc 65 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Zirconium 95 |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Alpha spec analysis: |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Uranium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Thorium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Americium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Plutonium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Neptunium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Curium |
| Liquid Scintillation Counter | Eichrom Technologies OTW01, OTS01 | Lead-210 |
| Alpha Spectroscopy | Laboratory SOP ST-RC-0210 | Polonium-210 |
| Liquid Scintillation Counter | Eichrom Technologies FEW01 | Iron-55 |
| Liquid Scintillation Counter | DOE RP-300 | Nickel 59/63 |

| Non-Potable Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Liquid Scintillation Counter | SM 7500-IB | Iodine-129 |
| **Preparation** | **Method** | **Type** |
| Organic Extraction & Sample Prep | EPA 3500C | Organic Extraction & Sample Prep |
| Volatile Prep | EPA 5000 | Sample Preparation for Volatile Organic Compounds |
| Organic Cleanup | EPA 3600A | Cleanup for Organic extracts |
| Organic prep/analysis | EPA 8000C | Determinative Chromatographic Separations |
| Acid Digestion (Aqueous samples) | EPA 3010A | Acid Digestion for Metals (Aqueous samples) |
| Purge & Trap | EPA 5030B | Purge & Trap for Aqueous Volatile Samples |
| Sep Funnel Liquid-Liquid Extraction | EPA 3510C | Sep Funnel Liquid-Liquid Extraction |
| Continuous Liquid-Liquid Extraction | EPA 3520C | Continuous Liquid-Liquid Extraction |
| Organic Cleanup | EPA 3600A | Cleanup for Organic extracts |
| Florisil Cleanup | EPA 3620C | Florisil Cleanup |
| Sulfur Cleanup | EPA 3660B | Sulfur Cleanup |
| TCLP Extraction | EPA 1311 | TCLP Extraction |
| SPLP Extraction | EPA 1312 | SPLP Extraction |
| CWET Extraction | CA Title 22 | CWET Extraction |
| Solid Phase Extraction | EPA 3535A | Solid Phase Extraction |

| Drinking Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gas Flow Proportional Counter | EPA 900.0<br>EPA 9310 | gross alpha/beta |
| Gas Flow Proportional Counter | EPA 903.0<br>EPA 9315 | Radium-226 |

| Drinking Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gas Flow Proportional Counter | EPA 904.0<br>EPA 9320 | Radium-228 |
| Gas Flow Proportional Counter | EPA 905.0 / DOE HASL 300 Sr-02 | Strontium-90 |
| Liquid Scintillation Counter | EPA 906.0 | Tritium |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Gamma Emitters: |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Actinium 227 (assumes equilibrium w/ Th-227) |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Actinium 228 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Americium 241 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Antimony 124 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Antimony 125 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium-137 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium/Lanthanum-140 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium 133 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium 140 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Beryllium 7 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 211 eq Th-227 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 207 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth-210M |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 212 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 214 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Calcium-45 |

| Drinking Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cerium 141 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cerium 139 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cerium 144 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cesium 134 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cesium 137 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 56 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 57 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 58 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 60 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Europium 152 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Europium 154 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Europium 155 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Hafnium 181 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Iodine 131 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Iridium 192 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Iron 59 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lanthanum 140 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 210 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 211 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 212 |

LABORATORY ACCREDITATION BUREAU

Certificate # L2305

| Drinking Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 214 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Manganese-56 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Manganese 54 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Mercury 203 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Neptunium 237 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Neptunium 239 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Niobium 83 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Niobium 94 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Niobium 95 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Potassium 40 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Promethium 144 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Promethium 146 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Promethium 147 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Protactinium 234M |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Protactinium 231 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Protactinium 234 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium (226) |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium 228 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium 223 (assumes equilibrium w/ Th-227) |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium 224 |

LABORATORY ACCREDITATION BUREAU

Certificate # L2305

| Drinking Water | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Ruthenium 106 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Scandium 46 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Sodium 22 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Sodium 24 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Strontium 85 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thallium 208 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 227 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 228 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 230 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 231 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 232 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 234 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Tin 113 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Uranium 235 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Uranium 238 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Vanadium-48 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Yttrium 88 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Zinc 65 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Zirconium 95 |

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| ICP-AES | EPA 6010C | Aluminum |
| ICP-AES | EPA 6010C | Antimony |
| ICP-AES | EPA 6010C | Arsenic |
| ICP-AES | EPA 6010C | Barium |
| ICP-AES | EPA 6010C | Beryllium |
| ICP-AES | EPA 6010C | Bismuth |
| ICP-AES | EPA 6010C | Boron |
| ICP-AES | EPA 6010C | Cadmium |
| ICP-AES | EPA 6010C | Calcium |
| ICP-AES | EPA 6010C | Chromium |
| ICP-AES | EPA 6010C | Cobalt |
| ICP-AES | EPA 6010C | Copper |
| ICP-AES | EPA 6010C | Iron |
| ICP-AES | EPA 6010C | Lead |
| ICP-AES | EPA 6010C | Lithium |
| ICP-AES | EPA 6010C | Magnesium |
| ICP-AES | EPA 6010C | Manganese |
| ICP-AES | EPA 6010C | Molybdenum |
| ICP-AES | EPA 6010C | Nickel |
| ICP-AES | EPA 6010C | Phosphorus |
| ICP-AES | EPA 6010C | Potassium |
| ICP-AES | EPA 6010C | Selenium |
| ICP-AES | EPA 6010C | Silicon |
| ICP-AES | EPA 6010C | Silver |
| ICP-AES | EPA 6010C | Sodium |
| ICP-AES | EPA 6010C | Strontium |
| ICP-AES | EPA 6010C | Sulfur |
| ICP-AES | EPA 6010C | Thallium |
| ICP-AES | EPA 6010C | Thorium |
| ICP-AES | EPA 6010C | Tin |
| ICP-AES | EPA 6010C | Titanium |
| ICP-AES | EPA 6010C | Uranium |
| ICP-AES | EPA 6010C | Vanadium |
| ICP-AES | EPA 6010C | Zinc |
| GC/MS | EPA 8260C | Acetone |
| GC/MS | EPA 8260C | Acetonitrile |

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8260C | Acrolein |
| GC/MS | EPA 8260C | Acrylonitrile |
| GC/MS | EPA 8260C | Benzene |
| GC/MS | EPA 8260C | Benzyl chloride |
| GC/MS | EPA 8260C | Bromobenzene |
| GC/MS | EPA 8260C | Bromochloromethane |
| GC/MS | EPA 8260C | Bromodichloromethane |
| GC/MS | EPA 8260C | Bromoform |
| GC/MS | EPA 8260C | Bromomethane |
| GC/MS | EPA 8260C | n-Butanol |
| GC/MS | EPA 8260C | 2-Butanone |
| GC/MS | EPA 8260C | n-Butylbenzene |
| GC/MS | EPA 8260C | sec-Butylbenzene |
| GC/MS | EPA 8260C | tert-Butylbenzene |
| GC/MS | EPA 8260C | Carbon disulfide |
| GC/MS | EPA 8260C | Carbon tetrachloride |
| GC/MS | EPA 8260C | Chlorobenzene |
| GC/MS | EPA 8260C | Chlorobromomethane |
| GC/MS | EPA 8260C | 2-Chloro-1,3-butadiene |
| GC/MS | EPA 8260C | Chlorodibromomethane |
| GC/MS | EPA 8260C | Dibromochloromethane |
| GC/MS | EPA 8260C | Chloroethane |
| GC/MS | EPA 8260C | 2-Chloroethyl vinyl ether |
| GC/MS | EPA 8260C | Chloroform |
| GC/MS | EPA 8260C | Chloromethane |
| GC/MS | EPA 8260C | Allyl chloride |
| GC/MS | EPA 8260C | 2-Chlorotoluene |
| GC/MS | EPA 8260C | 4-Chlorotoluene |
| GC/MS | EPA 8260C | Cyclohexane |
| GC/MS | EPA 8260C | Cyclohexanone |
| GC/MS | EPA 8260C | 1,2-Dibromo-3-chloropropane |
| GC/MS | EPA 8260C | 1,2-Dibromoethane |
| GC/MS | EPA 8260C | Dibromomethane |
| GC/MS | EPA 8260C | 1,2-Dichlorobenzene |
| GC/MS | EPA 8260C | 1,3-Dichlorobenzene |
| GC/MS | EPA 8260C | 1,4-Dichlorobenzene |

**Solid and Chemical Materials**

| Technology | Method | Analyte |
|---|---|---|
| GC/MS | EPA 8260C | trans-1,4-Dichloro-2-butene |
| GC/MS | EPA 8260C | Dichlorodifluoromethane |
| GC/MS | EPA 8260C | 1,1-Dichloroethane |
| GC/MS | EPA 8260C | 1,2-Dichloroethane |
| GC/MS | EPA 8260C | cis-1,2-Dichloroethene |
| GC/MS | EPA 8260C | trans-1,2-Dichloroethene |
| GC/MS | EPA 8260C | 1,1-Dichloroethene |
| GC/MS | EPA 8260C | 1,2-Dichloroethene (total) |
| GC/MS | EPA 8260C | 1,2-Dichloropropane |
| GC/MS | EPA 8260C | 1,3-Dichloropropane |
| GC/MS | EPA 8260C | 2,2-Dichloropropane |
| GC/MS | EPA 8260C | cis-1,3-Dichloropropene |
| GC/MS | EPA 8260C | trans-1,3-Dichloropropene |
| GC/MS | EPA 8260C | 1,1-Dichloropropene |
| GC/MS | EPA 8260C | 1,2-Dichloro-1,1,2,2-tetrafluoroethane |
| GC/MS | EPA 8260C | Dimethyl disulfide |
| GC/MS | EPA 8260C | 1,4-Dioxane |
| GC/MS | EPA 8260C | Ethyl acetate |
| GC/MS | EPA 8260C | Ethylbenzene |
| GC/MS | EPA 8260C | Ethyl ether |
| GC/MS | EPA 8260C | Diethyl ether |
| GC/MS | EPA 8260C | Ethyl methacrylate |
| GC/MS | EPA 8260C | Freon 113 |
| GC/MS | EPA 8260C | Hexachlorobutadiene |
| GC/MS | EPA 8260C | n-Hexane |
| GC/MS | EPA 8260C | 2-Hexanone |
| GC/MS | EPA 8260C | Iodomethane |
| GC/MS | EPA 8260C | Isobutanol |
| GC/MS | EPA 8260C | Isopropylbenzene |
| GC/MS | EPA 8260C | p-Isopropyltoluene |
| GC/MS | EPA 8260C | Methacrylonitrile |
| GC/MS | EPA 8260C | Methyl acetate |
| GC/MS | EPA 8260C | Methyl butyl ketone |
| GC/MS | EPA 8260C | Methylcyclohexane |
| GC/MS | EPA 8260C | Dichloromethane |
| GC/MS | EPA 8260C | Methylene chloride |

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8260C | Methyl methacrylate |
| GC/MS | EPA 8260C | 4-Methyl-2-pentanone |
| GC/MS | EPA 8260C | MTBE |
| GC/MS | EPA 8260C | Naphthalene |
| GC/MS | EPA 8260C | 2-Nitropropane |
| GC/MS | EPA 8260C | Nonanal |
| GC/MS | EPA 8260C | Pentachloroethane |
| GC/MS | EPA 8260C | Propionitrile |
| GC/MS | EPA 8260C | n-Propylbenzene |
| GC/MS | EPA 8260C | Styrene |
| GC/MS | EPA 8260C | 1,1,1,2-Tetrachloroethane |
| GC/MS | EPA 8260C | 1,1,2,2-Tetrachloroethane |
| GC/MS | EPA 8260C | Tetrachloroethene |
| GC/MS | EPA 8260C | Tetrahydrofuran |
| GC/MS | EPA 8260C | Toluene |
| GC/MS | EPA 8260C | 1,3,5-Trichlorobenzene |
| GC/MS | EPA 8260C | 1,2,3-Trichlorobenzene |
| GC/MS | EPA 8260C | 1,2,4-Trichlorobenzene |
| GC/MS | EPA 8260C | 1,1,1-Trichloroethane |
| GC/MS | EPA 8260C | 1,1,2-Trichloroethane |
| GC/MS | EPA 8260C | Trichloroethene |
| GC/MS | EPA 8260C | Trichlorofluoromethane |
| GC/MS | EPA 8260C | 1,2,3-Trichloropropane |
| GC/MS | EPA 8260C | 1,1,2-Trichloro-1,2,2-trifluoroethane |
| GC/MS | EPA 8260C | Trichlorotrifluoroethane |
| GC/MS | EPA 8260C | 1,2,4-Trimethylbenzene |
| GC/MS | EPA 8260C | 1,3,5-Trimethylbenzene |
| GC/MS | EPA 8260C | Vinyl acetate |
| GC/MS | EPA 8260C | Vinyl chloride |
| GC/MS | EPA 8260C | m-Xylene & p-Xylene |
| GC/MS | EPA 8260C | o-Xylene |
| GC/MS | EPA 8260C | Xylenes (total) |
| GC/MS | EPA 8270D | Acenaphthene |
| GC/MS | EPA 8270D | Acenaphthylene |
| GC/MS | EPA 8270D | Acetophenone |
| GC/MS | EPA 8270D | 2-Acetylaminofluorene |

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8270D | 4-Aminobiphenyl |
| GC/MS | EPA 8270D | Aniline |
| GC/MS | EPA 8270D | Anthracene |
| GC/MS | EPA 8270D | Aramite (total) |
| GC/MS | EPA 8270D | Atrazine |
| GC/MS | EPA 8270D | Azobenzene |
| GC/MS | EPA 8270D | Benzaldehyde |
| GC/MS | EPA 8270D | Benzidine |
| GC/MS | EPA 8270D | Benzo(a)anthracene |
| GC/MS | EPA 8270D | Benzo(b)fluoranthene |
| GC/MS | EPA 8270D | Benzo(k)fluoranthene |
| GC/MS | EPA 8270D | Benzoic acid |
| GC/MS | EPA 8270D | Benzo(ghi)perylene |
| GC/MS | EPA 8270D | Benzo(a)pyrene |
| GC/MS | EPA 8270D | Benzyl alcohol |
| GC/MS | EPA 8270D | 1,1'-Biphenyl |
| GC/MS | EPA 8270D | bis(2-Chloroethoxy)methane |
| GC/MS | EPA 8270D | bis(2-Chloroethyl) ether |
| GC/MS | EPA 8270D | bis(2-Chloroisopropyl) ether |
| GC/MS | EPA 8270D | bis(2-Ethylhexyl) phthalate |
| GC/MS | EPA 8270D | 4-Bromophenyl phenyl ether |
| GC/MS | EPA 8270D | n-Butylbenzenesulfonamide |
| GC/MS | EPA 8270D | Butyl benzyl phthalate |
| GC/MS | EPA 8270D | Caprolactam |
| GC/MS | EPA 8270D | Carbazole |
| GC/MS | EPA 8270D | 4-Chloroaniline |
| GC/MS | EPA 8270D | Chlorobenzilate |
| GC/MS | EPA 8270D | p-Chlorobenzilate |
| GC/MS | EPA 8270D | 4-Chloro-3-methylphenol |
| GC/MS | EPA 8270D | 2-Chloronaphthalene |
| GC/MS | EPA 8270D | 2-Chlorophenol |
| GC/MS | EPA 8270D | 4-Chlorophenyl phenyl ether |
| GC/MS | EPA 8270D | Chrysene |
| GC/MS | EPA 8270D | Cresols (total) |
| GC/MS | EPA 8270D | Cyclohexanol |
| GC/MS | EPA 8270D | Diallate |

**Solid and Chemical Materials**

| Technology | Method | Analyte |
|---|---|---|
| GC/MS | EPA 8270D | Dibenz(a,h)anthracene |
| GC/MS | EPA 8270D | Dibenzo(a,h)anthracene |
| GC/MS | EPA 8270D | Dibenzofuran |
| GC/MS | EPA 8270D | Di-n-butyl phthalate |
| GC/MS | EPA 8270D | 1,2-Dichlorobenzene |
| GC/MS | EPA 8270D | 1,3-Dichlorobenzene |
| GC/MS | EPA 8270D | 1,4-Dichlorobenzene |
| GC/MS | EPA 8270D | 3,3'-Dichlorobenzidine |
| GC/MS | EPA 8270D | 2,4-Dichlorophenol |
| GC/MS | EPA 8270D | 2,6-Dichlorophenol |
| GC/MS | EPA 8270D | Diethyl phthalate |
| GC/MS | EPA 8270D | O,O-Diethyl-O-(2-pyrazinyl) phosphorothioate |
| GC/MS | EPA 8270D | Dimethoate |
| GC/MS | EPA 8270D | p-Dimethylaminoazobenzene |
| GC/MS | EPA 8270D | 7,12-Dimethylbenz(a)anthracene |
| GC/MS | EPA 8270D | 3,3'-Dimethylbenzidine |
| GC/MS | EPA 8270D | Dimethylformamide |
| GC/MS | EPA 8270D | alpha,alpha-Dimethylphenethylamine |
| GC/MS | EPA 8270D | 2,4-Dimethylphenol |
| GC/MS | EPA 8270D | Dimethyl phthalate |
| GC/MS | EPA 8270D | 1,3-Dinitrobenzene |
| GC/MS | EPA 8270D | 1,4-Dinitrobenzene |
| GC/MS | EPA 8270D | 4,6-Dinitro-2-methylphenol |
| GC/MS | EPA 8270D | 2,4-Dinitrophenol |
| GC/MS | EPA 8270D | 2,4-Dinitrotoluene |
| GC/MS | EPA 8270D | 2,6-Dinitrotoluene |
| GC/MS | EPA 8270D | 2-sec-Butyl-4,6-dinitrophenol |
| GC/MS | EPA 8270D | Dinoseb |
| GC/MS | EPA 8270D | Di-n-octyl phthalate |
| GC/MS | EPA 8270D | 1,4-Dioxane |
| GC/MS | EPA 8270D | 1,2-Diphenylhydrazine (as Azobenzene) |
| GC/MS | EPA 8270D | Disulfoton |
| GC/MS | EPA 8270D | Ethyl methacrylate |
| GC/MS | EPA 8270D | Ethyl methanesulfonate |
| GC/MS | EPA 8270D | Famphur |
| GC/MS | EPA 8270D | Fluoranthene |

**Solid and Chemical Materials**

| Technology | Method | Analyte |
|---|---|---|
| GC/MS | EPA 8270D | Fluorene |
| GC/MS | EPA 8270D | Hexachlorobenzene |
| GC/MS | EPA 8270D | Hexachlorobutadiene |
| GC/MS | EPA 8270D | Hexachlorocyclopentadiene |
| GC/MS | EPA 8270D | Hexachloro-1,3-cyclopentadiene |
| GC/MS | EPA 8270D | Hexachloroethane |
| GC/MS | EPA 8270D | Hexachlorophene |
| GC/MS | EPA 8270D | Hexachloropropene |
| GC/MS | EPA 8270D | Indeno(1,2,3-cd)pyrene |
| GC/MS | EPA 8270D | Isodrin |
| GC/MS | EPA 8270D | Isophorone |
| GC/MS | EPA 8270D | Isosafrole |
| GC/MS | EPA 8270D | Kepone |
| GC/MS | EPA 8270D | Methapyrilene |
| GC/MS | EPA 8270D | 2-Methylbenzenamine |
| GC/MS | EPA 8270D | 3-Methylcholanthrene |
| GC/MS | EPA 8270D | 4,4'-Methylenebis(2-chloroaniline) |
| GC/MS | EPA 8270D | Methyl methacrylate |
| GC/MS | EPA 8270D | Methyl methanesulfonate |
| GC/MS | EPA 8270D | 2-Methylnaphthalene |
| GC/MS | EPA 8270D | Methyl parathion |
| GC/MS | EPA 8270D | 2-Methylphenol |
| GC/MS | EPA 8270D | 3-Methylphenol & 4-Methylphenol |
| GC/MS | EPA 8270D | 2-Methylphenol, 3-methylphenol and 4-methylphenol |
| GC/MS | EPA 8270D | Methylphenols (total) |
| GC/MS | EPA 8270D | Naphthalene |
| GC/MS | EPA 8270D | 1,4-Naphthoquinone |
| GC/MS | EPA 8270D | 1-Naphthylamine |
| GC/MS | EPA 8270D | 2-Naphthylamine |
| GC/MS | EPA 8270D | 2-Nitroaniline |
| GC/MS | EPA 8270D | 3-Nitroaniline |
| GC/MS | EPA 8270D | 4-Nitroaniline |
| GC/MS | EPA 8270D | Nitrobenzene |
| GC/MS | EPA 8270D | 2-Nitrophenol |
| GC/MS | EPA 8270D | 4-Nitrophenol |
| GC/MS | EPA 8270D | 4-Nitroquinoline-1-oxide |

**Solid and Chemical Materials**

| Technology | Method | Analyte |
|---|---|---|
| GC/MS | EPA 8270D | N-Nitrosodi-n-butylamine |
| GC/MS | EPA 8270D | N-Nitrosodiethylamine |
| GC/MS | EPA 8270D | N-Nitrosodimethylamine |
| GC/MS | EPA 8270D | N-Nitrosodiphenylamine |
| GC/MS | EPA 8270D | N-Nitrosodi-n-propylamine |
| GC/MS | EPA 8270D | N-Nitrosomethylethylamine |
| GC/MS | EPA 8270D | N-Nitrosomorpholine |
| GC/MS | EPA 8270D | N-Nitrosopiperidine |
| GC/MS | EPA 8270D | N-Nitrosopyrrolidine |
| GC/MS | EPA 8270D | 5-Nitro-o-toluidine |
| GC/MS | EPA 8270D | 2,2'-oxybis(1-Chloropropane) |
| GC/MS | EPA 8270D | Parathion |
| GC/MS | EPA 8270D | Pentachlorobenzene |
| GC/MS | EPA 8270D | Pentachloroethane |
| GC/MS | EPA 8270D | Pentachloronitrobenzene |
| GC/MS | EPA 8270D | Pentachlorophenol |
| GC/MS | EPA 8270D | Phenacetin |
| GC/MS | EPA 8270D | Phenanthrene |
| GC/MS | EPA 8270D | Phenol |
| GC/MS | EPA 8270D | p-Phenylene diamine |
| GC/MS | EPA 8270D | Phorate |
| GC/MS | EPA 8270D | 2-Picoline |
| GC/MS | EPA 8270D | Pronamide |
| GC/MS | EPA 8270D | Pyrene |
| GC/MS | EPA 8270D | Pyridine |
| GC/MS | EPA 8270D | Safrole |
| GC/MS | EPA 8270D | Sulfotepp |
| GC/MS | EPA 8270D | 1,2,4,5-Tetrachlorobenzene |
| GC/MS | EPA 8270D | 2,3,4,6-Tetrachlorophenol |
| GC/MS | EPA 8270D | Tetraethyldithiopyrophosphate (Sulfotepp) |
| GC/MS | EPA 8270D | Thionazin |
| GC/MS | EPA 8270D | o-Toluidine |
| GC/MS | EPA 8270D | Tributyl phosphate |
| GC/MS | EPA 8270D | 1,2,4-Trichlorobenzene |
| GC/MS | EPA 8270D | 2,4,5-Trichlorophenol |
| GC/MS | EPA 8270D | 2,4,6-Trichlorophenol |

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| GC/MS | EPA 8270D | O,O,O-Triethyl phosphorothioate |
| GC/MS | EPA 8270D | 1,3,5-Trinitrobenzene |
| GC/MS | EPA 8270D | Tris(2-chloroethyl)phosphate |
| GC/MS | EPA 8270D | 1-Methyl naphthalene |
| GC-ECD | EPA 8081B | Aldrin |
| GC-ECD | EPA 8081B | alpha-BHC |
| GC-ECD | EPA 8081B | beta-BHC |
| GC-ECD | EPA 8081B | delta-BHC |
| GC-ECD | EPA 8081B | gamma-BHC (Lindane) |
| GC-ECD | EPA 8081B | alpha-Chlordane |
| GC-ECD | EPA 8081B | gamma-Chlordane |
| GC-ECD | EPA 8081B | Chlordane (technical) |
| GC-ECD | EPA 8081B | 4,4'-DDD |
| GC-ECD | EPA 8081B | 2,4'-DDD |
| GC-ECD | EPA 8081B | 4,4'-DDE |
| GC-ECD | EPA 8081B | 2,4'-DDE |
| GC-ECD | EPA 8081B | 4,4'-DDT |
| GC-ECD | EPA 8081B | 2,4'-DDT |
| GC-ECD | EPA 8081B | Dieldrin |
| GC-ECD | EPA 8081B | Endosulfan I |
| GC-ECD | EPA 8081B | Endosulfan II |
| GC-ECD | EPA 8081B | Endosulfan sulfate |
| GC-ECD | EPA 8081B | Endrin |
| GC-ECD | EPA 8081B | Endrin aldehyde |
| GC-ECD | EPA 8081B | Endrin ketone |
| GC-ECD | EPA 8081B | Heptachlor |
| GC-ECD | EPA 8081B | Heptachlor epoxide |
| GC-ECD | EPA 8081B | Methoxychlor |
| GC-ECD | EPA 8081B | Toxaphene |
| GC-ECD | EPA 8082A | Aroclor 1016 |
| GC-ECD | EPA 8082A | Aroclor 1221 |
| GC-ECD | EPA 8082A | Aroclor 1232 |
| GC-ECD | EPA 8082A | Aroclor 1242 |
| GC-ECD | EPA 8082A | Aroclor 1248 |
| GC-ECD | EPA 8082A | Aroclor 1254 |
| GC-ECD | EPA 8082A | Aroclor 1260 |

**Solid and Chemical Materials**

| Technology | Method | Analyte |
|---|---|---|
| GC-ECD | EPA 8082A | Aroclor 1262 |
| GC-ECD | EPA 8082A | Aroclor 1268 |
| GC-ECD | EPA 8151A | 2,4-D |
| GC-ECD | EPA 8151A | Dalapon |
| GC-ECD | EPA 8151A | 2,4-DB |
| GC-ECD | EPA 8151A | Dicamba |
| GC-ECD | EPA 8151A | Dichlorprop |
| GC-ECD | EPA 8151A | Dinoseb |
| GC-ECD | EPA 8151A | MCPA |
| GC-ECD | EPA 8151A | MCPP |
| GC-ECD | EPA 8151A | 4-Nitrophenol |
| GC-ECD | EPA 8151A | Pentachlorophenol |
| GC-ECD | EPA 8151A | 2,4,5-TP (Silvex) |
| GC-ECD | EPA 8151A | 2,4,5-T |
| LC/MS/MS | EPA 8321A | 2-Amino-4,6-dinitrotoluene |
| LC/MS/MS | EPA 8321A | 4-Amino-2,6-dinitrotoluene |
| LC/MS/MS | EPA 8321A | 3,5-Dinitroaniline |
| LC/MS/MS | EPA 8321A | 1,3-Dinitrobenzene |
| LC/MS/MS | EPA 8321A | 2,4-Dinitrotoluene |
| LC/MS/MS | EPA 8321A | 2,6-Dinitrotoluene |
| LC/MS/MS | EPA 8321A | DNX |
| LC/MS/MS | EPA 8321A | HMX |
| LC/MS/MS | EPA 8321A | HNAB |
| LC/MS/MS | EPA 8321A | HNS |
| LC/MS/MS | EPA 8321A | MNX |
| LC/MS/MS | EPA 8321A | Nitrobenzene |
| LC/MS/MS | EPA 8321A | Nitroglycerin |
| LC/MS/MS | EPA 8321A | 4-Nitrotoluene |
| LC/MS/MS | EPA 8321A | 3-Nitrotoluene |
| LC/MS/MS | EPA 8321A | 2-Nitrotoluene |
| LC/MS/MS | EPA 8321A | PETN |
| LC/MS/MS | EPA 8321A | RDX |
| LC/MS/MS | EPA 8321A | TATB |
| LC/MS/MS | EPA 8321A | Tetryl |
| LC/MS/MS | EPA 8321A | TNX |
| LC/MS/MS | EPA 8321A | 1,3,5-Trinitrobenzene |

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| LC/MS/MS | EPA 8321A | 2,4,6-Trinitrotoluene |
| LC/MS/MS | EPA 8321A | Tris (o-cresyl) Phosphate |
| LC/MS/MS | EPA 8321A | 2,4-diamino-6-nitrotoluene |
| LC/MS/MS | EPA 8321A | 2,6-diamino-4-nitrotoluene |
| HPLC | EPA 8330B | 2-Amino-4,6-dinitrotoluene |
| HPLC | EPA 8330B | 4-Amino-2,6-dinitrotoluene |
| HPLC | EPA 8330B | 1,3-Dinitrobenzene |
| HPLC | EPA 8330B | 2,4-Dinitrotoluene |
| HPLC | EPA 8330B | 2,6-Dinitrotoluene |
| HPLC | EPA 8330B | HMX |
| HPLC | EPA 8330B | HNAB |
| HPLC | EPA 8330B | HNS |
| HPLC | EPA 8330B | Nitrobenzene |
| HPLC | EPA 8330B | Nitroglycerin |
| HPLC | EPA 8330B | 2-Nitrotoluene |
| HPLC | EPA 8330B | 3-Nitrotoluene |
| HPLC | EPA 8330B | 4-Nitrotoluene |
| HPLC | EPA 8330B | PETN |
| HPLC | EPA 8330B | RDX |
| HPLC | EPA 8330B | TATB |
| HPLC | EPA 8330B | Tetryl |
| HPLC | EPA 8330B | MNX |
| HPLC | EPA 8330B | DNX |
| HPLC | EPA 8330B | TNX |
| HPLC | EPA 8330B | 1,3,5-Trinitrobenzene |
| HPLC | EPA 8330B | 2,4,6-Trinitrotoluene |
| HPLC | EPA 8310 | Acenaphthene |
| HPLC | EPA 8310 | Acenaphthylene |
| HPLC | EPA 8310 | Anthracene |
| HPLC | EPA 8310 | Benzo(a)anthracene |
| HPLC | EPA 8310 | Benzo(b)fluoranthene |
| HPLC | EPA 8310 | Benzo(k)fluoranthene |
| HPLC | EPA 8310 | Benzo(ghi)perylene |
| HPLC | EPA 8310 | Benzo(a)pyrene |
| HPLC | EPA 8310 | Chrysene |
| HPLC | EPA 8310 | Dibenz(a,h)anthracene |

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| HPLC | EPA 8310 | Fluoranthene |
| HPLC | EPA 8310 | Fluorene |
| HPLC | EPA 8310 | Indeno(1,2,3-cd)pyrene |
| HPLC | EPA 8310 | Naphthalene |
| HPLC | EPA 8310 | Phenanthrene |
| HPLC | EPA 8310 | Pyrene |
| GC/MS SIM | EPA 8270D | Acenaphthene |
| GC/MS SIM | EPA 8270D | Acenaphthylene |
| GC/MS SIM | EPA 8270D | Anthracene |
| GC/MS SIM | EPA 8270D | Benzo(a)anthracene |
| GC/MS SIM | EPA 8270D | Benzo(b)fluoranthene |
| GC/MS SIM | EPA 8270D | Benzo(k)fluoranthene |
| GC/MS SIM | EPA 8270D | Benzo(ghi)perylene |
| GC/MS SIM | EPA 8270D | Benzo(a)pyrene |
| GC/MS SIM | EPA 8270D | Chrysene |
| GC/MS SIM | EPA 8270D | Dibenz(a,h)anthracene |
| GC/MS SIM | EPA 8270D | Fluoranthene |
| GC/MS SIM | EPA 8270D | Fluorene |
| GC/MS SIM | EPA 8270D | Indeno(1,2,3-cd)pyrene |
| GC/MS SIM | EPA 8270D | Naphthalene |
| GC/MS SIM | EPA 8270D | Phenanthrene |
| GC/MS SIM | EPA 8270D | Pyrene |
| GC/MS SIM | EPA 8260C | 1,4- dioxane |
| GC-FID | EPA 8015B | Diesel Range Organics |
| GC-FID | EPA 8015B | Motor Oil Range Organics |
| GC-FID | EPA 8015B | TPH (as Diesel) |
| GC-FID | EPA 8015B | Gasoline Range Organics |
| GC-FID | EPA 8015B | Ethanol |
| GC-FID | EPA 8015B | Methanol |
| GC-FID | EPA 8015B | Ethylene glycol |
| GC-FID | EPA 8015B | Propylene glycol |
| LC/MS/MS | EPA 6850 | Perchlorate |
| ICP-MS | EPA 6020A | Aluminum |
| ICP-MS | EPA 6020A | Antimony |
| ICP-MS | EPA 6020A | Arsenic |
| ICP-MS | EPA 6020A | Barium |

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**Solid and Chemical Materials**

| Technology | Method | Analyte |
|---|---|---|
| ICP-MS | EPA 6020A | Beryllium |
| ICP-MS | EPA 6020A | Bismuth |
| ICP-MS | EPA 6020A | Boron |
| ICP-MS | EPA 6020A | Cadmium |
| ICP-MS | EPA 6020A | Calcium |
| ICP-MS | EPA 6020A | Cerium |
| ICP-MS | EPA 6020A | Cesium |
| ICP-MS | EPA 6020A | Chromium |
| ICP-MS | EPA 6020A | Cobalt |
| ICP-MS | EPA 6020A | Copper |
| ICP-MS | EPA 6020A | Hafnium |
| ICP-MS | EPA 6020A | Iron |
| ICP-MS | EPA 6020A | Lanthanum |
| ICP-MS | EPA 6020A | Lead |
| ICP-MS | EPA 6020A | Lithium |
| ICP-MS | EPA 6020A | Magnesium |
| ICP-MS | EPA 6020A | Manganese |
| ICP-MS | EPA 6020A | Molybdenum |
| ICP-MS | EPA 6020A | Neodymium |
| ICP-MS | EPA 6020A | Nickel |
| ICP-MS | EPA 6020A | Niobium |
| ICP-MS | EPA 6020A | Palladium |
| ICP-MS | EPA 6020A | Phosphorus |
| ICP-MS | EPA 6020A | Platinum |
| ICP-MS | EPA 6020A | Potassium |
| ICP-MS | EPA 6020A | Praseodymium |
| ICP-MS | EPA 6020A | Rhodium |
| ICP-MS | EPA 6020A | Ruthenium |
| ICP-MS | EPA 6020A | Samarium |
| ICP-MS | EPA 6020A | Selenium |
| ICP-MS | EPA 6020A | Silicon |
| ICP-MS | EPA 6020A | Silver |
| ICP-MS | EPA 6020A | Sodium |
| ICP-MS | EPA 6020A | Strontium |
| ICP-MS | EPA 6020A | Sulfur |
| ICP-MS | EPA 6020A | Tantalum |

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| ICP-MS | EPA 6020A | Technetium-99 |
| ICP-MS | EPA 6020A | Tellurium |
| ICP-MS | EPA 6020A | Thallium |
| ICP-MS | EPA 6020A | Thorium |
| ICP-MS | EPA 6020A | Tin |
| ICP-MS | EPA 6020A | Titanium |
| ICP-MS | EPA 6020A | Tungsten |
| ICP-MS | EPA 6020A | Uranium |
| ICP-MS | EPA 6020A | Uranium 233 |
| ICP-MS | EPA 6020A | Uranium 234 |
| ICP-MS | EPA 6020A | Uranium 235 |
| ICP-MS | EPA 6020A | Uranium 236 |
| ICP-MS | EPA 6020A | Uranium 238 |
| ICP-MS | EPA 6020A | Vanadium |
| ICP-MS | EPA 6020A | Yttrium |
| ICP-MS | EPA 6020A | Zinc |
| ICP-MS | EPA 6020A | Zirconium |
| CVAA | EPA 7471B | Mercury |
| Colormetric | EPA 9010C<br>EPA 9012B | Cyanide |
| Ion Chromatrography | EPA 300.0<br>EPA 9056A | Bromide |
| Ion Chromatrography | EPA 300.0<br>EPA 9056A | Chloride |
| Ion Chromatrography | EPA 300.0<br>EPA 9056A | Fluoride |
| Ion Chromatrography | EPA 300.0<br>EPA 9056A | Nitrate |
| Ion Chromatrography | EPA 300.0<br>EPA 9056A | Nitrite |
| Ion Chromatrography | EPA 300.0<br>EPA 9056A | Sulfate |
| Ion Chromatrography | EPA 300.0<br>EPA 9056A | Ortho-phosph |
| Ion Chromatrography | EPA 300.0<br>EPA 9056A | Iodide |
| Ion Chromatrography | EPA 314.0 | Perchlorate |
| Gravimetric | EPA 2540B<br>EPA 2540C<br>EPA 2540D | Solids |

**Solid and Chemical Materials**

| Technology | Method | Analyte |
|---|---|---|
| Probe | EPA 9040C<br>EPA 9045D<br>EPA 150.1 | pH |
| Titration | SM 2320B<br>EPA 310.1 | Alkalinity |
| Titration | EPA 9030 | Sulfide |
| Penske-Martin | EPA1010A | Ignitability |
| Colormetric | EPA 353.1 | nitrate/Nitrite |
| Colormetric | EPA 350.1 | Ammonia |
| Colormetric | EPA 351.2 | TKN |
| TOC Analyzer | EPA 9060 | TOC |
| Tritrmetric | EPA 9020 | TOX |
| Colormetric | EPA 7196A | Hex Chromium |
| Gravimetric | EPA 1664A | Oil & Grease |
| Gravimetric | EPA 1664A | TPH |
| Probe | EPA 9050A | Conductivity |
| Probe | SM 5210B<br>EPA 405.1 | BOD/CBOD |
| Gas Flow Proportional Counter | EPA 900.0<br>EPA 9310 | gross alpha/beta |
| Gas Flow Proportional Counter | EPA 903.0<br>EPA 9315 | Radium-226 |
| Gas Flow Proportional Counter | EPA 903.0<br>EPA 9315 | total radium |
| Gas Flow Proportional Counter | EPA 904.0<br>EPA 9320 | Radium-228 |
| Gas Flow Proportional Counter | EPA 905.0 / DOE HASL 300 Sr-02 | Strontium-90 |
| Liquid Scintillation Counter | EPA 906.0 | Tritium |
| Liquid Scintillation Counter | Eichrom Technologies TCW01/TCS01 | Tecnetium-99 |
| Liquid Scintillation Counter | EERF C-01-C14 | Carbon-14 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Gamma Emitters: |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Actinium 227 (assumes equilibrium w/ Th-227) |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Actinium 228 |

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Certificate # L2305

## Solid and Chemical Materials

| Technology | Method | Analyte |
|---|---|---|
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Americium 241 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Antimony 124 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Antimony 125 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium-137 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium/Lanthanum-140 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium 133 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Barium 140 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Beryllium 7 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 211 eq Th-227 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 207 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth-210M |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 212 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Bismuth 214 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Calcium-45 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cerium 141 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cerium 139 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cerium 144 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cesium 134 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cesium 137 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 56 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 57 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 58 |

**Solid and Chemical Materials**

| Technology | Method | Analyte |
|---|---|---|
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Cobalt 60 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Europium 152 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Europium 154 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Europium 155 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Hafnium 181 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Iodine 131 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Iridium 192 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Iron 59 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lanthanum 140 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 210 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 211 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 212 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Lead 214 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Manganese-56 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Manganese 54 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Mercury 203 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Neptunium 237 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Neptunium 239 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Niobium 83 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Niobium 94 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Niobium 95 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Potassium 40 |

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Certificate # L2305

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Promethium 144 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Promethium 146 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Promethium 147 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Protactinium 234M |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Protactinium 231 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Protactinium 234 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium (226) |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium 228 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium 223 (assumes equilibrium w/ Th-227) |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Radium 224 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Ruthenium 106 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Scandium 46 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Sodium 22 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Sodium 24 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Strontium 85 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thallium 208 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 227 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 228 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 230 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 231 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 232 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Thorium 234 |

| Solid and Chemical Materials | | |
|---|---|---|
| **Technology** | **Method** | **Analyte** |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Tin 113 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Uranium 235 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Uranium 238 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Vanadium-48 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Yttrium 88 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Zinc 65 |
| Gamma Spectroscopy | EPA 901.1 / DOE HASL 300 Ga-01-R | Zirconium 95 |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Alpha spec analysis: |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Uranium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Thorium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Americium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Plutonium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Neptunium |
| Alpha Spectroscopy | DOE HASL 300 A-01-R | Isotopic Curium |
| Liquid Scintillation Counter | Eichrom Technologies OTW01, OTS01 | Lead-210 |
| Alpha Spectroscopy | Laboratory SOP ST-RC-0210 | Polonium-210 |
| Liquid Scintillation Counter | Eichrom Technologies FEW01 | Iron-55 |
| Liquid Scintillation Counter | DOE RP-300 | Nickel 59/63 |
| Liquid Scintillation Counter | SM 7500-IB | Iodine-129 |

LABORATORY ACCREDITATION BUREAU

**Certificate # L2305**

| Preparation | Method | Type |
|---|---|---|
| Organic Extraction & Sample Prep | EPA 3500C | Organic Extraction & Sample Prep |
| Volatile Prep | EPA 5000 | Sample Preparation for Volatile Organic Compounds |
| Organic Cleanup | EPA 3600A | Cleanup for Organic extracts |
| Organic prep/analysis | EPA 8000C | Determinative Chromatographic Separations |
| Acid Digestion (Aqueous samples) | EPA 3010A | Acid Digestion for Metals (Aqueous samples) |
| Acid Digestion (solids) | EPA 3050B | Acid Digestion for Metals of Sedimtent/Soils |
| Purge & Trap | EPA 5030B | Purge & Trap for Aqueous Volatile Samples |
| Closed System Purge & Trap and Extraction for Volatiles | EPA 5035 | Closed System Purge & Trap and Extraction for Volatiles |
| Sep Funnel Liquid-Liquid Extraction | EPA 3510C | Sep Funnel Liquid-Liquid Extraction |
| Ultrasonic Extraction | EPA 3550C | Ultrasonic Extraction Organic Soils |
| Continuous Liquid-Liquid Extraction | EPA 3520C | Continuous Liquid-Liquid Extraction |
| Solid Phase Extraction | EPA 3535A | Solid Phase Extraction |
| Florisil Cleanup | EPA 3620C | Florisil Cleanup |
| Sulfur Cleanup | EPA 3660B | Sulfur Cleanup |
| Waste Dilution | EPA 3585 | Waste Dilution Volatile Organics |
| Waste Dilution | EPA 3580A | Waste Dilution SemiVolatile Organics |
| TCLP Extraction | EPA 1311 | TCLP Extraction |
| SPLP Extraction | EPA 1312 | SPLP Extraction |
| CWET Extraction | CA Title 22 | CWET Extraction |
| Alkaline Digestion | EPA 3060A | Alkaline Digestion for Hexavalent Chromium |

Notes:

1) This laboratory offers commercial testing service.

Approved by: ______________________
R. Douglas Leonard
Chief Technical Officer

Date: May 31, 2013

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