Separations Process Research Unit Final RCRA ICM Data Report for Lower Level Land Areas

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Approval for Use

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The Separations Process Research Unit Final RCRA ICM Data Report for Lower Level Land Areas was originally published on July 29, 2011. After review by the New York State Department of Environmental Conservation (NYSDEC), NYSDEC submitted comments that required revisions to several pages in the report.

The revised pages include the cover page, and pages i, ii, iii, 1, 5, 6, 11, 12, 14, 17, 19, 30, 96, and 123. Once these pages were revised, the following duplexed pages were replaced: i-iii, 1–2, 5–6, 11–12, 13–14, 17-18, 19-20, 29–30, 95–96, and 123–124.

Please note that the pages that were revised contain footers with a different revision number (Rev. 1 to Rev. 2) and published date (July 29, 2011, to October 26, 2011).

Accelerated Remediation Company
A Portage-Shaw Joint Venture

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Acronyms

ACM	asbestos containing material
AOC	area of concern
aRc	Accelerated Remediation Company
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
DOE	U.S. Department of Energy
EE/CA	engineering evaluation and cost analysis
ELAP	Environmental Laboratory Approval Program
EPA	U.S. Environmental Protection Agency
FSS	final status survey
ICM	interim corrective measures
KAPL	Knolls Atomic Power Laboratory
LLRBA	Lower Level Rail Bed Area
LLPL	Lower Level Parking Lot
NELAP	National Environmental Laboratory Approval Program
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
ORISE	Oak Ridge Institute for Science and Education
PAH	polycyclic aromatic hydrocarbon
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
RFA SV	RCRA Facility Assessment Sampling Visit
RFI	RCRA Facility Investigation
RSA	Railroad Staging Area
SCO	soil cleanup objective
SPDES	State Pollution Discharge Elimination System
SPRU	Separations Process Research Unit
SPRU-LL	SPRU Lower Level
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
SWPPP	storm water pollution prevention plan
TAGM	Technical and Administrative Guidance Memorandum

TAL	target analyte list
TCE	trichloroethylene
VOC	volatile organic compound
XRF	X-ray fluorescence

1.0 Executive Summary

This report documents the completion of the Separations Process Research Unit Lower Level (SPRU-LL) land area remediation performed by the Accelerated Remediation Company (aRc) in accordance with requirements specified in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereinafter referred to as the interim corrective measures [ICM] work plan) (Attachment 18) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (QAPjP) (ARC-PLN-6402) (Attachment 19). This ICM report is limited to Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) chemical remediation and any reference to radiological contamination is for informational purposes only.

The aRc scope of work was to safely remediate the SPRU-LL land area to allow for reuse. Soils remediation activities took place from the fall of 2008 through summer of 2010. This included the excavation and offsite disposal of wastes consistent with established cleanup criteria. In addition, some of the metals and polycyclic aromatic hydrocarbons (PAHs) associated with the former railroad were remediated as part of a U.S. Department of Energy (DOE) voluntary cleanup.

After excavation was completed, confirmation sampling was performed for each final status survey (FSS) unit, which included field screening and sampling for metals and radiological constituents. Additionally, in FSS-16 sampling was performed for volatile organic compounds (VOCs), and in FSS-01 sampling was performed for PAHs (see Section 4.3.2). Analytical results for each FSS unit were provided to the DOE in interim reports that documented remediation efforts and analytical results associated with each FSS unit. The interim reports indicated that all of the cleanup objectives had been met per the ICM work plan (i.e., met soil cleanup objectives [SCOs] and/or consultation with New York State Department of Environmental Conservation [NYSDEC]).

This report compiles and documents the results of those interim reports to support a “no further action” determination for the SPRU-LL land area. The evaluation of the resulting analytical data for all FSS units within the SPRU-LL indicates the data to be of sufficient quality and quantity for decision-making purposes and supports a no further action decision for the SPRU-LL land area.

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory (KAPL) at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU-LL land area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.). The NYSDEC is overseeing cleanup of the chemical contamination at the SPRU-LL under the RCRA corrective action program.

The DOE is using its authority under the CERCLA non-time critical removal process to pursue cleanup of the SPRU-LL site. A CERCLA engineering evaluation and cost analysis (EE/CA) (DOE 2006) was issued, presented to the public, and DOE selected the preferred alternative. The EE/CA considered potential future uses at the KAPL site and evaluated the residual chemical and radiological contamination to develop remedial action objectives for the SPRU-LL. These objectives include: (1) restoring the SPRU land areas to a state suitable for reuse by KAPL in an area zoned for industrial use, (2) reducing surveillance and maintenance costs, and (3) reducing or eliminating the potential for future radiological

and chemical releases from SPRU-LL (DOE 2006). The project's SCOs are described in Section 3 of this report and are based on the Title 6 New York Code of Rules and Regulations (NYCRR) Part 375-6.8(b) (NYSDEC 2006) SCOs which were promulgated for residual chemical contamination in soil based on a site's reasonably foreseeable future use. DOE seeks to obtain a "no further action" determination from the NYSDEC for chemicals attributed to waste releases from SPRU-LL land areas. Cleanup goals for radiological contamination are based on DOE Order 5400.5, "Radiation Protection of the Public and the Environment." To meet these objectives in the SPRU-LL, aRc has removed chemical and radiological contamination left in the soils impacted by the former SPRU operations. This ICM report is limited to RCRA chemical remediation and any reference to radiological contamination is for informational purposes only. In addition, some of the metals and PAHs associated with the former railroad were remediated as part of a DOE voluntary cleanup.

2.1 Physical Setting and Site Description

KAPL is located in the Town of Niskayuna, within Schenectady County, New York, on the southern bank of the Mohawk River. It consists of 170 acres, located mostly on a bluff approximately 115 to 120 ft above the Mohawk River surface (Figure 1). Along the northern margin of the KAPL site, the land surface slopes steeply to a natural bench about 15 to 20 ft above the river's surface.

The KAPL site, which fronts approximately 4,200 ft of the river, is bounded to the north and east by the Mohawk River; to the south by a mixture of open land, parks, and the town of Niskayuna's closed municipal landfill; to the west and southwest by a low-density suburban residential area; and to the west and northwest by an industrial research center.

KAPL is owned by the U.S. Government and operated by Bechtel Marine Propulsion Corporation, for the U.S. DOE, Naval Reactors Laboratory Field Office-Schenectady. The KAPL site mission is expected to continue indefinitely. SPRU research and development activities were not associated with or used for the KAPL programs.

The SPRU facilities were constructed in the late 1940s to research the chemical separation of plutonium and uranium. SPRU operated between February 1950 and October 1953, after which research activities ceased. After discontinuing operations in October 1953, SPRU was maintained in a caretaking status until decommissioning began in 2000.

The SPRU-LL is located on approximately 24 acres in the northwest corner of the KAPL site (Figure 2) and consists of two distinct areas, the Lower Level Rail Bed Area (LLRBA) and the Lower Level Parking Lot Area (LLPL). The LLRBA contains four solid waste management units (SWMUs): the former K6 Storage Pad (SWMU-036), former K7 Storage Pad (SWMU-037), Railroad Staging Area (RSA) (SWMU-038), and former K5 Retention Basin (SWMU-040). The LLPL includes the area of concern (AOC) AOC-003.

The Lower Level area extends along the parking lot and old railroad spur within the bench between the Lower Level facility area and the hill slope rising up to the KAPL upper level. The eastern portion of the Lower Level area is primarily a grassy surface with asphalt roadways bisecting the area along the east-west and north-south axes. The western portion of the Lower Level area consists of an asphalt parking lot.

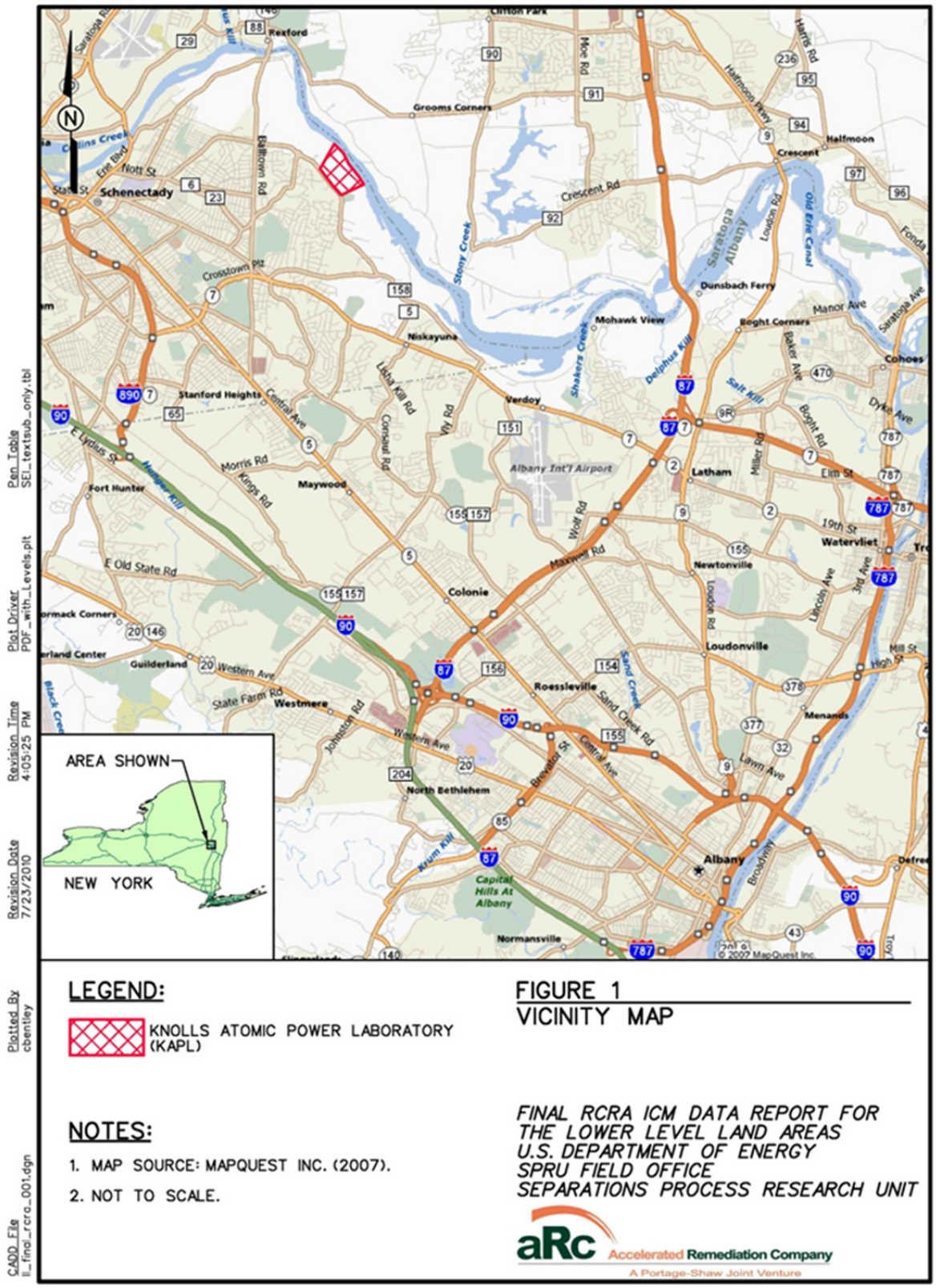

Figure 1 Site location map

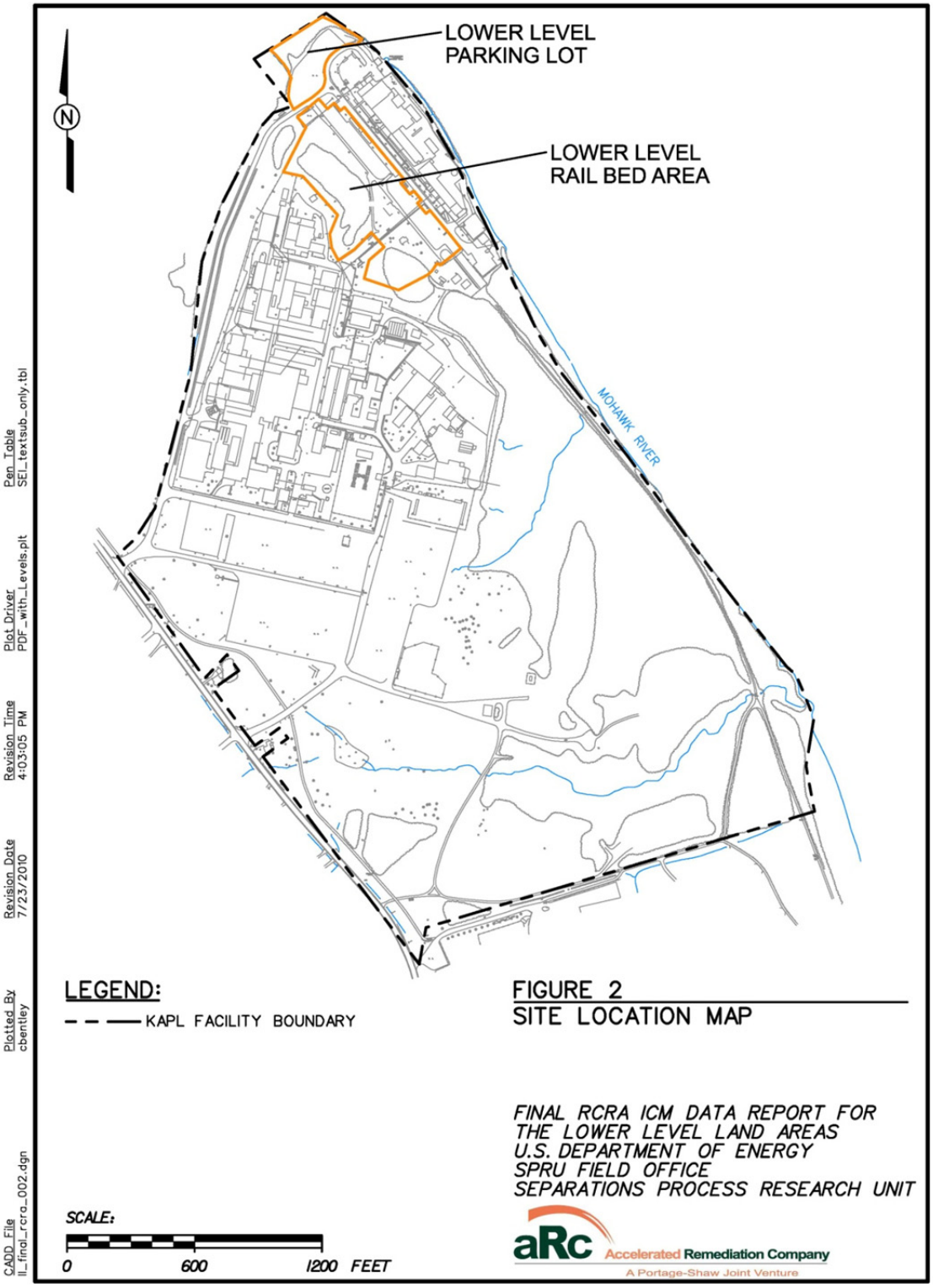

Figure 2 SPRU-LL vicinity map

3.0 Scope of Work

The aRc scope of work was to safely remediate the SPRU-LL land area to allow for reuse of the site. This included the excavation and offsite disposal of wastes consistent with established cleanup criteria. Remediation of the SPRU-LL included the removal of radiologically and chemically contaminated soil and debris to meet the cleanup criteria, including chemicals that are not regulated as a RCRA release.

The initial excavation sequence, including the voluntary cleanup area, is defined in the ICM work plan and was later modified as outlined in Section 4.3.1. Upon completion of designed excavations, the areas were designated as FSS units as defined in the *Radiological Confirmation Sampling and Analysis Plan/Final Status Survey (CSAP/FSS) for the Separations Process Research Unit Lower Level Land Areas* (ARC-PLN-6511). During remediation of the SPRU-LL, 17 FSS units were established (Figure 3) requiring remediation for chemical contamination, radiological contamination, and/or voluntary cleanup.

FSS-01, FSS-02, and FSS-08 were primarily voluntary and radiological cleanup areas. FSS-03, FSS-04, FSS-05, FSS-06, FSS-07, FSS-09, FSS-10, FSS-11, FSS-12, FSS-16 and the LLPL within FSS-13 and FSS-14 were remediated for RCRA corrective action and radiological contamination. FSS-15, FSS-17, and the areas within FSS-13 and FSS-14 that were not included in the LLPL remediation were remediated for radiological constituents only. Section 5.3 contains more information on each individual FSS unit.

3.1 Interim Corrective Measures Objective

The objectives of the SPRU-LL land areas ICM as recommended in the *SPRU RCRA Facility Assessment Sampling Visit Report* (i.e., the RFA SV) (DOE/CH2M HILL 2002) were to remove soil contaminated with constituents of concern (COCs) that were above SCOs and to achieve a no further action determination from NYSDEC for chemicals attributed to SPRU waste releases. In addition, metals and PAH contamination associated with the former railroad were remediated as part of a DOE voluntary cleanup.

3.1.1 Constituents of Concern and Soil Cleanup Objectives

The SPRU-LL COCs for soils were identified based on the results of the RFA SV (DOE/CH2M HILL 2002). These COCs included metals that were found in concentrations above background that could be attributed to SPRU operations and VOCs found at trace levels that could be attributed to a chemical release. Table 1 lists the COCs identified. The COCs cadmium, chromium, cobalt, silver, mercury, thallium, vanadium, and zinc were determined to potentially be associated with SPRU operations. Antimony, arsenic, copper, and lead are primarily attributed to the former railroad construction and operation rather than SPRU operations.

The VOC trichloroethylene (TCE) was found at trace levels below SCOs for the L5 area (SPRU Grid Unit 1126). TCE was included as a COC for SPRU Grid Unit 1126 to ensure that the RFA SV sampling did not overlook potential contamination in that area. Acetone was included as a COC in the K5 Retention Basin area due to contamination that was believed to have occurred during the demolition of the basin.

The SCOs for the COCs are also provided in Table 1. The SCO value for each chemical is the more stringent of the SCOs as defined within 6 NYCRR Part 375-6.8(b) for the protection of groundwater or for residential exposure. Under 375-6, no SCOs were promulgated for antimony, cobalt, thallium, or vanadium. For antimony and thallium, the laboratory contract-required quantitation limit (reporting limits for Test America Labs) was used as the SCO in accordance with NYSDEC Technical and Administrative

Guidance Memorandum (TAGM) 4046 guidance (O'Toole 1994). For cobalt and vanadium, the TAGM 4046 numerical values for recommended SCOs were determined to be appropriate SCOs since they are the more stringent.

As defined within the ICM work plan, when constituents not listed as COCs were found in soil samples at concentrations exceeding the more stringent NYSDEC Part 375-6 SCO for residential exposure or protection of groundwater, NYSDEC was notified and consulted regarding any further actions. The FSS unit sampling summaries in Section 5.3 identify exceedances of all non-COCs for which NYSDEC was consulted and concurred that the clean-up objectives had been met. All of the cleanup objectives were met per the ICM work plan (i.e., met SCOs and/or consultation with NYSDEC).

Table 1 Soil cleanup objectives

Constituent of Concern (Metals)	Soil Cleanup Objectives (ppm)
Antimony	1[a]
Arsenic	16
Cadmium	2.5
Trivalent Chromium	36
Cobalt	30[b]
Copper	270
Lead	400
Mercury	0.73
Silver	8.3
Thallium	2[a]
Vanadium	150[b]
Zinc	2,200
Constituent of Concern (VOCs)	Soil Cleanup Objectives (ppm)
Acetone[c]	0.05
TCE[d]	0.47

a. Reporting limit for Test America Labs.
b. TAGM 4046 recommended cleanup levels (O'Toole 1994).
c. COC only in SWMU-040.
d. COC in SPRU Grid Unit 1126.

4.0 Sampling and Analysis

The ICM work plan (ARC-PLN-6106) describes the post-excavation confirmation sampling for the SPRU-LL land area. The intent of the RCRA Corrective Action post-excavation sampling program was to confirm that soils remaining after excavation met SCOs. Detailed quality assurance procedures for implementation of the ICM work plan are presented in the associated quality assurance project plan (QAPjP) (ARC-PLN-6402).

4.1 Post-Excavation Confirmatory Soil Sampling Design

The SPRU-LL sampling approach followed guidance in *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002). This guidance provides a tiered approach for sampling excavations depending on their perimeter and the nature of the contamination. Specifically, for excavations with perimeters of less than 20 ft, one bottom sample and one sidewall sample biased in the direction of the surface runoff is to be collected. For perimeters between 20 and 300 ft, one sample is to be collected for every 900 ft^2 of bottom area and one sample every 30 linear ft of sidewall from the bottom of a subsurface spill. For excavations with perimeters greater than 300 ft, the DER-10 guidance provides for a reduced sample frequency based on a methodology acceptable to NYSDEC. Due to the nature of the contamination in the LLPL and K5 excavations, and with concurrence from NYSDEC on the sampling approach, the DER-10 criteria for subsurface spills with excavation perimeters less than 300 linear ft were used for these excavations.

For all remaining sample areas within the LLRBA, the sampling design was based on a methodology outlined in the RCRA QAPjP (ARC-PLN-6402) as allowed under the DER-10 guidance. This approach established sample points across a systematic grid, based on a random start point. The design resulted in 12 being defined as the minimum number of samples for the confirmation sampling for all COCs. Note 16 samples per FSS unit were required for radiological characterization, and the decision was made to collocate radiological samples and metals samples. Therefore, 16 RCRA samples were scheduled for collection per FSS unit.

4.2 XRF Field Screening

An Innov-X x-ray fluorescence (XRF) instrument for the screening level analysis of metals in soils and sediments was used to help guide excavation in the SPRU-LL. Upon completing the designed excavation in an FSS unit, an in-situ field survey was obtained for select inorganic COCs using the XRF and following procedures outlined in "Metals in Soil Screening Using the Innov-X XRF Instrument Standard Operating Procedure for the Separations Process Research Unit Land Areas Remediation" (ARC-PRC-6802). XRF readings were collected in the excavated areas of each FSS unit. If XRF readings indicated that concentrations of metals COCs were below SCOs, the FSS unit was determined ready for confirmation sampling. Once sampling locations had been determined and identified, XRF readings were taken from each sample location before collection of the confirmation samples. In addition, samples were collected during the post-excavation confirmation sampling effort and analyzed in the onsite laboratory using the XRF in accordance with ARC-PRC-6802. However, because of the high XRF detection limits and the low SPRU metals SCOs, the XRF results had limited value as a screening tool for this project; therefore, the XRF was only used on a limited basis as a screening tool. XRF was still used to take in situ readings at each sample location and used for the reading of samples after preparation in the onsite lab. Comparison of offsite laboratory analytical data and XRF in situ and onsite laboratory readings showed very little correlation, especially for the COCs associated with the SPRU-LL remediation.

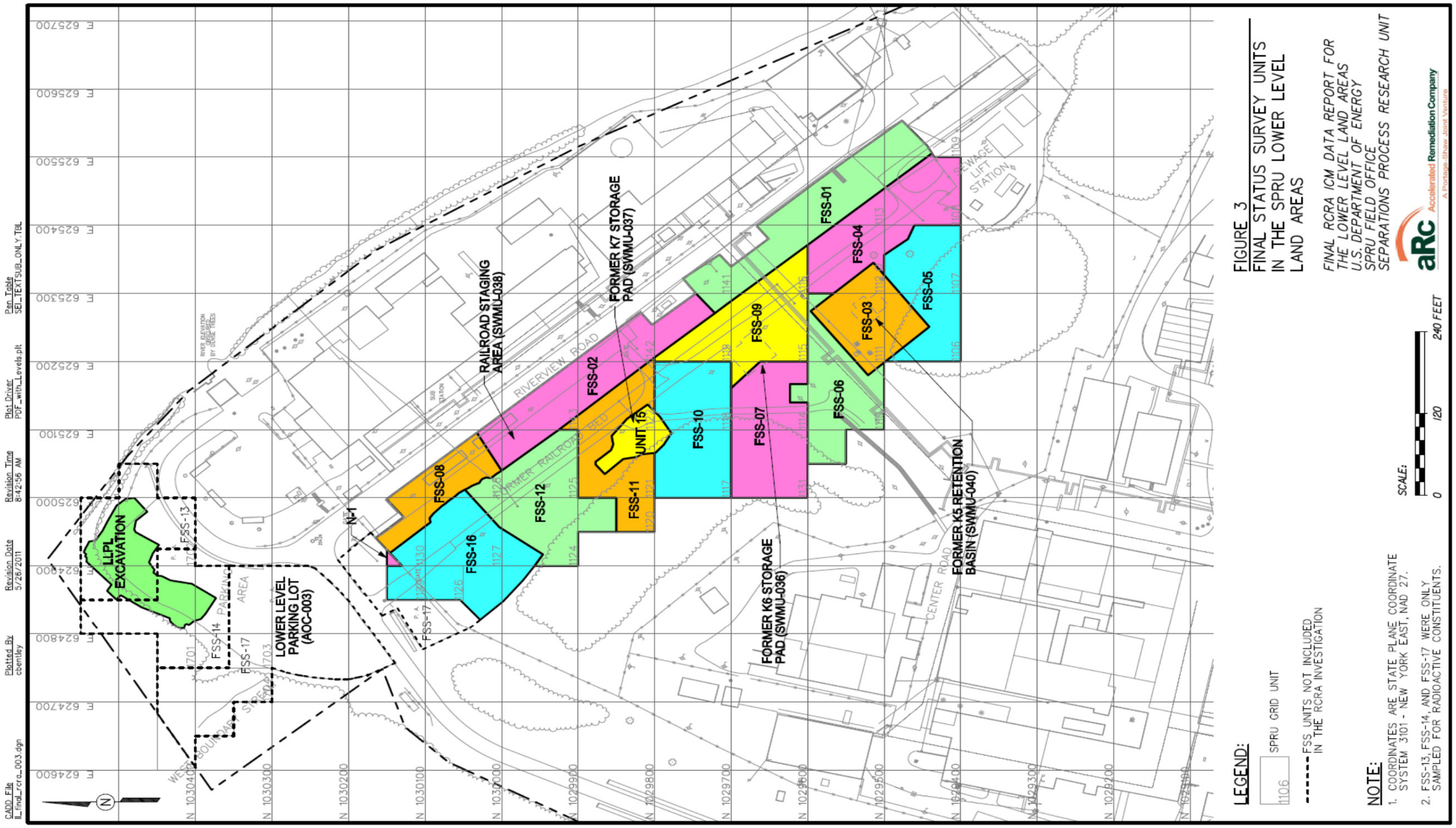

Figure 3 SPRU-LL FSS units map

4.3 Modifications to ICM Work Plan and QAPjP

During the course of the SPRU-LL project, several revisions and modifications were made to the ICM work plan (ARC-PLN-6106) and RCRA QAPjP (ARC-PLN-6402) to address changing conditions associated with remediation efforts. The sections below are brief descriptions of these modifications.

4.3.1 FSS Unit and Excavation Sequence Changes

Revisions to the ICM work plan (ARC-PLN-6106) were made to address FSS units and excavation sequence changes (Appendix A-1). Field operations and site physical constraints dictated modifications of the planned sequence of excavations and changes in FSS unit design. Strict adherence to the delineated excavation sequence defined in the ICM work plan would have resulted in excavations remaining open for extended periods of time and crossing natural storm water barriers and utility corridors. Because the full extent of chemical concentration at the SPRU-LL could not be completely defined until remediation efforts for chemical and radiological contamination were finished, field activities dictated that in some cases excavation proceeded into an area not previously scheduled for excavation based on initial assumptions during ICM work plan development. Therefore, cleanup areas did not receive final division into FSS units until remedial actions were near completion and confirmation sampling was imminent. The FSS units included 100% of the area delineated for RCRA cleanup in the ICM work plan, including excavated and unexcavated areas. Subsequent to issuance of the ICM work plan, the boundaries of the voluntary area were modified to include only the voluntary cleanup area inside the SPRU railroad staging area boundary fence.[a] The number of samples taken was changed to 16, which exceeded the minimum number of samples (12) specified in Section 3.2.1 of the ICM work plan.

4.3.2 PAH Sampling

The statistical approach planned for the sampling and analysis of PAHs, which was part of the DOE voluntary cleanup efforts, was revised (see letter, Appendix A-2). aRc determined that 128 samples were taken during the RFA SV (74 from the areas outside the rail bed, i.e., K5, K6, K7 and LLPL, and 54 from the LLRBA). Of the 128 sample results, only seven exceeded the approved SCO for PAH compounds, all of which were associated with samples within the rail bed itself or were beneath or immediately adjacent to asphalted areas. All other detections were a factor of 10 or more below the SCO and, with the exception of one data point, were attributable to the rail bed or asphalted areas. Therefore, further sampling was not deemed to be warranted due to very low levels of PAHs outside the rail bed and asphalted areas and because areas with elevated PAHs above SCOs were planned to be repaved.

4.3.3 Fuel Oil Line Removal

Removal of an abandoned 4-in fuel line, unrelated to the SPRU activities, was scheduled as part of the LLRBA activities. An assessment of the former fuel oil line location (i.e., based on planned excavations at the LLRBA) was conducted in March 2009 (O'Hearn 2009) and determined that the fuel line would only be exposed during aRc's excavation and removal of the storm drain culvert CB-9 and adjacent piping (also see assessment, Appendix A-3). As a result of this assessment, the only section of fuel oil line removed was the section required to allow extraction of the CB-9 culvert and adjacent piping. The fuel oil line was capped and the rest of the existing fuel oil line was not exposed and left in place.

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a. Davis, Hugh, DOE-SPRU, email correspondence with Margaret Rogers, New York State Department of Environmental Conservation, "Discussion on SPRU Voluntary Cleanup," October 21–22, 2008.

4.3.4 Demobilization Activities

Revisions to the ICM work plan demobilization activities were made to address any potential contaminated soils discovered within the footprint of the site soil staging, container loading, and decontamination areas. Upon completion of demobilization activities, which included the removal of the soil staging, container loading, and decontamination areas, the soils beneath these areas underwent field surveys and confirmation sampling in accordance with the ICM work plan. The "RCRA Interim Corrective Measures Work Plan, ARC-PLN-6106, Revisions for Demobilization," is included in Appendix A-4. Results of the confirmation sampling can be found in *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 16* (ARC-RPT-6029), included in Attachment 17.

4.3.5 Decommissioning Borehole and Monitoring Wells

Revisions to the ICM work plan and RCRA QAPjP (ARC-PLN-6402) were initiated to incorporate updated protocols for decommissioning of soil boreholes and groundwater monitoring wells at the request of NYSDEC. The "Amendment to RCRA ICM QAPjP – ARC-PLN-6402, Revisions for Well and Borehole Decommissioning," is included in Appendix A-5. Well decommissioning logs for each well are included in Appendix C.

4.3.6 Modification to Data Quality Objectives in the QAPjP

A modification to the RCRA QAPjP (ARC-PLN-6402) to remove the less stringent of the two decision rules was made to streamline data submissions to NYSDEC and expedite the review process. Removal of the less stringent decision rule eliminated the applicability of the statistical procedures included in Sections 3.1.6, Decision Error Limits, and 3.1.7, Sampling Design, of the QAPjP. The revision to the data quality assessment approach for the QAPjP is included in Appendix A-6.

4.3.7 Confirmation Sampling in SPRU Grid Units 1126, 1129 and 1130

Once demobilization activities were completed for the soil staging area in SPRU Grid Unit 1126, confirmation samples were collected for VOCs in addition to metals. This modification to the ICM work plan identified a minimum of five samples to be collected. Three systematic sample locations and two judgmental sample locations were sampled and analyzed for VOCs. Section 3.2.1 of the RCRA ICM work plan indicated that 12 samples were to be collected for VOCs in Grid 1126.

In addition to modification to the FSS-16 sampling, a small portion of SPRU Grid Unit 1130 in FSS-17 was modified to include RCRA sampling. The area is located outside the Lower Level staging area and is designated Subunit N-1. FSS-17 was set up using the random-start triangular pattern grid system for radiological systematic sampling used by all of the FSS units. One sample location from the systematic sample design for FSS-17 fell within Subunit N-1 and was sampled for RCRA metals. The "RCRA Interim Corrective Measures Work Plan, ARC-PLN-6106, Revisions for Confirmation Sampling in SPRU Grid Unit 1126, 1129, and 1130," is included in Appendix A-7.

5.0 Summary of Remediation and Sampling Activities

Soils remediation activities took place from the fall of 2008 through summer of 2010. During the first season (July–October 2008) efforts focused on the LLRBA, including the former K5 Retention Basin. During the second season (April 2009–July 2010) efforts focused on the remaining portions of the LLRBA and the LLPL area. Pre-excavation and post-excavation sampling reports were generated for the sampling performed in the K-5 Retention Basin. For the rest of the SPRU-LL, the results of the excavation process and confirmation sampling were summarized in individual interim RCRA ICM data reports. The individual reports are included as attachments to this report. This section provides a short summary of each of the sampling events that were performed during the SPRU-LL land area remediation.

A total of 9,431 byd^3 were removed during remediation of the Lower Level areas. All of the soils and debris removed were disposed of at the Energy Solutions waste disposal facility in Clive, Utah. None of the wastes removed met the RCRA definition of a characteristically hazardous waste.

5.1 Pre-Excavation Sampling of the K5 Retention Basin for Acetone

The former K5 Retention Basin is located in the SPRU-LL land area, primarily in SPRU Grid Unit 1111 (Figure 3). Pre-excavation sampling of the K5 Retention Basins was performed in August 2008 to determine if further excavation of the K5 area would be required because of residual acetone contamination, which may have resulted from coating materials used as dust suppressant during demolition of the K5 structure. Sampling focused on the area of the former retention basin foundation where trace amounts of acetone were identified. A direct push method was used to obtain samples from eight locations, one at each corner of the former basin and one along each side (midsection) of the former basin. The direct push method was driven to bedrock, estimated at 15 ft, and samples were collected at 2-ft intervals, including at the bedrock-soil interface. The samples were analyzed in accordance with the RCRA QAPjP (ARC-PLN-6402).

Results of pre-excavation sampling of the former K5 Retention Basin soils indicated residual acetone was present above the SCO. Results of the pre-excavation sampling of the former K5 Retention Basin can be found in *Pre-Excavation Sampling of the K5 Retention Basins for Acetone* (ARC-RPT-6001). A copy of this report is included in Attachment 1. The report concluded that additional excavation of this area was warranted because acetone was present in concentrations above the SCO.

5.2 Post-Excavation Sampling of the K5 Retention Basin for Acetone

The November 2008 K5 excavation effort was conducted to remove acetone contamination per ARC-RPT-6001 recommendations, as well as to remove radiological and arsenic contamination identified in the RFA SV report (DOE/CH2M HILL 2002). Confirmation sampling for other chemical and radiological contamination was conducted during FSS-03 sampling, discussed in Section 5.3.3.

The acetone sampling focused on the K5 excavation and was conducted per requirements set forth in Section 2 of the ICM work plan (ARC-PLN-6106). The K5 excavation consisted of three connected excavations. To ensure that confirmation sampling requirements of the project were met, a bottom sample was collected from each of the excavations, five sidewall samples were collected from the largest excavation, and two sidewall samples were collected from each of the smaller excavations. This sampling scheme (as described in Section 4.1) met the sample density recommendations stated in NYSDEC *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002).

Excavation was completed on November 13, 2008. Confirmation sampling was conducted on November 20, 2008. The purpose of this sampling effort was to confirm that the residual acetone contamination associated with the former K5 Retention Basin had been removed to levels below the acetone SCO of 50 µg/kg. All samples analyzed reported concentrations of acetone below the SCO; therefore, no further excavation was required in the former K5 Retention Basin area for residual acetone. The report *K5 Post-Excavation Confirmation Sampling for Acetone* (ARC-RPT-6007) provides the results of the acetone confirmation sampling and is included in Attachment 2.

5.3 FSS Unit Sampling

During remediation of the SPRU-LL, 17 FSS units were established. Of those 17 FSS units, FSS Units 1-16 were initially established as requiring RCRA remediation. Unit 15 was later identified as the former K-7 site that had previously been determined to be a "no further action site"; therefore, data collected for Unit 15 was submitted for information only. FSS Unit 17 was a radiological unit only, except for one small corner of SPRU Grid Unit 1130. This small section of FSS Unit 17 was designated as "N-1" and data collected from N-1 was included in the FSS-16 interim report. In addition, for FSS Units 13 and 14 that comprised the LLPL, only the excavated portions of those two FSS units were sampled per the ICM work plan (see Figure 3). The data from the LLPL excavation in FSS Units 13 and 14 were reported in the interim report for the LLPL.

A total of 318 samples were collected for RCRA COCs, including 276 for total metals, 19 for semi-volatile organic compound (SVOC), and 23 for VOC analysis. Soils from all sample locations were collected and analyzed for target analyte list (TAL) metals. Additionally, the sample locations in FSS-01 were sampled for PAH compounds, and five locations in FSS-16 were sampled for VOCs.

Figure 3 shows the location of each FSS unit in the SPRU-LL and Figure 4 shows all of the sample locations in the SPRU-LL. The following sections provide a summary of sampling activities performed in each FSS unit. Additional information can be found in the interim reports attached to this final report.

5.3.1 Post-Excavation Soil Sampling FSS-01

FSS-01 includes portions of SPRU Grid Units 1108, 1109, 1112, 1113, 1115, 1116, 1119, and 1141. A civil survey of the final excavated surface of FSS-01 was conducted after completion of the remediation efforts. An estimated 481 bank cubic yards (byd^3) of material was removed from FSS-01. Sixteen soil samples and one field duplicate soil sample were collected and analyzed in accordance with the ICM work plan (ARC-PLN-6106) and RCRA QAPjP (ARC-PLN-6402) on October 30, 2008, and sent to an offsite laboratory for analysis of metals and PAH compounds (see Section 4.3.2).

In FSS-01, the concentrations of all COCs subject to RCRA requirements were below SCOs. The SCOs for arsenic and PAH compounds were exceeded in five of the sampling locations, all of which are associated with the historical railroad activities. Arsenic concentrations were detected at values greater than the SCO in four samples, and concentrations of PAH compounds were above the SCOs in three samples. This historical rail bed material is not subject to regulations under RCRA. Additional information can be found in the *Interim RCRA ICM Data Report for Final Status Survey Unit 01* (ARC-RPT-6005), included in Attachment 3.

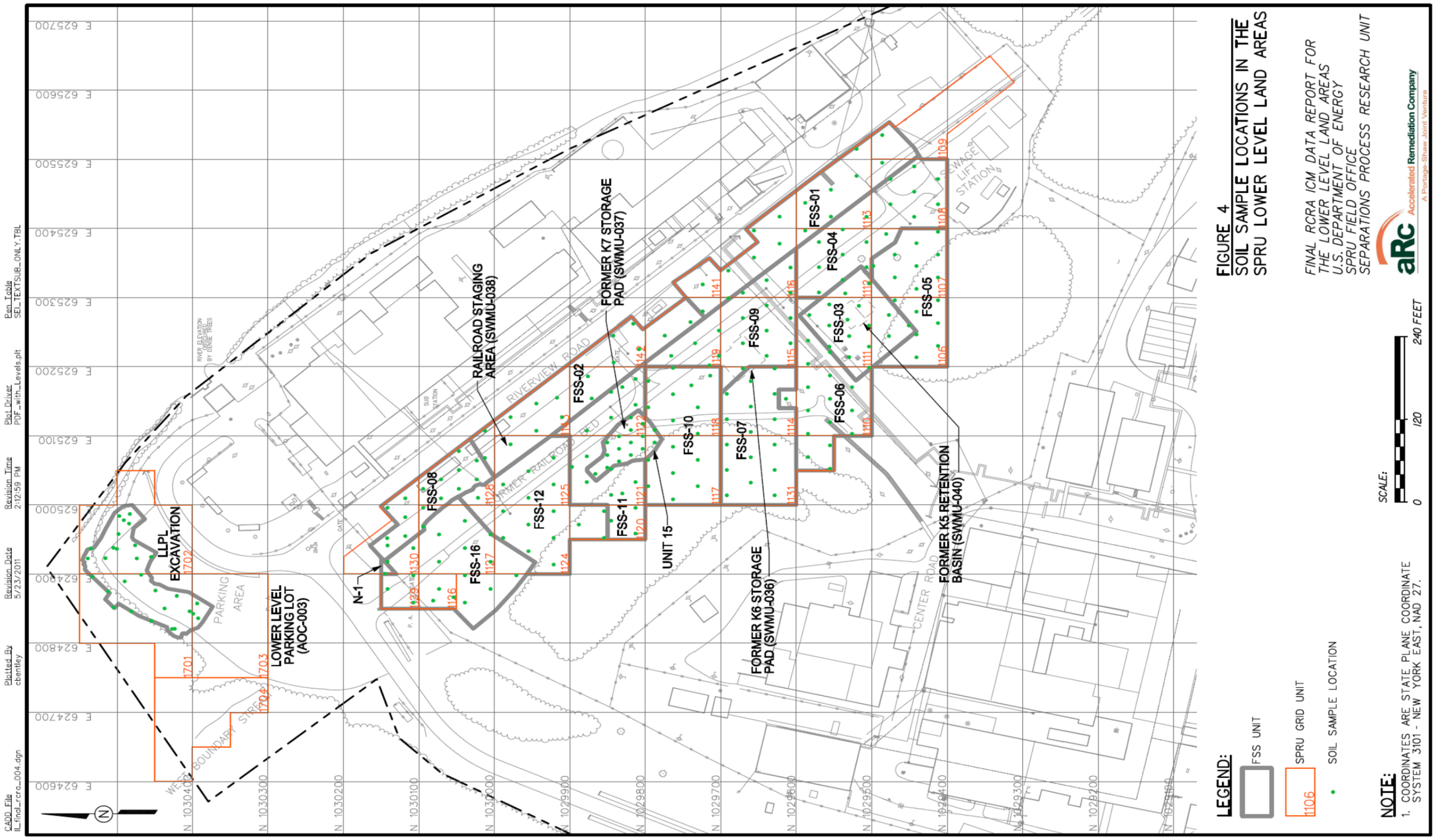

Figure 4 Sampling locations for all FSS units

5.3.2 Post-Excavation Soil Sampling FSS-02

FSS-02 includes portions of SPRU Grid Units 1119, 1142, 1122, 1143, 1125, and 1128. A civil survey of the final excavated surface of FSS-02 was conducted after completion of the FSS efforts. An estimated 939 byd^3 of material was removed from FSS-02. Sixteen soil samples and one duplicate were collected within FSS-02 on November 19, 2008, and submitted for analysis in accordance with the ICM work plan and RCRA QAPjP. During review of preliminary laboratory data, two sample locations were determined to have COCs above SCOs. The concentration of cadmium in the one sample location was greater than the SCO, and the other location had chromium at a concentration greater than the SCO.

Additional excavation of the failed sampling points was performed and consisted of a 20-ft radius around each sampling point being excavated an additional 6 in. in depth. At the sample location where chromium was above the SCO, the X-ray fluorescence field readings indicated that elevated levels of chromium were still present, so the excavation was continued to the depth of 2 ft. Approximately one-half of the additional excavation of sample location was outside of FSS-02; this part of the excavation was evaluated during sampling of the adjacent FSS-08. The excavation and re-sampling of FSS-02 was performed in April 2009.

After the initial excavation for removal of contamination in FSS-02, a portion of the former fuel oil line was excavated and removed from FSS-02. An excavation approximately 100 ft long and 8 ft deep in SPRU Grid Unit 1142 was created during removal of the pipeline. This excavation was not considered part of the FSS because the excavation was performed for removal of a structure, not for removal of contamination.

In FSS-02, the concentrations of all COCs subject to RCRA requirements were determined to be below SCOs. Only compounds (arsenic and antimony) associated with historical railroad activities were detected above SCOs. Arsenic concentrations were detected greater than the SCO in five samples, and concentrations of antimony were above the SCOs in two samples. This historical rail bed material is not subject to regulations under RCRA. Additional information can be found in the *Interim RCRA ICM Data Report for Final Status Survey Unit 02* (ARC-RPT-6006), included in Attachment 4.

5.3.3 Post-Excavation Soil Sampling FSS-03

FSS-03 includes portions of SPRU Grid Units 1106, 1107, 1110, 1111, and 1112. A civil survey of the final excavated surface of FSS-03 was conducted after completion of the FSS efforts. An estimated 521 byd^3 of material was removed from FSS-03.

Sixteen soil samples and one duplicate were collected and analyzed in accordance with the ICM work plan and RCRA QAPjP. In addition, one judgmental (biased) sample was collected from the floor of the K-5 excavation, where previous investigation had determined that arsenic concentration was above the SCO. Three systematic sample locations that fell within the K-5 excavation were offset because of the inaccessibility of the K-5 excavation. Samples were collected for FSS-03 on April 27 and 28, 2009. Because of concerns associated with the depth and sloping of the back sidewall in the K-5 excavation, final status survey samples within the excavation were collected remotely. A track hoe with a 20-ft boom was used to extricate soil from each location. Samples were then collected from the soil in the bucket.

In FSS-03, the concentrations of all COCs subject to RCRA requirements were determined to be below SCOs with the exception of antimony. Validated analytical data for antimony at one sample location had an undetected result at a concentration of 1.5 mg/kg, which is greater than the project's SCO of 1 mg/kg.

This sample slightly exceeds the SCO, but given the closeness of this value to the cleanup objective, the absence of any other antimony values of concern, and the undetected "U" flagging added during data validation, this sample location did not warrant re-excavation. Additional information can be found in the *Interim RCRA ICM Data Report for Final Status Survey Unit 03* (ARC-RPT-6009), included in Attachment 5.

5.3.4 Post-Excavation Soil Sampling FSS-04

FSS-04 includes portions of SPRU Grid Units 1107, 1108, 1112, and 1113. A civil survey of the final excavated surface of FSS-04 was conducted after completion of the FSS efforts. An estimated 465 byd^3 of material was removed from FSS-04.

In FSS-04, 17 soil samples and one field duplicate were collected and analyzed in accordance with the ICM work plan and RCRA QAPjP. Two sample locations were inside the secure areas near the sewage lift station. Samples were collected from these two locations once the excavation in the secure area was completed on April 15, 2009. The remaining samples for FSS-04 were collected on May 19, 2009. In addition, one judgmental sample was collected from the portion of the excavation that was initially designed to be in FSS-05. The corner of SPRU Grid Unit 1107 that extended into the FSS-04 excavation was added to expedite backfilling of FSS-04. Because the corner of Grid 1107 was added to FSS-04 after the sampling locations were established, the judgmental sample was added in this area to ensure adequate sample coverage. After FSS-04 was sampled, additional excavation was required due to the reported results for one of the radiological judgmental samples. A 20-ft radius around this sampling point was excavated and this additional excavation included Sampling Location 15. Once the excavation was completed, Sampling Location 15 (SFS-R004-015-M) was re-sampled on May 27, 2009.

All COCs subject to RCRA requirements analyzed for in FSS-04 had concentrations below the corresponding SCOs. Additional information can be found in the *Interim RCRA ICM Data Report for Final Status Survey Unit 04* (ARC-RPT-6010), included in Attachment 6.

5.3.5 Post-Excavation Soil Sampling FSS-05

FSS-05 includes portions of SPRU Grid Units 1106 and 1107. A civil survey of surface soil sampling locations at FSS-05 was conducted after completion of the FSS efforts. No excavation was conducted in this FSS unit. Sixteen systematic samples and one field duplicate soil sample were collected on June 10, 2009, in accordance with the ICM work plan and RCRA QAPjP.

All COCs subject to RCRA requirements analyzed for in FSS-05 had concentrations below the corresponding SCOs. However, validated analytical results for manganese in two sample locations were 2,290 and 2,310 mg/kg, which exceed the corresponding SCO of 2,000 mg/kg for manganese. However, manganese is not a RCRA hazardous constituent per the SPRU 6 NYCRR Part 373 Permit; hence, it is not subject to RCRA corrective action. In addition, manganese is not an ICM COC defined in the ICM work plan and the presence of manganese at concentrations slightly above the SCO is believed to be attributable to natural soil mineralogy and not believed to be associated with historical operations; therefore, no further excavation was required in this FSS unit. Additional information can be found in the *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 05* (ARC-RPT-6015), included in Attachment 7.

5.3.6 Post-Excavation Soil Sampling FSS-06

FSS-06 includes portions of SPRU Grid Units 1110, 1111, and 1114. It also includes a portion of the unnamed grid northwest of SPRU Grid Unit 1110. A civil survey of the final excavated surface of FSS-06 was conducted after completion of the FSS efforts. An estimated 17 byd^3 of material was removed from FSS-06. Sixteen systematic surface soil samples and one field duplicate sample were collected in accordance with the ICM work plan and RCRA QAPjP.

The concentrations of all COCs subject to RCRA requirements were determined to be below their corresponding SCOs with the exception of antimony. Validated analytical data for antimony at one location indicate a non-detect result at an estimated concentration of 1.2 mg/kg, which exceeds the project SCO of 1 mg/kg. The reporting limit for this sample slightly exceeds the SCO, but this sample location does not warrant re-excavation given the closeness of this value to the cleanup objective, the absence of any other antimony exceedances, the fact that the sample location is uphill from and not near any waste management areas, and the undetected "U" flagging added during data validation. Additional information can be found in the *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 06* (ARC-RPT-6016), included in Attachment 8.

5.3.7 Post-Excavation Soil Sampling FSS-07

FSS-07 includes portions of SPRU Grid Units 1131 and 1114. No excavation was planned in this FSS unit; however, a small amount (~7 byd^3) of excavation was performed later in FSS-07 due to benching of a deep excavation in FSS-09 that bordered FSS-07. Surface sample locations were established after completion of the final radiological walkover in FSS-07.

Sixteen soil samples and one duplicate were collected at FSS-07 on July 15, 2009, and analyzed in accordance with the ICM work plan and RCRA QAPjP. The concentrations of all COCs subject to RCRA requirements were below SCOs. Additional information can be found in the *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 07* (ARC-RPT-6017), included in Attachment 9.

5.3.8 Post-Excavation Soil Sampling FSS-08

FSS-08 includes portions of SPRU Grid Units 1127, 1128, and 1130. FSS-08 also includes a portion of the unnamed grid east of SPRU Grid Unit 1130. A civil survey of the final excavated surface of FSS-08 was conducted after completion of the FSS efforts. An estimated 258 byd^3 of material was removed from FSS-08.

Sixteen soil samples and one duplicate were collected at FSS-08 on June 30, 2009, and analyzed in accordance with the ICM work plan and RCRA QAPjP. In FSS-08 the location of the security fence did not match the as-built diagrams on which the FSS unit design was based; therefore, a mismatch between the as-built diagram and the field location of the security fence resulted in the following consequence: The coordinates for one sample fell in a location on the inaccessible side of the security fence. Accordingly, this sample was collected approximately 12 ft away from its design coordinates.

In FSS-08, the concentrations of all COCs subject to RCRA requirements were determined to be below SCOs. The SCOs for arsenic and antimony were exceeded at three sampling locations, all of which are associated with historical railroad activities. Arsenic concentrations were detected at levels greater than the SCO in two samples, and concentrations of antimony exceeded the SCO in two samples. This

historical rail bed material is not subject to regulations under RCRA. Additional information can be found in *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 08* (ARC-RPT-6018), included in Attachment 10.

5.3.9 Post-Excavation Soil Sampling FSS-09

FSS-09 includes portions of SPRU Grid Units 1114, 1115, 1116, and 1119. A civil survey of the final excavated surface of FSS-09 was conducted after completion of the FSS efforts. An estimated 1,645 byd^3 of material was removed from FSS-09.

Sixteen soil samples and one duplicate sample were collected at FSS-09 on August 13, 2009. All samples were analyzed in accordance with the ICM work plan and RCRA QAPjP. The concentrations of all COCs subject to RCRA requirements were determined to be below SCOs.

Upon completion of FSS-09, the Oak Ridge Institute for Science and Education (ORISE), the independent verification contractor for DOE-SPRU, conducted independent sampling for metals in FSS-09. Six samples were collected in FSS-09. Analytical results from this sampling showed arsenic concentration greater than the corresponding SCOs in one location. Additional excavation was conducted, an additional soil sample (S045) was collected on May 5, 2010, and subsequent analyses indicated no RCRA COCs above SCOs. Additional information can be found in *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 09* (ARC-RPT-6019), included in Attachment 11.

5.3.10 Post-Excavation Soil Sampling FSS-10

FSS-10 includes SPRU Grid Units 1117 and 1118. A civil survey of the final excavated surface of FSS-10 was conducted after completion of the FSS efforts. An estimated 658 byd^3 of material was removed from FSS-10.

Fourteen soil samples and one field duplicate soil sample were collected on September 30, 2009. Two samples were not taken due to infrastructure remaining in the FSS unit. Sample Location 14 was impacted by the presence of two water storage tanks used for managing groundwater from excavation areas, and Sample Location 5 was impacted by its proximity to a utility pole.

Location 14 was relocated and sampled on February 2, 2010, but results showed arsenic concentration above SCO, so this location required further excavation. On March 10, 2010, the relocated Sample Location 5 and the re-excavated Sample Location 14 were sampled. The area under the water storage tanks was excluded from FSS-10 and designated as Unit 15, as documented in the FSS-15 report.

In FSS-10, the concentrations of all COCs that are subject to RCRA requirements were determined to be below SCOs, with the exception of manganese and antimony. The validated analytical result for manganese in one location was 3,560 mg/kg, which exceeds the corresponding SCO of 2,000 mg/kg for manganese.

This sample location does not warrant further excavation, given that (a) manganese is not a RCRA hazardous constituent per the SPRU 6 NYCRR Part 373 Permit and, thus, not subject to RCRA Corrective Action; (b) manganese is not a COC as defined in the ICM work plan; and (c) there are no other manganese exceedances in FSS-10.

The presence of manganese at concentration above the SCO is believed to be attributable to natural soil mineralogy and is not believed to be associated with historical operations. Validated analytical data for antimony at one location indicate a non-detect result at an estimated concentration of 1.1 mg/kg, which exceeds the project SCO of 1 mg/kg. The reporting limit for this sample slightly exceeds the SCO, but this sample location does not warrant further excavation, given the closeness of this value to the cleanup objective, the absence of any other antimony exceedances, and the undetected "U" flagging added during data validation.

Upon completion of FSS-10, ORISE conducted independent sampling for metals in FSS-10. Six samples were collected in FSS-10. Analytical results from this sampling showed arsenic concentration greater than the corresponding SCOs in one location. Additional excavation was conducted, an additional soil sample (S040) was collected on April 12, 2010, and subsequent analyses indicated no RCRA COCs above SCOs. Additional information can be found in *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 10* (ARC-RPT-6020), included in Attachment 12.

5.3.11 Post-Excavation Soil Sampling FSS-11

FSS-11 includes portions of SPRU Grid Units 1120, 1121, 1122, and a small corner of 1142 and 1143. A civil survey of the final excavated surface of FSS-11 was conducted after completion of the FSS efforts. An estimated 47 byd^3 of banked material was removed from FSS-11.

Thirteen systematic soil samples were collected on October 13, 2009. Three samples were not collected due to the presence of water tanks used for storage of groundwater. Ultimately, it was determined to exclude the storage tank area from FSS-11 and relocate the samples. The three relocated samples (one with an associated field duplicate) were collected on December 10, 2009. These samples were analyzed in accordance with the ICM work plan and RCRA QAPjP.

The concentrations of all COCs that are subject to RCRA requirements were determined to be below SCOs, with the exception of arsenic. Validated analytical data for arsenic at two locations (17.2 and 26.8 mg/kg) exceed the project's SCO of 16 mg/kg. Both of these sample locations are near the rail bed, where arsenic presence is associated with historical railroad activities in the SPRU-LL land areas, and, therefore, are not subject to cleanup requirements under RCRA. Additional information can be found in *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 11* (ARC-RPT-6021), included in Attachment 13.

5.3.12 Post-Excavation Soil Sampling FSS-12

FSS-12 includes portions of SPRU Grid Units 1120, 1124, 1125, and small corners of 1127 and 1128. A civil survey of the final excavated surface of FSS-12 was conducted after completion of the FSS efforts. An estimated 478 byd^3 of material was removed from FSS-12. Sixteen systematic soil samples and one duplicate sample were collected on April 2, 2010. These samples were analyzed in accordance with the ICM work plan and RCRA QAPjP.

In FSS-12, the concentrations of all COCs that are subject to RCRA requirements were determined to be below SCOs except for antimony at two locations and selenium at one location. Examination of validated data reported concentrations of antimony above the SCO for two sample locations, both at 1.1 mg/kg. However, antimony results were "U" flagged (i.e., undetected) based on levels of antimony in associated laboratory blanks. Selenium from one sample location was reported at 4.3 mg/kg from a ten-fold dilution analysis and the corresponding method detection limit was adjusted for dilution. The result was flagged as

undetected and the reported concentration for that undetected result was slightly greater than the SCO (4 mg/kg). All three values were determined to be undetected at reported concentration, and they were not viewed as actionable concentrations; therefore, no further excavation was required in this FSS unit. Additional information can be found in *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 12* (ARC-RPT-6027), included in Attachment 14.

5.3.13 Post-Excavation Soil Sampling LLPL Excavations

The LLPL excavation was sampled per the ICM work plan, which directed RCRA sampling to be conducted in the excavated areas only. The excavations in the LLPL are located within two of the designated FSS units; FSS-13 and FSS-14 (see Figure 3). The LLPL excavations include portions SPRU Grid Units 1701, 1702, and 1703. Based on the recommendations included in the *Direct-Push Summary Report Lower Level Parking Lot Separations Process Research Unit* (ARC-RPT-6008), excavations were initiated in three separate areas within the LLPL (Excavations A, B, and C); however, the extent of radiological contamination between Excavation A and Excavation B led the excavation activities until Areas A and B were combined to form one excavation area (AB). In addition, chemical contamination found between Excavation AB and Excavation C ultimately led to the three separate excavation areas being merged into one large excavation area within the LLPL. A civil survey of the final LLPL excavated surface was conducted after completion of the excavation efforts. An estimated 3,226 byd^3 of material was removed from the LLPL excavations.

Sampling locations for RCRA COCs were determined using the methodology described in the ICM work plan (ARC-PLN-6106), Section 3.2, following the guidance for excavations specified in the *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002) and discussed in Section 4.1 of this document. Twenty-five soil samples and one duplicate sample were collected from the LLPL excavations, including eighteen sidewall samples and seven bottom samples. In the LLPL, the concentrations of all COCs subject to RCRA requirements were determined to be below SCOs.

Upon completion of the combined Excavations A and B in the LLPL, ORISE conducted independent sampling for metals in the LLPL excavations. Twelve samples were collected in Excavation AB, and one sample was collected in Excavation C. Analytical results from this sampling showed antimony, mercury, and arsenic concentrations greater than the corresponding SCOs in four locations within Excavation AB. Additional excavation was conducted, and subsequent sampling and analyses indicated no RCRA COCs above SCOs. Additional information can be found in *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Lower Level Parking Lot Excavations* (ARC-RPT-6023), included in Attachment 15.

5.3.14 Post-Excavation Soil Sampling Unit 15

Unit 15 is located at the site of the former K7 Storage Pad. During the remediation of the SPRU-LL Railroad Staging Area, the asphalt pad in Unit 15 was used for the water storage tanks that collected and stored groundwater pumped from excavations in FSS-09, FSS-10 and the LLPL. Upon completion of the remediation requiring storage of groundwater, the tanks were removed and the area was released for sampling. Unit 15 includes portions of SPRU Grid Units 1121, 1122, 1117, and a small corner of 1118. A civil survey of the final excavated surface of Unit 15 was conducted after completion of the sampling efforts. An estimated 64 byd^3 of material was removed from Unit 15 for radiological reasons.

Unit 15 is located at the site of the former K7 Storage Pad and the soils underlying the storage pad were previously chemically characterized and found to meet NYSDEC TAGM 4046 (O'Toole 1994) SCOs (DOE/CH2M HILL 2002). The DOE and NYSDEC concurred that there is no further action necessary to address chemical contamination at the former K7 Storage Pad (NYSDEC 2008). Given that determination, the data collected in Unit 15 is not submitted in support of a final status survey but is presented as supporting information only.

Sixteen systematic soil samples and one duplicate sample were collected on March 15, 2010. However, due to the discovery of radiological contamination, two locations (10 and 3) required additional excavation, after which these two locations were resampled on March 17, 2010, and April 1, 2010, respectively. Additional information can be found in *Separations Process Research Unit Lower Level Land Areas Interim Data Report for Unit 15* (ARC-RPT-6028), included in Attachment 16.

5.3.15 Post-Excavation Soil Sampling FSS-16

FSS-16 includes portions of SPRU Grid Units 1126, 1127, 1129, 1130, 1124 and a portion of the L5 revetment area to the south of SPRU Grid Unit 1126. In addition to the sampling performed in FSS-16, SPRU Grid Unit 1130 includes a small area outside the Lower Level staging area that was not included in FSS-16, and this area, which was designated as Subunit N-1, required RCRA metals sampling. A civil survey of the final excavated surface of FSS-16 was conducted after completion of the FSS efforts. An estimated 530 byd^3 of material was removed from FSS-16.

Eighteen soil samples and one field duplicate sample were collected on May 11, 2010, from FSS-16 and Subunit N-1 for TAL metals. In addition, five samples and one duplicate sample were collected for VOC analyses from FSS-16. These sample locations were all located within the soil staging area where trace amounts of VOCs had been detected in the SPRU RFA SV (DOE/CH2M HILL 2002). During review of preliminary laboratory data, it was determined that one sample location had a concentration of 1.1 µg/kg mercury, which is greater than the SCO 0.73 µg/kg. As detailed in the ICM work plan, additional excavation of the failed confirmation sample location consisted of a 20-ft radius around the sample location being excavated an additional 6 in. in depth. The required excavation and re-sampling of this area was performed on June 2, 2010.

The concentrations of all COCs subject to RCRA requirements were determined to be below SCOs. Additional information can be found in *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 16* (ARC-RPT-6029), included in Attachment 17.

5.4 Groundwater and Surface Water Management

Because of the depth of some excavations, the depth to groundwater in the lower level areas, and contributions from precipitation, aRc managed a significant volume of groundwater and surface water during the period of the remediation. The surface water runoff as the result of local precipitation and the groundwater encountered during excavation activities were managed using the controls as described in the NYSDEC approved *Storm Water Pollution Prevention Plan for the Separations Process Research Unit Land Area Remediation* (i.e., the SWPPP) (ARC-PLN-6310). For the most part, the majority of the water collected in open excavations was allowed to evaporate or percolate into the surrounding soils. In FSS-09, a large excavation identified as "Excavation 10" was impacted by the inflow of groundwater that required the water to be pumped from the excavation and processed through 100- and 50-micron bag

filters on the effluent side of the frac tanks staged in FSS-15, prior to discharging the waters to the ground in FSS-01.

In addition to the SWPPP, aRc received a State Pollution Discharge Elimination System (SPDES) Permit Equivalent (Appendix B-1) to allow the discharging of water from the LLPL excavation to FFS-01. A summary of the volumes of water collected, processed, and discharged to FSS-01; the water sample analysis data collected; and soil sample data of FSS-01 after all water discharges to the FSS unit were completed is provided in Appendix B-2.

5.5 Well Decommissioning in the Lower Level

At the request of DOE-SPRU, aRc decommissioned 24 monitoring wells located in the SPRU Lower Level. The wells were decommissioned consistent with well decommissioning guidance developed for the NYSDEC and American Society for Testing and Materials (ASTM) D-5299-99, and outlined in the "Amendment to RCRA QAPjP for Well and Borehole Decommissioning" attached in Appendix A-5. Four of the wells were removed in entirety during excavation activities. The remaining wells were decommissioned in June of 2010 using a Geoprobe unit. All of the wells were decommissioned by pulling the casing and grouting the borehole except for two wells, which required perforating the casing and grouting in place. The well decommissioning log for each well is provided in Appendix C.

5.6 Non-SPRU Wastes

During the remediation of the LLPL, aRc encountered unexpected waste and debris. In February of 2010, aRc encountered several pieces of metal corrugated pipe that contained asbestos containing material (ACM). As a result of the ACM being encountered, approximately 212 yd^3 of the lower level soils and debris were shipped to Energy Solutions and disposed of as ACM waste. aRc also encountered two steel beams of approximately 20 ft in length in the LLPL that required that aRc cut the beams prior to bagging the waste and shipping it to Energy Solutions.

6.0 Laboratory Sample Analysis and Data Validation

6.1 Laboratory Analysis and Deliverables

Confirmatory analysis was completed by shipping the samples to Test America St. Louis, which is a laboratory certified by the New York State Department of Health Environmental Laboratory Approval Program.[b] All laboratory analytical and QA/QC procedures are based on U.S. Environmental Protection Agency (EPA) SW-846, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* (EPA 2008).

b. Per the aRc QAPjP (ARC-PLN-6402), the analytical laboratory will carry certification by the New York State Department of Health Environmental Laboratory Approval Program. The Environmental Laboratory Approval Program (ELAP) currently grants certification to commercial, facility self-monitoring and government operated environmental laboratories, in categories covering public potable (drinking) water, non-potable water, solid/hazardous waste and ambient air and emissions. The posted list of currently certified commercial laboratories (see http://www.wadsworth.org/labcert/elap/com.html) shows that Test America St. Louis is listed as one of the 168 out-of-state labs and is identified as LABID: 11616 as an ELAP certified commercial laboratory. That list includes each laboratory's level of accreditation as well as those matrices and analyses subject to ELAP accreditation. New York is not noted in the case narrative of each data package, as Test America has primary National Environmental Laboratory Approval Program (NELAP) accreditation by the state of Florida. Per the ELAP application process, Test America sought and was granted secondary NELAP accreditation in New York (hence, the listing on the posting of ELAP certified laboratories). Test America lists the primary NELAP accrediting bodies in their narratives.

Samples collected for confirmation sampling were analyzed by Test America following current SW-846 protocols, specifically, analyzing for TAL metals by Method 6010B, antimony and thallium by 6020A, and mercury by 7471A. Also, Method 6020A was used to analyze for thallium and antimony to obtain detection limits with numerical values below the required SCOs stated in the RCRA QAPjP (ARC-PLN-6402). Further detail regarding sample analysis is provided in the RCRA QAPjP.

In FSS-11 and FSS-15, the samples were analyzed for selenium using inductively coupled plasma (ICP) by Method 6010; however, spectral interferences from target and non-target analytes resulted in high relative standard deviation between scans at the wavelength for selenium determination. Therefore, the selenium data are reported from ICP/mass spectrometry (MS) Method 6020A, thereby eliminating the spectral interference.

VOC samples collected in the K5 Retention Basin and portions of FSS-16 were analyzed by Test America St. Louis following SW-846 Method 8260B protocol in accordance with the RCRA QAPjP. PAH samples in FSS-01 were analyzed by Test America St. Louis following SW-846 Method 8270B protocol in accordance with the RCRA QAPjP. The results generated were reported by the laboratory in accordance with analytical service protocol Category B data packages. The packages included all pertinent raw data, extraction notes, standard preparation, and instrument printouts and identifiers for all samples and quality control solutions prepared.

6.2 Data Validation

Analytical data validation involves evaluation of all sample-specific information generated from the time of sample collection to receipt of the final data package. Data validation for the SPRU-LL land area was performed and reported within the data summary reports. The validation report contained an itemized discussion of the validation process and results. Copies of the data forms, annotated for qualification as discussed in the validation report, are attached to the interim reports.

Laboratory data were validated internally by Test America Laboratories, Inc., in accordance with the RCRA QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Independent validation of the PAH data for FSS-01 and VOC data for K5 Retention Basin and FSS-16 samples was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1999). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses.

7.0 Data Quality Assessment

The data generated from each soil sampling effort were examined to ensure that the data quality was adequate for decision-making purposes and sample results were compared with the corresponding SCOs. The data reported in each of the interim reports met the RCRA QAPjP (ARC-PLN-6402) performance criteria and are suitable to achieve a no further action determination from NYSDEC for the SPRU-LL land areas.

7.1 Evaluation of Data Quality

Laboratory analytical procedures and data reporting followed the quality assurance/quality control protocols described in SW-846 (EPA 2008). Test America Laboratories, Inc., generated the analytical

data and performed an internal review in accordance with the RCRA QAPjP. The reported results included defined laboratory flags to denote information related to an analyte's concentration or quality control performance. The reported analytical data also underwent independent validation by Portage, Inc., in accordance with the RCRA QAPjP. During validation, sample receipt was reviewed, including preservation and holding times and chain of custodies. Laboratory method blanks, laboratory control samples, matrix spike samples, and laboratory duplicate sample results were verified. The results from the independent validation are documented in a limitations and validation report to assist the data user in making data use determinations.

Data validation qualifiers, if added, were based on *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004) or *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1999). The impacts of data qualification on data usability were assessed during preparation of each of the interim reports. All results from each sampling event were deemed usable for decision-making purposes.

The determination of whether field and laboratory analytical data quality objectives were met was accomplished by evaluating the measurement performance criteria for precision, accuracy, representativeness, completeness, and comparability. Details specific to each FSS unit are discussed in the corresponding attached interim reports.

7.1.1 Precision

Precision is a measure of agreement or reproducibility among individual measurements for the same property under the same conditions. Precision is expressed as relative percent difference.

Analytical precision was assessed based on the relative percent difference between laboratory duplicate measurements. The analytical laboratory reported the precision of their measurements in the sample matrix based on the results obtained from the matrix spike and matrix spike duplicate analyses. Acceptable laboratory precision was determined by method-specific criteria outlined in SW-846, for total metals and each requested organic analysis.

The combined sample and analytical precision was assessed based on field duplicate sample results. Field duplicate samples were collected at a minimum rate of one per 20 environmental samples or one per sample delivery group, per matrix, per parameter and sent to the laboratory blind (with two different sample identifications). For analytes with concentrations greater than the associated quantitation limit, the criterion for assessing field precision is 50% relative percent difference between field duplicates.

7.1.2 Accuracy

Accuracy is the relative agreement or non-agreement between a measured value and an accepted reference value. Accuracy reflects the measurement error associated with a measurement and is determined by assessing actual measurements in the sample matrix during the analysis of matrix spike samples. Accuracy is assessed by means of determining analyte recovery from matrix spikes, samples, or laboratory reference samples and is expressed as percent recovery.

Acceptable laboratory accuracy was determined by assessing the results against the method-specific criteria outlined in SW-846. Data qualification flags were assigned during validation based on USEPA national functional guidance (EPA 2004, 1999). The potential bias that may be reflected in the laboratory quality control measurements was assessed for any impacts to decision-making due to the accuracy of the

data. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted. Details specific to each FSS unit are in the attached interim reports.

7.1.3 Representativeness

Representativeness is a measure of the degree to which data accurately and precisely represent a characteristic of a population parameter at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative term that should be evaluated to determine whether in situ and other measurements are made and physical samples are collected in such a manner that the resulting data appropriately reflect the population parameter of interest in the media and phenomenon measured or studied.

Representativeness was achieved by collecting a sufficient number of unbiased samples, using sound rationale to select appropriate judgmental (biased) samples, and implementing a quality control program for the sample analyses and data interpretation. Sample handling protocols (e.g., holding times, storage, preservation and transportation) were followed to ensure the representativeness of the samples.

7.1.4 Completeness

Completeness is the measure of the amount of valid analytical data obtained compared to the total number of data points planned. Valid analytical data are those generated when analytical systems and the resulting analytical data meet all of the quantitative measurement quality objectives outlined for the project (i.e., all calibration verification, interference, and other checks not affected by the sample matrix meet acceptance criteria). It is important to understand that data that are flagged during the data validation process are not necessarily invalid data. Part of the data quality assessment process is the review of flagged data to determine the negative impact, if any, that the validation flags have on the intended use of the data. Therefore, the definition of "valid data" in the context of calculating completeness is: "data that are acceptable for their intended purpose."

Completeness for metals was ensured by collecting the systematic samples from the same sampling locations as determined for the radiological samples (i.e., 16 locations rather than the planned 12) and by increasing the number of results obtained through the collection of judgmental samples. Completeness was evaluated by confirming that analytical results were reported for all samples submitted, and that all results were usable as reported, with areas of concern with respect to any data quality noted in the limitation and validation reports.

7.1.5 Comparability

Comparability is the degree to which one data set can be compared to another obtained from the same population using similar techniques for data gathering. Comparability was achieved through the use of consistent sampling procedures, experienced sampling personnel, the same analytical method for like parameters, standard field and laboratory documentation, traceable laboratory standards, and data validation. Comparability was also demonstrated by independent sampling and analysis performed by ORISE.

7.1.6 Detection Limits

The laboratory followed guidance found in SW-846 (EPA 2008) or 40 Code of Federal Regulations (CFR) 136, Appendix B, "Definition and Procedure for the Determination of the Method Detection Limit

– Revision 1.11," to determine method detection limits for analytical methods. The method detection limit is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte. The quantitation limit (sometimes also referred to as practical quantitation level, estimated quantitation level, reporting limit, or limit of quantitation) is defined as the minimum amount of a substance that can be quantitatively measured with a specified degree of confidence and within the accuracy and precision guidelines of a specific measurement system.

The requested method detection limits were below the corresponding SCOs to ensure that project decisions were defensible. Elevated detection limits resulting from matrix effects, sample size, or other analytical interferences were evaluated to ensure that the values were adequate for decision-making purposes.

7.2 Comparison of Data to Site Cleanup Objectives

Analyses for antimony in six FSS units showed results that were greater than the project's SCO of 1 mg/kg, and it was determined that further excavation was not required. In FSS-02 and FSS-08, two antimony results in each FSS unit were from historical railroad material and are not subject to RCRA cleanup requirements. In FSS-03, FSS-06, FSS-10, and FSS-12, antimony results exceeded SCOs, but it was determined at all of these locations that given the closeness of this value to the cleanup objective, the absence of any other antimony exceedances, and the undetected "U" flagging added during data validation, these areas did not require further excavation. These results were determined to be false positives based on detections in the associated blank analyses.

Analyses for arsenic in four FSS units (FSS-01, FSS-02, FSS-08 and FSS-11) showed results greater than the SCO of 16 mg/kg. However FSS-01, FSS-02, and FSS-08 were FSS units remediated as a voluntary cleanup and arsenic is associated with the railroad construction material and not subject to RCRA cleanup requirements. The two locations in FSS-11 which had arsenic above the SCO are situated near the rail bed and were determined also to be associated with railroad construction material not subject to RCRA cleanup requirements.

Analyses for manganese in two FSS units (FSS-5 and FSS-10) showed results greater than the SCO of 2,000 mg/kg. However, manganese is not a RCRA hazardous constituent per the SPRU 6 NYCRR Part 373 Permit; hence, it is not subject to RCRA corrective action. In addition, manganese is not an ICM COC as defined in the ICM work plan and these results were believed to be attributed to natural soil mineralogy and are not believed to be associated with historical operations. All other COCs subject to RCRA requirements analyzed for in the SPRU-LL land area had concentrations below the corresponding SCOs.

8.0 Deviations from Planned Activities

The RCRA QAPjP (ARC-PLN-6402) specified sampling methods and activities to be completed at each of the sampling events. Conditions in the field were generally as expected and few deviations occurred. Minor deviations in the sampling plan occurred due to a variety of factors including environmental conditions, accessibility issues, weather, unpredictable events, and safety concerns. The deviations have no significant impact on the overall quality of data generated and do not impact the ability to make project decisions. This section explains the reasons for relevant deviations from the originally planned activities.

1) According to the RCRA QAPjP, cleaning of non-disposable sampling equipment was required prior to sampling the first location, between sampling intervals, between locations, and prior to leaving each area at the conclusion of sampling activities. The cleaning process planned for hand

washing the equipment using a non-phosphate detergent wash and tap water wash, followed by a tap water rinse and a distilled water rinse. The RCRA QAPjP requires that an equipment blank prepared from the source water that has been passed through and/or over cleaned sampling equipment be collected and analyzed with the associated environmental samples. Disposable sampling equipment (i.e., a plastic trowel) was always used to fill sample bottles with final status survey samples. Equipment blanks are not required for disposable equipment. When soil conditions at the sampling location were too hard packed to penetrate with a plastic trowel, a non-disposable shovel was first used to loosen the soil in the area. The shovel was rinsed with distilled water between uses as a best management practice. Equipment blanks were not collected after the use of the non-disposable shovel.

Data generated from equipment blanks were used to verify that the collected samples were not contaminated from the equipment or cross-contaminated from sampling locations. An FSS unit compliance is demonstrated by the determination that the concentration of all COCs meets the corresponding SCOs at each sampling location. Therefore, any significant contribution from external sources such as equipment or cross-contamination between sampling locations would be measured and included in the determination of meeting the SCOs. Any elevated concentrations would ultimately be resolved through additional excavation and re-sampling. As each constituent of concern was demonstrated as meeting the corresponding SCO, the lack of equipment blanks has no impact on the project decisions.

2) One sample bottle (SFS-003-008-M) was broken upon receipt at the laboratory. Project personnel were advised that sufficient, unaltered sample material was available to perform the requested metals analyses. Because of its vapor pressure, mercury is the only target analyte metal potentially impacted by the broken container. Historically, mercury has not been detected in the sampled FSS unit, the K-5 area, at concentrations that exceed the SCO; therefore, the impact of the broken container on metals concentration was deemed to be minimal, and the laboratory was instructed to proceed using the unaltered material. The reported results for all metals were qualified with a “J” validation flag (estimated) based on the broken container. All were deemed adequate for decision-making purposes in the attached interim report for FSS-03.

3) Samples were analyzed by Test America following EPA SW-846 methods specified in RCRA QAPjP with noted exceptions for thallium and selenium. In cases where matrix effects required dilution of the samples, the samples were analyzed for thallium and selenium using EPA SW-846 Method 6020 rather than Method 6010 to obtain detection limits below the required SCOs stated in RCRA QAPjP. Both methods have equally robust quality control protocols needed for generating data suitable for decision making purposes. The deviation in method selection is not considered significant.

9.0 Conclusions

The aRc scope of work was to safely remediate the SPRU-LL land area to allow for reuse of the site. This included the excavation and offsite disposal of wastes consistent with established cleanup criteria. Remediation of the SPRU-LL included the removal of radiologically and chemically contaminated soil and debris to meet the cleanup criteria, including chemicals that are not regulated as a RCRA release.

The initial excavation sequence, including the voluntary cleanup area, is defined in the ICM work plan and was later modified as outlined in Section 4.3.1. Upon completion of designed excavations, the areas were designated as FSS units as defined in the *Radiological Confirmation Sampling and Analysis Plan/Final Status Survey (CSAP/FSS) for the Separations Process Research Unit Lower Level Land*

Areas (ARC-PLN-6511). During remediation of the SPRU-LL, 17 FSS units were established (Figure 3) requiring remediation for chemical contamination, radiological contamination, and/or voluntary cleanup.

FSS-01, FSS-02, and FSS-08 were primarily voluntary and radiological cleanup areas. FSS-03, FSS-04, FSS-05, FSS-06, FSS-07, FSS-09, FSS-10, FSS-11, FSS-12, FSS-16 and the LLPL within FSS-13 and FSS-14 were remediated for RCRA Corrective Action and radiological contamination. FSS-15, FSS-17 and the areas within FSS-13 and FSS-14 not included in the LLPL remediation were remediated for radiological constituents only.

During remediation of the SPRU-LL, 17 FSS units were established. Of those 17 FSS units, FSS Units 1-16 were initially established as requiring RCRA remediation. Unit 15 was later identified as the former K-7 site that had previously been determined to be a "no further action site"; therefore, data collected was submitted for information only. FSS Unit 17 was a radiological FSS unit only, except for one small corner of grid 1130. This small section of FSS Unit 17 was designated as "N-1" and data collected from N-1 was included in the FSS-16 interim report. In addition, for FSS Units 13 and 14 that comprised the LLPL, only the excavated portions of those two FSS units were sampled per the ICM work plan. The data from the LLPL excavation in FSS Units 13 and 14 were reported in the interim report for the LLPL.

A total of 318 samples were collected for RCRA COCs, including 276 for total metals, 19 for SVOC, and 23 for VOC analysis. Soils from all sample locations were collected and analyzed for TAL metals. Additionally, the 16 sample locations in FSS-01 were sampled for PAH compounds, and five locations in FSS-16 were sampled for VOCs.

Evaluation of the validated laboratory data for each FSS unit was conducted, and results were reported in 15 individual interim reports. Evaluation of the COC exceedances of SCOs are discussed in Section 7.2 and it has been determined that none of these results affect the final decision that no additional excavation is required in the SPRU-LL land area. These evaluations indicated the data to be of sufficient quality and quantity for decision-making purposes and support a no further action decision for the SPRU-LL land area.

Civil surveys were conducted after completion of each of the FSS units. These surveys represented the final excavation elevations of each FSS unit after excavation was completed. Figure 5 is a compilation topographical map of all of the surveys conducted for the SPRU-LL remediation. From the survey data, an estimated total of 9,431 byd^3 of material was determined to have been removed during the SPRU-LL remediation. No further excavation is recommended at SPRU-LL land area. Upon completion of the remediation in the Lower Level, the remediated areas were backfilled, graded, and hydro-seeded or paved to restore area conditions to pre-remediation condition. Figure 6 is a topographical map of the final survey conducted for the SPRU-LL after being restored to pre-remediation conditions.

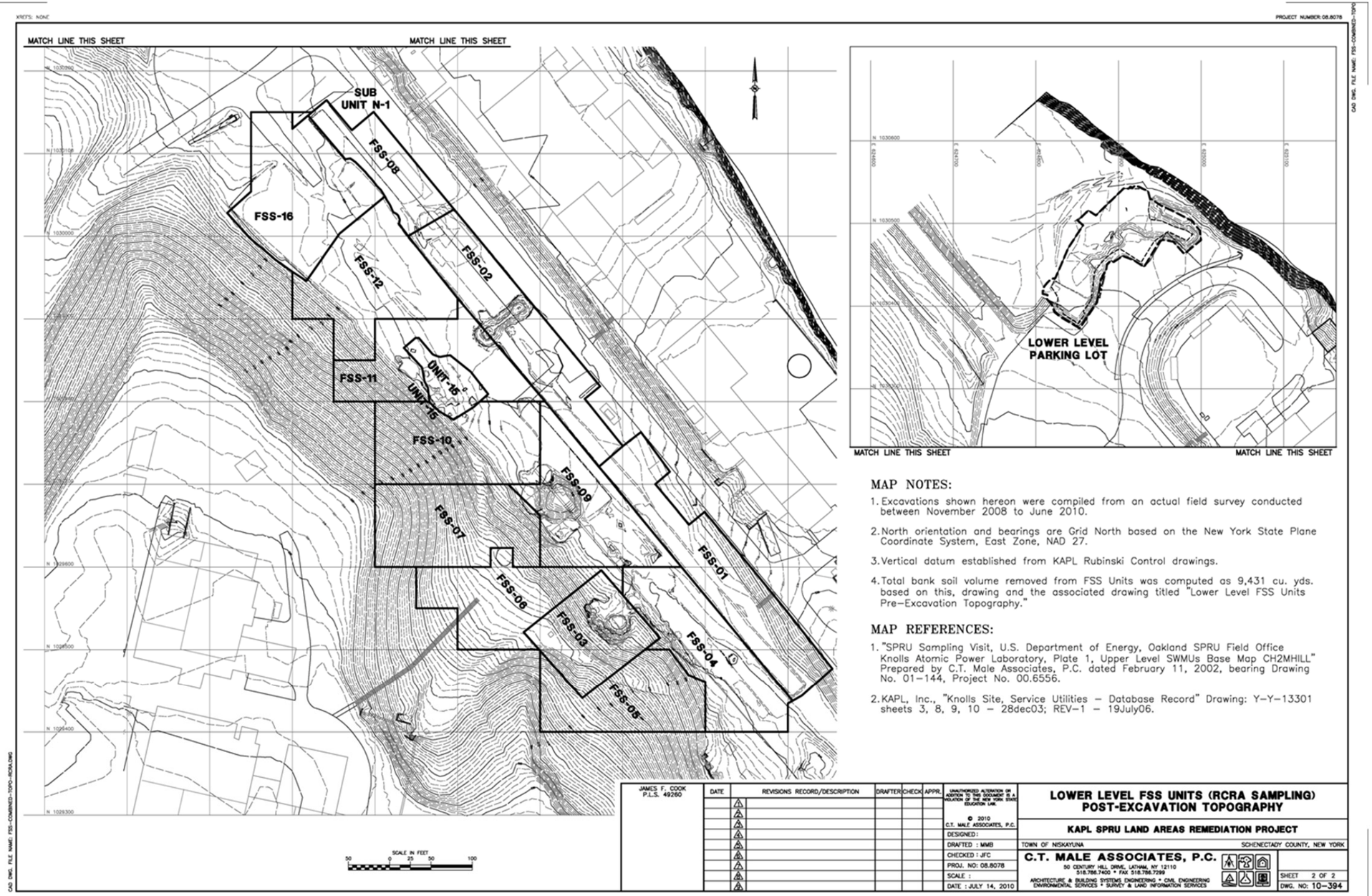

Figure 5 SPRU-LL final topographical map

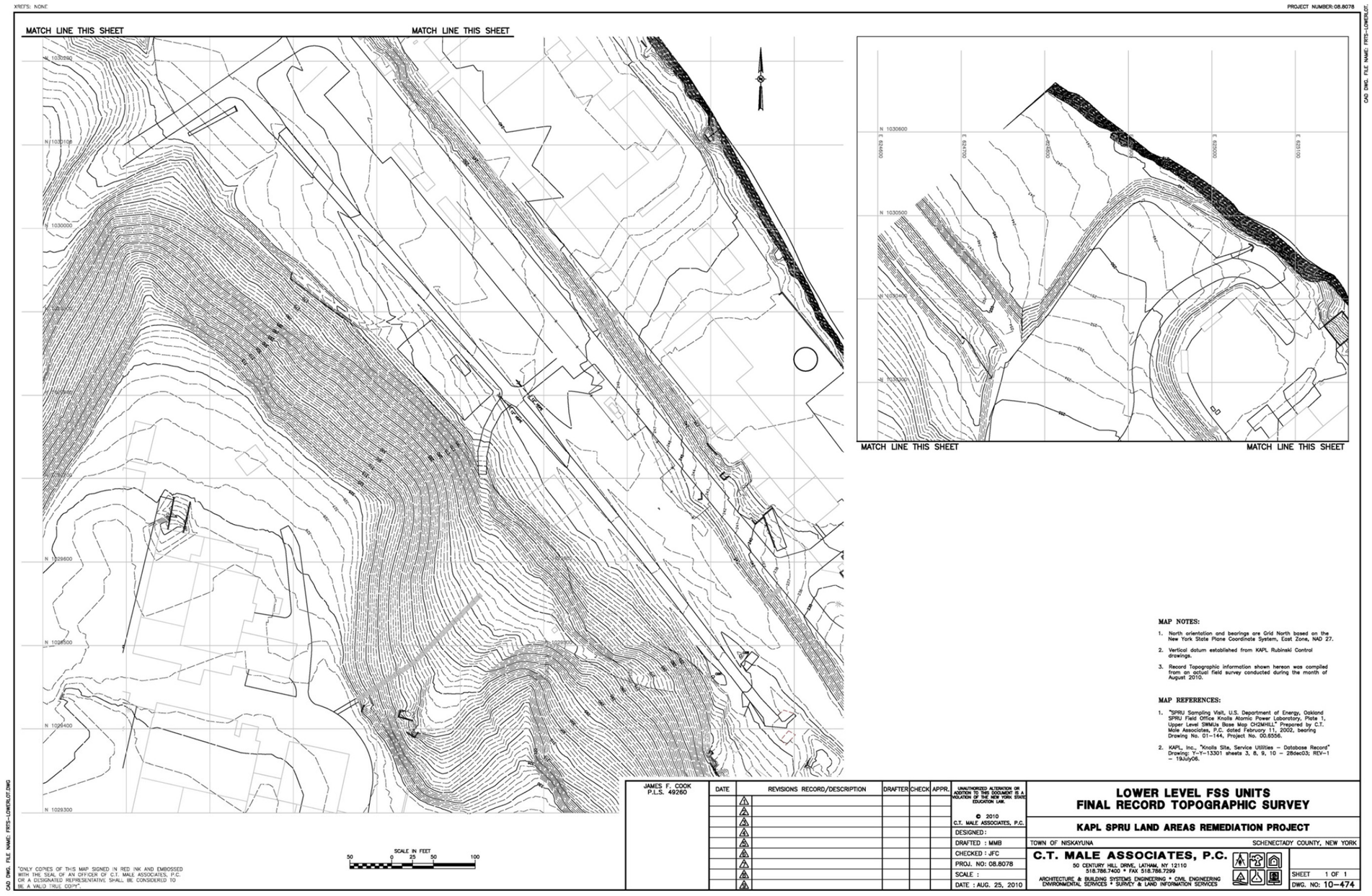

Figure 6. SPRU-LL final topographical survey

10.0 References

40 CFR 136, Appendix B, "Definition and Procedure for the Determination of the Method Detection Limit – Revision 1.11," *Code of Federal Regulations*, Office of the Federal Register, current revision.

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

ARC-PLN-6310, Rev. 6, *Storm Water Pollution Prevention Plan for the Separations Process Research Unit Land Area Remediation*, Accelerated Remediation Company, December 2009.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 3, Accelerated Remediation Company, May 2009.

ARC-PLN-6511, *Radiological Confirmation Sampling and Analysis Plan/Final Status Survey (CSAP/FSS) for the Separations Process Research Unit Lower Level Land Area,* Rev. 3, Accelerated Remediation Company, March 2010.

ARC-PRC-6802, "Metals in Soil Screening Using the Innov-X XRF Instrument Standard Operating Procedure for the Separations Process Research Unit Land Areas Remediation," Rev. 0, Accelerated Remediation Company, July 28, 2008.

ARC-RPT-6001, *Pre-Excavation Sampling of the K5 Retention Basins for Acetone*, Rev. 1, Accelerated Remediation Company, November 14, 2008.

ARC-RPT-6005, *Interim RCRA ICM Data Report for Final Status Survey Unit 01*, Rev. 1, Accelerated Remediation Company, April 15, 2009.

ARC-RPT-6006, *Interim RCRA ICM Data Report for Final Status Survey Unit 02*, Rev. 1, Accelerated Remediation Company, June 25, 2009.

ARC-RPT-6007, *K5 Post-Excavation Confirmation Sampling for Acetone*, Rev. 1, Accelerated Remediation Company, November 14, 2008.

ARC-RPT-6008, *Direct-Push Summary Report Lower Level Parking Lot Separations Process Research Unit*, Rev. 4, Accelerated Remediation Company, January 28, 2010.

ARC-RPT-6009, *Interim RCRA ICM Data Report for Final Status Survey Unit 03*, Rev. 2, Accelerated Remediation Company, July 22, 2009.

ARC-RPT-6010, *Interim RCRA ICM Data Report for Final Status Survey Unit 04*, Rev. 0, Accelerated Remediation Company, July 21, 2009.

ARC-RPT-6015, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 05*, Rev. 1, Accelerated Remediation Company, September 29, 2009.

ARC-RPT-6016, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 06*, Rev. 1, Accelerated Remediation Company, October 19, 2009.

ARC-RPT-6017, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 07*, Rev. 1, Accelerated Remediation Company, October 19, 2009.

ARC-RPT-6018, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 08*, Rev. 1, Accelerated Remediation Company, February 11, 2010.

ARC-RPT-6019, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 09*, Rev. 0, Accelerated Remediation Company, October 10, 2009.

ARC-RPT-6020, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 10*, Rev. 2, Accelerated Remediation Company, June 9, 2010.

ARC-RPT-6021, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 11*, Rev. 4, Accelerated Remediation Company, June 29, 2010.

ARC-RPT-6023, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Lower Level Parking Lot Excavations*, Rev. 1, Accelerated Remediation Company, May 27, 2010.

ARC-RPT-6027, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 12*, Rev. 1, Accelerated Remediation Company, June 01, 2010.

ARC-RPT-6028, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Unit 15*, Rev. 0, Accelerated Remediation Company, June 11, 2010.

ARC-RPT-6029, *Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 16*, Rev. 0, Accelerated Remediation Company, July 06, 2010.

ASTM , D-5299-99, *Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities*, American Society for Testing and Materials, 2005.

DOE O 5400.5, 1990, "Radiation Protection of the Public and the Environment," U.S. Department of Energy, February 8, 1990.

DOE, 2006, *Engineering Evaluation Cost Analysis for the Separations Process Research Unit Disposition Project*, U.S. Department of Energy, December 2006.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 1999, *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review,* EPA 540/R-99/008, U.S. Environmental Protection Agency, Washington, D.C., October 1999.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated December 3, 2008.

NYSDEC, 2002, *Draft DER-10 Technical Guidance for Site Investigation and Remediation*, New York State Department of Environmental Conservation, December 25, 2002.

NYSDEC, 2006, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2008, DEC # 4-4224-00024/00042, "DOE-EM Separations Process Research Unit (SPRU) EPA I.D. #NYR000096859, 6 NYCRR Part 373 Final Permit," New York State Department of Environmental Conservation, October 1, 2008.

O'Hearn, 2009, aRc, to Steven Feinberg, DOE-SPRU Field Office, March 18, 2009, "CONTRACT NO. DE-AM09-05SR22399/Task Order: DE-AT30-07CC60013/SP15 Fuel Oil Line Assessment, Task Log Item 71."

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels," TAGM 4046.

Appendix A-1
ICM Work Plan Revisions for Survey Units and Excavation Sequence

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

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November 20, 2008

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Re: Department of Energy (DOE) Separations Process Research Unit (SPRU) *RCRA Interim Corrective Measures Work Plan (ARC-PLN-6106, Revision 2), Revisions for Survey Units and Excavation Sequence*

Dear Ms. Rogers:

Please find enclosed the DOE-SPRU *Revisions for Survey Units and Excavation Sequence*. This document revises sections of the approved Interim Corrective Measures Work Plan that describe the excavation sequence in the SPRU Lower Level and the approach for establishing confirmation sampling survey units.

Thank you for your review of this document. Please feel free to call me at (518) 395-4956 if you have any questions.

Sincerely,

Hugh Davis
Regulatory and Waste Program Manager

Enclosure: Department of Energy (DOE) Separations Process Research Unit (SPRU) *RCRA Interim Corrective Measures Work Plan (ARC-PLN-6106, Revision 2), Revisions for Survey Units and Excavation Sequence*, November 18, 2008

cc (w/o Enclosure):

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New York State Department of Environmental Conservation
Office of Environmental Quality, Region 4
1130 North Westcott Road, Schenectady, New York 12306-2014
Phone: (518) 357-2045 • **FAX:** (518) 357-2398
Website: www.dec.ny.gov

Alexander B. Grannis
Commissioner

December 4, 2008

Dr. Hugh Davis
Regulatory and Waste Program Manager
U.S. Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, NY 12309

Re: Department of Energy (DOE) Separations Process Research Unit (SPRU)
RCRA Interim Corrective Measures Work Plan (ARC-PLN-6106, Revision 2)
SPRU Lower Level Land Areas Remediation
Revisions for Survey Units and Excavation Sequence
November 20, 2008

Dear Dr. Davis:

The Department has reviewed the above-referenced revisions to the SPRU Lower Level ICM Work Plan, and herewith approves the revisions and the Plan as amended. Please note the following in regard to this approval:

- The Department is unclear as to the reference made to SPRU Grid Units 1104 through 1113. It was our understanding that (apart from the voluntary cleanup), the originally-designated grids 1104, 1105 and portions of 1109 outside of the southwestern fence line were not to be included in this effort. Please provide a clarification.

- The Department will review the coverage provided by the new Final Status Survey Units to determine overall consistency with coverage provided by the original grid system. Additional samples may be required if and where it is deemed that coverage is not comparable.

- The Department requests to be provided with the configurations of the new Final Status Survey Units as they are defined, plus the anticipated excavation soil volumes associated with each, to replace the estimates provided in the original Work Plan.

Should you have any questions concerning the foregoing, please call me at (518) 357-2353.

Sincerely,

Margaret Rogers

Margaret Rogers
Engineering Geologist II

MOR lg\KAPL\SPRU\LFSSUrev.wpd.

cc: M. Infurna - USEPA Region II
J. Hill - USDOE-NRLFO
L. Winterberger - NYSDEC Central Office
File

cc: R. Forgea - NYSDEC Region 4

RCRA Interim Corrective Measures Work Plan (ARC-PLN-6106, Revision 2)

Revisions for Survey Units and Excavation Sequence

Changes to SPRU Survey Unit Design

Lower Level Rail Bed Area Excavation Sequence

The Separation Process Research Unit (SPRU) grid units delineated in the current figures of the approved RCRA Interim Corrective Measures (ICM) Work Plan (WP) (ARC-PLN-6106) were based on the New York State Plane Coordinate system map for the area with 100-foot square units. This grid system has been historically used for characterization work in the lower level area. In the approved ICM WP, two of these SPRU grid units were to function as final survey units. These SPRU grid units were also intended to facilitate confirmation sampling and analysis to obtain approval to backfill efficiently, minimizing open excavations. Field operations and site physical constraints have dictated modifications to the planned sequence of excavations. The SPRU grid units now cover separate areas of excavation (i.e., those that extend from the rail bed Voluntary Cleanup Area southwest to the Rail Staging Area road). Strict adherence to the delineated SPRU grid units and combining two as the final survey units would result in excavations remaining open for extended periods of time and crossing natural stormwater barriers and utility corridors. Though confirmation sampling may vary slightly from the exact approach outlined in the ICM WP, 100% of the area defined in the WP will be sampled at a density consistent with that defined in the WP.

Modifications to the RCRA ICM WP

Field operations and the final sequence of excavations are dictated by changing site conditions. Year 2008 field work began late in the season, which limits completion of the work scheduled for this field season. The following conditions have forced modifications to the planned excavation sequencing, as defined in Sections 2.2.2 and 2.2.3 of the RCRA ICM WP:

- Excavations within the KAPL secure area were postponed because escorts were not available. As a result, excavations began outside the security fence along the rail line in the Voluntary Cleanup Area and have extended north to the Rail Staging Area boundary or NW security fence. Additionally, in an effort to maintain availability of the Rail Staging Area road intact to provide a vehicle pathway to the sewage lift station (SLS) through the winter, remediation of the entire rail bed during the 2008 field season was required.

- Once excavations in the Voluntary Cleanup Area are completed, excavations began within the K5 Retention Basin. As such, the initial planned sequence to excavate and perform confirmation sampling in SPRU Grid Units 1104 through 1113 and 1116 will not be performed until later.

- The final survey units in the Rail Staging Area and Voluntary Cleanup Area will therefore most likely not coincide with the SPRU grid units in Section 2.2.1 of the RCRA ICM WP.

Justification for Modifying Final Survey Unit Design

The full extent of chemical contamination at the SPRU lower level cannot be completely defined until remediation efforts for chemical and radiological contamination are finished. Field activities may dictate that excavations proceed into an area not previously scheduled for excavation, based on assumptions made about the extent of contamination. Additionally, circumstances may dictate that the planned sequence of excavation be modified, as has happened during the FY08 field season. The cleanup areas will, therefore, receive final division into specific survey units when remedial actions are near completion and confirmation sampling is imminent. Final delineation of survey unit boundaries for confirmation sampling and analysis will be determined in consideration of the SPRU grid units defined in the RCRA ICM WP, changing field conditions and excavation sequencing, and physical site constraints such as power poles, fences, and drainage culverts.

Following the currently delineated SPRU grid units, in conjunction with modified field operations and sequence of excavations, would result in large areas of excavation remaining open longer than necessary. At that time, the other areas within a particular SPRU grid unit would be excavated and confirmation sampling and analysis for the entire survey unit would be performed. Modifications to the approach to delineating the final survey units are necessary to maintain compliance with stormwater erosion and sediment controls, minimize wastewater generated from open excavations, and facilitate prompt backfilling of units that meet the soil cleanup objectives (SCOs).

Confirmation Sampling and Analysis Conformance

The final survey units will include 100% of the area designated to be sampled in the ICM WP including the full extent of the Rail Road Staging Area and K5, and excavated and unexcavated areas. The sample density will be consistent with the ICM WP and samples will be collected within units that will not exceed 2,390 yd^2 in size, as defined in Section 2.2.1 of the RCRA ICM Work Plan. The SPRU grid units were civil-surveyed and marked in the Rail Staging Area and Voluntary Cleanup Area prior to commencement of excavations. The final survey units, as dictated by changing field conditions, will also be surveyed and marked in accordance with Sections 2.2.1 and 2.2.2 of the RCRA ICM WP. The sub-grid approach (survey, excavate, resurvey) described in Section 2.2.1 and shown in Figure 6 of the RCRA ICM WP will continue to be followed. The final survey units will be delineated differently, however, to encompass both unexcavated areas and actual field excavations. The size limit for survey units will not be exceeded.

Confirmation sampling and analysis for RCRA constituents of concern (COCs) will be performed as described in the Section 3 of the RCRA ICM WP to ensure SCOs have been met; however, the number of samples taken will be 16 and will exceed the minimum number of samples (12) specified in Section 3.2.1 of the RCRA ICM WP, which will result in an increased sample density. The final survey units will be defined on maps included in the data package reports provided to NYSDEC. The maps will include confirmation sample locations, sample points above SCOs identified in the SPRU RCRA Facility Assessment Sampling Visit Report (February 2002), and any subsequent discoveries.

The anticipated soil volumes for each area, approach to determining sample locations, and survey unit size remain unchanged, although the soil volumes for the field seasons will change according to the areas excavated.

Appendix A-2
Letter Regarding Approach to PAH Sampling and Analysis

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

DOE SPRU Field Office SP-26
2425 River Road
Niskayuna, NY 12309

April 28, 2009 LAR-09-038

Steven Feinberg, Federal Project Director
U.S. Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, New York 12309

Subject: CONTRACT NO. DE-AM09-05SR22399/Task Order: DE-AT30 7CC60013/SP15.
aRc's response to DOE SPRU Office's Letter SPRU 08-230 dated 12/22/08 regarding Comments on PAH Sampling and Analysis for SPRU-LA Project

Dear Mr. Feinberg,

In response to your letter, SPRU 08-230 dated 12/22/08, Comments on PAH Sampling and Analysis for SPRU-LA Project, aRc began to incorporate the comments related to the statistical approach consistent with the RCRA ICM WP regarding all areas where PAHs have been detected at any concentration. aRc utilized the statistical method and EPA guidance and determined that a minimum of eight samples would be required in several SPRU grid units with the exception of FSS Units 001 and 002 in the voluntary cleanup area, as requested.

Through a series of correspondence and DOE-SPRU's decision to not utilize the statistical method for confirmation sampling and analysis and the related data validation, aRc requested further clarification regarding PAH sampling and analysis and whether a similar approach should be applied as well. In the process of determining a reasonable and consistent approach to PAH sampling, aRc performed an analysis of the PAH data tables from the RFA SV Report that DOE-SPRU previously provided.

aRc determined that 128 samples were taken during the RFA SV (74 from the areas outside the rail bed, i.e. K5, K6, K7, and LLPL, and 54 from the LLRBA). Of the 128 samples, only seven (7) exceeded the approved 6 NYCRR 375-6.8(b) SCOs for the SPRU-LA project. All seven (7) exceedances were associated with samples within the rail bed itself or were beneath or immediately adjacent to asphalted areas. All other detections were a factor of 10 or more below the SPRU SCOs and, with the exception of one data point, were attributable to the rail bed or asphalted areas.

Given that all but one data point were attributable to the rail line or asphalted areas and were more than a factor of 10 below the SCOs, and those samples that exceeded the SCOs were within the rail bed or beneath asphalt, it does not appear that confirmation sampling and analysis for PAHs across the lower level in non-asphalted/rail line areas to determine whether we have met cleanup levels for PAHs is warranted. Likewise, confirmation sampling and analysis for PAHs in asphalted areas that will be repaved at the conclusion of the project does not appear to be warranted.

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

aRc requests technical direction as to whether or not DOE-SPRU agrees with aRc's assessment of the data and that PAH sampling is not warranted due to the very low levels of PAHs outside the rail bed and asphalted areas and because areas with elevated PAHs above SOCs are currently paved and will be repaved.

Please feel free to contact me at 518-344-2860 or the aRc Regulatory Affairs Manager, Rich Morris, at 210-497-2473 if you have any questions or concerns.

Sincerely,

Jack O'Hearn, Project Manager
Accelerated Remediation Company

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

US Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, New York 12309

SPRU 09-070 May 27, 2009

Mr. Jack O'Hearn
Accelerated Remediation Company
c/o Portage Environmental
2425 River Road, SP-26
Niskayuna, NY 12309

Subject: Contract DE-AM09-05SR22399
Task Order DE-AT30-07CC60013, SP15
DOE-SPRU Response to aRc's Response to DOE-SPRU Office Letter SPRU-08-230 Regarding PAH Sampling and Analysis for the SPRU Lower Level Project

Dear Mr. O'Hearn:

The U.S. Department of Energy, Separations Process Research Unit (DOE-SPRU) Field Office has reviewed aRc's response (LAR-09-038) dated April 28, 2009, pertaining to polyaromatic hydrocarbon (PAH) sampling in the SPRU lower level. DOE-SPRU agrees with aRc's assessment that further PAH sampling and analysis is not needed in the lower level.

If you have any questions, or wish to discuss this letter, please call Hugh Davis at (518) 395-4956.

The technical direction contained in this document is not intended to be a change in accordance with FAR 52.243. The contractor must proceed promptly with the performance of technical direction duly issued by the Contracting Officer's Representative (COR) in the manner prescribed by DEAR 952.242-70 "Technical Direction," and within its authority under the provisions of this clause. If, in the opinion of the contractor, any instruction or direction by the COR falls within one of the categories defined in (c) (1) through (c) (5) of this clause, the contractor must not proceed and must notify the Contracting Officer in writing within five (5) working days after receipt of any such instruction or direction and must request the Contracting Officer to modify the contract accordingly.

Sincerely,

S. B. Feinberg

Steven Feinberg, Federal Project Director
Designated Contracting Officer's Representative
SPRU Field Office

cc: John Rampe, DOE-SPRU
Hugh Davis, DOE-SPRU
Derrick Franklin, EMCBC CO
Marilyn Long, EMCBC CO
Jeff McMillan, DOE-OSSP
Jeff Hill, NRLFO-SCH
David Herman, NRLFO-SCH
Ted Christensen, aRc

Appendix A-3
Former Fuel Oil Line Assessment

United States Government Department of Energy

COPY

memorandum

NRLFO:AMO-S:FDCOM:09-063

DATE: March 30, 2009

REPLY TO ATTN OF: J. A. Upson, NRLFO-SCH

SUBJECT: **DOE-SPRU CONTRACTOR (aRc) COMPLETION REPORTS FOR FINAL STATUS SURVEY UNIT 01, NRLFO COMMENTS AND REQUEST FOR DOE-SPRU ACTION**

TO: J. J. Rampe, Manager, DOE-SPRU Field Office

DOE-SPRU memorandum SPRU 09-032 dated March 9, 2009, provided Final Status Survey (FSS) Unit 01 Information for NRLFO concurrence that all soil cleanup objectives have been met for FSS Unit 01, and NRLFO agreement that no additional soil removal needs to be conducted. Additionally, DOE-SPRU requested approval to leave the abandoned fuel oil line in at the lower level railbed and approval to re-grade FSS Unit 01 rather than backfilling to its original grade.

As discussed during a meeting between DOE-SPRU, NRLFO, KAPL, aRc, and WGI on November 4, 2008, NRLFO approves leaving the abandoned fuel oil line in place. NRLFO also agrees to DOE-SPRU's re-grading plan provided in DOE-SPRU memorandum SPRU 09-032 dated March 9, 2009.

KAPL and NRLFO have reviewed the SPRU Lower Level Land Areas Radiological Completion Report for Final Status Survey Unit 01 (ARC-RPT-6003, Revision 1) dated March 5, 2009, and Interim RCRA ICM Data Report for Final Status Survey Unit 01 (ARC-RPT-6005, Revision 1) dated March 3, 2009. NRLFO concurs with DOE-SPRU's assessment that the soil cleanup objectives have been met for radiological and chemical cleanup. NRLFO also concludes that no further soil removal is needed by the Naval Reactors Program.

However, in reviewing the SPRU Lower Level Land Areas Radiological Completion Report for Final Status Survey Unit 01, NRLFO is concerned about the quality of the report, including the fact that some of the information presented in the report is inaccurate. These concerns are reflected in NRLFO and KAPL comments on the current report, listed below and in the attachments for DOE-SPRU's consideration.

J. J. Rampe, Manager, -2-
DOE-SPRU Field Office

1. As identified in Table 9, two samples did not meet the required minimum detectable activity (MDA) required of 2.0 pCi/gm for Pu-241. Samples SFS-001-001-R and SFS-001-003-R had MDA's of 4.0 and 3.2 pCi/gm respectively.

COPY

2. Table 12 radioactivity data for sample SFS-J001-018-R does not match the data for the same sample reported on Table 7.

3. Section 5.1.2.2, second paragraph identifies threshold color coding values for Figure 4 that are inconsistent with the data reported in Table 4. Specifically, the paragraph states that data points at the mean plus one times the standard deviation or 15,600 cpm up to the mean plus 2.3 times the standard deviation or 20,800 cpm are shown as yellow. The paragraph also states that data points at 20,800 cpm and higher data points are shown as red on Figure 4. However, based on the data in Table 4, the minimum value for data points to be indicated as yellow should be 13,694 cpm and 16,169 cpm for data points to be indicated as red. Therefore, the last sentence of the second paragraph of 5.1.2.2 would not be accurate since it identifies that there are no data points greater than the red value even though the maximum scan data value is 20,463 cpm.

Any questions or comments on this memorandum should be directed to me or J. T. Hill at (518) 395-4493.

J. A. Upson, Project Officer
Facilities, Construction, Deactivation,
Engineering and Plant Operations

Attachment:
As Stated

cc: S. B. Feinberg, DOE-SPRU
J. M. Steele, NR08R
J. T. Hill, NRLFO
C. A. Obos, KAPL (Bin 003)
M. Palitsch, KAPL (Bin 57)

FUEL OIL LINE CROSSING & EXCAVATION DEPTH ASSESSMENT

aRc Dwg # C002 shows arc's planned excavation cross-sections . The former fuel 4-inch diameter oil line profile is as shown on G.E. Arch/Engr drawing entitled FUEL OIL FACILITIES dated June 29, 1954, subcontract # K-187 .

Based on a review of the above references, the fuel oil line crosses two of the remaining areas of aRc's planned excavation. These areas are ARC excavation No. 12 in grid 1124/1125 and that portion of Grid 1122 being excavated to remove the 12" corrugated metal pipe outlet from CB-9 towards CB-25.

The GE pipe line drawing shows a minimum cover depth of 3.5' ft below the 1954 existing grade.

Excavation No.12 is planned at a depth of 1 ft and will result in at least 2.5 ft of additional cover below planned excavation depth.

The fuel oil line will be exposed when aRc conducts the planned removal of Catch Basin CB-9 outlet piping within grid 1122. This 12" CMP Storm Drainage Piping is scheduled for removal to a depth of 12 feet. The fuel oil line crosses through this excavation at an estimated depth of 4-5 ft below original 1954 grade.

aRc proposes to remove only that section of pipe required to facilitate removal of the culvert pipe. Removal will require aRc to saw cut the former fuel line in the excavation trench where it crosses the culvert alignment.. The cut ends of the fuel line will be grouted with a non-shrink grout in the same manner as was performed when the fuel oil line was cut at the perimeter fencing in grid 1143/FSS Unit 2. No specific additional soil volume is expected to be generated in the removal of this section of fuel line that crosses the excavation trench for the culvert.

The remainder of the existing fuel oil line will not be exposed and will not be within 2.5 ft of aRc's planned excavations in the Lower Level Rail Bed Area operable unit. The fuel oil line slopes upward from the current terminal point in FSS Unit two (approximately -8 ft) to a depth not less than 3.5 ft as shown on the GE drawing in the vicinity of grid 1127.

Appendix A-4
ICM Work Plan Revisions for Demobilization

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

US Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, New York 12309

SPRU 08-209

October 29, 2008

Ms. Margaret Rogers
Engineering Geologist II
New York State Department of Environmental Conservation
Office of Environmental Quality, Region 4
1130 North Westcott Road
Schenectady, New York 12306-2014

Re: Submittal of Separations Process Research Unit (SPRU) Demobilization Activities Plan and Request for Extension for Lower Level Parking Lot Plan.

Dear Ms. Rogers:

In our letter to you dated September 18, 2008, we stated our intention to submit plans by November 3, 2008, for investigations in the Lower Level Parking Lot and for the decommissioning of the decontamination and soil staging areas in the Rail Road Staging Area. Enclosed is our decommissioning plan for the soil staging and decontamination area.

As we discussed on October 23, 2008, DOE-SPRU has requested a six-week extension from the November 3, 2008, date for submittal of the workplan for additional investigations in the Lower Level Parking Lot. The new date for submittal of this workplan would be December 15, 2008.

Please feel free to call me at (518) 395-4956 if you have any questions.

Sincerely,

Hugh Davis
Regulatory and Waste Program Manager

Enclosure: RCRA Interim Corrective Measures Workplan (ARC-PLN-6106), Revisions for Demobilization

cc (w/o Enclosure):
L. Winterberger, NYSDEC Central Office
M. Infurna, USEPA Region II
J. Rampe, DOE-EM
T. Crandall, DOE-EM
J. Hill, NRFLO-Schenectady
A. Sheeran, aRc

New York State Department of Environmental Conservation
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1130 North Westcott Road, Schenectady, New York 12306-2014
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Alexander B. Grannis
Commissioner

November 26, 2008

Dr. Hugh Davis
Regulatory and Waste Program Manager
U.S. Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, NY 12309

Re: Separations Process Research Unit (SPRU) Demobilization Activities Plan
Request for Extension for Submittal of Lower Level Parking Lot Plan
October 29, 2008

Dear Dr. Davis:

The Department has reviewed the above-referenced document, which you had submitted in response to our 8/21/08 contingent approval letter for the SPRU Lower Level RCRA Interim Corrective Measures (ICM) Work Plan. The Department's specific request in this case concerned the need to develop a plan for the management of any contaminated soils discovered within the footprint of the current soil staging area, subsequent to its decommissioning.

Please note that the plan, as submitted and with the clarification you provided via e-mail to me today, is acceptable and is herewith approved as an addendum to the Lower Level ICM Work Plan.

Please also note that the Department agrees to the extension requested in your 10/29/08 cover letter concerning the supplemental investigation work plan for the Lower Level Parking Lot. The due date is now 12/15/08.

Please let me know if you have any questions regarding the foregoing.

Sincerely,

Margaret Rogers

Margaret Rogers
Engineering Geologist II

MR:lg\MOR\Files\KAPL\SPRULLdemobapp28.wpd

cc: M. Infurna - USEPA Region II
J. Hill - USDOE-NRLFO
L. Winterberger - NYSDEC Central Office
File

ec: R. Forgea - NYSDEC Region 4

From: Margaret Rogers
To: Davis, Hugh
Subject: RE: Work Plan Demobilization Revisions
Date: Tuesday, November 25, 2008 10:23:20 AM

That's fine, Hugh -- thanks. I'll send a response letter out shortly.

>>> "Davis, Hugh" <hugh.davis@spru.doe.gov> 11/25/2008 12:06 PM >>>
Margaret,

Yes, we will be sampling all areas identified within the outer boundaries of the SPRU grid units regardless of whether excavation has occurred.

Hope that answers the question, regards, Hugh

-----Original Message-----
From: Margaret Rogers [mailto:morogers@gw.dec.state.ny.us]
Sent: Tuesday, November 25, 2008 10:43 AM
To: Davis, Hugh
Subject: Work Plan Demobilization Revisions

Hi Hugh,

I've 'finally' gotten a chance to turn some attention to the ICM work plan revision you submitted on 10/29. It looks fine, although there is one point that I would like to clarify with you. Under the section "Confirmation Sampling and Analysis," field surveys are prescribed "as normal for excavated areas." Figure 5 of the work plan indicates no planned excavation area for the areas occupied by the soil storage cells. I just wanted to make sure that these areas will be screened and sampled regardless of whether excavation is required (please note NRLFO's comment #4 from the 7/25 comment resolution document. I think this comment is in a similar vein).

Thanks,

Margaret

RCRA Interim Corrective Measures Work Plan
ARC-PLN-6106
Revisions for Demobilization

Site Demobilization

Soil Staging Area

During demobilization activities, the crushed stone, geotextile, and stormwater erosion and sediment control materials will be removed, sampled, and analyzed for chemical contaminants in accordance with the *Waste Management Plan* (WMP) (ARC-PLN-6701). Beginning with the soil staging area located furthest to the south, the soil staging areas will be deconstructed individually. The west and south Jersey/concrete barriers will be removed, decontaminated if necessary, and stored in the Clean Laydown Area. Once the waste from the first soil staging area has been packaged and shipped for disposal, deconstruction will continue with the second soil staging area in the same manner as the first with decontamination of the barriers and removal, stockpiling, characterization, and disposal of the crushed stone and geotextile utilizing the final soil staging area to stockpile the waste. For the final soil staging area, the crushed stone will be sampled in place, characterized, direct loaded into shipping containers, and disposed in accordance with the WMP.

Container Loading Area

During demobilization activities, the remaining crushed stone surrounding the container loading area will be sampled in place, properly characterized, direct loaded into shipping containers, and disposed in accordance with the WMP. The loading frame(s) will then be removed, decontaminated, and stored in the Clean Laydown Area.

Decontamination Area

During demobilization activities, geotextile, stone, and plastic materials will be removed, sampled, and analyzed for chemical contaminants in accordance with the WMP. The decontamination sump will first have liquids removed to the water tanks, if necessary, which will be sampled, analyzed, and discharged as normally if appropriate. Sediment in the bottom of the sump and stone surrounding the sump will then be sampled in place and analyzed in accordance with the WMP. Finally, the decontamination area will be deconstructed with the liners and stone being direct loaded into a shipping container(s) for disposal.

Confirmation Sampling and Analysis

Once demobilization activities are complete, all areas where temporary facilities were removed will undergo field surveys in accordance with Section 2.2 as normal for excavated areas as well as confirmation sampling and analysis. If contamination exists and exceeds the soil cleanup objectives for the site, soils in those areas will be excavated in accordance with the *RCRA Interim Corrective Measures Work Plan* (ARC-PLN-6106), and direct loaded into shipping containers for disposal. Exposed soils will be resurveyed with field instruments (i.e., XRF and NaI detectors) and confirmation sampling and analysis will be repeated.

Appendix A-5
Amendment to RCRA QAPjP for Well and Borehole Decommissioning

Davis, Hugh

From: Margaret Rogers [morogers@gw.dec.state.ny.us]
Sent: Friday, April 23, 2010 3:14 PM
To: Davis, Hugh
Subject: Re: Revised procedures for borehole and GWM well decommissioning

Hugh,

Just a couple of thoughts: Since pulling has been identified as the preferred method, a procedure should be in place should the well break during pulling (i.e auger out remainder and grout). Pulling wells greater than 25 feet in depth (don't know if you have any of these) is discouraged unless they can be pulled without breaking. Obviously, wells of unknown origin should be sounded or information otherwise obtained to make sure that this method is appropriate. Also, please refer to the procedure for removal of stick-up casings (e.g. the easternmost well north of the former K5 that we saw yesterday).

Thanks,

Margaret

>>> "Davis, Hugh" <hugh.davis@spru.doe.gov> 4/21/2010 7:17 AM >>>
Margaret, I will formally transmit this to you via letter today. Attached is the revised procedure for decommissioning boreholes and groundwater monitoring wells so that it is consistent with the new state guidance. I have also attached a redline/strikeout version so you can see the exact changes.

Thanks for your review of this document.

Hugh

8/18/2010

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

US Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, New York 12309

SPRU 10-095

May 28, 2010

Ms. Margaret Rogers
Engineering Geologist II
New York State Department of Environmental Conservation (NYSDEC)
Office of Environmental Quality, Region 4
1130 North Westcott Road
Schenectady, New York 12306-2014

Re: Department of Energy (DOE) Separations Process Research Unit (SPRU) Revised Groundwater Monitoring and Borehole Decommissioning Procedures

Dear Ms. Rogers:

Please find enclosed the amendment to the Resource Conservation and Recovery Act Interim Corrective Measures Quality Assurance Project Plan, *Revisions for Well and Borehole Decommissioning*, ARC-PLN-6402. This document has been renumbered, based on comments in your May 14, 2010, email to me.

Thank you for your review of this document. Please feel free to call me at (518) 395-4956 if you have any questions.

Sincerely,

Hugh Davis
Regulatory and Waste Program Manager

Enclosure: *Revisions for Well and Borehole Decommissioning*, ARC-PLN-6402

cc (w/Enclosure):

J. Hill, NRLFO-Schenectady

cc (w/o Enclosure):

R. Phaneuf, NYSDEC Central Office
M. Infurna, USEPA Region II
J. Rampe, DOE-SPRU
M. Zullo, DOE-SPRU
R. Ribail, EMCBC-CO
M. Pearson-Hurley, DOE-HQ
J. Moon, DOE-HQ
J. O'Hearn, aRc

FILE NO. SPRU10-095
RTG. SYMBOL
Initials/Sig JR
Date 5-28-10
RTG. SYMBOL
Initials/Sig
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aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

New York State Department of Environmental Conservation
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Alexander B. Grannis
Commissioner

June 3, 2010

Dr. Hugh Davis
Regulatory and Waste Program Manager
U.S. Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, NY 12309

Re: Department of Energy Separations Process Research Unit (DOE-SPRU)
Revised Groundwater Monitoring Well and Borehole Decommissioning Procedures, 5/28/10,
Amendment to RCRA ICM QAPjP – ARC-PLN-6402
6 NYCRR Part 373 Permit # 4-4224-00024/00042

Dear Dr. Davis:

The Department has reviewed the above-referenced submittal, which was revised from your earlier 4/21/10 submittal based on my 4/27/10 discussion with you and Mr. Morris of aRc/Portage Inc., as well as my 5/14/10 e-mail to you. Prior to the former discussion, you had provided a copy of a pertinent portion of the document ARC-WP-018, "Well Installation and Decommissioning," which is a protocol developed by aRc for use during the SPRU project. The revised submittal now references this latter document.

Your 5/28/10 submittal is herewith approved, with the understanding and expectation that the procedures outlined in ARC-WP-018 will be followed with respect to the issues raised in my 4/23/10 e-mail to you. We request that you provide the Department with the schedule and scope of all such well and borehole decommissioning activities prior to initiation, and documentation upon completion.

Should you have any questions, please contact me at (518) 357-2353.

Sincerely,

Margaret Rogers

Margaret Rogers
Engineering Geologist II

MR:lg:spruwelldecomm.doc

cc: M. Infurna – USEPA Region II
J. Hill – USDOE-NRLFO
L. Winterberger – NYSDEC Central Office
File

cc: R. Forgea – NYSDEC Region 4

40 years of stewardship 1970-2010

Amendment to RCRA ICM QAPjP – ARC-PLN-6402

Revisions for Well and Borehole Decommissioning

Changes to Section 2.1

Amendments

The text from Section 2.1 (Well Installation and Development Procedures) from the SPRU RCRA Interim Corrective Measures Quality Assurance Project Plan (SPRU RCRA ICM QAPjP) (ARC-PLN-6402), Revision 2, dated August 12, 2008, is modified as follows with these requirements implemented in aRc's work package, "*Well Installation and Decommissioning,*" (ARC-WP-018):

"Section 2.1 Well and Borehole Installation, Development, and Decommissioning Procedures

The following procedures will be used to complete well and borehole installation, development, and/or decommissioning activities. The specific methods selected and the locations for the monitoring wells/temporary well points/soil borings will be determined, as needed, during implementation of ICM activities.

Supervision of well installation, well development, and well decommissioning activities will be provided by a qualified geologist or hydrogeologist who will be in attendance during field activities to determine the well depth and screen interval based on field conditions, to ensure decommissioning procedures are followed, to prepare well completion logs, and to complete daily drilling records."

Changes to Section 2.1.1

Amendments

The following text from the New York State Department of Environmental Quality *Groundwater Monitoring Well Decommissioning Procedures* (slightly modified for clarity), dated August 2009, is inserted before the current Section 2.1.1, Permanent Monitoring Well Installation, of the SPRU RCRA ICM QAPjP, ARC-PLN-6402 Revision 2, dated 8-12-08. The current Section 2.1.1, Permanent Monitoring Well Installation is therefore renumbered as Section 2.1.2. The current Section 2.1.2, Temporary Well Point Installation Procedures is renumbered as Section 2.1.3. And the current Section 2.1.3, Well Development, is renumbered as 2.1.4.

"Section 2.1.1 Well and Borehole Decommissioning Procedures

Section 2.1.1.1 Groundwater Monitoring Well Decommissioning

Consistent with well decommissioning guidance developed for the New York State Department of Environmental Conservation (NYSDEC) [Reference 1] and American Society for Testing and Materials (ASTM) D-5299-99 [Reference 2], three methods of well decommissioning are proposed: perforating the well casing with grouting in-place, pulling riser

while grouting well, or overdrilling the well. For monitoring wells to be decommissioned by perforating the well casing and grouting in-place, a perforating tool will be lowered into the well and used to perforate the well screen and well casing with a series of small diameter holes at a minimum of five holes per linear foot [Reference 1]. After removing the perforating tool from the well, the perforated monitoring well will be grouted from the bottom of the well to approximately 0.5 feet below grade. The grout material will consist of Type I Portland cement mixed with either a powdered or granular bentonite. The NYSDEC guidance (Reference 1, pg. 11), specifies that the grout mixture shall consist of 94 pounds of type I Portland cement, 3.9 pounds powdered bentonite, and 7.8 gallons of water shall be used. Decommissioned wells shall be marked using a ferrous metal marker embedded in the top of the grout to indicate the location of the former monitoring well as described in Reference 1.

For pulling the riser while grouting the well (preferred method), a hollow stem auger or other lifting device will be used to pull and remove the casing by lifting. Grout is to be placed by tremie from the bottom of the well to the top of the well during pulling; the grout will fill the space once occupied by the material being withdrawn. An acceptable procedure to remove casing involves puncturing the bottom of the well or using a casing cutter to cut away the screen, grouting, using jacks to free casing from the hole, and lifting the casing out by using a drill rig, backhoe, crane, or other suitable equipment. Additional grout must be added to the casing as it is withdrawn. In wells or well points in which the bottom cannot be punctured, the casing or screened interval will be perforated or cut away prior to being filled with grout. The NYSDEC guidance (Reference 1, pg. 11), specifies that the grout mixture shall consist of 94 pounds of type I Portland cement, 3.9 pounds powdered bentonite, and 7.8 gallons of water shall be used. Decommissioned wells shall be marked using a ferrous metal marker embedded in the top of the grout to indicate the location of the former monitoring well as described in Reference 1.

For monitoring wells to be decommissioned by overdrilling, a hollow stem auger fitted with a plug cutter will be advanced through the existing well. The plug cutter will grind the well construction materials, which will be brought to the surface by the auger. After drilling to a depth of approximately one-half foot below the measured well depth, the borehole will be filled with grout from the bottom of the borehole to approximately one-half foot below grade. The grout material will consist of Type I Portland cement mixed with either a powdered or granular bentonite. The NYSDEC guidance (Reference 1, pg. 11), specifies that the grout mixture shall consist of 94 pounds of type I Portland cement, 3.9 pounds powdered bentonite, and 7.8 gallons of water shall be used. Decommissioned wells shall be marked using a ferrous metal marker embedded in the top of the grout to indicate the location of the former monitoring well as described in Reference 1. Depending on the location of the well, the remaining half foot of borehole will be backfilled with an asphalt patch or clean soil. If possible, temporary wells will be decommissioned by pulling the well casing and screen from the ground and filling the resultant borehole with bentonite chips or equivalent. If necessary, temporary well boreholes will be filled with cement/bentonite grout mixed as above."

"Well decommissioning activities will be recorded in the field book or on separately prepared forms. Information to be recorded shall include, but not necessarily be limited to, the decommissioning method, date of decommissioning, backfill and surface restoration method."

Add Sections 2.1.1.2 and 2.1.1.3

Add Section 2.1.1.2 Overburden Monitoring Well Decommissioning

"In general, the preferred method for overburden monitoring wells requiring decommissioning is pulling the well with concurrent grouting as described above. Where this is not feasible, grouting in-place via perforation or puncturing of the casing, or over-drilling, may be performed. NYSDEC and ASTM guidance [References 1 and 2] should be followed for circumstances involving contaminated wells penetrating a confining layer, bedrock or telescoped wells, or wells demonstrating non-aqueous phase liquid (NAPL) or dense non-aqueous phase liquid (DNAPL) contamination."

The following language from Section A.4.4.1 (Soil Sampling) from the April 2000 SPRU RFA Work Plan, as approved by the NYSDEC on May 18, 2000, is added to the SPRU QAPjP:

Add Section 2.1.1.3 Borehole Decommissioning

"Where possible, shallow hand-sampled holes will be backfilled with surrounding soil. Deeper hand-sampled or direct-push holes may require backfill with bentonite chips or granules. Test borings derived from drilling activities that are not backfilled with soil cuttings or are not completed as monitoring wells will be backfilled with a cement/grout mixture."

"Adequate hydration of dry bentonite (e.g., pellets) is required if the borehole is installed above the water table and/or where only perched water has been encountered."

References

1.) CP-43: *Groundwater Monitoring Well Decommissioning Procedures*, New York State Department of Environmental Conservation, Division of Environmental Remediation, November 2009.

2.) ASTM 1999. *Standard Guide For Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities,* D-5299-99.

3.) ARC-WP-018, "*Well Installation and Decommissioning,*" Accelerated Remediation Company, current revision.

Appendix A-6
Letter Regarding Modifications to Confirmation Sampling Approach and Data Quality Assessment for QAPjP

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

US Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, New York 12309

SPRU 09-028

February 17, 2008

Ms. Margaret Rogers
Engineering Geologist II
New York State Department of Environmental Conservation
Office of Environmental Quality, Region 4
1130 North Westcott Road
Schenectady, New York 12306-2014

Re: Modification to Confirmation Sampling Approach for the Rail Road Staging Area

Dear Ms. Rogers:

With this letter, the Department of Energy, Separations Process Research Unit Field Office formally requests to modify the approach for confirmation sampling in the Railroad Staging Area (RRSA). This modification would remove the less stringent of two decision rules used to determine when cleanup objectives have been met. This change would result in streamlined data submissions, allow the New York State Department of Environmental Conservation to expedite its review process, and help close excavated areas more expeditiously.

DOE-SPRU proposes to modify the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Revision 2, August 12, 2008, as follows:

- Section 3.1.5, Decision Rule.

  1) ~~*If* the true mean concentration of any COC in the soils exceeds the ALs, then additional excavation of the SPRU grid units will be required.~~
  2) *If* the concentration of any COC [constituent of concern] in the soils at any location is greater than the contaminant-specific AL [action level] specified in Table 3, *then* that location will be considered a hotspot and additional excavation for that location will be required.
  3) *If* ~~the true mean concentration of all COCs in the sols do not exceed the ALs and~~ the concentration at all locations is less than the AL, *then* the site as a whole will be considered in compliance and no further excavation will be necessary. [note that, in this context, "site as a whole" refers to an individual final status survey unit].

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

Background

The *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ICM Workplan), Revision 2, August 12, 2008, includes a site-specific confirmation sampling approach for the RRSA that applies to each final status survey (FSS) unit. The *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (QAPjP), Revision 2, August 12, 2008, establishes the decision rules to be applied to the RRSA FSS units to determine when cleanup is complete (See Section 3.1.5). These rules can be paraphrased as: 1) the mean concentration of COCs must be less than the site cleanup objectives (SCOs); and, 2) each individual sample concentration must be less than the SCOs. Since the first decision rule is less stringent than the second, it is not needed. Sections 3.1.6, Decision Error Limits, and 3.1.7, Sampling Design of the QAPjP include statistical procedures for assessing confirmation sample results. As explained in these Sections, these statistics only apply to the less stringent decision rule and do not apply to the single point data comparisons.

Thank you for your consideration of this request. Please call me at (518) 395-4956 if you have any questions.

Sincerely,

Hugh Davis
Regulatory and Waste Program Manager

cc: R. Phaneuf, NYSDEC Central Office
M. Infurna, USEPA Region II
J. Rampe, DOE-EM
T. Crandall, DOE-EM
J. Hill, NRLFO-Schenectady
D. Herman, NRLFO-Schenectady
J. O'Hearn, aRc

New York State Department of Environmental Conservation
Office of Environmental Quality, Region 4
1130 North Westcott Road, Schenectady, New York 12306-2014
Phone: (518) 357-2045 • **FAX:** (518) 357-2398
Website: www.dec.ny.gov

Alexander B. Grannis
Commissioner

February 23, 2009

Dr. Hugh Davis
Regulatory and Waste Program Manager
U.S. Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, NY 12309

Re: Modification to Confirmation Sampling Approach for the Railroad Staging Area, 2/17/09 RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation, Revision 2, 8/12/08

Dear Dr. Davis:

The Department is in receipt of your 2/17/09 request to modify the above-referenced RCRA Quality Assurance Project Plan in regard to the decision rules presently specified for determining attainment of project cleanup objectives. As we discussed on 2/13/09, the Department approves the changes to the plan as proposed in your letter.

Should you have any questions, please call me at (518) 357-2353.

Sincerely,

Margaret Rogers

Margaret Rogers
Engineering Geologist II

MR:lg\SPRULLQAPPamend.wpd.

cc: M. Infurna - USEPA Region II
J. Hill - USDOE-NRLFO)
L. Winterberger - NYSDEC Central Office
File

cc: R. Forgea - NYSDEC Region 4

Appendix A-7
Revisions to ICM Work Plan for Confirmation Sampling

From: Margaret Rogers
To: Davis, Hugh
Subject: RE: DRAFT EMAIL
Date: Thursday, December 11, 2008 9:19:24 AM

Hugh,

Thanks for the clarification (both of them). Have a nice weekend, if I don't talk to you sooner.

Margaret

>>> "Davis, Hugh" <hugh.davis@spru.doe.gov> 12/11/2008 8:29 AM >>>
OOPS-sorry, I meant to change the header on the email! Please let me know if you have any questions. Thanks,

Hugh

From: Davis, Hugh
Sent: Thursday, December 11, 2008 8:26 AM
To: Margaret Rogers
Subject: FW: DRAFT EMAIL

Margaret,

Thank you for your letter of December 4, 2008, approving the confirmation survey unit approach for the lower level cleanup.

With regard to the first point raised in your letter, you are correct that aRc's corrective action efforts will be inside the area outlined by the original SPRU grid system and will not include grids 1104, 1105, and portions of 1109 that lie outside the southwestern SPRU fence line. With regard to the sentence in ARC-PLN-6106, Revision 2, "As such, the initial planned sequence to excavate and perform confirmation sampling in SPRU Grid Units 1104 through 1113 and 1116 will not be performed until later," it would be more accurate to state: "Excavation and confirmation sampling in SPRU Grid Units 1107, 1108, 1112, 1113, and 1116 will be performed after excavations and confirmation sampling at the former K-5 Retention Basins have been completed."

Regards, Hugh

RCRA ICM WP – ARC-PLN-6106

Confirmation Sampling in SPRU Grid Units 1126, 1129, and 1130

Confirmation Sampling in SPRU Grid Unit 1126 for VOCs

Once demobilization activities are completed for the site soil staging area in SPRU Grid Unit 1126, confirmation samples will be taken in this unit and will include analysis for VOCs in addition to metals, in particular trichloroethylene (TCE) that has been detected in trace concentrations in the L5 Revetment during previous investigations. SPRU Grid Unit 1126 falls within a standard final status survey (FSS) unit consisting of 2,000 square meters in which the physical sample locations will be laid out using a random–start triangular grid pattern as usual. Sixteen samples will be taken in this FSS unit. Those samples that fall within SPRU Grid Unit 1126 will be analyzed for VOCs using EPA Method 8260B in accordance with the approved RCRA Interim Corrective Measures Quality Assurance Project Plan (ARC-PLN-6402). An example layout of the samples indicates that three (3) samples will fall within unit 1126. A minimum of five (5) samples will be taken in unit 1126 for VOC analysis. Therefore additional, biased samples will be taken beyond those that result from the FSS sampling pattern to ensure a minimum of five (5) samples are obtained with biased samples taken in the vicinity of the L5 Revetment and the previous sample boring (B3848) from the RFA SV where elevated TCE was found. The VOC sample results will be reported in a separate section of the confirmation sampling and analysis report submitted to NYSDEC for review and approval. See attached proposed FSS Unit map depicting unit 1126.

Confirmation Sampling in SPRU Grid Units 1129 and 1130 Outside the Security Fence

SPRU Grid Units 1130 includes a small area outside the lower level rail staging area that is not included in the proposed FSS Unit L. The area within SPRU Grid Unit 1129 will be included in proposed FSS Unit L for confirmation sampling and analysis for RCRA metals. As such, a sub-unit (N-1) has been designated to delineate the small area within SPRU Grid Unit 1130 that requires RCRA confirmation sampling while the remainder of proposed FSS Unit N does not. See attached proposed FSS Unit map depicting sub-unit N-1. FSS unit N is a standard FSS unit consisting of 2,000 square meters in which the physical sample locations will be laid out using a random–start triangular grid pattern as usual. Sixteen samples will be taken in this FSS unit. Those samples that fall within sub-unit N-1 will be analyzed for metals using EPA Methods 6010C and 6020 in accordance with the approved RCRA Interim Corrective Measures Quality Assurance Project Plan (ARC-PLN-6402). The remainder of proposed FSS Unit N will not be analyzed for any RCRA constituents.

Appendix B-1
SPRU Lower Level NYSDEC SPDES Permit Equivalent for LLPL Water Discharge to FSS-01

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

New York State Department of Environmental Conservation
Office of Environmental Quality, Region 4
1130 North Westcott Road, Schenectady, New York 12306-2014
Phone: (518) 357-2045 • **FAX:** (518) 357-2398
Website: www.dec.ny.gov

November 24, 2009

Alexander B. Grannis
Commissioner

Dr. Hugh Davis
Regulatory and Waste Program Manager
U.S. Department of Energy
SPRU Field Office, SP-23
2424 River Road
Niskayuna, New York 12309

Re: SPDES Permit Equivalent, Effluent Limitations and Monitoring Requirements
Discharge of Excavation Water from Separations Process Research Unit
Lower Level Parking Lot Area
EPA I.D. NYR000096859
6 NYCRR Part 373 Corrective Action Permit #4-4224-00024/00042

Dear Dr. Davis,

Per your 11/23/09 letter to both myself and Mr. Mirabile of our Division of Water, attached please find the above-referenced effluent limitations and monitoring requirements for water to be removed from the Lower Level Parking Lot excavated area, as part of the SPRU Lower Level Interim Corrective Measure ("ICM"). Please note that this permit equivalent applies only to water being removed from this area, and authorizes discharge of this water only within the boundaries of the area designated as "Final Status Survey Unit 001" (FSS-001). In addition to the parameters listed in the attachment, the Department requests that analysis be conducted for the remaining project contaminants of concern ("COC's"), to demonstrate that prior cleanup at FSS-001 is not being impacted by this action.

Please note that, per Additional Condition 1 of the attached, the Department has reviewed the processing methods for the excavated water as described in your 11/23/09 letter. The proposed action is herewith approved, as conducted in accordance with the provisions of the attached permit equivalent. An expiration date for this action has been provided, per the attached.

Should you have any questions, please call me at (518) 357-2353.

Sincerely,

Margaret Rogers

Margaret Rogers
Engineering Geologist II

MR:lg\HSR\MOR\KAPL\SPRULLPLSPDESequiv.doc.
Enc.
cc: M. Infurna – USEPA Region II
J. Hill – USDOE-NRLFO
L. Winterberger – NYSDEC Central Office
W. Mirabile – NYSDEC Central Office
A, Dzierwa – Regional Water Engineer, NYSDEC Region 4
File
ec: R. Forgea – Regional Solid and Hazardous Waste Engineer, NYSDEC Region 4

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning: **December 3, 2009**
and lasting until: **December 31, 2009**

The discharges from the treatment facility to water index number NA, Class GA , RECEIVING WATER shall be limited and monitored by the operator as specified below:

Outfall Number and Parameter	Discharge Limitations		Units	Minimum Monitoring Requirements	
	Monthly Avg.	Daily Max		Measurement Frequency	Sample Type
FSS 001 - Treated Groundwater Remediation Discharge:					
Flow	Monitor	Monitor	GPD	Continuous	Meter
pH (range)	6.5 to 8.5		SU	Monthly	Grab
Mercury, Total (EPA Method 245.1)	Monitor	1.4	µg/l	2/Month	Grab
Vanadium, Total	Monitor	100	µg/l	2/Month	Grab
VOCs (EPA Method 624) (Footnote 1)	Monitor	5.0	µg/l	2/Month	Grab
SVOCs (EPA Method 625) (Footnote 1)	Monitor	10	µg/l	2/Month	Grab
Oil & Grease	Monitor	15	mg/l	2/Month	Grab

Footnote:

1 – Limit applies separately to each individual compound.

Additional Conditions:

(1) Discharge is not authorized until such time as an engineering submission showing the method of treatment is approved by the Department. The discharge rate may not exceed the effective or design treatment system capacity. All monitoring data, engineering submissions and modification requests must be submitted to:

Division of Solid & Hazardous Materials
NYSDEC, 1130 Westcott Road
Schenectady, New York 12306-2014
Attn: Margaret Rogers

Tel: 518-357-2353

Regional Water Engineer, Region 4
NYSDEC, 1130 Westcott Road
Schenectady, New York 12306-2014
Attn: Andrea Dzierwa

Tel: 518-357-2377

Page 1 of 2

(2) Only site generated wastewater (i.e., ground water or storm water) is authorized for treatment and discharge.

(3) Authorization to discharge is valid only for the period noted above but may be renewed if appropriate. A request for renewal must be received 1 week prior to the expiration date to allow for a review of monitoring data and reassessment of monitoring requirements.

(4) Any use of corrosion/scale inhibitors, biocidal-type compounds, or other water treatment chemicals used in the treatment process must be approved by the Department prior to use.

(5) This discharge and administration of this discharge must comply with the substantive requirements of 6NYCRR Part 750.

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

New York State Department of Environmental Conservation
Office of Environmental Quality, Region 4
1130 North Westcott Road, Schenectady, New York 12306-2014
Phone: (518) 357-2045 • **FAX:** (518) 357-2398
Website: www.dec.ny.gov

Alexander B. Grannis
Commissioner

December 24, 2009

Mr. John Rampe, Manager
U.S. Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, New York 12309

Re: SPRU Request for Renewal of 11/24/09 SPDES Permit Equivalent, Effluent Limitations and Monitoring Requirements
Discharge of Excavation Water from Separations Process Research Unit, Lower Level Parking Lot Area
EPA I.D. NYR000096859
6 NYCRR Part 373 Corrective Action Permit #4-4224-00024/00042

Dear Mr. Rampe:

Per Dr. Hugh Davis's 12/21/09 letter to me, and the Department's conference call of the same day with SPRU, NRLFO and aRc personnel, attached please find the above-referenced SPDES permit equivalent renewal for the period of 1/1/10 through 2/28/10. Pursuant to the original SPDES permit equivalent, and our 12/21/09 conference call, the renewed permit equivalent specifies effluent limitations and monitoring requirements for water to be removed from the Lower Level Parking Lot excavation during the SPRU Lower Level Interim Corrective Measure ("ICM").

Please note that this permit equivalent applies only to water being removed from the Lower Level Parking Lot, and authorizes discharge of this water only within the boundaries of the area designated as "Final Status Survey Unit 001" (FSS-001). All other conditions pertaining to water collection, filtration and discharge will remain in effect as previously required. In addition to the parameters listed in the attachment, the Department requests that analysis be conducted for the remaining project contaminants of concern ("COC's"), to demonstrate that prior cleanup at FSS-001 is not being impacted by this action.

Should you have any questions of the foregoing, please call me at (518) 357-2353.

Sincerely,

Margaret Rogers

Margaret Rogers
Engineering Geologist II

Enc.

cc: M. Infurna – USEPA Region II
J. Hill – USDOE-NRLFO
L. Winterberger – NYSDEC Central Office
W. Mirabile – NYSDEC Central Office
A, Dzierwa – Regional Water Engineer, NYSDEC Region 4
File

ec: R. Forgea – Regional Solid and Hazardous Waste Engineer, NYSDEC Region 4

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning: **January 1, 2010**
and lasting until: **February 28, 2010**

The discharges from the treatment facility to water index number NA, Class GA, RECEIVING WATER shall be limited and monitored by the operator as specified below:

Outfall Number and Parameter	Discharge Limitations		Units	Minimum Monitoring Requirements	
	Monthly Avg.	Daily Max		Measurement Frequency	Sample Type
FSS 001 - Treated Groundwater Corrective Action Discharge:					
Flow	Monitor	Monitor	GPD	Continuous	Meter
pH (range)	6.5 to 8.5		SU	Monthly	Grab
Mercury, Total (EPA Method 245.1)	Monitor	1.4	µg/l	2/Month	Grab
Vanadium, Total	Monitor	170	µg/l	2/Month	Grab
VOC's (EPA Method 624) (Footnote 1)	Monitor	5.0	µg/l	2/Month	Grab
SVOC's (EPA Method 625) (Footnote 1)	Monitor	10	µg/l	2/Month	Grab
Oil & Grease	Monitor	15	mg/l	2/Month	Grab

Footnote:

1 – Limit applies separately to each individual compound.

Additional Conditions:

(1) Discharge is not authorized until such time as an engineering submission showing the method of treatment is approved by the Department. The discharge rate may not exceed the effective or design treatment system capacity. All monitoring data, engineering submissions and modification requests must be submitted to:

Division of Solid & Hazardous Materials
NYSDEC, 1130 Westcott Road
Schenectady, New York 122306-2014
Attn: Margaret Rogers

Tel: 518-357-2353

Regional Water Engineer, Region 4
NYSDEC, 1130 Westcott Road
Schenectady, New York 122306-2014
Attn: Andrea Dzierwa

Tel: 518-357-2377

(2) Only site generated wastewater (i.e., ground water or storm water) is authorized for treatment and discharge.

(3) Authorization to discharge is valid only for the period noted above but may be renewed if appropriate. A request for renewal must be received 1 week prior to the expiration date to allow for a review of monitoring data and reassessment of monitoring requirements.

(4) Any use of corrosion/scale inhibitors, biocidal-type compounds, or other water treatment chemicals used in the treatment process must be approved by the Department prior to use.

(5) This discharge and administration of this discharge must comply with the substantive requirements of 6 NYCRR Part 750.

Appendix B-2
SPRU Lower Level Post Water Discharge Sampling of FSS-01

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture
SPRU Field Office SP-26
2425 River Road
Niskayuna, NY 12309

May 12, 2010 LAR-10-041

Matthew Zullo, Federal Project Director
U.S. Department of Energy
SPRU Field Office, SP-23
2425 River Road
Niskayuna, New York 12309

Subject: CONTRACT NO. DE-AM09-05SR22399/Task Order: DE-AT30 7CC60013/SP15.
Response to SPRU Field Office Acceptance of Final Status Survey Unit 2, 3, 4, 5, and 6 Radiological and Chemical Reports and Request for aRc Action (SPRU 10-011).

Mr. Zullo:

On January 19, 2010 the U.S. Department of Energy, Separations Process Research Unit (DOE-SPRU) Field Office accepted the revised chemical and radiological Final Status Survey (FSS) unit 2 through 6 report subject to aRc resolution of comments enclosed with SPRU 10-011. aRc's resolutions to the DOE's comments were submitted on January 27, 2010 (LAR-10-005).

DOE also requested, based on aRc's discharging of groundwater from excavations in the Lower Level Rail Bed and the Lower Level Parking Lot, a sample strategy to resample FSS 1 and report any findings. Additionally, DOE requested a summary of the groundwater discharges to FSS 1. Attached are a summary of groundwater discharges to FSS 1(Attachment 1), the FSS 1 sampling strategy (Attachment 2), and the findings from the requested additional sampling in FSS-01 (Attachment 3).

Should you have any questions or require further information please contact the undersigned at 518-344-2860.

Sincerely,

Doug Collins, Deputy Project Manager
Accelerated Remediation Company

Attachment: As stated

Date	Volume (gal) EX-10	LLPL
27-Jul-09	1,900	
28-Jul-09	9,818	
29-Jul-09	4,909	
29-Jul-09	23,450	
30-Jul-09	16,162	
31-Jul-09	22,863	
31-Jul-09	28,096	
1-Aug-09	11,285	
1-Aug-09	7,428	
2-Aug-09	11,959	
3-Aug-09	10,161	
4-Aug-09	8,206	
4-Aug-09	7,050	
6-Aug-09	4,909	
10-Aug-09	10,552	
10-Aug-09	10,552	
17-Aug-09	15,244	
25-Aug-09	19,454	
31-Aug-09	18,372	
8-Sep-09	16,809	
10-Sep-09	15,244	
26-Oct-10		4,000
29-Oct-09		2,500
30-Oct-09		3,000
3-Nov-09		3,000
4-Nov-09	5,435	
5-Nov-09	18,827	
6-Nov-09	7,815	
9-Nov-09	8,206	
11-Nov-09	12,898	
12-Nov-09	10,552	
1-Dec-09		6,000
3-Dec-09		1,700
4-Dec-10		2,500
7-Dec-09		4,750
16-Dec-09		2,850
5-Jan-10	7,000	
6-Jan-10	8,206	
7-Jan-10	20,266	
8-Jan-10	30,266	
Subtotals	403,894	30,300
total volume	434,194	gallons

SummaryTables for Ground Water Discharges from Excavation #10 and the Lower Level Parking Lot to FSS-01

		Excavation #10 Data Summary			LLPL Data Summary			
	ARC-PLN-6404 Dishcarge Limits	5/29/2009 SSW-001-001	7/7/2009 SWW-EX1-001	7/7/2009 SWW-EX1-001 dissolved	11/3/2009 SSW-002-001	11/3/2009 SSW-EX15-001	11/3/2009 SSW-EX15-001 dissolved	12/18/2009** SSW-004-001-R
Parameter	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
Antimony	6		7 B	ND	ND	ND	ND	
Arsenic	50	2.3 B	2.6	ND	4.2 B	10.5	4.0 B	
Cadmium	10	ND	1.7	ND	ND	1.3 B	ND	
Trivalent chromium	100	ND	ND	ND	ND	10.9	ND	
Cobalt	Monitor	ND	ND	ND	ND	6.6 B	ND	
Copper	400	5.2 B	5.6 B	4.7 B	7.0 B	88.1	8.8 B	
Lead	50	2.4 B	ND	ND	ND	29	ND	
Silver	100	ND	ND	ND	ND	ND	ND	
Thallium	Monitor	ND	ND	ND	ND	ND	3.3 B	
Vanadium	Monitor	ND	4.1 B	ND	53.7	211	147	157
Zinc	5000	29 E	10 B	18	29.2	134	7.9 B	< PQL
Mercury	1.4	ND	0.071	.067 B	0.13 B	3.5	0.2	< PQL
Acetone	50	6.4	ND	na	14	9.5	na	
Trichloroethylene (TCE)	5	ND	ND	na		ND	na	
PAHs 8270c		ND						
624 TAL VOCs	100				ND or <RL	ND or <RL*		< PQL
625 TAL SVOCs	100				ND			< PQL
Total suspended solids	< 500mg/l	3.0 B			14			
Oil and grease	15 mg/l	1.7 B,J			7.2			< PQL
pH	6.5-8.5		7.9					
Radionuclide	DL pCi/l	pCi/l	pCi/l		pCi/l	pCi/l		
Gross alpha	15	3.1	3.2 U		11 U	15 U		
Gross beta	1000	10.7	8.5		13	26		
Am-241	30	0.022 U	-0.027 U		-0.017U	0.042 U		
Cs-137	3000	3 U	2.8 U		-0.9 U	-1 U		
H-3	2.0 E+6	20 U			-7 U			
Pu-238	40	0.073 U	0.06 U		-0.008 U	-0.066 U		
Pu-239/240	30	0.019 U	-0.045 U		-0.049 U	-0.017 U		
Pu-241	2000	-0.6 U			0.6 U	-0.6 U		
Sr-90	1000	5.07			2.18	1.66		
Th-232	400	-0.020 U	0.031 U		0.005 U	0.2		
U (total)	500	3.26	2.25		2.67	7.95		

* Sample results less non detect or below reporting limit except Butyl benzyl phthalate at 8.0 ug/l.

** Sample collected by aRc, transferred to KAPL for radiological analysis for release to Adirondack Labs for chemical analysis. No definition for PQL provided.

B flag indicates estimated results. Result is less than reporting limit (RL).

U flag indicates result is less than the instrument detection liimit.

E flag indicates matrix interference.

ND = Non detect, RL = Reporting Limit

Sampling Strategy for FSS 1 Receiving LLPL and LLRB Excavation Groundwater Discharges

To assess the impacts to FSS-01 from the non-routine water discharge, two locations will be sampled for chemical and two locations for radiological analyses following procedures in ARC-WP-07, *Work Package for Sampling and Analysis Tasks Associated with the SPRU- LA Lower Level Remediation,* Section 12.1 with a few minor variations.

1. One biased location will be chosen for the chemical sample location at the point where the discharge of the water occurred (near the end of the hose); the second location will be chosen based on guidance from NYSDEC DER-10 down gradient of the biased sample point.
2. Sample location will be screened by the XRF.
3. Soil samples will be collected for TAL Total Metals, VOCs, SVOCs and and Gamma Spec analyses.

The radiological surveys/sampling will be conducted using the following approach:

1. The area down gradient of the FSS 1 groundwater discharge point will be scanned using a Ludlum Model 44-10 2" x 2" detector, coupled with a Ludlum Model 2221 scaler/ratemeter. Based on observations during groundwater discharges, the visible flow of groundwater discharged was confined to an area approximately twenty feet wide by sixty feet wide down gradient of the FSS 1 discharge location.
2. One biased location will be chosen at the point where the discharge of the water occurred (near the end of the hose) 1x 500 mL plastic Marenilli, the second location will be selected based on the most elevated scan readings within the area of general discharge. The samples collected will be analyzed in the on-site laboratory by gamma spectroscopy to ensure that concentrations of gamma emitters are less than their respective DCGLs (< 30 pCi/gm) and that their SORs are less than half of unity (< 0.50). In addition, the two samples will be sent to an off-site laboratory to be analyzed for Strontium-90.
3. ROC's that are not quantifiable by on-site analysis will be assumed to be at or near background levels for the SOR calculation. In addition, if the on-site analysis exceeds the SOR of 0.50, the sample will be analyzed at an off-site commercial laboratory (Test America) for the 11 radionuclides of concern.

Upon completion of the radiological screening of the area, the soil sampling will occur as follows:

1. Conduct pre-job briefing to work package ARC-WP-007.
2. Locate sampling location at water discharge location in FSS-01.
3. Collect VOC sample using disposable scoop and place directly in sample container.
4. Collect soil using disposable scoop from approximately 6-in. diameter by 6-12 in. deep plug into an aluminum pan.
5. Composite the soil using the cone and quarter method described in ARC-WP-007.
6. Transfer composited sample material to appropriate container defined in ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, and summarized in table below.
7. Record sampling information on sample container and in field sampling logbook.
8. Prepare and ship sample to offsite laboratory for analyses.

Parameter	Analytical Method	Matrix Sample	Containers	Preservation	Hold Times
TAL total metals	6010B and 7471A for Hg	Soil	1 × 250-mL widemouth glass container with PTFE-lined cap	<6°C	6 months/ 28 days Hg
VOCs	8260B	Soil	1 x 125 mL glass jar with PTFE-lined lid	<6°C	14 days
VOCs	8260B	Water (Trip Blank)	3 × 40 mL glass vial with PTFE-lined septum cap	<6°C HCL	14 days
SVOCs	8270C	Soil	1 × 250-mL widemouth glass container with PTFE-lined cap	<6°C	14/40 days
Gamma Spec	EML-GA-01-R	Soil	1x 500 mL plastic Marenilli	NA	6 months
Sr-90(total)	DOE-SR-02-RC-Mod	Soil	1x 500 mL plastic Marenilli	NA	6 months

If additional off-site radiological analysis is required additional sample analysis methods and collection will be provided.

1

3/16/2010

Soil Sampling Results for Area FSS-01, Post Water Discharges

Sampling to assess the impacts to FSS-01 from the aRc non-routine water discharges, were conducted at two locations. Each location was sampled for chemical and for radiological analyses following procedures in ARC-WP-07, *Work Package for Sampling and Analysis Tasks Associated with the SPRU- LA Lower Level Remediation,* Section 12.1. One biased location was chosen at the point where the discharge of the water occurred (near the end of the hose); the second location was chosen based on guidance from NYSDEC DER-10 down gradient of the biased sample point (see figure 1 for sample locations).

Samples were collected for Total Metals, SVOCs, VOCs, Total Strontium and Gamma Spec. All but the Gamma Spec samples were sent to Test America, St Louis for analyses. Gamma spec was analyzed at the on-site laboratory. All off-site laboratory data was validated by Portage Inc. Table 1 provides the analytical results and data validation flagging for the two samples.

All metal COCs subject to RCRA requirements analyzed in the FSS-01 discharge area had concentrations below the corresponding SCOs, with the exception of arsenic and antimony. Validated analytical data for arsenic and antimony in both samples exceed the project's SCO of 16 mg/kg for arsenic and 1 mg/kg for antimony. All of FSS-01 is located within the railbed voluntary clean up area where arsenic and antimony presence is associated with historic railroad activities and those constituents were not required to meet project SCOs. The RCRA interim report for FSS-01 (ARC-RPT-6005) reported concentration of arsenic and antimony above SCO similar to the concentration report with this sampling.

Similar to metals, low levels of SVOC were found in both samples however all results were below SCOs. SVOC in these samples would be expected because sample results from PAH sampling in FSS-01 reported in Interim report ARC-RPT-6005 indicated SVOCs above SCO were left in this area because they were associated with historical railroad activities and were not required to be removed from the voluntary cleanup area of FSS-01.

VOC data for the two samples had hits for acetone and methylene chloride in both samples and trichloroethene in one sample. All VOC concentrations are below SCOs.

Tables 1 and 2 provide radiological analytic results for the two samples. Walkover scans were also performed in the area using a 2" x2" Sodium iodide detector probe. These results found no elevated locations and are plotted on Figure 1.

Review of the chemical and radiological data from the FSS-01 post water discharge samples indicate there was no impact in chemical or radiological concentration in FSS-01 due to non-routine water discharges in this area.

Table 1 FSS-01 Post Groundwater Discharge Sampling (4-1-10)

CLIENT ID	METHOD	COMPOUND NAME	RESULT	UNITS	RPT LIMIT	Lab Flag	Val Flag	DIL
SGD-001-001-V	8260B	1,1,1-Trichloroethane	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	1,1-Dichloroethane	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	1,1-Dichloroethene	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	1,2,4-Trimethylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-001-V	8260B	1,2-Dichlorobenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-001-V	8260B	1,2-Dichloroethane	0.0058	mg/kg	0.0058	U		1
SGD-001-001-V	8260B	1,3,5-Trimethylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-001-V	8260B	1,3-Dichlorobenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-001-V	8260B	1,4-Dichlorobenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-001-V	8260B	1,4-Dioxane	0.093	mg/kg	0.093	U	R	1
SGD-001-001-V	8260B	Acetone	0.012	mg/kg	0.023	J	J	1
SGD-001-001-V	8260B	Benzene	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	Carbon tetrachloride	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	Chlorobenzene	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	Chloroform	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	cis-1,2-Dichloroethene	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	Ethylbenzene	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	Methyl ethyl ketone	0.023	mg/kg	0.023	U		1
SGD-001-001-V	8260B	Methyl tert-butyl ether	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	Methylene chloride	0.012	mg/kg	0.0082		J	1
SGD-001-001-V	8260B	n-Butylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-001-V	8260B	n-Propylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-001-V	8260B	sec-Butylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-001-V	8260B	tert-Butylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-001-V	8260B	Tetrachloroethene	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	Toluene	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	trans-1,2-Dichloroethene	0.0058	mg/kg	0.0058	U		1
SGD-001-001-V	8260B	Trichloroethene	0.012	mg/kg	0.012	U		1
SGD-001-001-V	8260B	Vinyl chloride	0.0058	mg/kg	0.0058	U		1
SGD-001-001-V	8260B	Xylenes (total)	0.012	mg/kg	0.012	U		1
SGD-001-002-V	8260B	1,1,1-Trichloroethane	0.012	mg/kg	0.012	U		1
SGD-001-002-V	8260B	1,1-Dichloroethane	0.012	mg/kg	0.012	U		1
SGD-001-002-V	8260B	1,1-Dichloroethene	0.012	mg/kg	0.012	U		1
SGD-001-002-V	8260B	1,2,4-Trimethylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-002-V	8260B	1,2-Dichlorobenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-002-V	8260B	1,2-Dichloroethane	0.0058	mg/kg	0.0058	U		1
SGD-001-002-V	8260B	1,3,5-Trimethylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-002-V	8260B	1,3-Dichlorobenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-002-V	8260B	1,4-Dichlorobenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-002-V	8260B	1,4-Dioxane	0.093	mg/kg	0.093	U	R	1
SGD-001-002-V	8260B	Acetone	0.0096	mg/kg	0.023	J	J	1
SGD-001-002-V	8260B	Benzene	0.012	mg/kg	0.012	U		1
SGD-001-002-V	8260B	Carbon tetrachloride	0.012	mg/kg	0.012	U		1
SGD-001-002-V	8260B	Chlorobenzene	0.012	mg/kg	0.012	U	UJ	1
SGD-001-002-V	8260B	Chloroform	0.012	mg/kg	0.012	U		1
SGD-001-002-V	8260B	cis-1,2-Dichloroethene	0.012	mg/kg	0.012	U		1
SGD-001-002-V	8260B	Ethylbenzene	0.012	mg/kg	0.012	U	UJ	1
SGD-001-002-V	8260B	Methyl ethyl ketone	0.023	mg/kg	0.023	U		1
SGD-001-002-V	8260B	Methyl tert-butyl ether	0.012	mg/kg	0.012	U		1
SGD-001-002-V	8260B	Methylene chloride	0.0085	mg/kg	0.0081		J	1
SGD-001-002-V	8260B	n-Butylbenzene	0.012	mg/kg	0.012	U	R	1

Table 1 FSS-01 Post Groundwater Discharge Sampling (cont.)(4-1-10)

CLIENT ID	METHOD	COMPOUND NAME	RESULT	UNITS	RPT LIMIT	Lab Flag	Val Flag	DIL
SGD-001-002-V	8260B	n-Propylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-002-V	8260B	sec-Butylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-002-V	8260B	tert-Butylbenzene	0.012	mg/kg	0.012	U	R	1
SGD-001-002-V	8260B	Tetrachloroethene	0.012	mg/kg	0.012	U	UJ	1
SGD-001-002-V	8260B	Toluene	0.012	mg/kg	0.012	U	UJ	1
SGD-001-002-V	8260B	trans-1,2-Dichloroethene	0.0058	mg/kg	0.0058	U		1
SGD-001-002-V	8260B	Trichloroethene	0.0016	mg/kg	0.012	J	J	1
SGD-001-002-V	8260B	Vinyl chloride	0.0058	mg/kg	0.0058	U		1
SGD-001-002-V	8260B	Xylenes (total)	0.012	mg/kg	0.012	U	UJ	1

CLIENT ID	METHOD	COMPOUND NAME	RESULT	UNITS	MDC	Lab Flag	Val Flag	DILUTION
SGD-001-001-R	SR-03-RC MOD	Strontium Total	0.04	pCi/g	0.32	U	U	1
SGD-001-002-R	SR-03-RC MOD	Strontium Total	0.17	pCi/g	0.3	U	U	1

CLIENT ID	METHOD	COMPOUND NAME	RESULT	UNITS	RPT LIMIT	Lab Flag	Val Flag	DILUTION
SGD-001-001-S	8270C	Acenaphthene	380	ug/kg	380	U		1
SGD-001-001-S	8270C	Acenaphthylene	380	ug/kg	380	U		1
SGD-001-001-S	8270C	Anthracene	380	ug/kg	380	U		1
SGD-001-001-S	8270C	Benzo(a)anthracene	140	ug/kg	380	J	J	1
SGD-001-001-S	8270C	Benzo(a)pyrene	130	ug/kg	380	J	J	1
SGD-001-001-S	8270C	Benzo(b)fluoranthene	180	ug/kg	380	J	J	1
SGD-001-001-S	8270C	Benzo(ghi)perylene	66	ug/kg	380	J	J	1
SGD-001-001-S	8270C	Benzo(k)fluoranthene	190	ug/kg	380	J	J	1
SGD-001-001-S	8270C	Chrysene	180	ug/kg	380	J	J	1
SGD-001-001-S	8270C	Dibenz(a,h)anthracene	380	ug/kg	380	U		1
SGD-001-001-S	8270C	Fluoranthene	270	ug/kg	380	J	J	1
SGD-001-001-S	8270C	Fluorene	380	ug/kg	380	U		1
SGD-001-001-S	8270C	Indeno(1,2,3-cd)pyrene	51	ug/kg	380	J	J	1
SGD-001-001-S	8270C	Naphthalene	380	ug/kg	380	U		1
SGD-001-001-S	8270C	Phenanthrene	100	ug/kg	380	J	J	1
SGD-001-001-S	8270C	Pyrene	220	ug/kg	380	J	J	1
SGD-001-002-S	8270C	Acenaphthene	380	ug/kg	380	U		1
SGD-001-002-S	8270C	Acenaphthylene	380	ug/kg	380	U		1
SGD-001-002-S	8270C	Anthracene	380	ug/kg	380	U		1
SGD-001-002-S	8270C	Benzo(a)anthracene	42	ug/kg	380	J	J	1
SGD-001-002-S	8270C	Benzo(a)pyrene	39	ug/kg	380	J	J	1
SGD-001-002-S	8270C	Benzo(b)fluoranthene	48	ug/kg	380	J	J	1
SGD-001-002-S	8270C	Benzo(ghi)perylene	380	ug/kg	380	U		1
SGD-001-002-S	8270C	Benzo(k)fluoranthene	55	ug/kg	380	J	J	1
SGD-001-002-S	8270C	Chrysene	53	ug/kg	380	J	J	1
SGD-001-002-S	8270C	Dibenz(a,h)anthracene	380	ug/kg	380	U		1
SGD-001-002-S	8270C	Fluoranthene	95	ug/kg	380	J	J	1
SGD-001-002-S	8270C	Fluorene	380	ug/kg	380	U		1
SGD-001-002-S	8270C	Indeno(1,2,3-cd)pyrene	380	ug/kg	380	U		1
SGD-001-002-S	8270C	Naphthalene	380	ug/kg	380	U		1
SGD-001-002-S	8270C	Phenanthrene	380	ug/kg	380	U		1
SGD-001-002-S	8270C	Pyrene	76	ug/kg	380	J	J	1

Table 1 FSS-01 Post Groundwater Discharge Sampling (cont.)(4-1-10)

CLIENT ID	METHOD	COMPOUND NAME	RESULT	UNITS	RPT LIMIT	Lab Flag	Val Flag	DIL
CLIENT ID	METHOD	COMPOUND NAME	RESULT	UNITS	MDL	Lab Flag	Val Flag	DILUTION
SGD-001-001-M	6010B	Aluminum	6910	mg/kg	163	NE		10
SGD-001-001-M	6020	Antimony	1.4	mg/kg	0.076	E		1
SGD-001-001-M	6010B	Arsenic	40	mg/kg	0.37	E		1
SGD-001-001-M	6010B	Barium	61.6	mg/kg	0.29			1
SGD-001-001-M	6010B	Beryllium	0.59	mg/kg	0.2			1
SGD-001-001-M	6010B	Cadmium	0.58	mg/kg	0.58	U		10
SGD-001-001-M	6010B	Calcium	8230	mg/kg	155	NE*	J	10
SGD-001-001-M	6010B	Chromium	14.1	mg/kg	0.36			1
SGD-001-001-M	6010B	Cobalt	9.8	mg/kg	1.1			1
SGD-001-001-M	6010B	Copper	83.1	mg/kg	0.85	E		1
SGD-001-001-M	6010B	Iron	22900	mg/kg	34.6	NE	J	10
SGD-001-001-M	6010B	Lead	58.4	mg/kg	0.2	E	J	1
SGD-001-001-M	6010B	Magnesium	4200	mg/kg	96.8	NE*	J	10
SGD-001-001-M	6010B	Manganese	358	mg/kg	0.18	N		1
SGD-001-001-M	7471A	Mercury	0.11	mg/kg	0.007	E		1
SGD-001-001-M	6010B	Nickel	24.5	mg/kg	0.26			1
SGD-001-001-M	6010B	Potassium	848	mg/kg	393	N	J	1
SGD-001-001-M	6010B	Selenium	3.4	mg/kg	3.4	U		10
SGD-001-001-M	6010B	Silver	0.27	mg/kg	0.27	U		1
SGD-001-001-M	6010B	Sodium	61	mg/kg	54.9	B		1
SGD-001-001-M	6020	Thallium	0.14	mg/kg	0.14	U		2
SGD-001-001-M	6010B	Vanadium	33.5	mg/kg	1.5			1
SGD-001-001-M	6010B	Zinc	363	mg/kg	2.3			1
SGD-001-002-M	6010B	Aluminum	11700	mg/kg	163	NE		10
SGD-001-002-M	6020	Antimony	1.2	mg/kg	0.076	E		1
SGD-001-002-M	6010B	Arsenic	22.7	mg/kg	0.37	E		1
SGD-001-002-M	6010B	Barium	86.8	mg/kg	0.29			1
SGD-001-002-M	6010B	Beryllium	0.82	mg/kg	0.2			1
SGD-001-002-M	6010B	Cadmium	0.58	mg/kg	0.58	U		10
SGD-001-002-M	6010B	Calcium	15200	mg/kg	155	NE*	J	10
SGD-001-002-M	6010B	Chromium	20.4	mg/kg	0.36			1
SGD-001-002-M	6010B	Cobalt	15.6	mg/kg	1.1			1
SGD-001-002-M	6010B	Copper	49.5	mg/kg	0.84	E		1
SGD-001-002-M	6010B	Iron	32300	mg/kg	34.5	NE	J	10
SGD-001-002-M	6010B	Lead	24	mg/kg	0.2	E	J	1
SGD-001-002-M	6010B	Magnesium	8630	mg/kg	96.6	NE*	J	10
SGD-001-002-M	6010B	Manganese	573	mg/kg	0.18	N		1
SGD-001-002-M	7471A	Mercury	0.038	mg/kg	0.007	BE		1
SGD-001-002-M	6010B	Nickel	35.1	mg/kg	0.26			1
SGD-001-002-M	6010B	Potassium	1510	mg/kg	392	N	J	1
SGD-001-002-M	6010B	Selenium	3.4	mg/kg	3.4	U		10
SGD-001-002-M	6010B	Silver	0.27	mg/kg	0.27	U		1
SGD-001-002-M	6010B	Sodium	55.8	mg/kg	54.7	B		1
SGD-001-002-M	6020	Thallium	0.13	mg/kg	0.13	U		2
SGD-001-002-M	6010B	Vanadium	29.9	mg/kg	1.5			1
SGD-001-002-M	6010B	Zinc	143	mg/kg	2.3			1

Laboratory Flags

* = Relative Percent Difference is outside stated control limits

U = The analyte was analyzed for but was not detected. The reported concentration is the method detection limit.

B = Result is between the MDL and the Reporting limit. (metals)

N = Spike analyte recovery outside stated control limits

E = Reported value an estimate because of the presence of interferance

J =Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.

Validation Flags

J =Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.

U = The analyte was analyzed for but was not detected. The reported concentration is the method detection limit.

R: Rejected

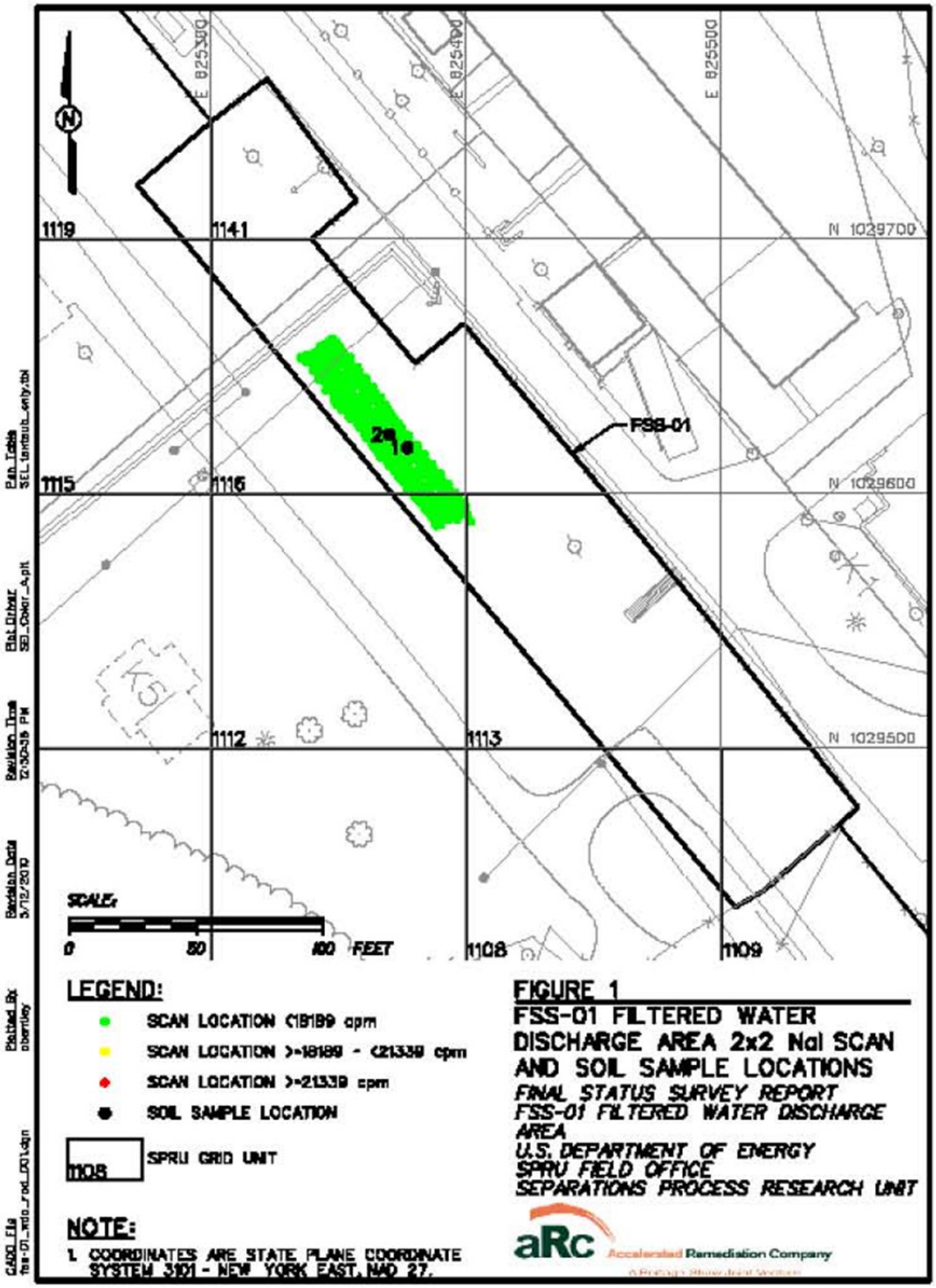
UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample

Table 2 Judgmental sample results summary for FSS-01 water discharge area

	Nuclide	Co-60	Sr-90[5]	Cs-137	Th-232	U-234	U-235	U-238	Pu-238	Pu-239/240	Pu-241	Am-241	SOR
	DCGL	9.78	4654	30	9.05	1162	188	851	792	714	19120	574	1.00
Sample ID	SGD-001-001-R	*0.101*	*0.32*	0.392	*0.654*	NA	*0.15*	*0.313*	*113*	*109*	NA	*1.23*	0.394
	SGD-001-002-R	*0.105*	*0.30*	*0.098*	*0.55*	NA	*0.115*	*0.267*	*91.1*	*88.3*	NA	*0.913*	0.316

NOTES:

1. All DCGLs and numerical results are reported in units of pCi/g.
2. All samples were analyzed by onsite gamma spectroscopy.
3. Values in *italics* are qualified as "U" and represent the minimum detectable activity.
4. NA = not analyzed. Because the analyses are performed only by gamma spectroscopy, the analysis for Sr-90, U-234, and Pu-241 is not possible.
5. Sr-90 was analyzed by the offsite laboratory. These results underwent validation.


E 825300
E 825400
E 825500
N
1119
1141
N 1029700
FSS-01
2
1115
1116
N 1029600
1112
1113
N 1029500
SCALE:
0
50
100 FEET
1108
1109
LEGEND:
SCAN LOCATION <18189 cpm
SCAN LOCATION >=18189 - <21339 cpm
SCAN LOCATION >=21339 cpm
SOIL SAMPLE LOCATION
1108
SPRU GRID UNIT
NOTE:
1. COORDINATES ARE STATE PLANE COORDINATE SYSTEM 3101 - NEW YORK EAST, NAD 27.
FIGURE 1
FSS-01 FILTERED WATER DISCHARGE AREA 2x2 NaI SCAN AND SOIL SAMPLE LOCATIONS
FINAL STATUS SURVEY REPORT
FSS-01 FILTERED WATER DISCHARGE AREA
U.S. DEPARTMENT OF ENERGY
SPRU FIELD OFFICE
SEPARATIONS PROCESS RESEARCH UNIT
aRc Accelerated Remediation Company

Appendix C
SPRU Lower Level Well Decommissioning Logs

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

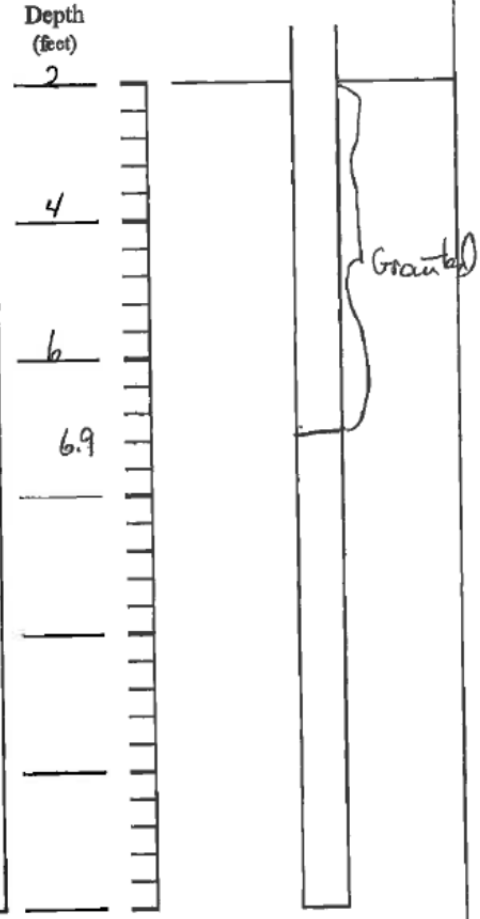
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: LWT-2
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: STB Services Inc.	Inspector: K. Dusek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	6.9
Casing type/dia. (in)	1
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-6.9
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: LWT-2 Removed grout pipe and identified with tag. Hole backfilled and decommissioned per NYS Dept of Environmental Conservation Monitoring Well Decommissioning Procedure (Nov 2009)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Accelerated Remediation Company
A Portage-Shaw Joint Venture

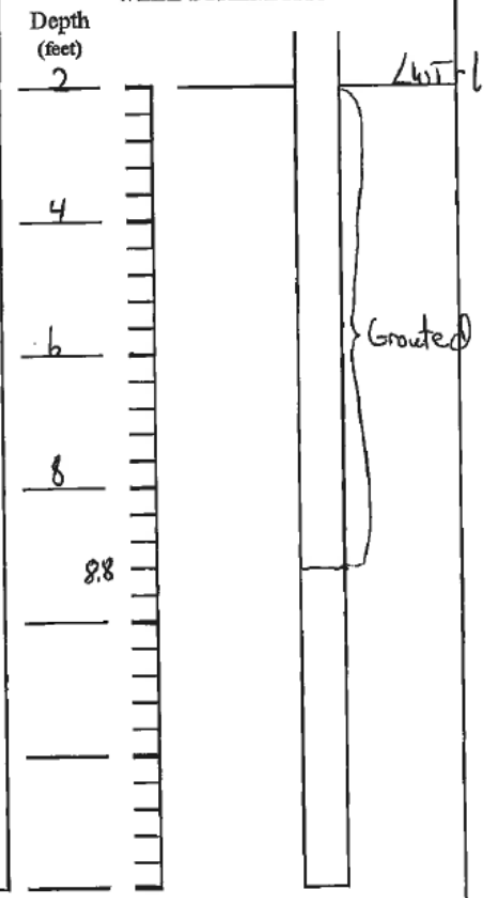
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: LWT-1
Site Location: KAPL	Driller: R Ciccateri
Drilling Co.: SJB Services Inc	Inspector: Kevin Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	8.8
Casing type/dia. (in)	1
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-8.8 ft
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: LWT-1 was pulled and decommissioned in accordance with NY State Dept of Environmental Conservation Monitoring Well Decommissioning Procedure (NOV 2009). Guard pipe removed and well identified with tag.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

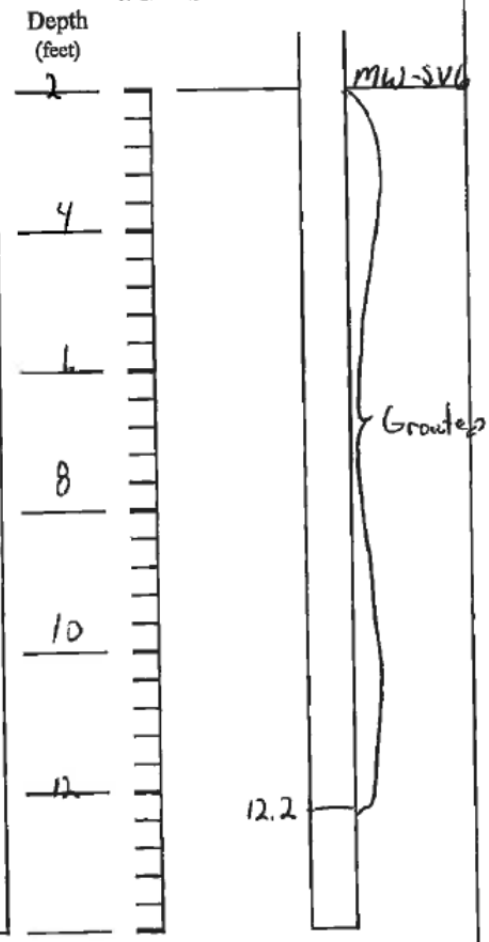
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU LOWER Level	Well I.D.: MW-~~SV4~~ SV6
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services Inc.	Inspector: K. Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	12.8
Casing type/dia. (in)	2
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: MW-SV6 Removed curb box and identified with tag. Pulled casing and decommissioned per NY State Dept. of Environmental Conservation Monitoring Well Decommissioning Procedure (Nov 2001). Identified with tag

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Accelerated Remediation Company
A Portage-Shaw Joint Venture

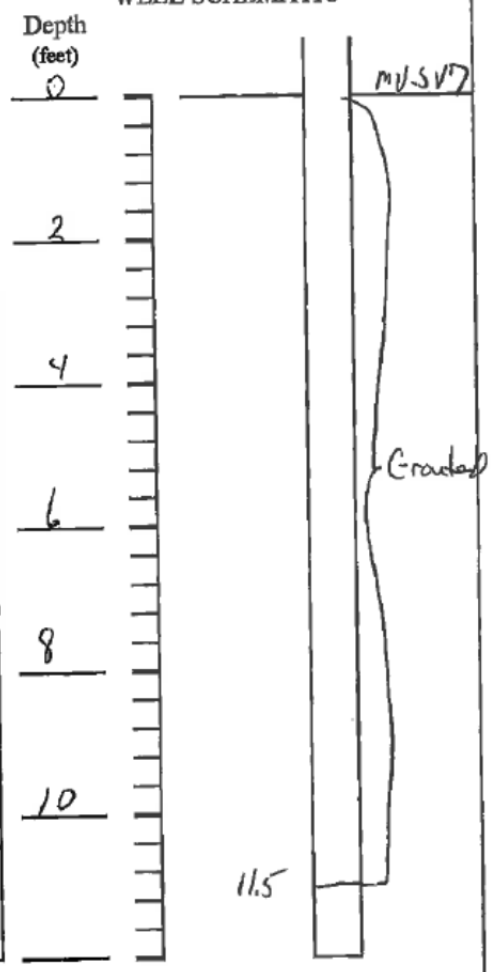
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: MW-SV7
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services Inc.	Inspector: K. Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	11.5
Casing type/dia. (in)	2
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: MW SV7 Removed curb box and identified with tag. Filled casing and decommissioned per NY State Dept of Envl Conservation Monitoring well decommissioning Procedure (Nov 2009) Present

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Accelerated Remediation Company
A Portage-Shaw Joint Venture

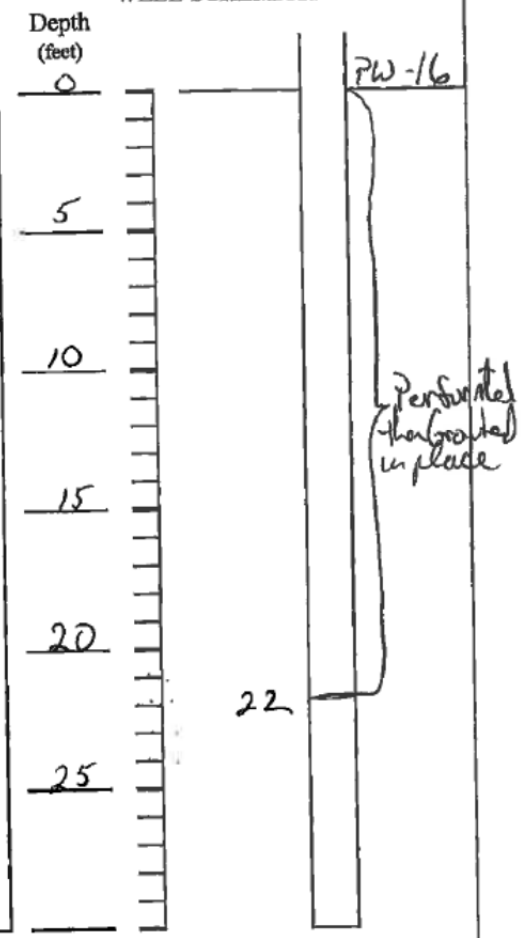
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: PW-16
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: STR Services Inc.	Inspector: K Dufek
	Date: 6-17-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	Geoprobe
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-22 ft
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: PW-16 casing could not be pulled because of cemented in place. Well was grouted in place per procedures on NY State Dept of ENV. Conservation Monitoring well decommissioning procedure (NOV 2005) curb box removed & dirt. seal with tag.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, e.g. well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

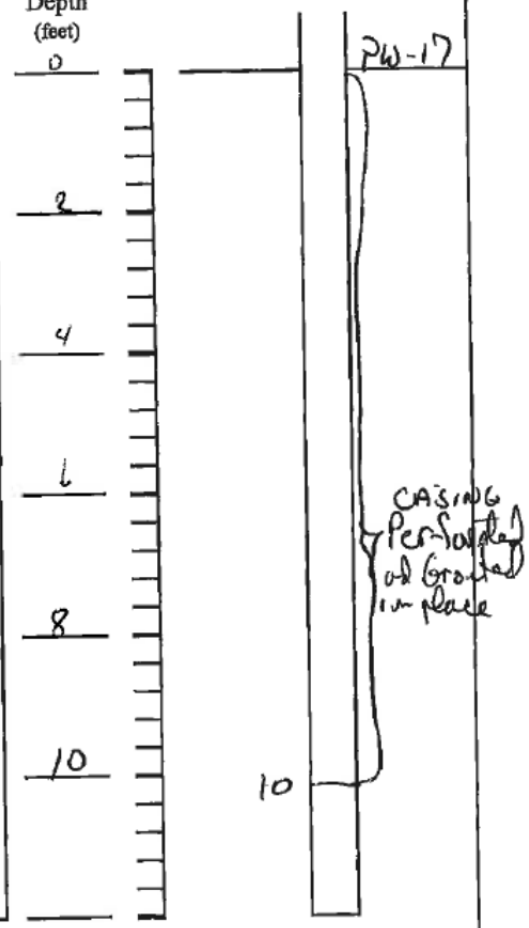
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: PW-17
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services Inc	Inspector: K. DuSek
	Date: 6-17-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	Keyhole
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-10 ft
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: PW-17 was grouted in place because well caved in place. Well was grouted in place per procedures in NY State Dept. of Env. Conservation Monitoring Well Decommissioning Procedure (Nov 2009) Curbhox removed. Identified with tag.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

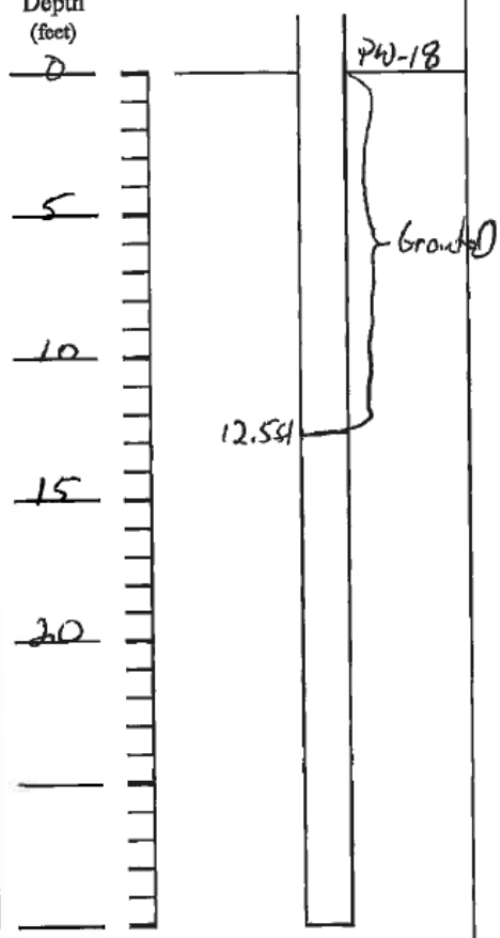
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: PW-18
Site Location: KAPL	Driller: R. Cicenteri
Drilling Co.: SJB Services Inc.	Inspector: K. Dufek
	Date: 6-10-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	12.5
Casing type/dia. (in)	2
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-12.5
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: PW-18 was pulled and grouted with bag remedial clay, tag installed per NY State Dept of Environmental Conservation Procedure Manual Well decommissioning (Nov 2005)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

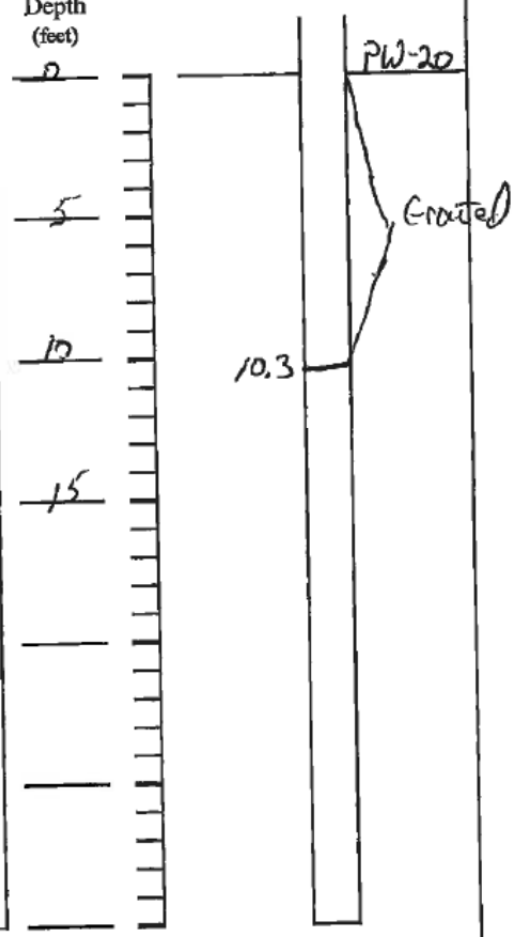
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: PW-20
Site Location: KAPL	Driller: R Ciccateri
Drilling Co.: SJB Services Inc.	Inspector: K. Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	10.3
Casing type/dia. (in)	2
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-10.3
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: PW-20 - Removed curbbox pulled casing and grouted per NY State Dept of Environmental Conservation Monitoring Well Decommissioning Procedure (Nov 2005) - Filled, sealed with tags.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Accelerated Remediation Company
A Portage-Shaw Joint Venture

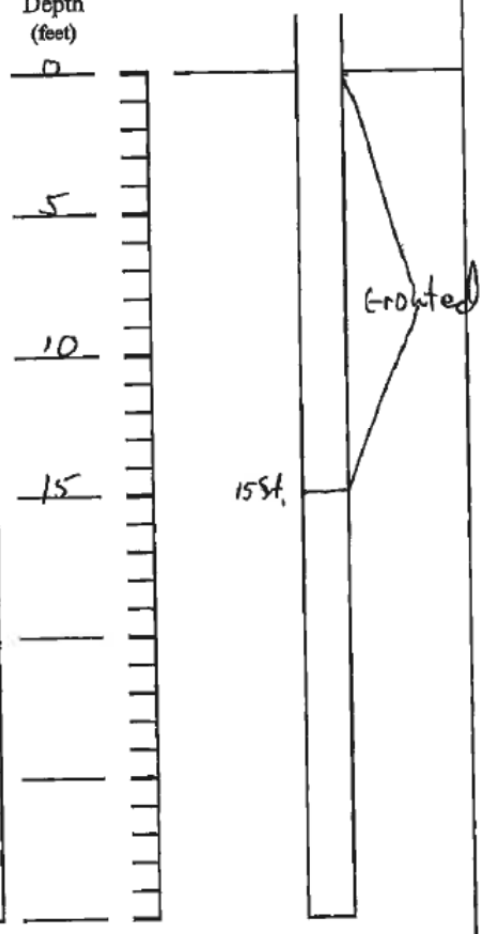
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: PW-28
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services	Inspector: D. Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	15
Casing type/dia. (in)	1
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-15
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: PW-28 Removed curb box pulled casing and grouted per NY State Dept. of Environmental Conservation Well Decommissioning Procedure (Nov 2005) Ident. field with Tag.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

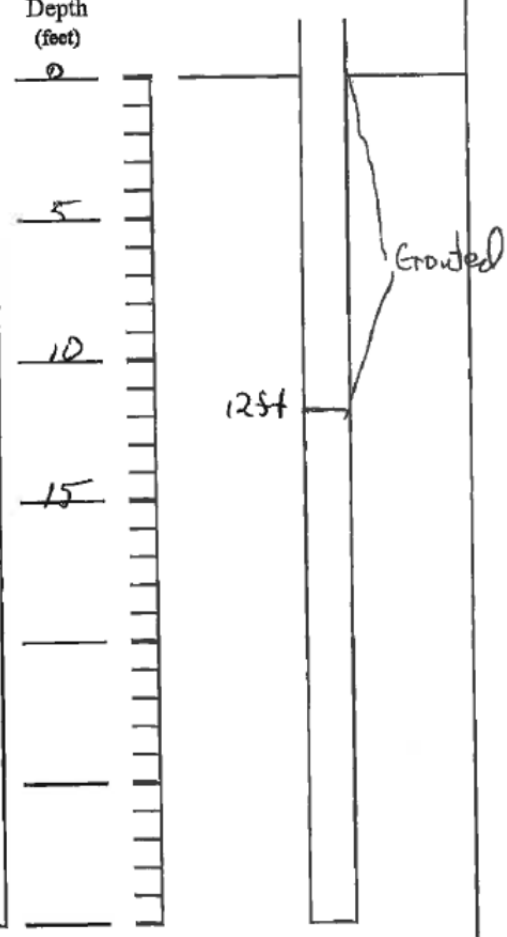
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: PW-29
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services Inc.	Inspector: K. Dufek
	Date: 6-17-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	12
Casing type/dia. (in)	1
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-12 ft
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: PW-29 (with low) removed and destroyed with Jack casing pulled and grouted per NY State Dept of Environmental Conservation Well Decommissioning procedure (Nov 2009).

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Accelerated Remediation Company
A Portage-Shaw Joint Venture

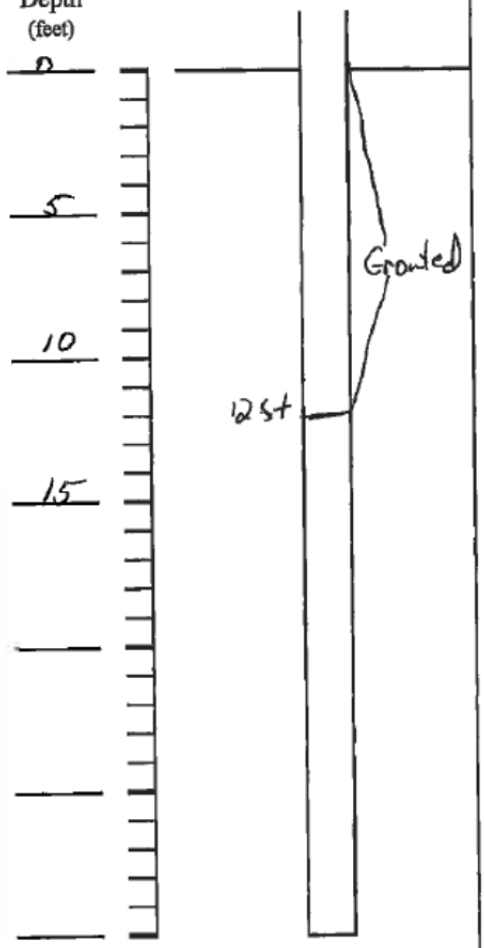
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: PW-30
Site Location: KAPL	Driller: R. Circeateri
Drilling Co.: SJB Services Inc.	Inspector: K. Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	12
Casing type/dia. (in)	1
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-12 ft
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: PW-30 hole was properly identified with tags, casing pulled and grouted per NYS State Dept of Environmental Conservation Well Decommissioning Procedure (NDU 2005)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

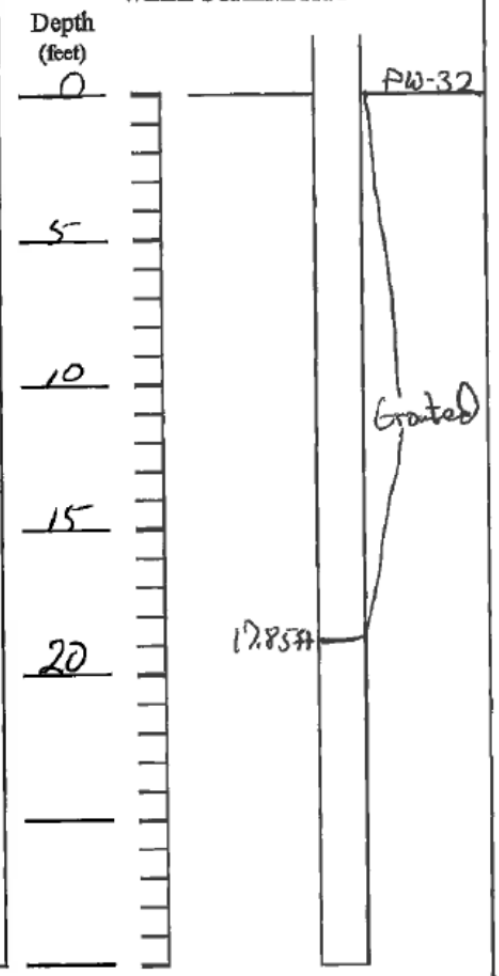
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: PW-32
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services Inc.	Inspector: K. Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	17.85
Casing type/dia. (in)	2
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0 - 17.85ft
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: PW32 Removed curb box, abandoned with tremie, pulled casing and grouted per NY State Dept of Environmental Conservation Well Decommissioning Procedure (Nov 2009)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

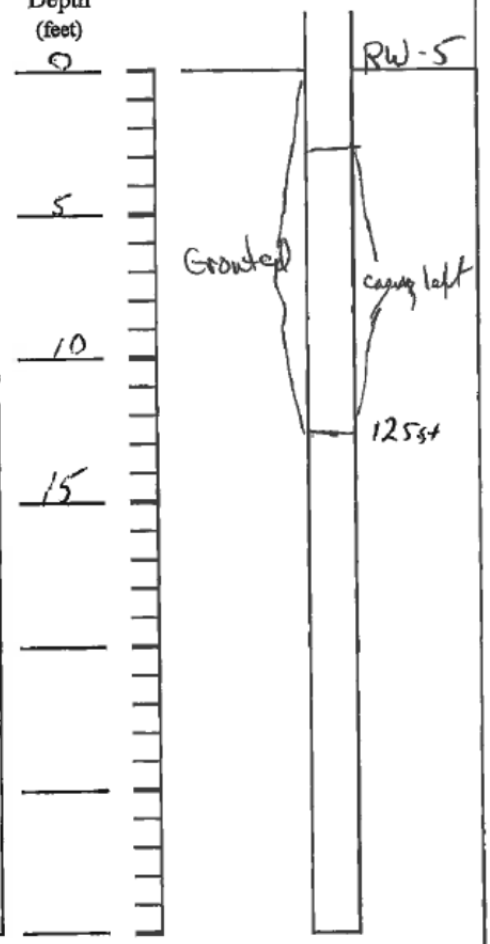
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: RW-5
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services Inc.	Inspector: K. Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Grapple
Casing retrieved (feet)	2.5'
Casing type/dia. (in)	2
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-12.5
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: RW-5 Removed except bottom 2.5ft with Tape 2.5ft casing removal not grouted in place per NY State Dept of Environmental Conservation Well Decommissioning Procedure. (Nov 2005)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

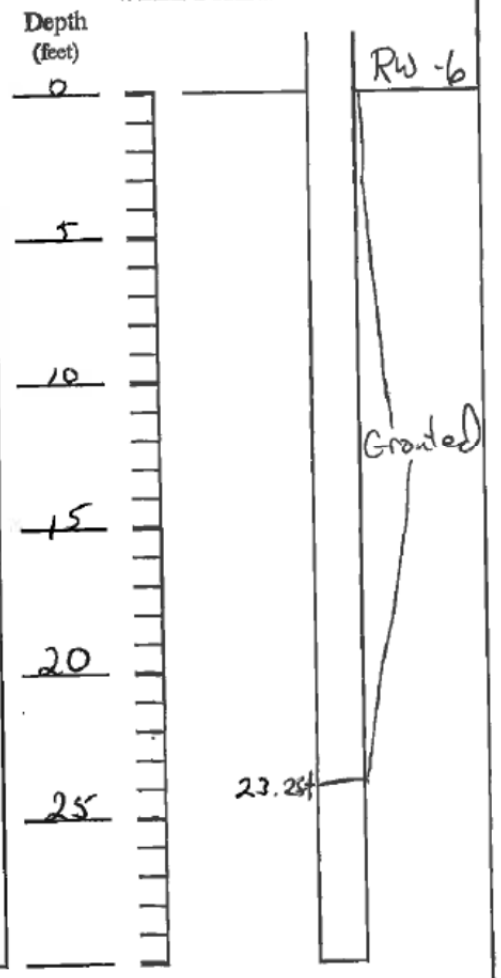
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: RW-6
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services Inc	Inspector: K Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	23.2
Casing type/dia. (in)	2"
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-23.2
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: RW-6 Removed curb box, identified with tag, pulled casing and grouted per NYS State Dept of Environmental Conservation Well Decommissioning Procedure (Nov 2009)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

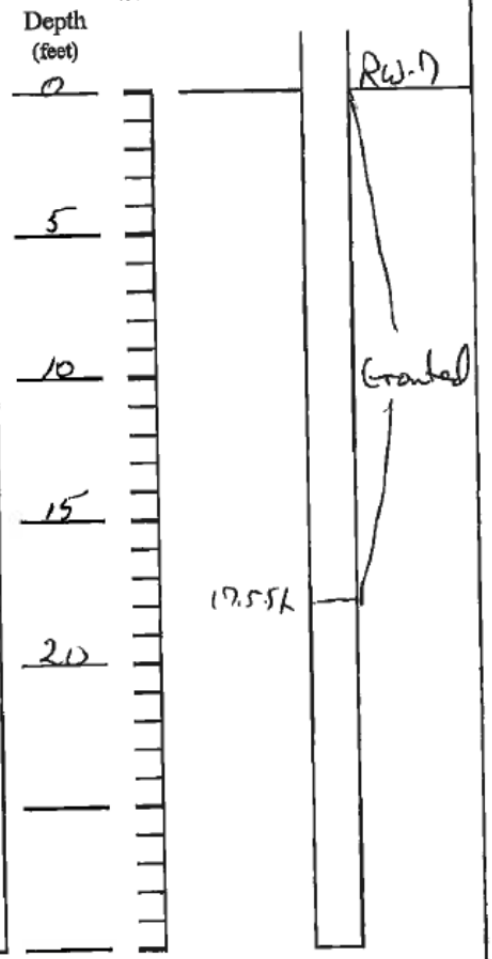
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: RW-7
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services Inc.	Inspector: K. Dufek
	Date: 6-10-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	17.5
Casing type/dia. (in)	2
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: RW-7 Removed curb box, identified with tag; pulled casing and sprayed per NY State Dept of Environmental Conservation Well decommissioning Procedure. (Nov 2005)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

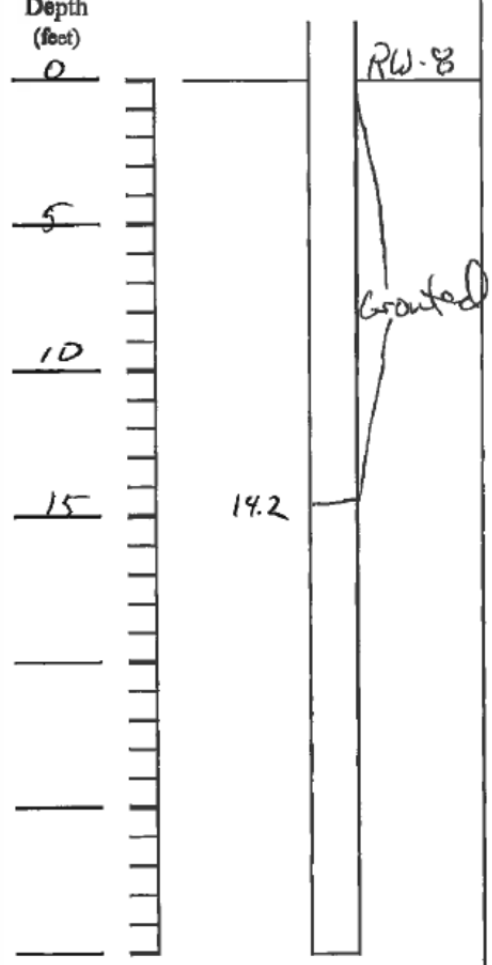
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: RW-8
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: SJB Services	Inspector: K. Dufek
	Date: 6-10-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	14.2
Casing type/dia. (in)	2
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-14.2
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: RW-8 Removed curb box, backfilled with tamp pulled casing and grouted per NY State Dept. of Environmental Conservation Well decommissioning Procedure (Nov 2009)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

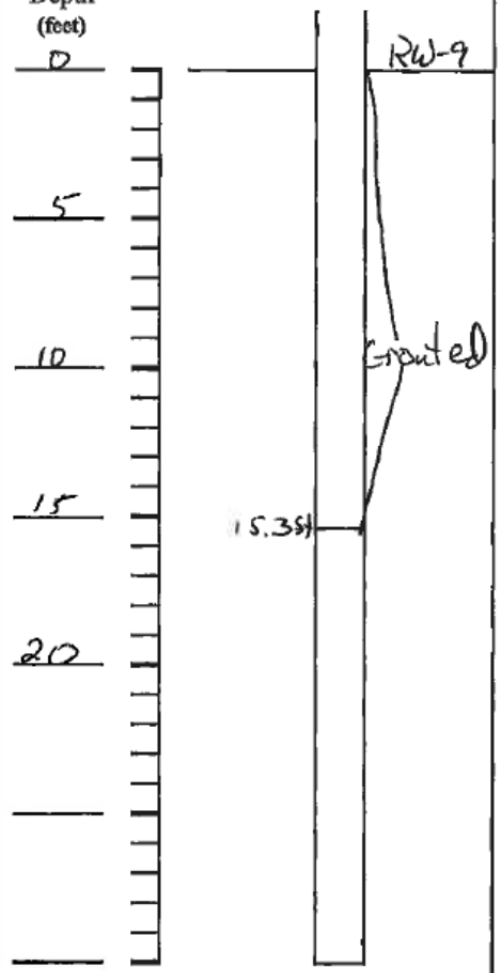
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: RW-9
Site Location: KAPL	Driller: R. Ciccateri
Drilling Co.: STB Services Inc.	Inspector: K. Dufek
	Date: 6-10-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	15.3
Casing type/dia. (in)	2
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-15.3
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: RW-9 Removed with hand operated jack and fitted with tag pulled casing and Grouted per NYS State Dept of Environmental Conservation Well Decommissioning Procedure (Nov 2009)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

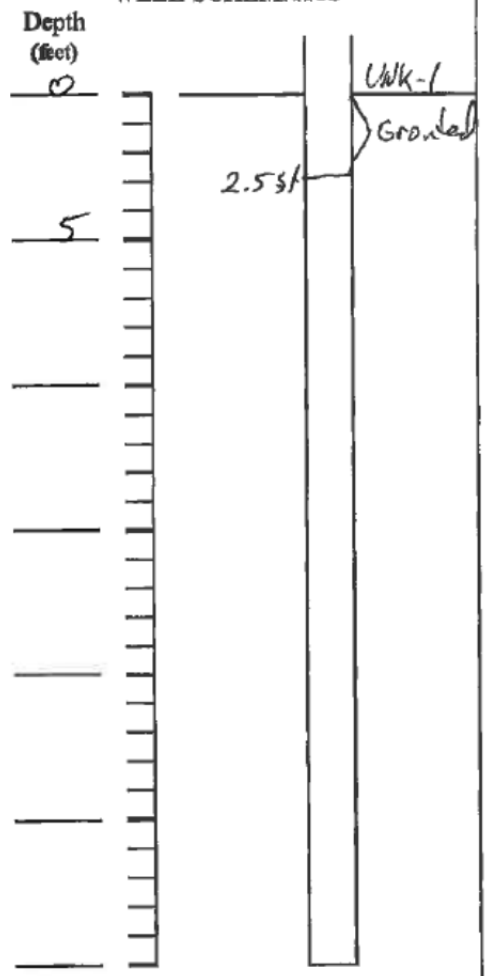
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: UNK-1
Site Location: KAPL	Driller: R Ciccateri
Drilling Co.: SJB Services Inc	Inspector: K Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geoprobe
Casing retrieved (feet)	2.5
Casing type/dia. (in)	4
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-2.5
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: UNK-1 ~~Pumped cuttings, dirt filled with tag~~ pulled casing and Grouted per NY State Dept of Environmental Conservation Well decommissioning procedure. (Nov 2009)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

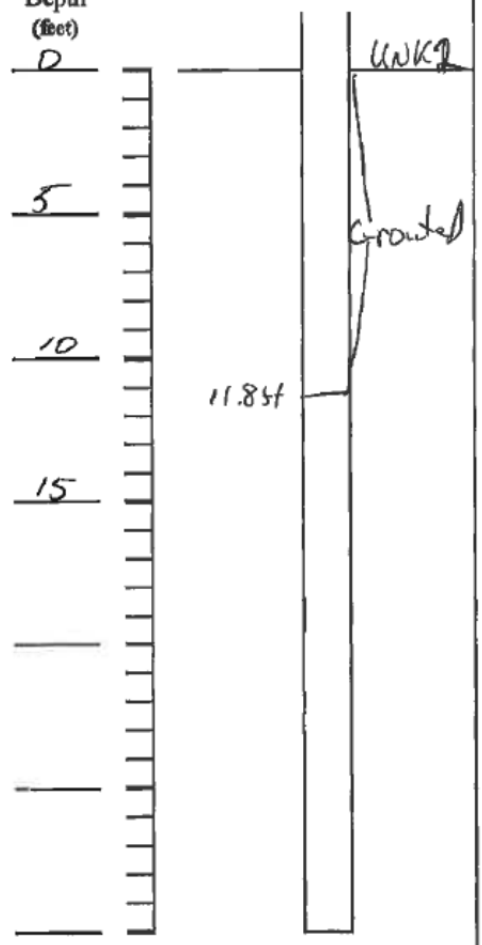
aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: UNK-X 2 (DW2)
Site Location: KAPL	Driller: R Ciccateri
Drilling Co.: SJB Services Inc	Inspector: K. Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA (Fill in all that apply)	
OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	Geo probe
Casing retrieved (feet)	11.8
Casing type/dia. (in)	4
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-11.8
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: UNK-2 ~~Removed casing, split, and with lay~~ pulled casing and grouted per NYS State Dept of Environmental Conservation Well Decommissioning Procedure (WDU 2005)

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

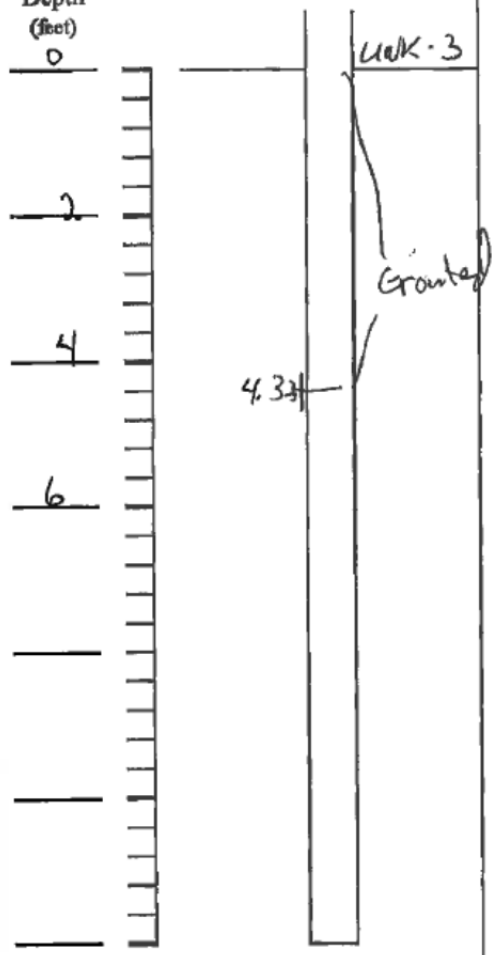
FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: UNK-3
Site Location: KAPL	Driller: R Ciccateri
Drilling Co.: SJB Services Inc.	Inspector: K Dufek
	Date: 6-14-2010

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	geoprobe
Casing retrieved (feet)	4.3
Casing type/dia. (in)	4
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	0-4.3
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS: UNK-3 Removed and identified with tag pulled casing and grouted per NY State Dept of Environmental Conservation Well decommissioning procedure (Nov 2005).

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: MW-SV5
Site Location: KAPL	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*

Depth (feet)

COMMENTS: Well MW-SV5 Removed during expansion activities

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Accelerated Remediation Company
A Portage-Shaw Joint Venture

FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: RW-4
Site Location: KAPL	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING
- Interval Drilled
- Drilling Method(s)
- Borehole Dia. (in.)
- Temporary Casing Installed? (y/n)
- Depth temporary casing installed
- Casing type/dia. (in.)
- Method of installing

CASING PULLING
- Method employed
- Casing retrieved (feet)
- Casing type/dia. (in)

CASING PERFORATING
- Equipment used
- Number of perforations/foot
- Size of perforations
- Interval perforated

GROUTING
- Interval grouted (FBLS)
- # of batches prepared

For each batch record:
- Quantity of water used (gal.)
- Quantity of cement used (lbs.)
- Cement type
- Quantity of bentonite used (lbs.)
- Quantity of calcium chloride used (lbs.)
- Volume of grout prepared (gal.)
- Volume of grout used (gal.)

WELL SCHEMATIC*
Depth (feet)

COMMENTS: RW-4 Removed during [illegible] calculations

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

aRc Accelerated Remediation Company
A Portage-Shaw Joint Venture

FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: PW-27
Site Location: KAPL	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*

Depth (feet)

COMMENTS: Well PW-27 removed during excavation activities

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Accelerated Remediation Company
A Portage-Shaw Joint Venture

FIGURE 3
WELL DECOMMISSIONING RECORD

Site Name: SPRU Lower Level	Well I.D.: MW-SV4
Site Location: KAPL	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING
Interval Drilled
Drilling Method(s)
Borehole Dia. (in.)
Temporary Casing Installed? (y/n)
Depth temporary casing installed
Casing type/dia. (in.)
Method of installing

CASING PULLING
Method employed
Casing retrieved (feet)
Casing type/dia. (in)

CASING PERFORATING
Equipment used
Number of perforations/foot
Size of perforations
Interval perforated

GROUTING
Interval grouted (FBLS)
# of batches prepared
For each batch record:
Quantity of water used (gal.)
Quantity of cement used (lbs.)
Cement type
Quantity of bentonite used (lbs.)
Quantity of calcium chloride used (lbs.)
Volume of grout prepared (gal.)
Volume of grout used (gal.)

WELL SCHEMATIC*
Depth (feet)

COMMENTS: Well Removed during excavation activities

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

Attachment 1
Pre-Excavation Sampling of the K5 Retention Basins for Acetone
(ARC-RPT-6001)

Pre-Excavation Sampling of the K5 Retention Basins for Acetone

ARC-RPT-6001
July 29, 2011
Revision 2

DOE Contract No. DE-AM09-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

Prepared by:
Accelerated Remediation Company (aRc)
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Prepared for:
U.S. Department of Energy
SPRU Project Field Office
Knolls Atomic Power Laboratory (KAPL)
2425 River Road
Niskayuna, NY 12309-7100

Pre-Excavation Sampling of the K5 Retention Basins for Acetone

Approval for Use

Doug Collins Deputy Project Manager	07/29/11 Date
David Lodman Characterization Lead	07/29/11 Date
Berta Oates Project Quality Assurance Manager	07/29/11 Date

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Appendix A, CD-ROM with Electronic Copy of Analytical Report Project No. 129223 Acetone Analyses of Samples Collected At SPRU Lots # F8H080241, F8H080246 and F8H080253 17

Appendix B, CD-ROM with Electronic Copies of SDGs F8H080241, F8H080246 and F8H080253 Data Limitations and Validation Report Acetone Analyses of Samples Collected At K5 Former Retention Basin 19

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Acronyms

ICM	Interim Corrective Measures
NYSDEC	New York State Department of Environmental Consultation
RCRA	Resource Conservation and Recovery Act
RSA	Railroad Staging Area
SCO	Soil Cleanup Objective
SPRU	Separations Process Research Unit

1.0 Introduction/Objective

The Separations Process Research Unit (SPRU) is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level Land Areas known as the Railroad Staging Area (RSA) and the Lower Level Parking Lot is being addressed under the Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq. 1976) and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq. 1980). The New York State Department of Environmental Conservation is overseeing cleanup of the chemical contamination at the SPRU Lower Level under the RCRA corrective action program. The *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (hereinafter referred to as the Interim Correction Measures [ICM] Work Plan) (ARC-PLN-6106) was developed in accordance with the 6 New York Code of Rules and Regulations Part 373 Hazardous Management Permit requirements and provides the cleanup approach that is being used for the SPRU Lower Level.

Sampling of the K5 Retention Basins was performed in fall and winter 2006–2007 after the building's foundation was removed (LATA/SHARP 2008). Acetone was detected in 24 of 32 soil samples with concentrations ranging from 28 to 230 parts per billion (ppb). Many of the samples had concentrations greater than the SPRU soil cleanup objective (SCO) of 50 ppb. These levels of acetone have not been identified as laboratory contamination. The reported values are not considered to be of SPRU origin because acetone was not detected in soil samples from the 2000–2001 sampling event or in the pre-demolition samples collected around the perimeter of the K5 foundation (LATA/SHARP 2008). Based on U.S. Department of Energy SPRU Field Office information, the acetone found may have resulted from the coating material used to control dust during the demolition of the K5 structure. In accordance with the approved ICM Work Plan, pre-excavation sampling of the area surrounding the K5 Retention Basins was conducted to determine the continued presence of residual acetone contamination.

2.0 Sampling Activities

2.1 Sampling Location

The purpose of the sampling effort was to confirm the presence of residual acetone in the K5 Retention Basins area. Accordingly, the sampling focused on the area of the former retention basin's foundation, including at the floor level of the former foundation, where acetone was predominantly identified in the 2006–2007 sampling. Prior to sampling, the site was surveyed for underground utilities. A civil survey for identification of the former retention basins location was conducted and sampling locations were located and staked. Because the acetone contamination was thought to be associated with the coating material used to control dust during the demolition of the K5 structure, sample locations were positioned as near as possible and to the outside of where the old K5 foundation was located (Figure 1).

2.2 Sample Collection

Sampling of the former K5 Retention Basin area was performed on August 8 and 9, 2008. Direct-push equipment was used to collect samples from eight locations, as shown on Figure 1. The boreholes were driven to bedrock, and samples were collected at approximately 2-ft intervals, including the bedrock-soil interface. Figure 2 indicates sampling locations and depth to bedrock of all sampled boreholes.

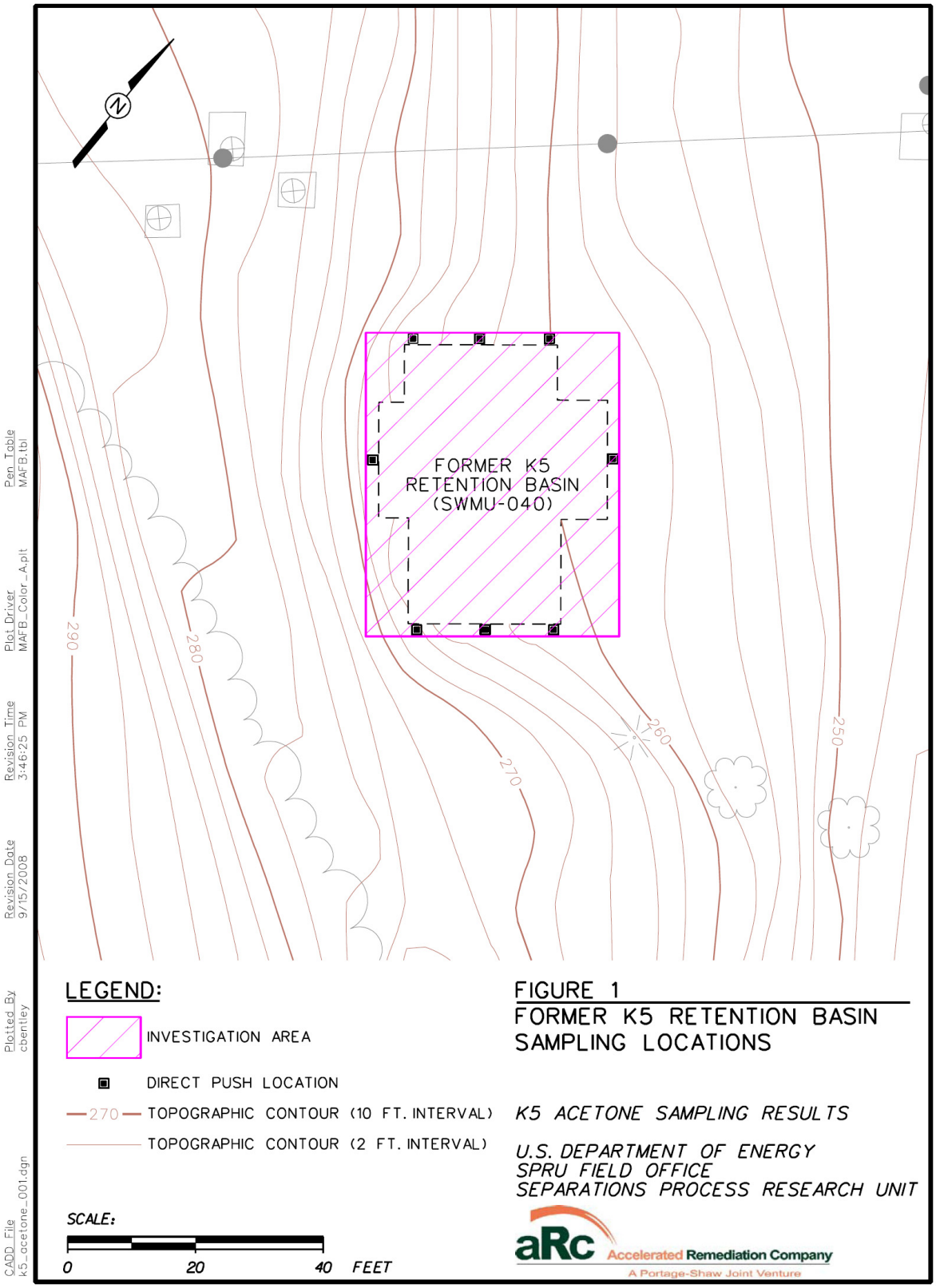
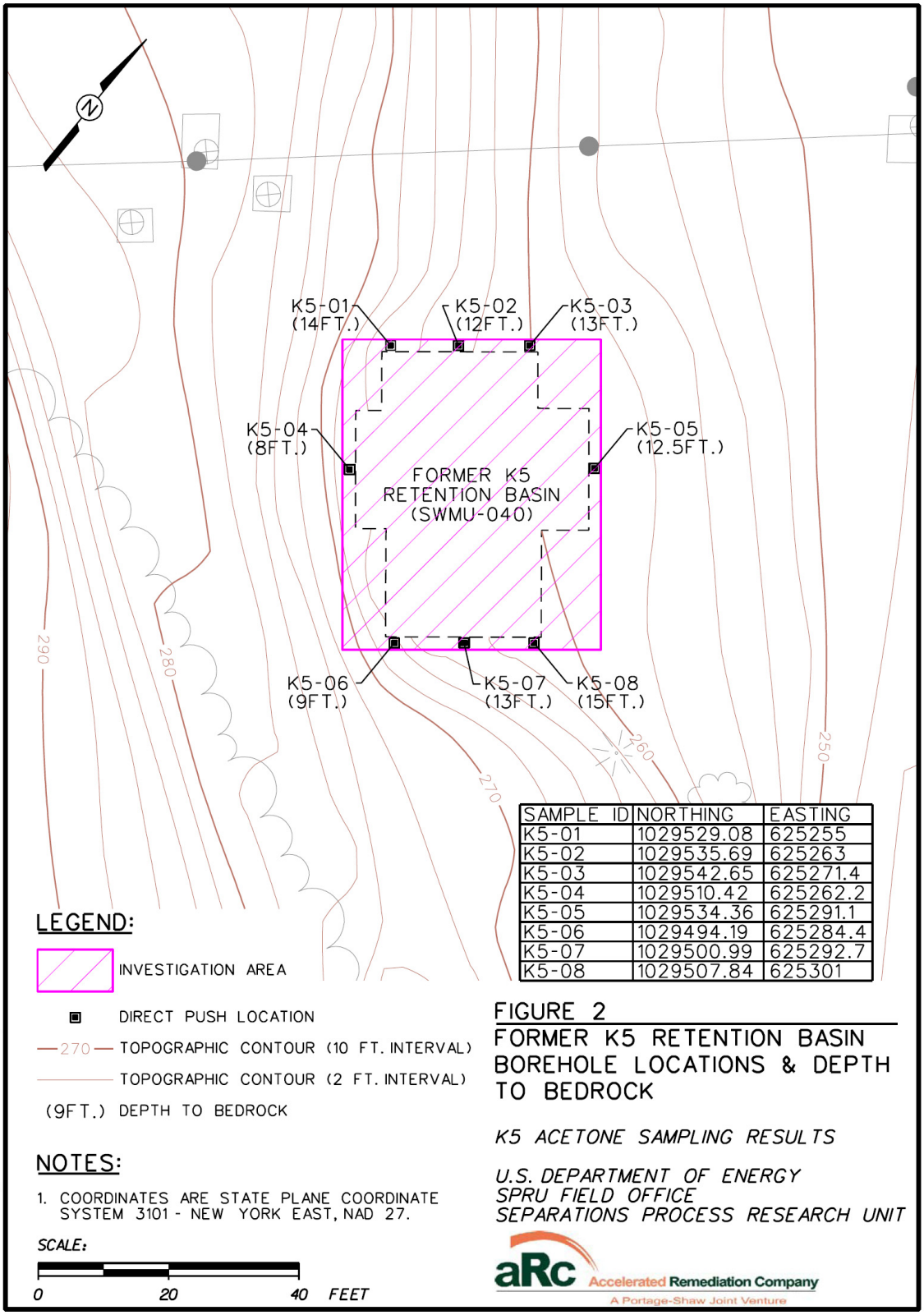


Figure 1 Former K5 Retention Basin sampling locations



SAMPLE ID	NORTHING	EASTING
K5-01	1029529.08	625255
K5-02	1029535.69	625263
K5-03	1029542.65	625271.4
K5-04	1029510.42	625262.2
K5-05	1029534.36	625291.1
K5-06	1029494.19	625284.4
K5-07	1029500.99	625292.7
K5-08	1029507.84	625301

Figure 2 Former K5 Retention Basin borehole locations and depth to bedrock

Soil samples were collected from a clear acetate liner used in the direct-push sampler. Upon retrieval from the direct-push sampler, the liner was cut lengthwise allowing sample inspection and collection. At the designated sampling depths, a representative portion of the soil sample was placed directly into the appropriate pre-cleaned containers minimizing disturbance of the sample. The soil samples were collected and placed in a cooler containing blue ice. To minimize the potential of cross-contamination, the direct-push samplers were cleaned in accordance with the cleaning protocols provided in the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402) and a new plastic sleeve insert was used for each soil sampling interval. Once all of the samples were collected, they were transferred to an off-site analytical laboratory following chain-of-custody procedures.

General characterization of the soil associated with each sample was documented. The majority of the soil appeared to be clay and gravel fill material representative of the material that was used as backfill during the K5 demolition efforts.

3.0 Sample Analysis

3.1 Analysis

The samples were analyzed by Test America (Test America 2008a, 2008b, 2008c) following U.S. Environmental Protection Agency SW-846 Method 8260B (EPA 2008) protocol in accordance with the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402). Table 1 provides the results of the analyses. Two samples collected from the K5-03 borehole have acetone concentrations above the SCO of 50.0 µg/kg. In addition, eight samples had acetone concentrations greater than laboratory method detection limit but less than the SCO. Acetone detections above the laboratory method detection limit are shown in Figure 3 along with associated data flagging.

Because sample SDP-K505-001-V was chosen by Test America as the laboratory duplicate, the lab reported the standard suite of VOCs for 8260B. The duplicate results had detects for carbon disulfide, ethyl benzene, toluene, xylene, 4-isoproyltoluene, and tetrochloroethene and are included in the attached data. The ICM work plan (ARC-PLN-6106) was specific to sampling for acetone and, therefore, the data were only validated for acetone. The RCRA Quality Assurance Project Plan (ARC-PLN-6402) requires reporting of non-constituents of concern if they are above SCOs and the reported values for these compounds were not above their SCOs. The VOCs that were detected are subject to regulation because they are listed on the New York State constituent lists; however, no further action was deemed warranted based on the concentration levels. The laboratory analytical reports, *Analytical Report*, Project No., 129223, Lot # F8H080241, F8H080246 and F8H080253, are on a CD-ROM provided as Appendix A with this report.

3.2 Data Validation

The laboratory data were validated internally by Test America in accordance with their Quality Assurance Manual (Appendix B of ARC-PLN-6402). Data are in Analytical Services Protocol (ASP) category B data packages, consistent with the RCRA Quality Assurance Project Plan (ARC-PLN-6402). Independent validation was performed by Portage, Inc. in accordance with the National Functional Guidelines (EPA 1999). Validation flags were assigned to reported levels based on laboratory performance on quality control analyses (Portage 2008a, 2008b, 2008c). Several of the sample results were assigned “J” flags (estimated) based on associated surrogate recoveries. These data are usable for our investigative purposes. One sample (SPD-K503-004-V) was rejected due to low surrogate recovery and exceeded internal standard criteria. The validation reports, *SPRU KAPL* SDGs F8H080241, F8H080246 and F8H080253, are on a CD-ROM provided as Appendix B with this report.

Table 1 Summary of sampling and analytical results

Sample ID	Estimated Depth (ft)	Analysis	Result (µg/kg)	Lab Flag[a]	Validation Flag[b]	Date Sampled	Time Sampled	Comments
SDP-K501-001-V	2	Acetone	11	U		8/6/2008	1256	Wet clay
SDP-K501-002-V	4	Acetone	11	U		8/6/2008	1258	Sandy clay, damp
SDP-K501-003-V	6	Acetone	11	U		8/6/2008	1301	Gravel/clay fill
SDP-K501-004-V	8	Acetone	10	U		8/6/2008	1303	Gravel/clay fill
SDP-K501-005-V	10	Acetone	11	U		8/6/2008	1304	Gravel/clay fill
SDP-K501-006-V	12	Acetone	7.2	J	J	8/6/2008	1310	Wet clay
SDP-K501-007-V	14	Acetone	12	U		8/6/2008	1311	Refusal shale bedrock at 14 ft
SDP-DU01-009-V	2	Acetone	11	U		8/6/2008	1256	Wet clay
SDP-K502-001-V	2	Acetone	12	U		8/6/2008	1326	Wet clay
SDP-K502-002-V	4	Acetone	10	U		8/6/2008	1328	Gravel/clay fill
SDP-K502-003-V	6	Acetone	11	U		8/6/2008	1338	Gravel/clay fill
SDP-K502-004-V	8	Acetone	26		J	8/6/2008	1339	Wet clay
SDP-K502-005-V	10	Acetone	12	U		8/6/2008	1348	Sandy clay, and gravel, damp
SDP-K502-006-V	12.5	Acetone	10	U	UJ	8/6/2008	1350	Refusal shale bedrock at 12.5 ft. Sand/clay gravel/clay fill /gravel shale bedrock
SDP-K503-001-V	2	Acetone	11	U		8/6/2008	1431	Clay fill
SDP-K503-002-V	4	Acetone	60		J	8/6/2008	1432	Clay and gravel fill
SDP-K503-003-V	6	Acetone	210	D	J	8/6/2008	1434	Sand and clay fill. Hit rock at 7 ft
SDP-K503-004-V	8	Acetone	11	U	R	8/6/2008	1437	Sand and clay fill.
SDP-K503-005-V	10	Acetone	11	U		8/6/2008	1445	Sand and gravel fill.
SDP-K503-006-V	13	Acetone	11	U		8/6/2008	1446	Hard clay /refusal bedrock
SDP-K504-001-V	2	Acetone	12	U		8/6/2008	1015	Wet clay
SDP-K504-002-V	4	Acetone	13	U		8/6/2008	1016	Wet clay
SDP-K504-003-V	6	Acetone	16		J	8/6/2008	1021	Dark rocky soil
SDP-K504-004-V	8	Acetone	11	U		8/6/2008	1023	Refusal bedrock at 8 ft, dark brown soil and bedrock
SDP-DU04-009-V	8	Acetone	10	J		8/6/2008	1023	Refusal bedrock at 8 ft, dark brown soil and bedrock
SDP-K505-001-V	2	Acetone	21		J	8/6/2008	1043	Wet clay

Table 1 (continued)

Sample ID	Estimated Depth (ft)	Analysis	Result (µg/kg)	Lab Flag[a]	Validation Flag[b]	Date Sampled	Time Sampled	Comments
SDP-K505-002-V	4	Acetone	12	U		8/6/2008	1045	Wet clay
SDP-K505-003-V	6	Acetone	4	J	J	8/6/2008	1053	Clay and gravel fill
SDP-K505-004-V	8	Acetone	27			8/6/2008	1051	Clay and gravel fill
SDP-K505-005-V	10	Acetone	6.3	J	J	8/6/2008	1113	Clay and gravel fill
SDP-K505-006-V	12.5	Acetone	12			8/6/2008	1115	Refusal bedrock at 12.5 ft
SDP-DU05-009-V	4	Acetone	13	U	J	8/6/2008	1045	Wet clay
SDP-K506-001-V	2	Acetone	3.3	J	J	8/7/2008	0844	Wet clay
SDP-K506-002-V	4	Acetone	3.2	J	J	8/7/2008	0845	Sample taken on transition from clay to sandy gravel fill
SDP-K506-003-V	6	Acetone	2.4	J	J	8/7/2008	0849	Sand and gravel fill
SDP-K506-004-V	8	Acetone	3.7	J	J	8/7/2008	0850	Sand and gravel fill
SDP-K506-005-V	10	Acetone	3.3	J	J	8/7/2008	0857	Sand and gravel fill
SDP-K506-006-V	12	Acetone	2.5	J	J	8/7/2008	0859	Wet clay
SDP-K506-007-V	14	Acetone	36			8/7/2008	0902	Wet clay with gravel fill
SDP-K506-008-V	15	Acetone	13		J	8/7/2008	0903	Refusal at 15 ft, sampled the shale bedrock hard clay interface
SDP-K507-001-V	2	Acetone	2.1	J	J	8/7/2008	0919	Wet clay
SDP-K507-002-V	4	Acetone	1.8	J	J	8/7/2008	0921	Sand and gravel fill
SDP-K507-003-V	6	Acetone	4.1	J	J	8/7/2008	0926	Sand and gravel fill. Rock at 61 pushed through
SDP-K507-004-V	9	Acetone	11	U		8/7/2008	0928	Slight tannish color change in fill sampled
SDP-K507-005-V	10	Acetone	7.1	J	J	8/7/2008	0933	Wet soil above bedrock
SDP-K507-006-V	12	Acetone	13		J	8/7/2008	0934	Taken at shale bedrock/clay interface
SDP-K508-001-V	2	Acetone	12	U		8/7/2008	1001	Wet clay
SDP-K508-002-V	4	Acetone	11	U		8/7/2008	1002	Sand and gravel fill
SDP-K508-003-V	6	Acetone	11	U		8/7/2008	1008	Sand and gravel fill

Table 1 (continued)

Sample ID	Estimated Depth (ft)	Analysis	Result (µg/kg)	Lab Flag[a]	Validation Flag[b]	Date Sampled	Time Sampled	Comments
SDP-K508-004-V	8	Acetone	2.7	J	J	8/7/2008	1010	Refusal at 9 ft, sampled the shale bedrock clay soil interface
SDP-DU08-009-V	8	Acetone	11	U	J	8/7/2008	1010	Refusal at 9 ft, sampled the shale bedrock clay soil interface
SDP-RB01-001-V	NA	Acetone	10	U		8/6/2008	1600	Deionized water preserved with HCL
SDP-TB01-001-V	NA	Acetone	10	U		8/6/2008	1600	Deionized water preserved with HCL

a. Laboratory flags:
U = The analyte was analyzed for but was undetected. The reported value is the quantitation limit.
D = The reported concentration is from dilution.
J = The analyte was positively detected and the reported concentration is below the quantitation limit.

b. Validation flags:
J = Estimated – the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample
R = Rejected.
UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample

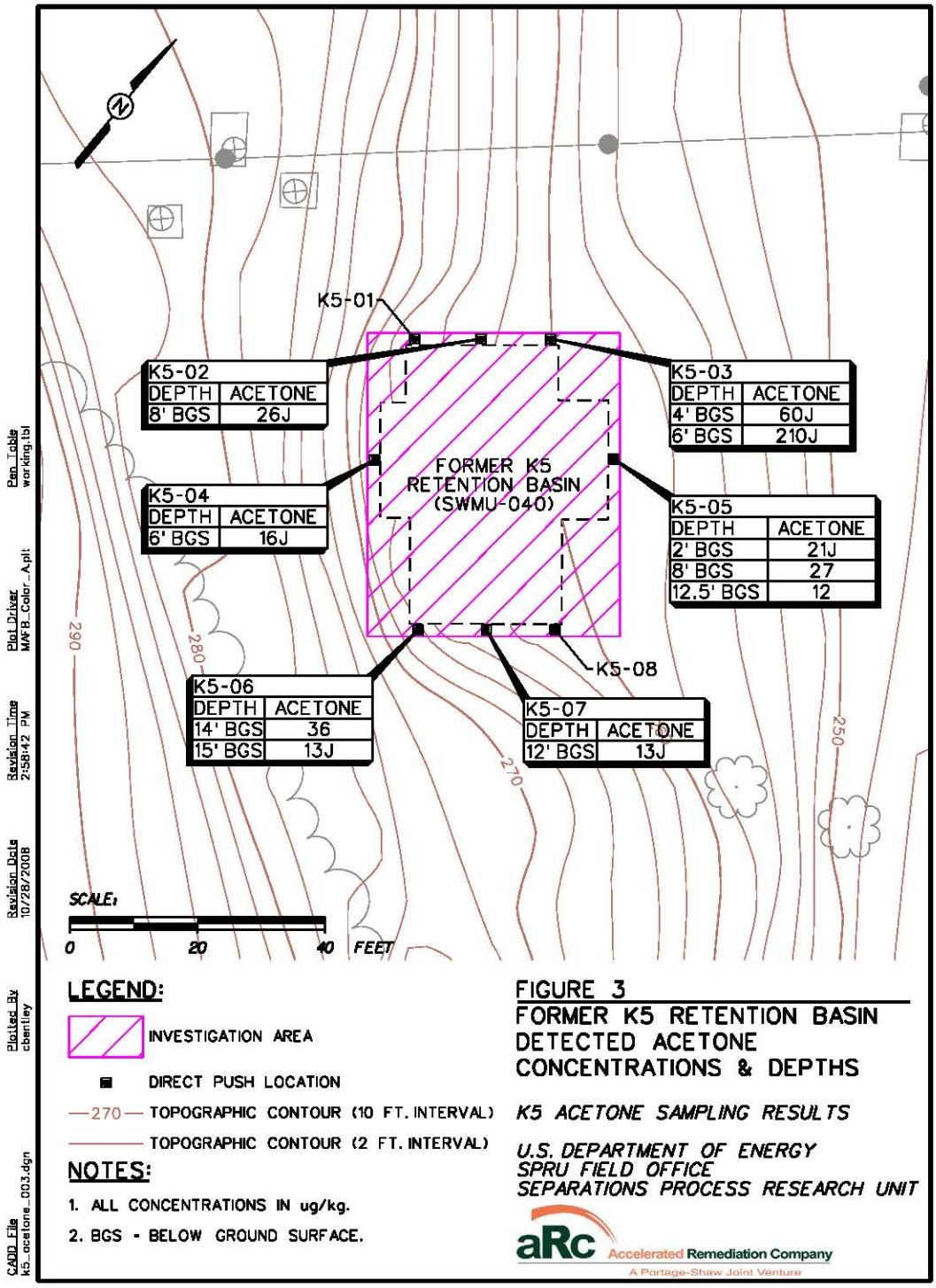


Figure 3 Former K5 Retention Basin detected acetone concentrations and depths

4.0 Discussion/Recommendations

The purpose of this sampling effort was to confirm the presence of residual acetone in the K5 Retention Basins area. None of the eight boreholes show acetone contamination above the soil cleanup objective (SCO) for acetone (50 ppb) at the depths that correlate with the floor of the excavation that resulted from the removal of the K-5 Basins in 2006 (see Figure 3). Four samples taken from the floor of the former excavation, samples SDP-K502-004 (8 ft), SDP-K504-003 (6 ft), SDP-K506-007/008 (15 ft), and SDP-K507-006 (12 ft) show positive indications of acetone below SCO. For comparison, Figure 4 shows the concentrations and locations of acetone identified during the 2006 confirmation sampling of the K5 Retention Basins (LATA/SHARP 2008). The majority of the 2006 samples were collected on the floor of the excavation at a depth 0–2 ft. The sample results taken by aRc during 2008 from the bottom of the former excavation (Figure 3) show concentrations of acetone near the bedrock surface are significantly lower than those found during the 2006 confirmation sampling (Figure 4). Due to the volatility and biodegradable nature of acetone, this is not unexpected.

Samples SDP-K503-002 and SDP-K0503-003 both identified concentrations of acetone above the SCO at depths of 4 and 6 ft, respectively. The reported result for sample SDP-K503-004 (collected at 8 ft bgs and below the two positive indications) was rejected during validation due to low surrogate recovery (2.9%) and exceedance of internal standard criteria. Acetone was not detected in the two additional samples at 10 ft and the 13-ft bedrock interface in the same borehole. The soil observed in borehole K5-03 appeared to be the same fill material (clay, sand, and gravel) as seen in the other boreholes. The only anomaly noted during sample collection within the K5-03 borehole was found at the 7-ft level when the direct-push sampling tube appeared to have hit a rock.

Because acetone is still present in concentrations above the SCO in K5-03, additional excavation of this area is warranted. The residual acetone contamination located near borehole K5-03 will be excavated during the scheduled excavation of the K5 (ARC-PLN-6106, 2008). In addition to excavation of residual acetone, portions of the K5 area will also be excavated for arsenic and Cesium-137 contamination. Arsenic in boring B4015 (LATA/SHARP 2008) and Cs-137 in boring B4013B (LATA/SHARP 2007b) were reported left in the K5 area above soil SCOs. Note that arsenic at levels just above the SCO in borings T4011 and T4016 was determined to be due to mineralogical variability (LATA/SHARP 2008) and does not warrant remediation. These excavations will be conducted simultaneously; therefore the excavation sequence for the entire K5 area is detailed below.

The area to be excavated will center on borings B4013B, B4015, and K5-03 in the K5 area; excavation of B4013B will include boring B4015 therefore there is no need for a separate excavation. Arsenic is the soil contaminant above SCO in B4015; Acetone was found in K5-03 above SCO, and Cs-137 was found in B4013B above cleanup levels. An approximate five foot square area centered around boring K5-03 will be excavated to a 6 foot depth. An approximate 15 foot by 20 foot rectangular area with boring B4013B centered length wise will be excavated 12.5 feet below grade; this excavation also includes the excavation of boring B4015 to three foot depth. Beyond the excavation footprint, the excavations will be sloped 1:1 for slope stabilization. Disturbed areas outside of the excavation will be mulched and seeded depending on the season. Drawings of the proposed excavations are provided as Figure 5 and 6.

The excavations will be dug by an excavator; spotters will be positioned to aid the operator's work. A starter bench will be prepared adjacent borings K5-03 to provide level ground for the excavator and dump truck to begin the excavating and loading operation. Borehole K5-03 will be excavated first; these excavations will be used as a platform to remove B4013B to 12.5 foot depth. Horizontal to vertical 1:1 sidewalls will be maintained in the deep excavations to prevent sloughing. Excavation will be limited to

overburden soils; aRc will cease excavation at locations where bedrock is encountered. Approximately 350 bank cubic yards (cy) (450 loose cubic yards) including cutback will be removed from the K5-03 & B4013B/B4015 excavations. The soil will be transferred to the soil staging area for sampling and load-out for offsite disposal.

Once the excavation of the K5 Retention Basin has been completed, confirmation sampling for acetone will be conducted of the entire excavation to determine if the acetone contamination has been cleaned up to meet SCOs. Sampling for acetone will follow the procedures outlined in Section 2 of the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Area Remediation* (ARC-PLN-6402). The confirmation sampling approach will follow the New York State Department of Environmental Conservation (NYSDEC) *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002). This guidance provides for prescriptive sampling for excavations depending on their perimeter and the nature of the contamination. Since the perimeter of the additional K5-03 excavation is estimated to be between 20 and 300 ft, one sample is to be collected for every 900 ft^2 of bottom area and one sample every 30 linear ft of sidewall from the bottom of the excavation. Confirmation sampling for arsenic and other constituents of concern will occur according to the approach in Section 3.2.1 (Sampling Design for the RSA) in the ICM Work Plan (ARC-PLN-6106). Under this approach, the K5 unit will be included as part of a larger sample unit against which sample locations will be established according to the protocol in Section 3.2.2 of the ICM Work plan (ARC-PLN-6106).

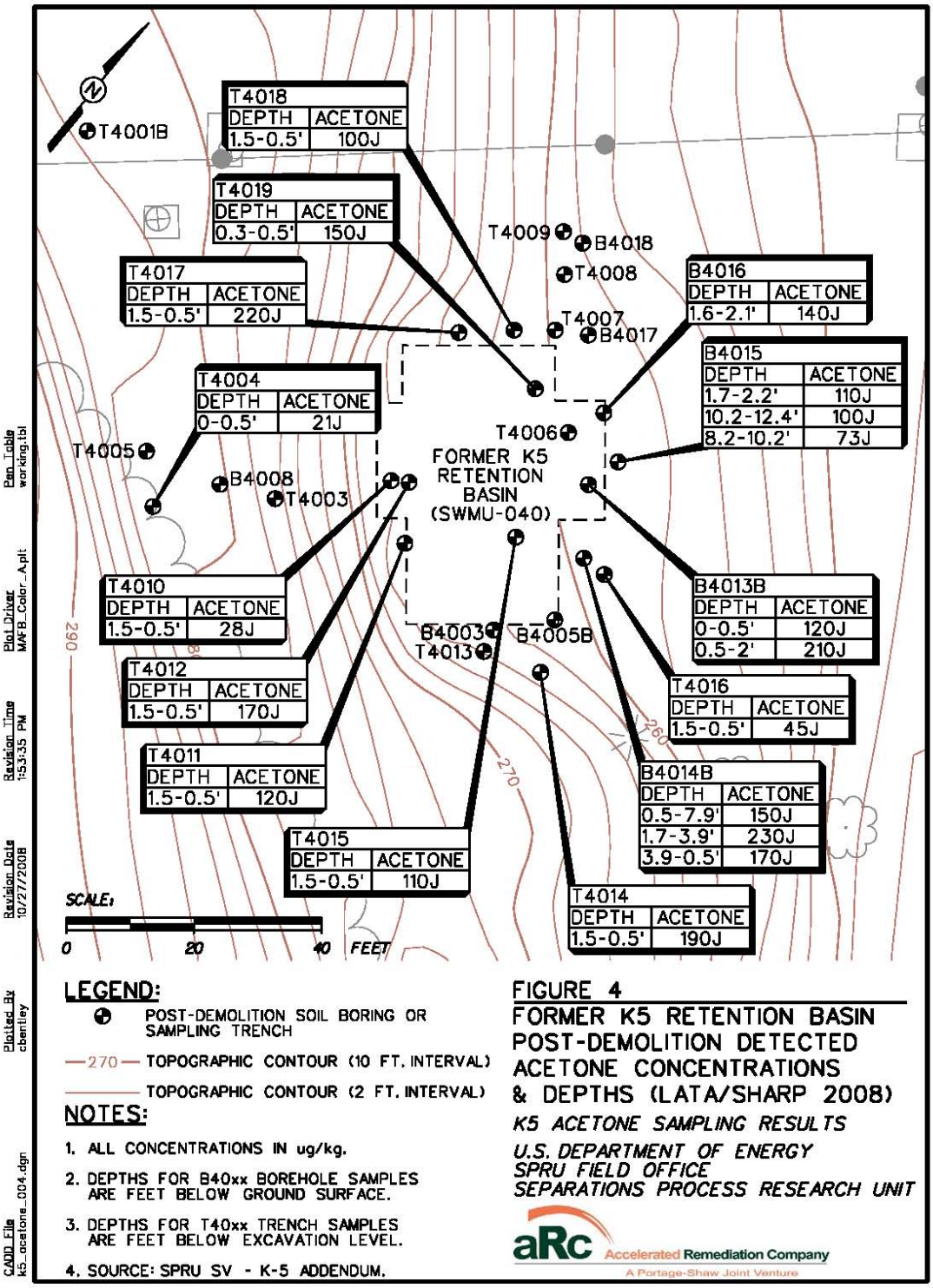


Figure 4 Former K5 Retention Basin post-demolition detected acetone concentrations & depths

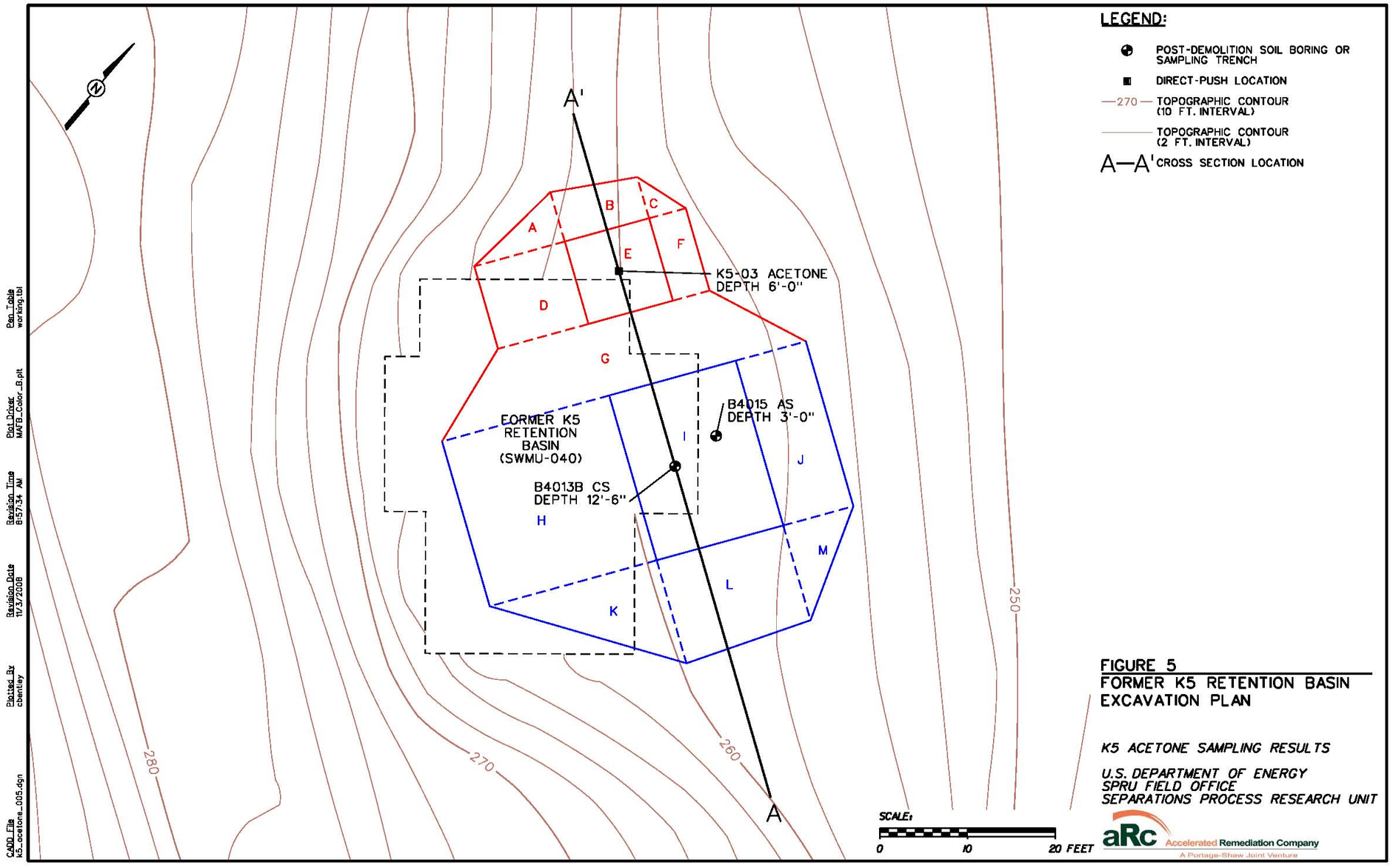


Figure 5 Former K5 Retention Basin Excavation Plan

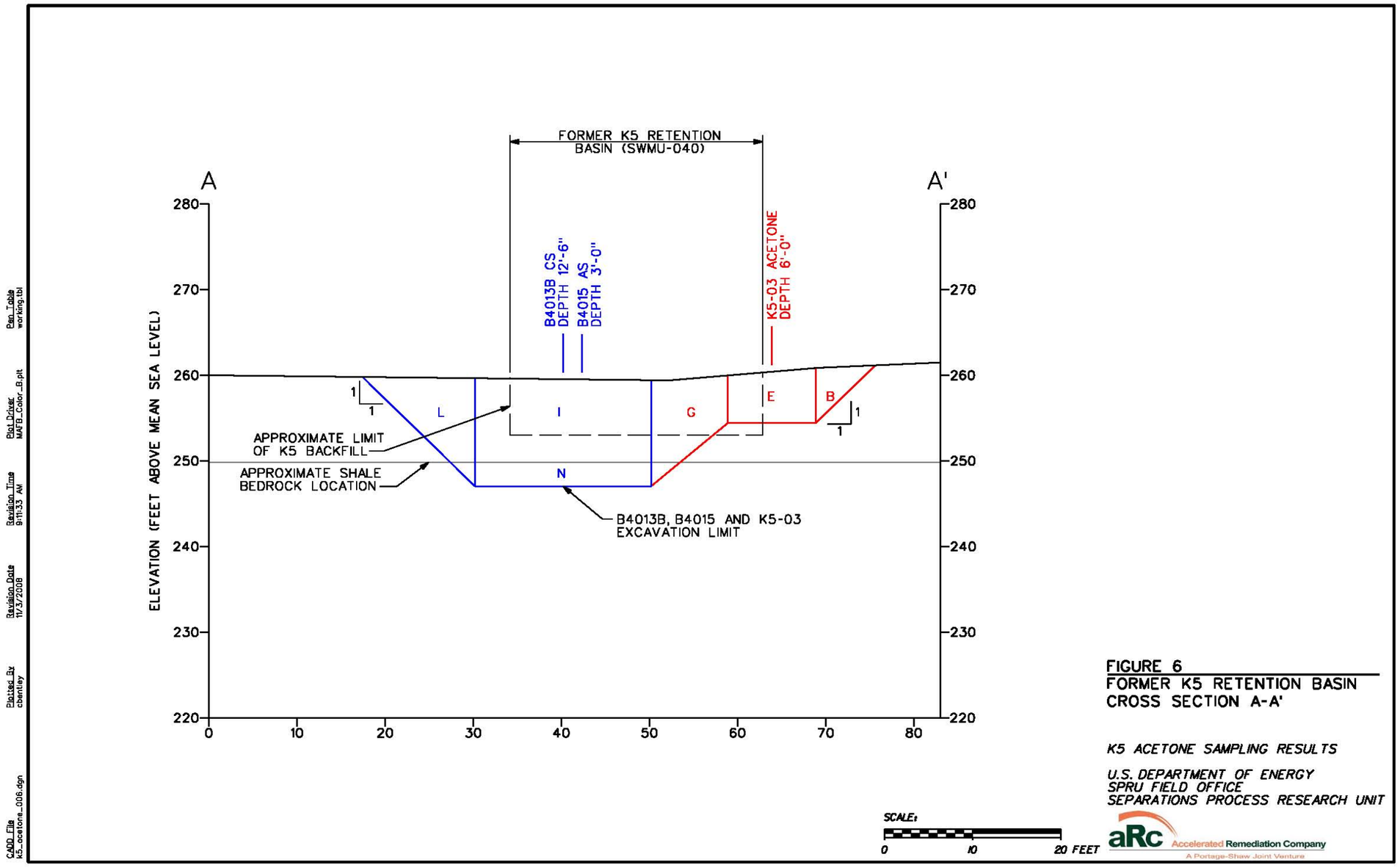


Figure 6 Former K5 Retention Basin Cross Section A-A'

5.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976," as amended.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980," as amended. (NOTE: The 1986 amendment is cited as "Superfund Amendments and Reauthorization Act of 1986," [SARA]).

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, Rev. 2, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, Rev. 2, August 2008.

Johnson, Kathryn, LATA/SHARP, to Steve Feinberg, SPRU Project Office, January 17, 2007, "K-5 Preliminary Characterization Report in Response to SPRU-06-166."

LATA/SHARP, 2006, *Sampling and Analysis Plan (SAP) for the Characterization of Chemical Constituents at the K-5 Retention Basin*, Rev. 0, April 19, 2006.

LATA/SHARP, 2007a, *K-5 Demolition Complete Report for the K-5 Retention Basin*, LSRS_SPRU-RPT-008, Rev. 0, May 9, 2007.

LATA/SHARP, 2007b, *RFA SV Amendment to K-5 Retention Basins*, RPT-006, Rev. 0, May 2007.

LATA/SHARP, 2008, *SPRU RFA SV Amendment to K-5 Retention Basins,* RPT-006, Rev. 1, February 2008.

EPA, 1999, *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review,* EPA 540/R-99/008, U.S. Environmental Protection Agency, Washington, D.C., October 1999.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008, Web page visited September 17, 2008.

NYSDEC, 2002, "Draft DER-10 Technical Guidance for Site Investigation and Remediation," Draft DER-10, New York State Department of Environmental Consultation, December 25, 2002.

Portage, 2008a, *Limitations and Validation Report for KAPL SPRU, SDG F8H080241*, Document # SPRU-F8H080241-Acetone, Portage, Inc., September 2, 2008.

Portage, 2008b, *Limitations and Validation Report for KAPL SPRU, SDG F8H080246*, Document # SPRU-F8H080246-Acetone, Portage, Inc., September 2, 2008.

Portage, 2008c, *Limitations and Validation Report for KAPL SPRU, SDG F8H080253*, Document # SPRU-F8H080253-Acetone, Portage, Inc., September 2, 2008.

Test America, 2008a, Analytical Report, Project No. 129223, Lot # F8H080241, Test America Laboratories, Inc., Earth City, MO, August 15, 2008.

Test America, 2008b, Analytical Report, Project No. 129223, Lot #F8H080246, Test America Laboratories, Inc., Earth City, MO, August 15, 2008.

Test America, 2008c, Analytical Report, Project No., 129223, Lot # F8H080253, Test America Laboratories, Inc. Earth City, MO, August 18, 2008.

Appendix A

CD-ROM with Electronic Copy of Analytical Report Project No. 129223 Acetone Analyses of Samples Collected At SPRU Lots # F8H080241, F8H080246 and F8H080253

Appendix B

CD-ROM with Electronic Copies of SDGs F8H080241, F8H080246 and F8H080253 Data Limitations and Validation Report Acetone Analyses of Samples Collected At K5 Former Retention Basin

Attachment 2
K5 Post-Excavation Confirmation Sampling for Acetone (ARC-RPT-6007)

K5 Post-Excavation Confirmation Sampling for Acetone

ARC-RPT-6007
July 29, 2011
Revision 2

DOE Contract No. DE-AM09-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

Prepared by:
Accelerated Remediation Company (aRc)
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Prepared for:
U.S. Department of Energy
SPRU Project Field Office
Knolls Atomic Power Laboratory (KAPL)
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Niskayuna, NY 12309-7100

K5 Post-Excavation Confirmation Sampling for Acetone

Approval for Use

Doug Collins Deputy Project Manager	07/29/11 Date
David Lodman Characterization Lead	07/29/11 Date
Berta Oates Project Quality Assurance Manager	07/29/11 Date

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Acronyms

FSS-03	Final Status Survey Unit 03
ICM	Interim Corrective Measures
NYCRR	*New York Code of Rules and Regulations*
NYSDEC	New York State Department of Environmental Conservation
RCRA	Resource Conservation and Recovery Act
SCO	Soil Cleanup Objective
SPRU	Separations Process Research Unit
USC	*United States Code*

1.0 Introduction

The Separations Process Research Unit (SPRU) is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level Land Areas known as the Railroad Staging Area and the Lower Level Parking Lot is being addressed under the Resource Conservation and Recovery Act (RCRA) (42 *United States Code* [USC] 6901 et seq. 1976) and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC 9601 et seq. 1980). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of the chemical contamination at the SPRU Lower Level under the RCRA corrective action program. The *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (hereinafter referred to as the Interim Correction Measures [ICM] Work Plan) (ARC-PLN-6106) was developed in accordance with the 6 *New York Code of Rules and Regulations* (NYCRR) Part 373 Hazardous Waste TSDF Permitting Requirements and provides the cleanup approach that is being used for the SPRU Lower Level.

The K5 former retention basin is located in the SPRU Lower Level Land Area primarily in SPRU Grid Unit 1111 (Figure 1). Pre-excavation sampling of the K5 Retention Basins was performed in August 2008 to determine if further excavation of the K5 area would be required because of residual acetone contamination. The *Pre-Excavation Sampling of the K5 Retention Basins for Acetone* (ARC-RPT-6001) concluded additional excavation of this area was warranted because acetone was present in concentrations above the soil cleanup objective (SCO). The November 2008 K5 excavation effort was conducted to remove acetone contamination per ARC-RPT-6001 recommendations, as well as to remove radiological and other chemical contamination. Confirmation sampling for other chemical and radiological contamination will be conducted during Final Status Survey Unit 03 (FSS-03) sampling, currently scheduled to be conducted in 2009.

The K5 Retention Basin remediation consisted of three separate but connected excavations. The deepest excavation centering on borehole B4013B was to remove radiological contamination to a depth of approximately 13.5 ft, the middle excavation centered on borehole K5-03 was for removal of the acetone contamination to a depth of approximately 6 ft, and the third excavation was extended north towards catch basin MCB26 to remove additional radiological contaminated soils indentified by radiological control technician to a depth of approximately 10 ft. The approximate dimensions of the total K5 Excavation are 40 ft perpendicular to the grade of the hill and 60 ft parallel to the hill grade. The total amount of material removed excavation was 521 banked cubic yards. Appendix A contains a cross-section of the K5 Excavation and pictures of the completed K5 Excavation.

The excavation was completed in November 2008. Confirmation sampling for acetone contamination was conducted on November 20, 2008. This report provides the results of the acetone confirmation sampling.

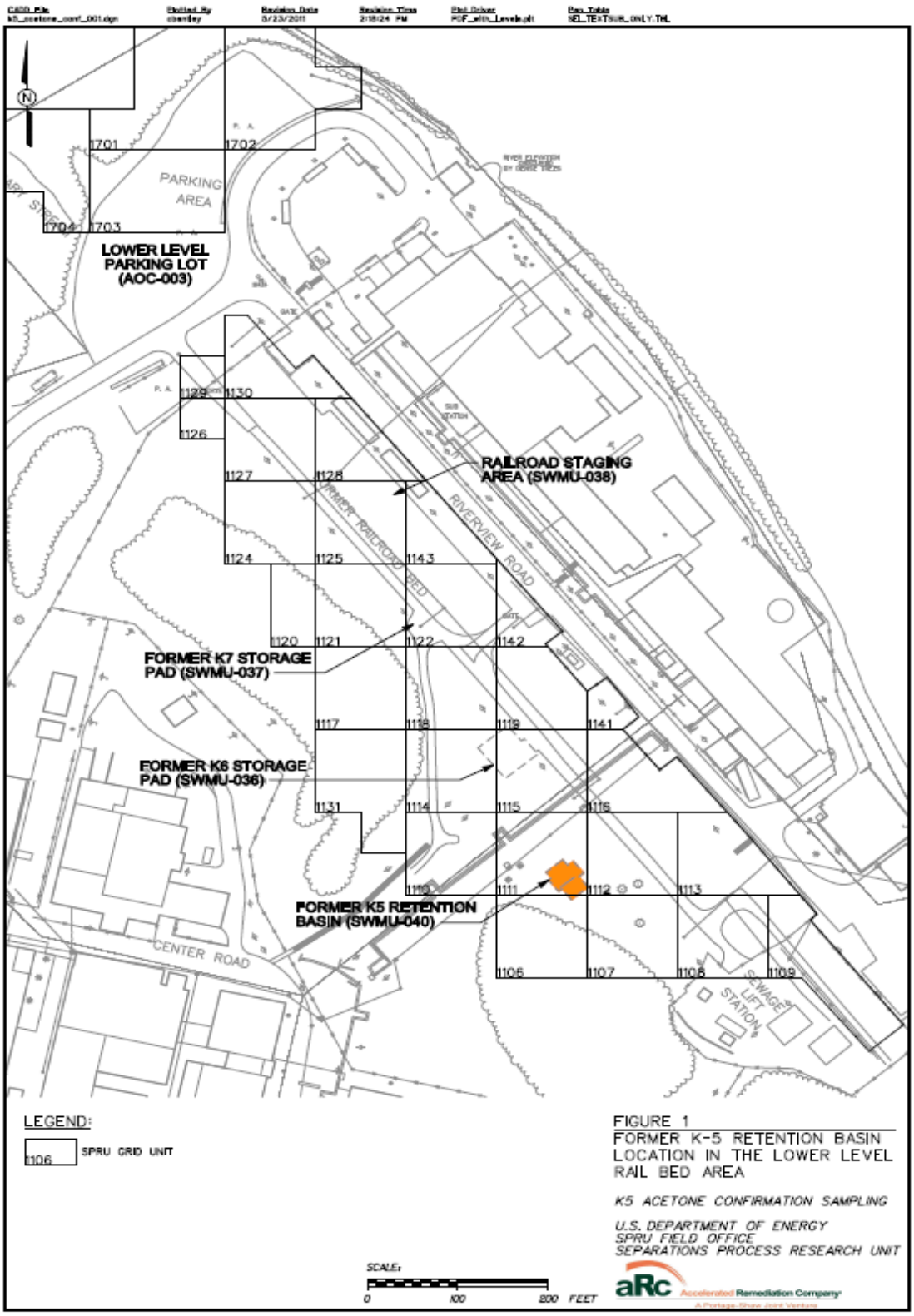

Figure 1 K5 Former Retention Basin location in the SPRU Lower Level Land Area

2.0 Sampling Activities

2.1 Sampling Location

The acetone sampling focused on the K5 Excavation and was conducted per requirements set forth in Section 2 of the ICM Work Plan (ARC-PLN-6106). The K5 Excavation consisted of three connected excavations. To ensure that confirmation sampling requirements of the project were met, a bottom sample was collected from each of the excavations, five sidewall samples were collected from the largest excavation generally centered on B9013B, and two sidewall samples were collected from each of the smaller excavations (Figure 2).

This sampling scheme met the sample density recommendations stated in NYSDEC "Draft DER-10 Technical Guidance for Site Investigation and Remediation" (NYSDEC 2002). Samples were collected on the uphill side of the sidewalls along the bed rock/soil interface zone. Sidewall samples from areas that did not have exposed bedrock present were collected approximately 2 ft above the bottom of the excavation.

2.2 Sample Collection

Because of concerns associated with the depth and sloping of the back sidewall, post-excavation samples were collected remotely. A track hoe with a 20-ft boom was used to extricate samples from each location. Samples were then collected from the soil in the bucket. The first foot of material was removed and set aside with the bucket, then fresh material was collected using the excavator bucket and a grab sample was collected from this material.

The soil samples were placed directly into pre-cleaned laboratory supplied 125-mL glass containers completely filling jars to minimize headspace. Samples were placed in a cooler containing blue ice. After all of the samples were collected, they were transferred to an offsite analytical laboratory following chain-of-custody procedures.

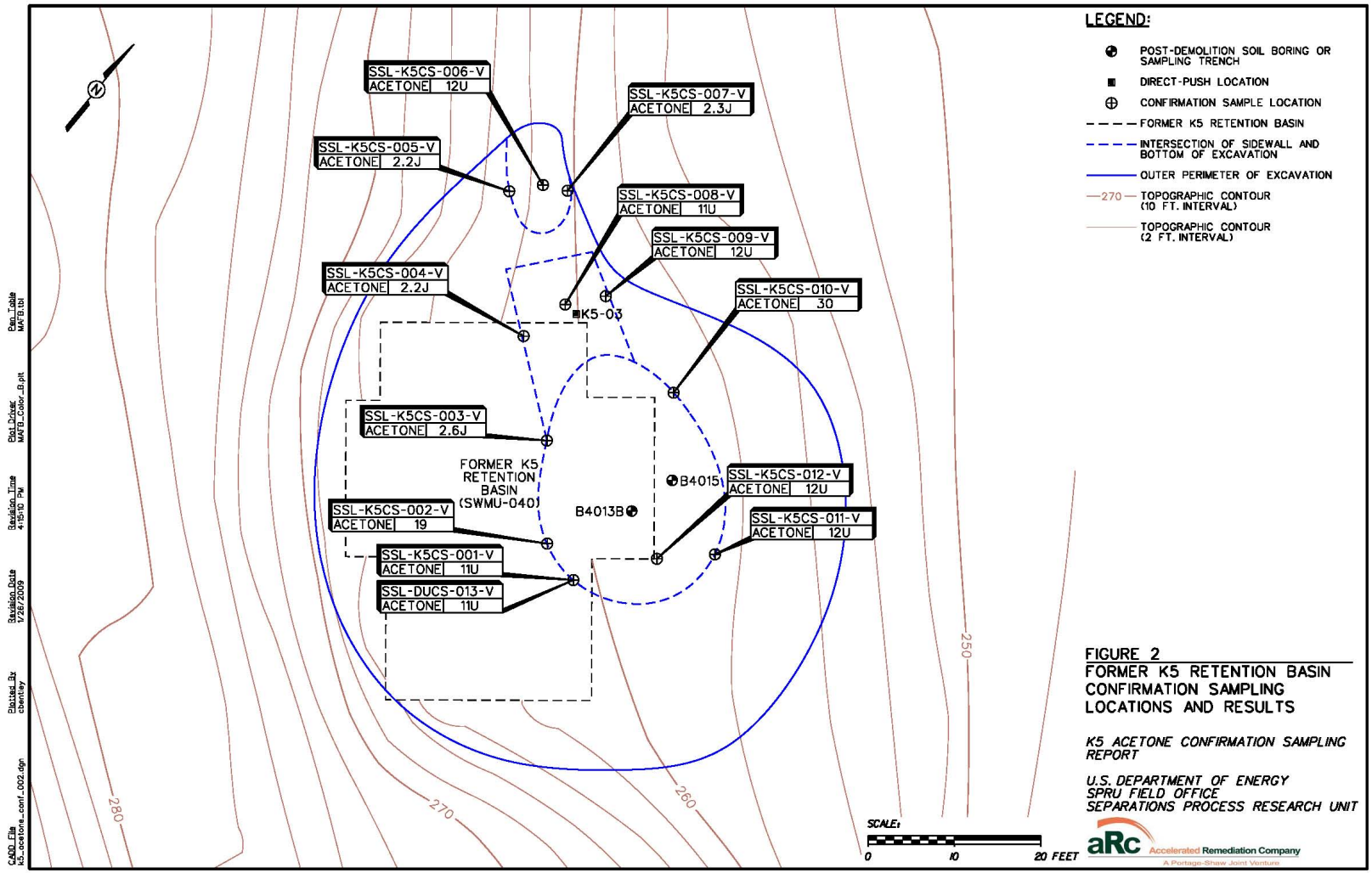

Figure 2 Former K5 Retention Basin confirmation sampling locations and results

3.0 Sample Analysis

3.1 Analysis

The samples were analyzed by Test America (Test America 2008) following U.S. Environmental Protection Agency SW-846 Method 8260B (EPA 2008) protocol in accordance with the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402). Table 1 provides the results of the analyses. The reported acetone concentration are below SCO (50 µg/kg) for all samples. The results for acetone are shown in Figure 1 along with associated laboratory data flagging. The complete data package is provided electronically with this report (Appendix B).

3.2 Data Validation

The laboratory data were validated internally by Test America in accordance with their quality assurance manual (Appendix B of ARC-PLN-6402). Independent validation was performed by Portage, Inc. in accordance with the National Functional Guidelines (EPA 1999), and data validation flags were assigned to the reported results based on the laboratory performance for the associated quality control analyses.

During validation of the volatile organic compound data, sample results reported for acetone were qualified based on instrument response factors. The response factors from the initial calibration verification and continuing calibration analyses associated with the solid matrix analyses were slightly below the 0.05 criterion (0.048 and 0.041, respectively). In accordance with the validation guidelines, when response factors are less than 0.05, then undetected results are rejected ("R" flagged) and positive results are qualified as estimates ("J" flagged) (Portage 2008). Although the response factors were low, acetone was detected in both the initial calibration (at concentrations ranging from 10 to 200 µg/L) and continuing calibration (at a concentration of 50 µg/L) analyses. Also, no unacceptable bias is reflected in the associated laboratory control results associated with these samples. The matrix spike/matrix spike duplicate analyses percent recovery for acetone was within acceptance limits for accuracy and precision. The solid matrix laboratory control sample associated with this batch of samples (with a known concentration of 50 µg/kg acetone) had a percent recovery of 99%. These quality control results indicate no bias in the quantitation of acetone. Had acetone been present in the samples, a detection would have been made. Therefore, the impact of the response factor on data usability is minimal and the acetone results reported in this document are adequate for decision-making purposes. The complete validation package is provided electronically with this report (Appendix C).

4.0 Discussion/Recommendations

The excavation of the K5 area was completed in November 2008 and consisted of the removal of 521 banked cubic yards of material. This volume is greater than the estimated 450 loose cubic yards of material calculated in ARC-RPT-6001, *Pre-Excavation Sampling of the K5 Retention Basins for Acetone.* Because of the continuous nature of the excavation and the proximity to the former K5 Retention Basin, the entire excavation was included in the acetone confirmation sampling.

All confirmation samples analyzed were below the acetone SCO of 50 µg/kg. Therefore, no further excavation is required in the former K5 Retention Basin area for residual acetone. However, until final status survey sampling for FSS-03 is completed and it is determined that radiological and metals constituents meet the SCOs, the K5 excavation will remain open. After the entire FSS-03 unit has been cleared, the K5 Excavation will be backfilled and contoured.

Table 1 Summary of sampling and analytical results

Sample ID	Analysis	Result (µg/kg)	Lab Flag[a]	Validation Flag[b]	Date Sampled	Time Sampled	Comments
SSL-K5CS-001-V	Acetone	11	U	R	11/20/2008	1000	1 ft into sidewall at the soil bedrock interface borehole B4013B excavation
SSL-K5CS-002-V	Acetone	19		J	11/20/2008	0920	2 ft into sidewall at the soil bedrock interface borehole B4013B excavation
SSL-K5CS-003-V	Acetone	2.6	J	J	11/20/2008	0926	2 ft into sidewall at the soil bedrock interface borehole B4013B excavation
SSL-K5CS-004-V	Acetone	2.2	J	J	11/20/2008	0935	2.5 ft into sidewall at the soil bedrock interface K5-03 excavation
SSL-K5CS-005-V	Acetone	2.2	J	J	11/20/2008	0950	Uphill side of north excavation 1 ft into sidewall
SSL-K5CS-006-V	Acetone	12	U	R	11/20/2008	0945	1 ft bgs bottom of north excavation
SSL-K5CS-007-V	Acetone	2.3	J	J	11/20/2008	0953	1 ft into sidewall north excavation
SSL-K5CS-008-V	Acetone	11	U	R	11/20/2008	0938	1 ft bgs in bottom of excavation in the K5-03 area
SSL-K5CS-009-V	Acetone	12	U	R	11/20/2008	0943	1 ft into sidewall K5-03 excavation
SSL-K5CS-010-V	Acetone	30		J	11/20/2008	0910	1 ft into sidewall borehole B4013B excavation
SSL-K5CS-011-V	Acetone	12	U	R	11/20/2008	0913	1 ft into sidewall borehole B4013B excavation
SSL-K5CS-012-V	Acetone	12	U	R	11/20/2008	0912	Bottom of the excavation 1 ft below ground surface near borehole B4013B
SSL-K5CS-013-V	Acetone	11	U	R	11/20/2008	1000	Duplicate of SSL-K5CS-001-V
SSL-K5CS-014-V	Acetone	10	U	R	11/20/2008	1000	Trip blank

Note: Acetone SCO is 50 µg/kg (ICM Work Plan, Table 1 [ARC-PLN-6106]).

a. U = Undetected; J = Estimated value. The analyte was positively identified in the sample, but reported value may not be accurate representation of concentration actually present in the sample.

b. R = Rejected; J =Estimated value. The analyte was positively identified in the sample, but reported value may not be accurate representation of concentration actually present in the sample.

5.0 References

6 NYCRR Part 373, "Hazardous Waste Management Facilities," *New York Code of Rules and Regulations*, as amended.

42 USC 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976," *United States Code*, as amended.

42 USC 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980," *United States Code*, as amended. (NOTE: The 1986 amendment is cited as "Superfund Amendments and Reauthorization Act of 1986," [SARA])

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

ARC-RPT-6001, *Pre-Excavation Sampling of the K5 Retention Basins for Acetone*, Rev. 1, Accelerated Remediation Company, November 2008.

EPA, 1999, *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review,* EPA 540/R-99/008, U.S. Environmental Protection Agency, Washington, D.C., October 1999.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008, Web page visited September 17, 2008.

NYSDEC, 2002, "Draft DER-10 Technical Guidance for Site Investigation and Remediation," Draft DER-10, New York State Department of Environmental Consultation, December 25, 2002.

Portage, 2008, *Limitations and Validation Report for SPRU, SDG F8K210318*, Document # SPRU-F8K210318-Acetone, Portage, Inc., January 6, 2009.

Test America, 2008, Analytical Report, Project No. 129223, Lot # F8K210318, Test America Laboratories, Inc., Earth City, MO, December 1, 2008.

Appendix A

Cross-Section and Photos of K5 Former Retention Basin Excavation

ATTACHMENT 2 AS-BUILT SECTION

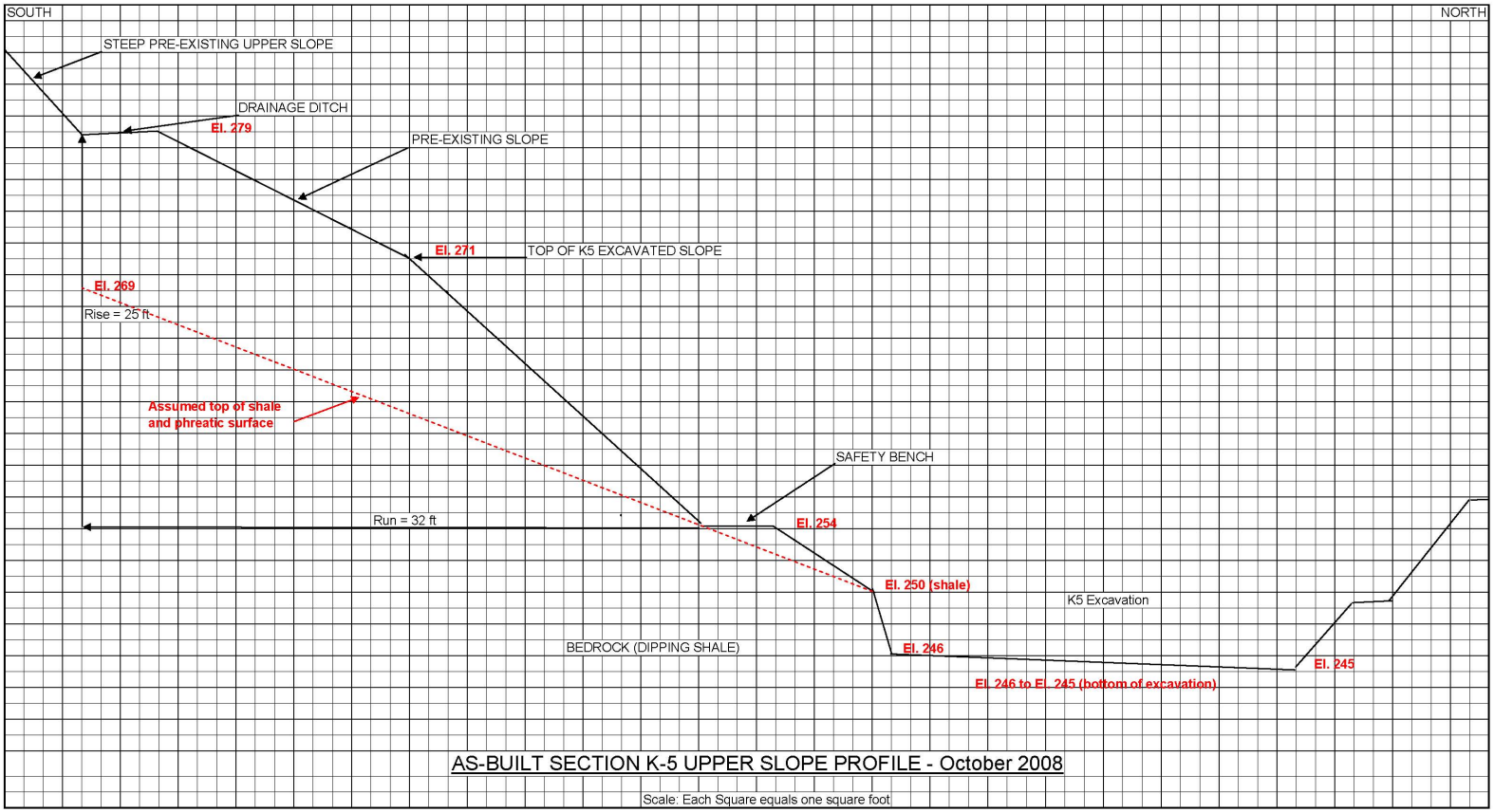

Figure A-1 Approximate cross-section of K5 Excavation

Figure A-2 Photo of K5 Excavation facing north

Figure A-3 Photo of excavation centered on borehole K5-03 facing downhill/slope

Figure A-4 Photo of excavation centering on borehole B4013B facing uphill to the northwest

Appendix B

CD-ROM with Electronic Copy of Analytical Report Project No. 129223 Acetone Analyses of Samples Collected At SPRU Lot #: F8K210318

Appendix C

CD-ROM with Electronic Copies of F8K210318 Data Limitations and Validation Report Acetone Analyses of Samples Collected At K5 Former Retention Basin

Attachment 3
Interim RCRA ICM Data Report for Final Status Survey Unit 01
(ARC-RPT-6005)

Interim RCRA ICM Data Report for Final Status Survey Unit 01

ARC-RPT-6005
August 1, 2011
Revision 3

DOE Contract No. DE-AM09-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

Prepared by:
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Interim RCRA ICM Data Report for Final Status Survey Unit 01

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
David Lodman Characterization Lead	08/01/11 Date
Berta Oates Project Quality Assurance Manager	08/01/11 Date

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Acronyms

COC	constituent of concern
EPA	U.S. Environmental Protection Agency
FSS-01	Final Status Survey Unit 01
ICM	interim corrective measures
NYSDEC	New York State Department of Environmental Conservation
PAH	polycyclic aromatic hydrocarbon
RCRA	Resource Conservation and Recovery Act
RSA	Railroad Staging Area
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level

1.0 Executive Summary

This interim report documents completion of the voluntary cleanup area defined as the Separations Process Research Unit (SPRU) Final Status Survey Unit 01 (FSS-01) in accordance with the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (hereinafter referred to as the Interim Correction Measures [ICM] Work Plan) (ARC-PLN-6106) and *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402).

Sample locations were established following completion of the excavation in FSS-01. Sampling locations for chemical constituents of concern (COCs) were determined using the methodology described in the ICM Work Plan (ARC-PLN-6106). Sixteen soil samples and one field duplicate sample were collected on October 30, 2008, for offsite laboratory analysis of metals and polycyclic aromatic hydrocarbon (PAH) compounds.

The concentrations of all COCs that are subject to Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) requirements are below soil cleanup objectives (SCOs). Only compounds (arsenic and PAH) associated with historical railroad activities, as reported in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002), have concentrations above soil cleanup objectives (SCOs).

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area (RSA) is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of the chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM Work Plan (ARC-PLN-6106) was developed in accordance with the 6 New York Code of Rules and Regulations Part 373 Hazardous Management Permit requirements and provides the cleanup approach for the SPRU-LL.

According to the ICM Work Plan (ARC-PLN-6106), as recommended in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006), the objectives of the ICM Work Plan are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from NYSDEC for chemicals in the SPRU land areas. The ICM Work Plan requires that NYSDEC be notified when cleanup levels of non-COCs exceed SCOs. PAH compounds and several metals (arsenic, antimony, lead and copper) associated with historical rail activities in the SPRU lower level (DOE/CH2M HILL 2002) are not subject to cleanup requirements under RCRA.

This interim report documents completion of the SPRU FSS-01 in accordance with the ICM Work Plan (ARC-PLN-6106) and *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402). The completion of the voluntary cleanup was accomplished by meeting SCOs and/or obtaining concurrence from NYSDEC for levels of constituents greater than SCOs. Subsequent to issuance of the ICM work plan, the boundaries of the voluntary area

were modified to include only the voluntary cleanup area inside the SPRU railroad staging area boundary fence. Figure 1 shows the location of FSS-01 in the SPRU-LL land areas.

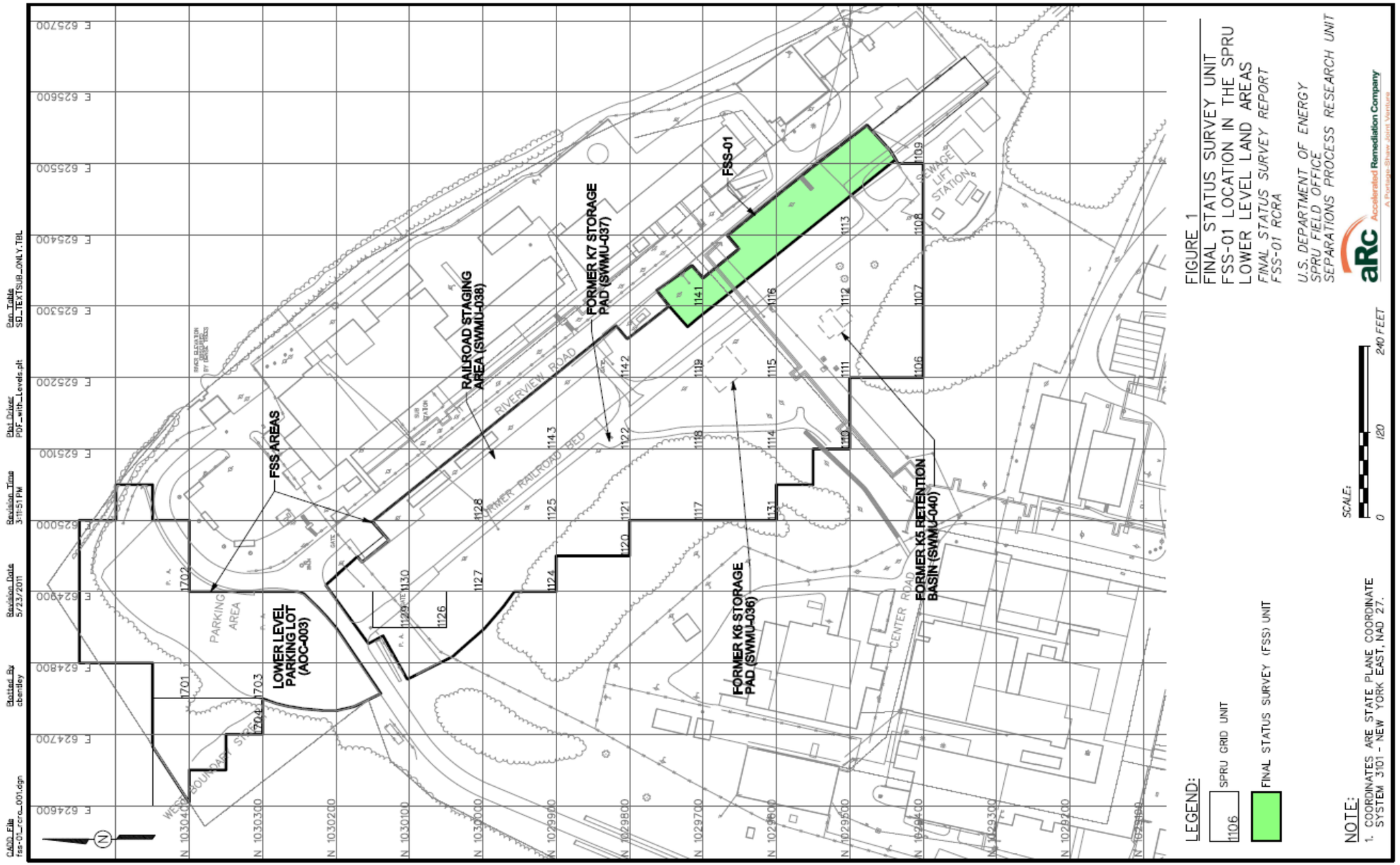

Figure 1 Final Status Survey Unit 01 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sampling Location

Sampling locations were established following completion of the excavation in FSS-01. Sampling locations for chemical COCs were determined using the methodology described in the ICM Work Plan (ARC-PLN-6106). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the ICM Work Plan (ARC-PLN-6106) used to determine the number of samples required for the chemical COCs was determined to be a minimum of 12 samples. To expedite sampling, 16 sampling locations were used for the chemical COCs and the radiological COCs for FSS-01. The locations were chosen using a random starting point with subsequent samples located using a triangular pattern with each sample location being 39.2 ft from the previous location. Figure 2 shows the locations of the samples collected for FSS-01.

3.2 Sample Collection

Samples were collected for FSS-01 on October 30, 2008. Sixteen soil samples and one duplicate were collected and analyzed in accordance with the ICM Work Plan (ARC-PLN-6106) and *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402). At each location a soil sample, approximately 6 in. deep by 6 in. diameter, was collected, and transferred to appropriate sample containers. Because of the chemical interference associated with the railroad bed, descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for total metals and PAH compounds.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler containing blue ice and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. All chemical samples were transferred to an offsite analytical laboratory following chain of custody procedures.

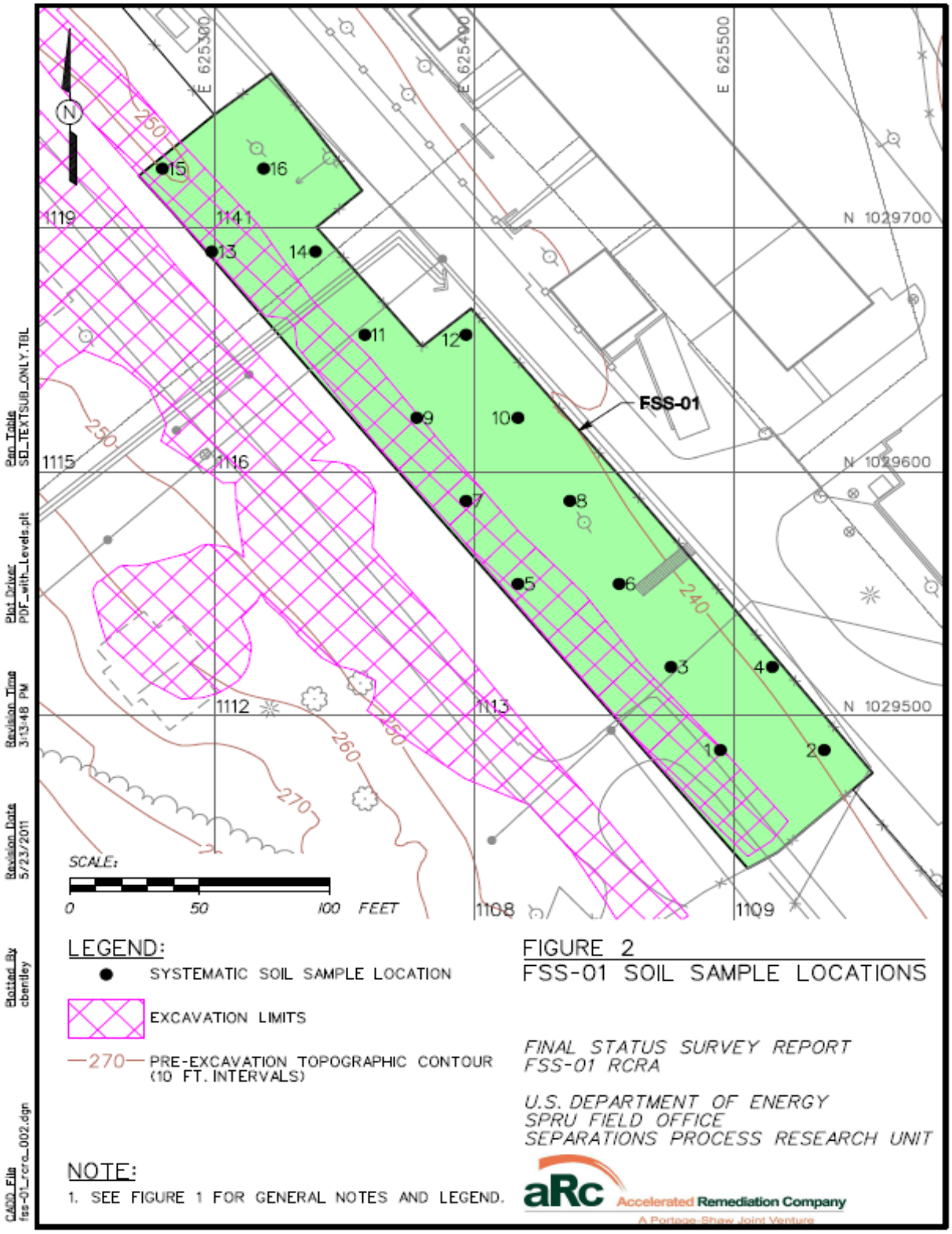

Figure 2 Sample locations for FSS-01

Table 1 Sample description

Sample ID	Map Location	Sample Description
SFS-001-001-M	1	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-001-002-M	2	Dark grey topsoil (no asphalt)
SFS-001-003-M	3	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-001-004-M	4	Dark grey topsoil (no asphalt)
SFS-001-005-M	5	Clay soil gravel mix (no asphalt)
SFS-001-006-M	6	Dark grey topsoil (no asphalt)
SFS-001-007-M	7	Clay soil, gravel mix (no asphalt)
SFS-001-008-M	8	Dark grey topsoil (no asphalt)
SFS-001-009-M	9	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-001-010-M	10	Brown clay topsoil (no asphalt)
SFS-001-011-M	11	Brown clay topsoil (no asphalt)
SFS-001-012-M	12	Brown clay topsoil (no asphalt)
SFS-001-013-M	13	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-001-014-M	14	Dark brown granular cinders intermixed with medium crushed gravel wet (no asphalt)
SFS-001-015-M	15	Dark brown granular cinders, intermixed with medium crushed gravel, and shale (no asphalt)
SFS-001-016-M	16	Brown clay topsoil, gravel (no asphalt)

4.0 Sample Analysis

4.1 Analysis

In accordance with the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402), the samples were analyzed by Test America (Test America 2008a, 2008b) following U.S. Environmental Protection Agency (EPA) SW-846 Methods 6010B for metals, 6020 for antimony, and 7471A for mercury (EPA 2008). Because of matrix effects, which required dilution of the samples, thallium was also analyzed using EPA Method 6020 to obtain detection limits below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results of the metals analyses. The metals data are provided in laboratory analytical report Project No. 179223, Lot # F8K010172, November 13, 2008 (Test America 2008a); and analytical report, Project No. 179223, Lot # F8L080167, December 22, 2008 (Test America 2008b). In addition, PAH data is provided in analytical report, Project No. 179223, Lot # F8K010174, November 28, 2008 (Test America 2008c). All data reports are on a CD-ROM provided as Appendix A with this report.

Table 2 Reported metals results from soil samples collected from SPRU FSS-01

Sample ID	**SCO#**	**SFS-001-001-M**			**SFS-D001-017-M**			**SFS-001-002-M**			**SFS-001-003-M**			**SFS-001-004-M**			**SFS-001-005-M**		
FSS Unit		**001**			**001**			**001**			**001**			**001**			**001**		
Sample Date	**(mg/kg)**	**10/30/2008**			**10/30/2008**			**10/30/2008**			**10/30/2008**			**10/30/2008**			**10/30/2008**		
Metals Results (mg/Kg)			L	V		L	V		L	V		L	V		L	V		L	V
Aluminum	NA	7560	NE*	J	9230	NE*	J	9560	NE*	J	3170	NE*	J	10900	NE*	J	14700	NE*	J
Antimony	1	0.35	BN	UJ	0.22	BN	UJ	0.27	BN	UJ	0.92	BN	UJ	0.19	UN	UJ	0.18	UN	UJ
Arsenic	16	**34.5**	**N**	**J**	**21.8**	**N**	**J**	5.1	N	J	**56.0**	**N**	**J**	4.0	N	J	14.4	N	J
Barium	350	63.3	N*	J	68.8	N*	J	58.0	N*	J	41.6	N*	J	60.1	N*	J	68.2	N*	J
Beryllium	14	0.62	B		0.66	B		0.55	B		0.41	U		0.61	B		0.78	B	
Cadmium	2.5	0.72	B	U	0.48	U		0.82	B		0.52	U		0.57	B	U	0.66	B	U
Calcium	NA	12400	NE*	J	10900	NE*	J	5940	NE*	J	2300	NE*	J	11800	NE*	J	4500	NE*	J
Chromium	36	13.6	N*	J	13.6	N*	J	14.7	N*	J	8.1	N*	J	14.2	N*	J	19.9	N*	J
Cobalt	30	9.0	BN		11.0	BN		10.3	BN		4.0	BN		9.3	BN		13.3	N	
Copper	270	33.5	N*	J	31.2	N*	J	30.4	N*	J	51.3	N*	J	18.8	N*	J	32.4	N*	J
Iron	NA	24700	N*		24600	N*		23500	N*		16800	N*		21900	N*		31400	N*	
Lead	400	28.7	N		23.7	N		37.4	N		47.8	N		23.0	N		25.2	N	
Magnesium	NA	4850	N*	J	5060	N*	J	5240	N*	J	1100	N*	J	7740	N*	J	6710	N*	J
Manganese	2000	355	N*	J	471	N*	J	617	N*	J	108	N*	J	500	N*	J	514	N*	J
Mercury	0.73	0.043			0.029	B		0.096			0.053			0.052			0.037	B	
Nickel	130	23.4	N	J	28.0	N	J	30.7	N	J	17.9	N	J	25.6	N	J	30.1	N	J
Potassium	NA	877	B	U	1780			896	B	U	362	U		807	B	U	998	B	U
Selenium	4	3.4	U		3.3	U		3.8	U		3.5	U		3.5	U		3.3	U	
Silver	8.3	0.85	U		0.82	U		0.95	U		0.88	U		0.88	U		0.83	U	
Sodium	NA	30.7	B*	U	27.0	U*		31.1	U*		30.8	B*	U	28.9	U*		27.4	U*	
Thallium	2	0.44	U		0.17	U		0.51	B	U	0.45	U		0.45	U		0.43	U	
Vanadium	150	45.5	N	J	32.0	N	J	52.1	N	J	92.0	N	J	50.4	N	J	26.1	N	J
Zinc	2200	84.9	N	J	94.0	N	J	260	N	J	54.5	BN	J	98.7	N	J	109	N	J

Table 2 (continued)

Sample ID		**SFS-001-006-M**			**SFS-001-007-M**			**SFS-001-008-M**			**SFS-001-009-M**			**SFS-001-010-M**			**SFS-001-011-M**		
FSS Unit	**SCO#**	**001**			**001**			**001**			**001**			**001**			**001**		
Sample Date	**(mg/kg)**	**10/30/2008**			**10/30/2008**			**10/30/2008**			**10/30/2008**			**10/30/2008**			**10/30/2008**		
Metals Results (mg/Kg)			L	V		L	V		L	V		L	V		L	V		L	V
Aluminum	NA	8540	NE*	J	16200	NE*	J	6910	NE*	J	3080	NE*	J	9860	NE*	J	11600	NE*	J
Antimony	1	0.18	UN	UJ	0.18	UN	UJ	0.18	UN	UJ	1.80	N	UJ	0.20	UN	UJ	0.19	UN	UJ
Arsenic	16	10.1	N	J	11.7	N	J	4.7	N	J	**24.7**	**N**	**J**	6.6	N	J	5.9	N	J
Barium	350	42.7	N*	J	82.0	N*	J	42.2	N*	J	39.6	N*	J	65.1	N*	J	69.0	N*	J
Beryllium	14	0.49	B		0.76	B		0.47	B		0.45	B		0.60	B		0.66	B	
Cadmium	2.5	0.55	B	U	0.81	B		0.49	U		0.62	B	U	0.63	B	U	0.51	U	
Calcium	NA	5710	NE*	J	3500	NE*	J	8410	NE*	J	2010	NE*	J	14600	NE*	J	4660	NE*	J
Chromium	36	13.1	N*	J	20.0	N*	J	9.5	N*	J	7.9	N*	J	15.2	N*	J	15.5	N*	J
Cobalt	30	7.9	BN		13.5	N		7.3	BN		5.4	BN		12.0	BN		11.3	BN	
Copper	270	27.6	N*	J	23.5	N*	J	40.2	N*	J	246	N*	J	32.3	N*	J	31.3	N*	J
Iron	NA	21100	N*		30400	N*		18200	N*		24000	N*		27500	N*		27500	N*	
Lead	400	26.0	N		21.3	N		21.6	N		87.1	N		23.8	N		21.5	N	
Magnesium	NA	5130	N*	J	7080	N*	J	3680	N*	J	1090	N*	J	7060	N*	J	4750	N*	J
Manganese	2000	302	N*	J	1650	N*	J	356	N*	J	123	N*	J	705	N*	J	532	N*	J
Mercury	0.73	0.046			0.024	B		0.041			0.053			0.058			0.081		
Nickel	130	25.8	N	J	30.9	N	J	23.1	N	J	20.5	N	J	32.3	N	J	26.3	N	J
Potassium	NA	679	B	U	690	B	U	995	B	U	371	U		1020	B	U	1340		
Selenium	4	3.3	U		3.3	U		3.3	U		3.6	U		3.6	U		3.4	U	
Silver	8.3	0.83	U		0.82	U		0.83	U		0.90	U		0.91	U		0.87	U	
Sodium	NA	27.3	U*		27.1	U*		27.2	U*		29.7	U*		30.1	U*		28.5	U*	
Thallium	2	0.43	U		0.42	U		0.43	U		0.46	U		0.47	U		0.45	U	
Vanadium	150	41.7	N	J	25.5	N	J	45.5	N	J	62.3	N	J	41.1	N	J	27.8	N	J
Zinc	2200	175	N	J	172	N	J	229	N	J	282.0	N	J	135	N	J	127	N	J

Table 2 (continued)

Sample ID		**SFS-001-012-M**			**SFS-001-013-M**			**SFS-001-014-M**			**SFS-001-015-M**			**SFS-001-016-M**		
FSS Unit	**SCO#**	**001**			**001**			**001**			**001**			**001**		
Sample Date	**(mg/kg)**	**10/30/2008**			**10/30/2008**			**10/30/2008**			**10/30/2008**			**10/30/2008**		
Metals Results (mg/Kg)			L	V		L	V		L	V		L	V		L	V
Aluminum	NA	8660	NE*	J	10500	NE*	J	4110	NE*	J	12800	NE*	J	2840	NE*	J
Antimony	1	0.20	UN	UJ	0.50	BN	UJ	0.36	BN	UJ	0.37	BN	UJ	0.22	BN	UJ
Arsenic	16	4.7	N	J	**40.6**	**N**	**J**	8.8	N	J	13.8	N	J	5.5	N	J
Barium	350	55.9	N*	J	62.0	N*	J	59.2	N*	J	61.5	N*	J	25.5	N*	J
Beryllium	14	0.51	B		0.58	B		0.42	U		0.85	B		0.39	U	
Cadmium	2.5	0.56	U		0.51	U		0.54	U		0.64	B	U	0.50	U	
Calcium	NA	17800	NE*	J	5930	NE*	J	1770	NE*	J	6270	NE*	J	992	NE*	J
Chromium	36	12.8	N*	J	13.1	N*	J	7.2	N*	J	18.9	N*	J	8.1	N*	J
Cobalt	30	8.8	BN		10.8	BN		4.1	BN		16.1	N		5.2	BN	
Copper	270	28.3	N*	J	42.1	N*	J	34.3	N*	J	68.7	N*	J	35.5	N*	J
Iron	NA	20800	N*		24800	N*		19700	N*		34600	N*		14400	N*	
Lead	400	19.9	N		32.1	N		28.2	N		52.2	N		25.8	N	
Magnesium	NA	7030	N*	J	5550	N*	J	1290	N*	J	7580	N*	J	621	N*	J
Manganese	2000	506	N*	J	612	N*	J	101	N*	J	556	N*	J	73.1	N*	J
Mercury	0.73	0.090			0.078			0.057			0.042			0.036	B	
Nickel	130	21.8	N	J	24.9	N	J	10.9	N	J	34.6	N	J	18.1	N	J
Potassium	NA	1370			1110	B	U	377	U		1370			477	B	U
Selenium	4	3.7	U		3.4	U		3.6	U		3.2	U		3.4	U	
Silver	8.3	0.94	U		0.86	U		0.92	U		0.79	U		0.85	U	
Sodium	NA	31.0	U*		28.4	U*		30.1	U*		31.1	B*	U	27.9	U*	
Thallium	2	0.49	U		0.18	U		0.19	U		0.16	U		0.17	U	
Vanadium	150	32.8	N	J	21.6	N	J	22.1	N	J	24.0	N	J	12.6	N	J
Zinc	2200	116	N	J	100	N	J	63.1	N	J	118	N	J	194	N	J

Table 2 (continued)

Notes:	SFS-D001-017-M is the field duplicate of sample SFS-001-001-M.	
	Results in bold font and shaded with grey indicate the value exceeds the soil cleanup objective (SCO).	
#	The SCO is the more stringent under 6 NYCRR Part 375-6.8 for the protection of groundwater or residential exposure or TAGM-4046 when Part 375-6 does not reference a value.	
NA =	not applicable.	
mg/Kg =	milligrams per kilogram.	
L =	Laboratory Flags:	
	U =	The analyte was analyzed for but was not detected. The reported concentration is the method detection limit.
	B =	Result is between the method detection limit and the reporting limit.
	E =	Serial dilution percent recovery not within limits.
	N =	Spike analyte recovery outside stated control limits.
	*=	Relative percent difference is outside stated control limits.
V =	Validation Flags:	
	J:	Estimated value. The analyte was positively identified in the sample, but reported value may not be accurate representation of concentration actually present in the sample.
	UJ:	The material was analyzed for but not detected. The sample quantitation limit is an estimated value based on results from associated laboratory quality control analyses.
	U:	Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with their quality assurance manual (Appendix B of ARC-PLN-6402). Independent validation of the metals and PAH data was performed by Portage, Inc. in accordance with the National Functional Guidelines for Inorganics (EPA 2004) and National Functional Guidelines for Organics (EPA 1999), respectively. Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitations and validation (L&V) reports, *SPRU Metals,* SDG SFS-001-001M (F8K010172) December 5, 2008 (Portage 2008) and *SPRU Metals,* SDG SFS-001-001M (F8L080167), January 7, 2009 (Portage 2009)*;* are on the CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2. In addition, PAH validation report *KAPL SPRU*, SDG F8K010174, December 16, 2008 (Portage 2008b) is provided on the CD-ROM in Appendix B.

5.0 Data Quality Assessment

Data quality is examined to ensure adequacy for decision-making and the data are compared to SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation of the metals data (Portage 2008), a “U” (undetected) validation flag was assigned to positive results of cadmium, potassium, and sodium in samples where reported concentrations were indistinguishable from levels detected in associated laboratory blanks. The remaining validation qualifiers assigned “J” flags (estimated) denote evidence of matrix interferences in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

Thallium results were generated initially by SW-846 Method 6010, “Inductively Coupled Plasma-Atomic Emission Spectrometry” (EPA 2008). Because of matrix interferences and dilutions performed to lessen their effects during analysis, the initial set of analytical data had slightly elevated reporting limits. Method 6020 allows a lower detection limit ensuring appropriate decisions at the SCO and was then used as the method for reanalysis of those samples with elevated reporting limits. The reanalysis data are the only data provided in this report. During validation of the thallium data (Portage 2009), positive results were assigned “U” (undetected) validation flags because of corresponding concentrations detected in the initial calibration blank.

5.2 Comparison of Data to Site Cleanup Objectives

This section provides the comparison of the FSS-01 data to the SCOs. All COCs subject to RCRA requirements analyzed for in FSS-01 had concentrations below SCOs. The only chemical constituents that exceeded SCOs (arsenic, and PAHs compounds) are COCs associated with historical railroad activities in the lower level and are not subject to cleanup requirements under RCRA. Table 3 lists by sampling location the concentrations of arsenic and the PAH compounds that exceeded their SCOs [(benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene and indeno(1,2,3-cd)pyrene)].

Table 3 List of SCO exceedances for non COCs for SPRU FSS-01.

Sample Location		1	1 (field duplicate)	3	9	13	14
Sample Date		**10/30/2008**	**10/30/2008**	**10/30/2008**	**10/30/2008**	**10/30/2008**	**10/30/2008**
Metal results (mg/kg)	**SCO**						
Arsenic	16	34.5	21.8	56.0	24.7	40.6	
PAH Results (mg/kg)							
Benzo(a)anthracene	1			2.2			1.4
Benzo(a)pyrene	1			1.8			1.4
Benzo(b)fluoranthene	1			2.5	1.4		2.6
Benzo(k)fluoranthene	1			2.1			1.8
Chrysene	1			3.5			2.1
Indeno(1,2,3-cd)pyrene	0.5			0.82	1.4		0.72

6.0 Conclusions

Analyses of the FSS-01 data were shown to be of sufficient quality and quantity for decision-making. The SCOs for arsenic and PAH compounds were exceeded in five of the sampling locations, all of which are associated with the historical railroad activities. Arsenic concentrations were detected greater than the SCO in four samples, and concentrations of PAH compounds are above the SCOs in three samples. This historical rail bed material is not subject to regulations under RCRA. All COCs subject to RCRA requirements had concentrations below SCOs.

A civil survey of the final excavated surface of FSS-01 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 481 yd^3 of materials were removed from FSS-01. Re-grading and seeding of the unit will be completed in the 2009 field season.

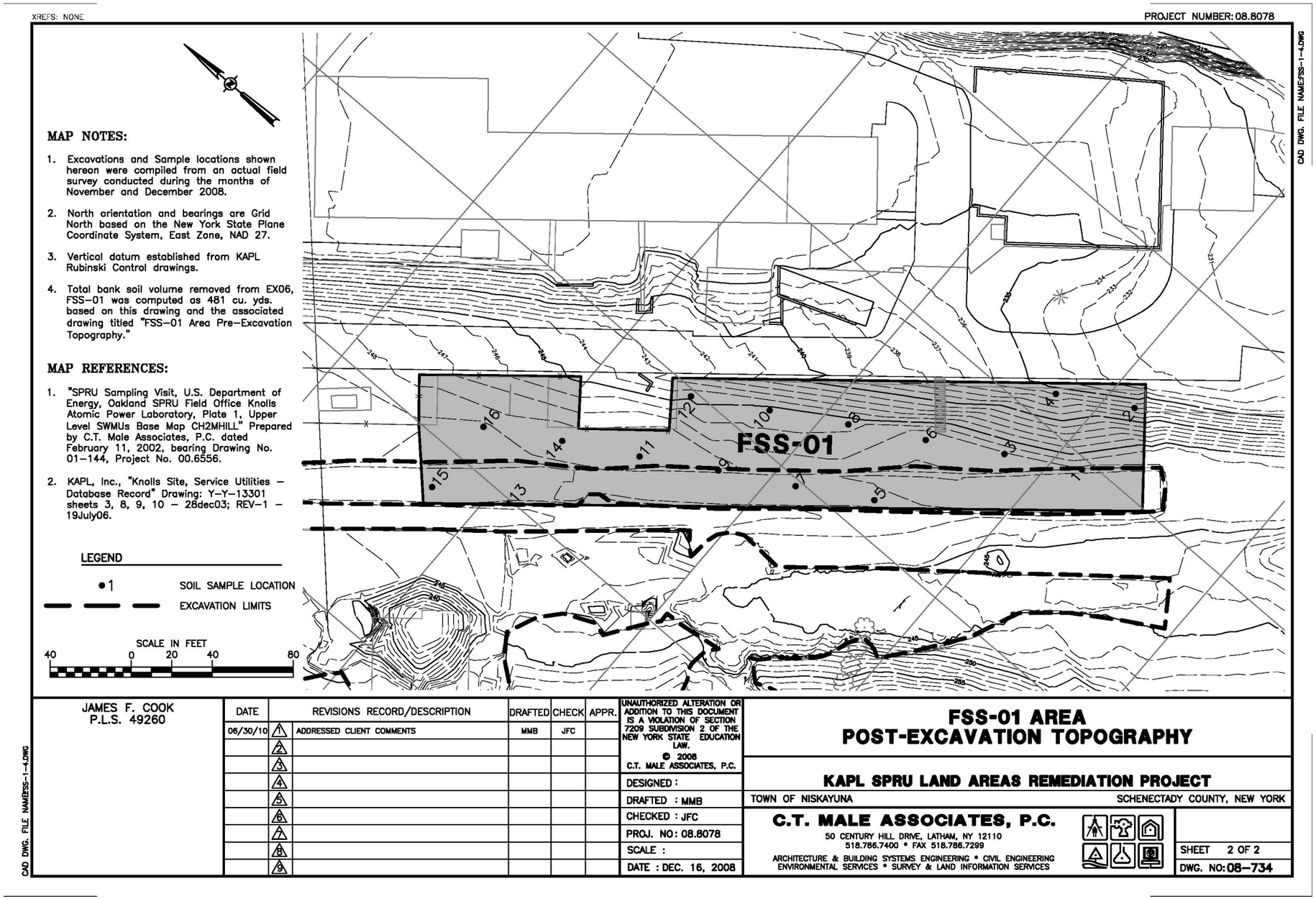

Figure 3 Topographical survey map of FSS-01

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976," as amended.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980," as amended. (NOTE: The 1986 amendment is cited as "Superfund Amendments and Reauthorization Act of 1986" [SARA].)

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, Rev. 2, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, Rev. 2, August 2008.

ARC-PLN-6511, *Radiological Confirmation Sampling and Analysis Plan/Final Status Survey (CSAP/FSS) SPRU Lower Level Land Areas,* Accelerated Remediation Company, Rev. 2, June 16, 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, February 2002.

EPA, 1999, *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review,* EPA 540/R-99/008, U.S. Environmental Protection Agency, Washington, D.C., October 1999.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008, Web page visited September 17, 2008.

NYSDEC, 2006, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, March 9, 2006.

Portage, 2008a, *SPRU Metals,* SDG SFS-001-001M (F8K010172), Portage, Inc., Idaho Falls, ID, December 5, 2008.

Portage, 2008b*, KAPL SPRU,* SDG F8K010174, Portage, Inc., Idaho Falls, ID, December 16, 2008.

Portage, 2009, *SPRU Metals,* SDG SFS-001-001M (F8L080167), Portage, Inc., Idaho Falls, ID, January 7, 2009.

Test America, 2008a, Analytical Report, Project No. 129223, Lot # F8K010172, Test America Laboratories, Inc., Earth City, MO, November 13, 2008.

Test America, 2008b, Analytical Report, Project No., 129223, Lot # F8L080167, Test America Laboratories, Inc. Earth City, MO, December 22, 2008.

Test America, 2008c, Analytical Report, Project No. 129223, Lot # F8K010174, Test America Laboratories, Inc., Earth City, MO, November 28, 2008.

Appendix A
CD-ROM with Electronic Copy of Analytical Report, Project No. 179223, SDG # F8K010172, SDG # F8K010174 and SDG # F8L080167, Final Status Survey Unit 01

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Reports SDG # F8K010172, SDG # F8K010174 and SDG # F8L080167, Final Status Survey Unit 01

Attachment 4
Interim RCRA ICM Data Report for Final Status Survey Unit 02
(ARC-RPT-6006)

Interim RCRA ICM Data Report for Final Status Survey Unit 02

ARC-RPT-6006
August 1, 2011
Revision 5

DOE Contract No. DE-AM09-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

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Interim RCRA ICM Data Report for Final Status Survey Unit 02

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
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Acronyms

COC	constituent of concern
EPA	U.S. Environmental Protection Agency
FSS-02	Final Status Survey Unit 02
ICM	interim corrective measures
NYSDEC	New York State Department of Environmental Conservation
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	Target Analyte List

1.0 Executive Summary

This interim report documents completion of the voluntary cleanup area defined as the Separations Process Research Unit (SPRU) Final Status Survey Unit 02 (FSS-02) in accordance with the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereinafter referred to as the interim corrective measures [ICM] work plan) and *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402).

Sample locations were established following completion of the excavation in FSS-02. Sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sixteen soil samples and one field duplicate sample were collected on November 19, 2008, for offsite laboratory analysis of Target Analyte List (TAL) metals.

During review of preliminary laboratory data, it was determined that two sample locations had concentrations greater than the soil cleanup objectives (SCOs) for the COCs chromium and cadmium. As detailed in the ICM work plan (ARC-PLN-6106), additional excavation of the failed confirmation sampling points consisted of a 20-ft radius around each sampling point being excavated an additional 6 in. in depth. At sample point 15, the X-ray fluorescence field readings indicated that elevated levels of chromium were still present, so the excavation was continued to the depth of 2 ft. The required excavation and re-sampling of these areas occurred in April 2009.

The concentrations of all COCs that are subject to RCRA (42 USC § 6901 et seq.) requirements are below SCOs. Only compounds (arsenic and antimony) associated with historical railroad activities, as reported in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002), have concentrations above SCOs.

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of the chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the 6 New York Code of Rules and Regulations Part 373 Hazardous Management Permit requirements and provides the cleanup approach for the SPRU-LL.

According to the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006), the objectives of the ICM work plan are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from NYSDEC for chemicals in the SPRU land areas. The ICM work plan requires that NYSDEC be notified when cleanup levels of non-COCs exceed SCOs. Metals (arsenic and antimony) associated with historical rail activities in the SPRU lower level (DOE/CH2M HILL 2002) are not subject

to cleanup requirements under RCRA. This interim report documents completion of the SPRU FSS-02 in accordance with the ICM work plan (ARC-PLN-6106) and *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402). Figure 1 shows the location of FSS-02 in the SPRU-LL land areas.

3.0 Sampling Activities

3.1 Sampling Location

Sample locations were established following completion of the excavation in FSS-02. Sampling locations for RCRA (42 USC § 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the ICM work plan (ARC-PLN-6106) was used to determine the number of samples required for the chemical COCs, i.e., a minimum of 12 samples. To expedite sampling, the same 16 locations determined for the radiological COCs were sampled for the chemical COCs for FSS-02. The locations were chosen using a random starting point, with subsequent samples located using a triangular pattern and each sample location being 39.2 ft from the previous location. Figure 2 shows the locations of the samples collected for FSS-02. The same sample location for sampling points 5 and 15 were used after these areas were re-excavated.

After the initial excavation for removal of contamination in FSS-02, a portion of the former fuel oil line was excavated and removed from FSS-02 as outlined in the ICM Work Plan. An excavation approximately 100 ft long and 8 ft deep in SPRU Grid Unit 1142 was created during removal of the pipeline (see Figure 3, which follows Section 6). This excavation was not considered part of the FSS because the excavation was performed for removal of a structure, not for removal of contamination.

3.2 Sample Collection

Samples were collected for FSS-02 on November 19, 2008. Sixteen soil samples and one duplicate were collected and analyzed in accordance with the ICM work plan (ARC-PLN-6106) and *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402). At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for total metals.

During review of preliminary laboratory data, it was determined that two sample locations had COCs above SCOs. The concentration of cadmium in the sample collected at point 5 was greater than the SCO, and sample point 15 had chromium at a concentration greater than SCOs. As detailed in the ICM work plan (ARC-PLN-6106), additional excavation of the failed confirmation sampling points consisted of a 20-ft radius around each sampling point being excavated an additional 6 in. in depth. At sample point 15, the X-ray fluorescence field readings indicated that elevated levels of chromium were still present, so the excavation was continued to the depth of 2 ft. Approximately one-half of the additional excavation of sample point 15 is outside of FSS-02; this part of the excavation will be evaluated during sampling of the adjacent FSS unit. The excavation and re-sampling of FSS-02 occurred in April 2009. Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler containing Blue Ice®, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. All chemical samples were transferred to an offsite analytical laboratory following chain-of-custody procedures.

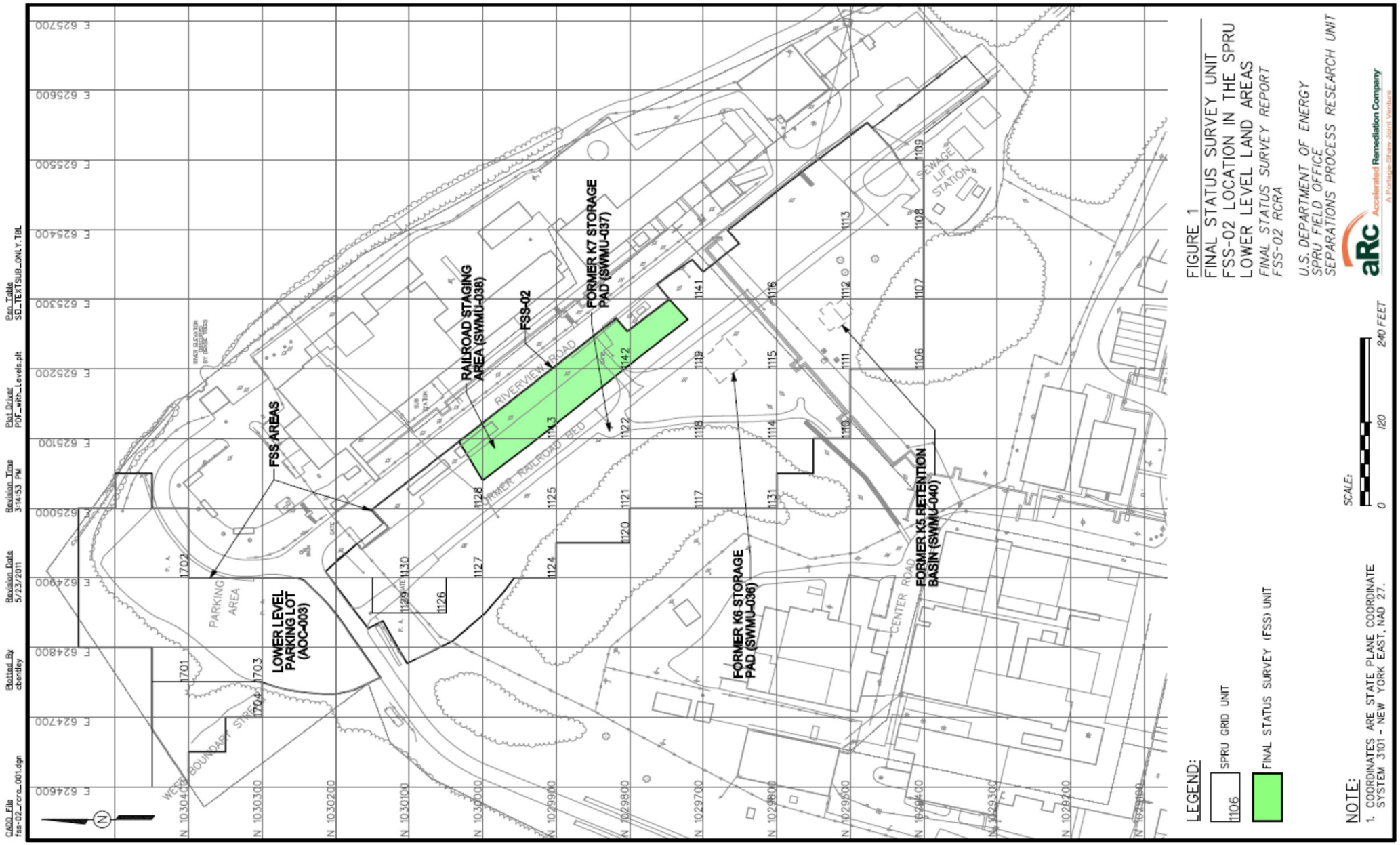

Figure 1 Final Status Survey Unit 02 location in the SPRU Lower Level land areas

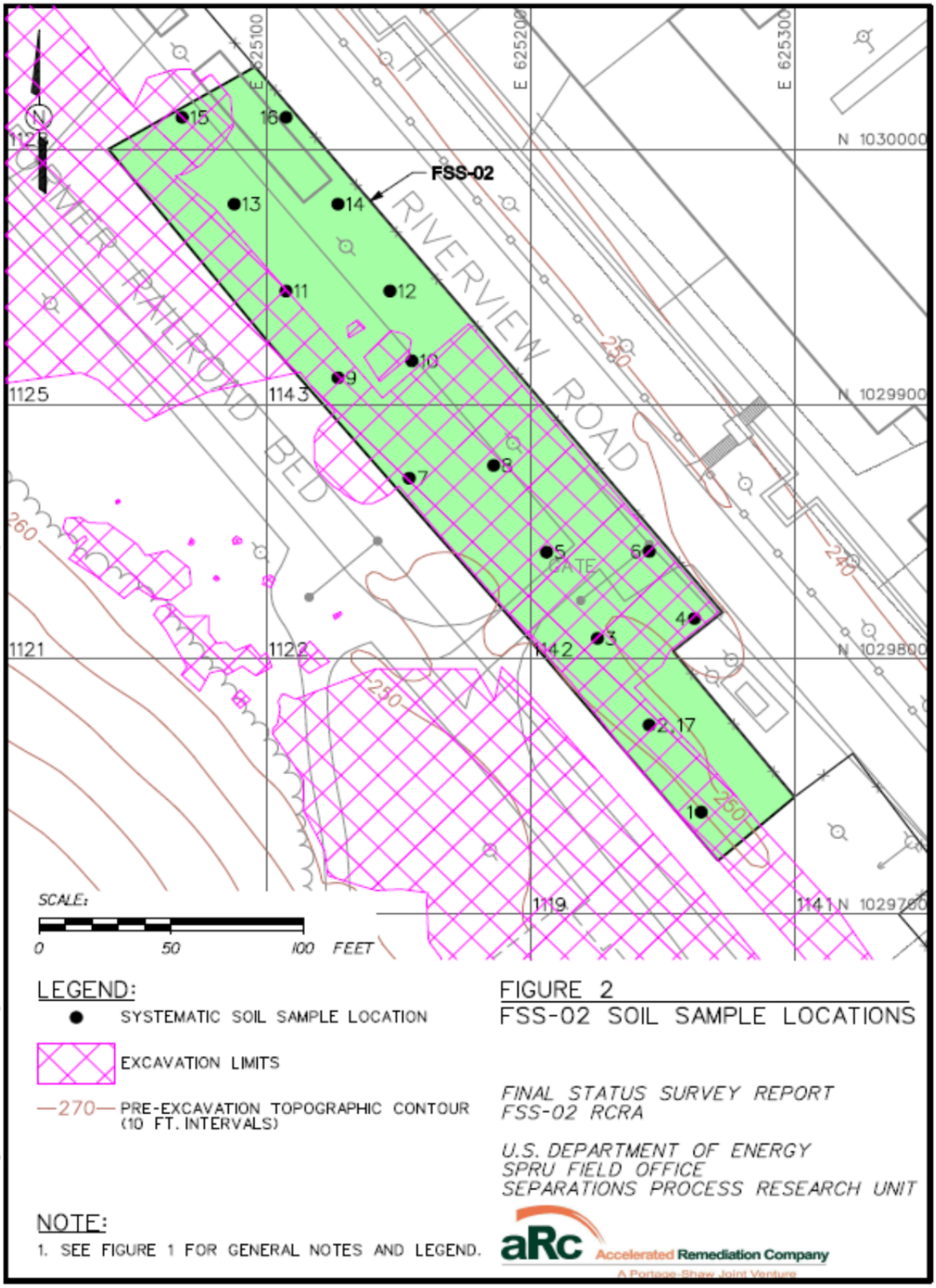

Figure 2 Sample locations for FSS-02

Table 1 Sample description

Sample ID	Map Location	Sample Description
SFS-002-001-M	1	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-002-002-M SFS-002-017-M	2, 17	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt); SFS-002-017-M is the field duplicate of SFS-002-002-M
SFS-002-003-M	3	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-002-004-M	4	Brown topsoil (no asphalt)
SFS-R002-005-M	5	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-002-006-M	6	Subgrade medium gravel fill under asphalt (no asphalt)
SFS-002-007-M	7	Clay and dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-002-008-M	8	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-002-009-M	9	Clay and dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-002-010-M	10	Brown topsoil (no asphalt)
SFS-002-011-M	11	Dark brown granular cinders, intermixed with medium crushed gravel (no asphalt)
SFS-002-012-M	12	Subgrade medium gravel fill under asphalt (chunks of asphalt)
SFS-002-013-M	13	Brown topsoil (no asphalt)
SFS-002-014-M	14	Subgrade gravel fill under asphalt (chunks of asphalt)
SFS-R002-015-M	15	Brown clay and silt no asphalt
SFS-002-016-M	16	Subgrade gravel fill under asphalt (chunks of asphalt)

4.0 Sample Analysis

4.1 Analysis

In accordance with the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency (EPA) SW-846 Methods 6010B for metals, 6020 for antimony, and 7471A for mercury (EPA 2008) protocols. Because of matrix effects, which required dilution of the samples, thallium was also analyzed using EPA Method 6020 to obtain detection limits below the SCO stated in ARC-PLN-6402.

The metals data for FSS-02 indicated the concentration of cadmium in location 5 (6.4 mg/Kg) and chromium in location 15 (81.3 mg/Kg) exceeded the corresponding SCOs of 2.5 mg/Kg and 36 mg/Kg, respectively. Therefore, excavation continued in these two locations and sampling was repeated. Additional excavation of the failed confirmation sampling points consisted of a 20-ft radius around each sampling point being excavated an additional 6 in. in depth. At sample point 15, the X-ray fluorescence field readings indicated that elevated levels of chromium were still present, so the excavation was continued to the depth of 2 ft. The new samples were analyzed using the same methods as the original samples. Results of the final sampling of all locations in FSS-002 are provided in Table 2. The laboratory analytical reports, *Analytical Report*, Project No. 129223, Lot # F8K210239, (Test America 2008a); *Analytical Report*, Project No., 129223, Lot # F8L080169 (Test America 2008b); and *Analytical Report*, Project No., 129223, Lot # F9D230263 (Test America 2009) are on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with its quality assurance manual. Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the National Functional Guidelines for Inorganics (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The data validation reports, *SPRU Metals,* SDG SFS-002-001-M (F8K210239) (Portage 2009a), *SPRU Metals,* SDG SFS-002-001M (F8L080169) (Portage 2009b), and *SPRU Metals,* SDG SFS-004-001M (F9D230263) (Portage 2009c), are on a CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Reported metals results from soil samples collected from SPRU FSS-02

Sample ID	SCO# (mg/kg)	SFS-002-001-M			SFS-002-002-M			SFS-D002-017-M			SFS-002-003-M			SFS-002-004-M			SFS-R002-005-M		
FSS Unit		**002**			**002**			**002**			**002**			**002**			**002**		
Sample Date		**11/19/2008**			**11/19/2008**			**11/19/2008**			**11/19/2008**			**11/19/2008**			**04/22/2009**		
Metals Results (mg/kg)			L	V		L	V		L	V		L	V		L	V		L	V
Aluminum	NA	15300	N		12000	N		8640	N		1960	N		11800	N		2690	N	
Antimony	1	0.87	BN	UJ	0.30	BN	UJ	0.40	BN	UJ	**9.0**	**N**	**J**	0.20	UN	UJ	0.67		U
Arsenic	16	**28.0**			**29.8**			**40.0**			14.2			6.8	B		11.2		
Barium	350	61.9			68.7			79.6			39.9			76.0			40.3	N	J
Beryllium	14	0.78	B		0.61	B		0.53	B		0.41	U		0.73	B		0.38	U	
Cadmium	2.5	0.46	U		0.50	U		0.47	U		0.52	U		0.54	U		0.49	U	
Calcium	NA	5230	N*	J	3380	N*	J	4330	N*	J	2700	N*	J	7150	N*	J	11300	N*	
Chromium	36	22.1			15.0			12.4			8.4			16.9			5.3	E	
Cobalt	30	23.1	N		12.3			10.2	BN		3.9	B		11.5	B		2.5	B	
Copper	270	55.8			43.2			42.1			23.4			25.7			19.6		
Iron	NA	36300	N		28500	N		25900	N		21900	N		26900	N		18300	N	
Lead	400	38.3	N	J	27.5	N	J	29.2	N	J	16.5	N	J	23.4	N	J	21.5	E	J
Magnesium	NA	8850	N*	J	5360	N*	J	4410	N*	J	591	BN*	J	5960	N*	J	2890	N	
Manganese	2000	454	N		468	N		325	N		60.5	N		603	N		87.1	N	
Mercury	0.73	0.061			0.080			0.037			0.060			0.082			0.038		J
Nickel	130	36.9			24.1			21.7			9.7			27.0			7.4	B	
Potassium	NA	1310	N	J	1290	N	J	929	BN	J	360	UN	UJ	1510	N	J	762	U	
Selenium	4	3.1	U		3.3	U		3.2	U		3.5	U		3.6	U		3.3	U	
Silver	8.3	0.77	U		0.84	U		0.80	U		0.87	U		0.91	U		0.53	U	
Sodium	NA	72.9	B	U	71.0	B	U	96.1	B	U	43.6	B	U	37.2	B	U	71.9	B	J
Thallium	2	0.44	B		0.43	U		0.42	U		0.45	U		0.47	U		0.20	B	U
Vanadium	150	26.7			21.3			19.9			25.6			37.7			11.7		
Zinc	2200	85.9	N	J	144	N	J	141	N	J	105	N	J	94.6	N	J	66.4		

Table 2 (continued)

Sample ID	SCO# (mg/kg)	SFS-002-006-M			SFS-002-007-M			SFS-002-008-M			SFS-002-009-M			SFS-002-010-M			SFS-002-011-M		
FSS Unit		**002**			**002**			**002**			**002**			**002**			**002**		
Sample Date		**11/19/2008**			**11/19/2008**			**11/19/2008**			**11/19/2008**			**11/19/2008**			**11/19/2008**		
Metals Results (mg/kg)			L	V		L	V		L	V		L	V		L	V		L	V
Aluminum	NA	8170	N		11400	N		2960	N		14500	N		3840	N		6070	N	
Antimony	1	0.17	UN	UJ	0.18	UN	UJ	0.42	BN	UJ	0.18	UN	UJ	1.0	BN	UJ	**1.7**	**N**	**UJ**
Arsenic	16	4.5	B		12.1			7.6	B		11.2	B		**92.2**			**204**		
Barium	350	41.5			65.4			53.5			89.1			51.3			77.1		
Beryllium	14	0.49	B		0.71	B		0.57	B		0.85	B		0.58	B		0.57	B	
Cadmium	2.5	0.47	U		0.48	U		0.55	U		0.50	U		0.87	B		0.52	U	
Calcium	NA	25300	N*	J	11400	N*	J	10900	N*	J	17400	N*	J	38300	N*	J	2910	N*	J
Chromium	36	11.8			17.3			7.7			19.8			17.5			11.5		
Cobalt	30	7.9	BN		13.1	N		4.9	BN		19.6			16.3			6.6	BN	
Copper	270	20.4			31.4			37.9			36.9			90.4			56.3		
Iron	NA	21400	N		28800	N		16800	N		35700	N		44600	N		24800	N	
Lead	400	7.8	BN	J	15.3	N	J	13.8	N	J	18.0	N	J	56.7	N	J	61.2	N	J
Magnesium	NA	7860	N*	J	7630	N*	J	3480	N*	J	9660	N*	J	9700	N*	J	1770	N*	J
Manganese	2000	508	N		626	N		57.1	N		671	N		234	N		253	N	
Mercury	0.73	0.050			0.061			0.042	B		0.038	B		0.13			0.15		
Nickel	130	17.3			30.7			53.1			40.0			75.2			17.8		
Potassium	NA	1120	N	J	1100	BN	J	380	UN	UJ	2480	N	J	498	BN	J	819	BN	J
Selenium	4	3.2	U		3.2	U		3.7	U		3.3	U		3.3	U		3.5	U	
Silver	8.3	0.8	U		0.82	U		0.92	U		0.84	U		0.82	U		0.88	U	
Sodium	NA	920			61.4	B	U	138	B		81.5	B	U	27.0	U		64.3	B	U
Thallium	2	0.41	U		0.42	U		0.48	U		0.43	U		0.42	U		0.45	U	
Vanadium	150	21.2			20.4			14			25.8			67.6			26.1		
Zinc	2200	55.4	N	J	81.8	N	J	20.9	BN	J	88.8	N	J	188	N	J	72.4	N	J

Table 2 (continued)

Sample ID	**SCO#**	**SFS-002-012-M**			**SFS-002-013-M**			**SFS-002-014-M**			**SFS-R002-015-M**			**SFS-002-016-M**		
FSS Unit		**002**			**002**			**002**			**001**			**002**		
Sample Date	**(mg/kg)**	**11/19/2008**			**11/19/2008**			**11/19/2008**			**04/22/2009**			**11/19/2008**		
Metals Results (mg/kg)			L	V		L	V		L	V		L	V		L	V
Aluminum	NA	2570	N		4240	N		6840	N		14700	N		3760	N	
Antimony	1	0.16	U	UJ	0.38	BN	UJ	0.17	UN	UJ	0.31	B	U	0.17	UN	UJ
Arsenic	16	7.4	B		**19.0**			5.1	B		3.5			6.1	B	
Barium	350	84.8			88.9			48.2			82.2	N	J	83.6		
Beryllium	14	0.46	B		0.47	B		0.47	B		0.69	B		0.40	B	
Cadmium	2.5	0.45	U		0.49	U		0.46	U		0.52	U		0.46	U	
Calcium	NA	123000	N*	J	5060	N*	J	51900	N*	J	13900	N*		113000	N*	J
Chromium	36	4.9			10.7			9.0			17.9	E		5.9		
Cobalt	30	5.2	BN		5.8	B		6.4	BN		13.3			5.1	BN	
Copper	270	10.5			27.5			13.9			31.7			11.6		
Iron	NA	9630	N		22600	N		16400	N		35600	N		12500	N	
Lead	400	8.8	BN	J	36.3	N	J	7.3	BN	J	19.4	E	J	8.6	BN	J
Magnesium	NA	54400	N*	J	3030	N*	J	18200	N*	J	8320	N		53300	N*	J
Manganese	2000	380	N		236	N		426	N		604	N		410	N	
Mercury	0.73	0.032	B		0.090			0.022	B		0.048		J	0.036		
Nickel	130	11.8			15.2			12.7			30.6			11.2		
Potassium	NA	1010	BN	J	742	BN	J	1020	BN	J	1870	N	J	1200	N	J
Selenium	4	3.0	U		3.3	U		3.1	U		3.5	U		3.1	U	
Silver	8.3	0.76	U		0.84	U		0.78	U		0.56	U		0.78	U	
Sodium	NA	40.1	B	U	71.1	B	U	93.8	B	U	18.3	B	J	32.0	B	U
Thallium	2	0.39	U		0.43	U		0.4	U		0.17	B	U	0.40	U	
Vanadium	150	16.3			24.2			19.7			22.7			16.7		
Zinc	2200	137	N	J	228	N	J	64.0	N	J	93.5			83.5	N	J

Table 2 (continued)

Notes: SFS-D002-017-M is the field duplicate of sample SFS-002-002-M.

= **Results in bold font and shaded with grey indicate the value exceeds the soil cleanup objective (SCO).**

The SCO is the more stringent under 6 NYCRR Part 375-6.8 for the protection of groundwater or residential exposure or TAGM-4046 for metals constituents when Part 375-6 does not reference a value.

NA = not applicable.

mg/Kg = milligrams per kilogram.

L = Laboratory Flags:

- U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
- B = Result is between the method detection limit and the reporting limit.
- E = Reported value was estimated because of the presence of interference.
- N = Spike analyte recovery outside stated control limits.
- * = Relative percent difference is outside stated control limits.

V = Validation Flags:

- J: Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
- UJ: The material was analyzed for but not detected. The sample quantitation limit is an estimated value based on results from associated laboratory quality control analyses.
- U: Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

5.0 Data Quality Assessment

Data quality is examined to ensure adequacy for decision-making, and the data are compared to SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation of the metals data (Portage 2009a, 2009b), all sodium sample results, excluding SFS-002-006-M, SFS-002-008-M, SFS-002-010-M, and SFS-002-015-M, were qualified with a "U" (undetected) validation flag to denote the data are non-detect at reported value due to positive blank detection.

During validation of the re-sampled points (Portage 2009c), antimony and thallium results for samples SFS-R002-005-M and SFS-R002-015-M were qualified with a "U" flag due to positive blank detections. Mercury results for samples SFS-R002-005-M and SFS-R002-015-M were qualified with a "J" flag due to negative blank detections.

All of the remaining validation qualifiers assigned "J" or "UJ" flags (estimated) denote evidence of matrix interferences in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

This section provides the comparison of the FSS-02 data to the SCOs. All COCs subject to RCRA requirements analyzed for in FSS-02 had concentrations below SCOs. The only chemical contaminants that exceeded the SCO (arsenic and antimony) are COCs associated with historical railroad activities in the lower level and are not subject to cleanup requirements under RCRA. Table 3 lists by sampling location the concentrations of arsenic and antimony that exceeded SCOs.

6.0 Conclusions

The FSS-02 data are of sufficient quality and quantity for decision-making. The SCOs for arsenic and antimony were exceeded in six of the sampling locations, all of which are associated with the historical railroad activities. Arsenic concentrations were detected greater than the SCO in five samples, and concentrations of antimony were above the SCOs in two samples. This historical rail bed material is not subject to regulations under RCRA. All COCs subject to RCRA requirements had concentrations below SCOs.

A civil survey of the final excavated surface of FSS-02 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 939 yd^3 of materials were removed from FSS-02. Re-grading and seeding of the unit will be completed in the 2009 field season.

Table 3 List of SCOs exceedances for non COCs for SPRU FSS-02

Sample Location		**1**	**2/17***	**3**	**10**	**11**	**13**
Sample Date		**11/19/2008**	**11/19/2008**	**11/19/2008**	**11/19/2008**	**11/19/2008**	**11/19/2008**
Metal results (mg/kg)	**SCO**						
Arsenic	16	28.0	29.8/40.0		92.2	204	19.0
Antimony	1			9.0		1.7	

*Sample point 17 is a field duplicate of sample point 2.

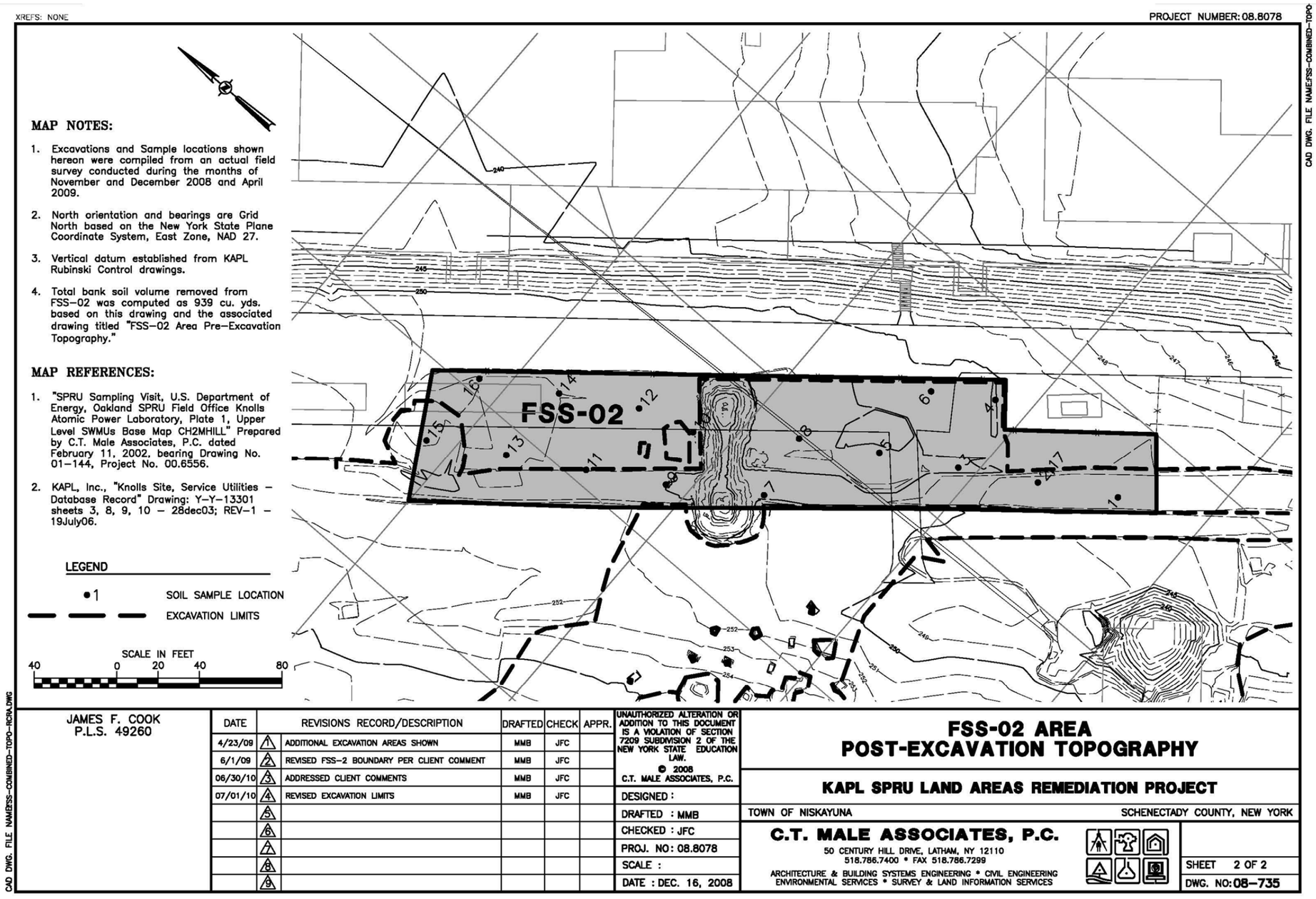

Figure 3 Topographical survey map of FSS-02

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976," as amended.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980," as amended. (NOTE: The 1986 amendment is cited as "Superfund Amendments and Reauthorization Act of 1986," [SARA])

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, Rev. 2, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, Rev. 2, August 2008.

ARC-PLN-6511, *Radiological Confirmation Sampling and Analysis Plan/Final Status Survey (CSAP/FSS) SPRU Lower Level Land Areas,* Accelerated Remediation Company, Rev. 2, June 16, 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008, Web page visited September 17, 2008.

NYSDEC, 2006, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, March 9, 2006.

Portage, 2009a, *SPRU Metals,* SDG SFS-002-001-M (F8K210239), Portage, Inc., Idaho Falls, ID, January 9, 2009

Portage, 2009b, *SPRU Metals,* SDG SFS-002-001M (F8L080169), Portage, Inc., Idaho Falls, ID, January 5, 2009.

Portage, 2009c, *SPRU Metals,* SDG SFS-004-001M (F9D230263), Portage, Inc., Idaho Falls, ID, May 27, 2009.

Test America, 2008a, Analytical Report, Project No. 129223, Lot # F8K210239, Test America Laboratories, Inc., Earth City, MO, December 9, 2008

Test America, 2008b, Analytical Report, Project No., 129223, Lot # F8L080169, Test America Laboratories, Inc. Earth City, MO, December 22, 2008.

Test America, 2009, Analytical Report, Project No., 129223, Lot # F9D230263, Test America Laboratories, Inc. Earth City, MO, May 18, 2009.

Appendix A
CD-ROM with Electronic Copy of Analytical Report, Project No. 179223, SDG # F8K210239, SDG # F8L080169 and SDG # F9D230263, Final Status Survey Unit 02

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Reports SDG # F8K210239,
SDG # F8L080169 and SDG # F9D230263, Final Status Survey Unit 02

Attachment 5
RCRA ICM Data Report for Final Status Survey Unit 03
(ARC-RPT-6009)

Interim RCRA ICM Data Report for Final Status Survey Unit 03

ARC-RPT-6009
August 1, 2011
Revision 4

DOE Contract No. DE-AM09-05SR22399
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Interim RCRA ICM Data Report for Final Status Survey Unit 03

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
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Acronyms

AES	auger electron spectroscopy
COC	constituent of concern
EPA	U.S. Environmental Protection Agency
FSS-03	Final Status Survey Unit 03
ICM	interim corrective measures
ICP	inductively coupled plasma
MS	mass spectrometry
MS	matrix spike
MSD	matrix spike duplicate
NYSDEC	New York State Department of Environmental Conservation
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	Target Analyte List

1.0 Executive Summary

This interim report documents completion of the Separations Process Research Unit (SPRU) Final Status Survey Unit 03 (FSS-03) in accordance with the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereinafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402).

Sample locations were established following completion of the excavation in FSS-03. Sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sixteen systematic samples, one judgmental sample, and one field duplicate soil sample were collected on April 27 and 28, 2009, for offsite laboratory analysis of Target Analyte List (TAL) metals. The judgmental sample was collected from the floor of the K-5 excavation in the same area where previous investigation had determined the presence of arsenic contamination.

Validated analytical data for antimony at sample location 10 indicate an undetected result at a concentration of 1.5 mg/kg, which is greater than project's soil cleanup objective (SCO) of 1 mg/kg. This sample slightly exceeds the SCOs, but given the closeness of this value to the cleanup objective, the absence of any other antimony values of concern, and the undetected "U" flagging added during data validation, this sample location does not warrant re-excavation. Acetone contamination around the K5 former retention basin located within FSS-03 was remediated to levels below the SCO and is discussed in *K5 Post-Excavation Sampling for Acetone* (ARC-RPT-6007). The remainder of the COCs subject to RCRA requirements analyzed for in FSS-03 had concentrations below the SCOs.

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of the chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the 6 New York Code of Rules and Regulations Part 373 Hazardous Management Permit requirements and provides the cleanup approach for the SPRU-LL.

According to the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006), the objectives of the ICM work plan are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from NYSDEC for chemicals in the SPRU land areas.

This interim report documents completion of the SPRU FSS-03 in accordance with the ICM work plan (ARC-PLN-6106) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402). Figure 1 shows the location of FSS-03 in the SPRU-LL land areas.

Figure 1 Final Status Survey Unit 03 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sampling Location

Sample locations were established following completion of the excavation in FSS-03. Sampling locations for chemical COCs were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the ICM work plan (ARC-PLN-6106) determined a minimum of 12 samples are required for the RCRA COCs. Therefore, to expedite sampling, the same 16 locations for the radiological samples were used to collect samples to determine the RCRA COCs for FSS-03. The locations were chosen using a random starting point, with subsequent samples located using a triangular pattern and each sample location being 30 ft from the previous location. In addition, one judgmental sample was collected from the floor of the K-5 excavation at map location 18, where previous investigation had determined that arsenic concentration was above the SCO. Systematic sample locations 7, 11, and 12 that fell within the K-5 excavation were offset because of the inaccessibility of the K-5 excavation and may not reflect the initial sample locations generated by the systematic sampling method. Figure 2 shows the locations of the samples collected for FSS-03.

3.2 Sample Collection

Samples were collected for FSS-03 on April 27 and 28, 2009. Seventeen soil samples and one duplicate were collected and analyzed in accordance with the ICM work plan (ARC-PLN-6106) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402). At each location outside of the K-5 excavation, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Because of concerns associated with the depth and sloping of the back sidewall in the K-5 excavation, final status survey samples within the excavation were collected remotely. A track hoe with a 20-ft boom was used to extricate soil from each location. Samples were then collected from the soil in the bucket. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for total metals.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler containing Blue Ice®, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. When the gamma analysis indicated that samples could be shipped, all RCRA samples were transferred to an offsite analytical laboratory following chain-of-custody procedures.

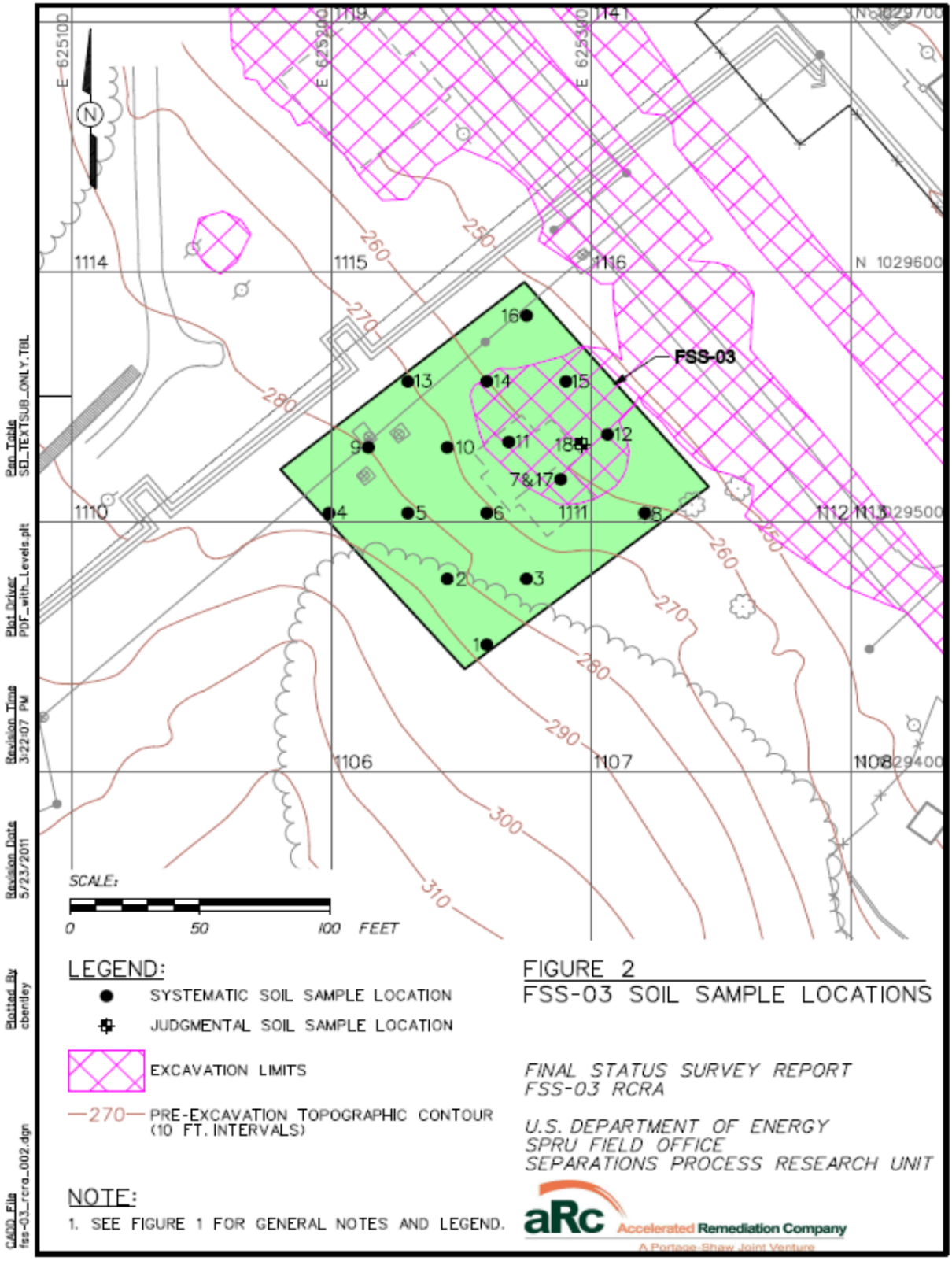

Figure 2 Sample locations for FSS-03

Table 1 Sample description

Sample ID	Map Location	Sample Description
SFS-003-001-M	1	Top soil silt and clay (wet)
SFS-003-002-M	2	Top soil silt and clay (wet)
SFS-003-003-M	3	Top soil silt and clay
SFS-003-004-M	4	Silt and clay intermixed with fill
SFS-003-005-M	5	Silt and clay intermixed with fill
SFS-003-006-M	6	Top soil silt and clay
SFS-003-007-M SFS-003-017-M	7 & 17	Fill material collected from the back wall of K-5 excavation (sampled from excavator bucket); SFS-003-017-M is the field duplicate of SFS-003-007-M
SFS-003-008-M	8	Top soil silt and clay
SFS-003-009-M	9	Top soil silt and clay
SFS-003-010-M	10	Top soil silt and clay
SFS-003-011-M	11	Fill material collected from the floor of K-5 excavation (sampled from excavator bucket)
SFS-003-012-M	12	Fill material collected from the sidewall of K-5 excavation (sampled from excavator bucket)
SFS-003-013-M	13	Top soil silt and clay
SFS-003-014-M	14	Gravel and clay fill
SFS-003-015-M	15	Gravel and clay fill
SFS-003-016-M	16	Gravel and clay fill
SFS-J003-018-M	18	Fill material collected from the floor in the deep K-5 excavation sampled from excavator bucket (judgmental sample)

4.0 Sample Analysis

4.1 Analysis

In accordance with the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency (EPA) SW-846 Methods 6010B for metals, 6020 for antimony, and 7471A for mercury (EPA 2008) protocols. Because of matrix effects, which required dilution of the samples, thallium was also analyzed using EPA Method 6020 to obtain detection limits below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results of the metals analyses. The laboratory analytical report, *Analytical Report*, Project No., 129223, Lot # F9D290254 (Test America 2009), is on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with its quality assurance manual (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the national functional guidelines for inorganics (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses.

In a letter dated August 20, 2009, NYSDEC provided comments on the data qualifiers assigned by the laboratory and the Portage validator (see footnotes to Table 2). It is important to note that extraneous laboratory flags were appended to the reported results. Typically, the practice is to note in the L&V report when flags were inappropriately assigned rather than remove them. In this report, the serial dilution for mercury was reported to have exceeded the 10% QC limit; however, as it is only required for inductively coupled plasma (ICP) analysis, the “E” flag for mercury was extraneous. Similarly, all of the antimony recoveries were within the USEPA National Functional Guidelines spike QC criteria for ICP/mass spectrometry (MS) (75–125%); therefore, the laboratory “N” flag was extraneous. The validation report, *SPRU Metals,* SDG SFS-003-001-M (F9D290254) (Portage 2009), is on a CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Reported metals results from soil samples collected from SPRU FSS-03

Sample ID		**SFS-003-001-M**			**SFS-003-002-M**			**SFS-003-003-M**			**SFS-003-004-M**			**SFS-003-005-M**			**SFS-003-006-M**		
FSS Unit		**03**			**03**			**03**			**03**			**03**			**03**		
Sample Date		**04/28/2009**			**04/28/2009**			**04/28/2009**			**04/28/2009**			**04/28/2009**			**04/27/2009**		
Analyte	**SCO#**	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V
Aluminum	NA	14700	N		12500	N		11400	N		12800	N		10700	N		14400	N	
Antimony	1	0.41	BN	U	0.49	BN	U	0.33	BN	U	0.45	BN	U	0.59	BN	U	0.33	N	U
Arsenic	16	6.0	B		5.9	B		2.9	B		4.5	B		3.3	B		1.4	U	
Barium	350	94.2	N	J	83.1	N	J	73.6	N	J	101	N	J	71.4	N	J	93.3	N	J
Beryllium	14	2.0	B		1.1	U		1.0	U		0.97	U		0.96	U		1.1	U	
Cadmium	2.5	1.7	B		1.1	B		1.0	B		1.1	B		1.1	B		0.88	B	U
Calcium	NA	1300	BN	J	4990	N	J	3870	N	J	7690	N	J	12500	N	J	9990	N	J
Chromium	36	25.2			21.1			18.1			21.0			17.9			16.6		
Cobalt	30	25.8	B		15.4	B		14.1	B		18.7	B		13.8	B		12.6	B	
Copper	270	34.3			35.0			29.6			35.2			32.9			20.7		
Iron	NA	40600	N*		34400	N*		31300	N*		36600	N*		30200	N*		30200	N*	
Lead	400	29.7			24.0			24.6			25.0			21.2			17.1		
Magnesium	NA	6650	N		6700	N		5740	N		7100	N		8740	N		6310	N	
Manganese	2000	1840	N*		836	N*		683	N*		969	N*		730	N*		524	N*	
Mercury	0.73	0.061	E		0.032	BE	U	0.046	E	U	0.052	E		0.037	BE	U	0.028	BE	U
Nickel	130	36.5			36.2			33.6			40.8			31.5			26.8		
Potassium	NA	1700	N	J	1080	BN	J	1960	N	J	2000	N	J	1310	N	J	1790	N	J
Selenium	4	2.2	B	U	1.8	U		1.8	U		1.7	U		1.6	U		1.8	U	
Silver	8.3	1.5	U		1.5	U		1.4	U		1.3	U		1.3	U		1.5	U	
Sodium	NA	15.1	U		26.0	B	U	30.9	B	U	28.6	B	U	76.6	B		148	B	
Thallium	2	0.73	B	U	0.92	B		0.31	B	U	0.25	B	U	0.17	B	U	0.24	B	U
Vanadium	150	32.1			28.0	B		30.9			25.3	B		23.3	B		24.5	B	
Zinc	2200	90.8	NE	J	123	NE	J	140	NE	J	138	NE	J	155	NE	J	85.5	NE	J

Table 2 (continued)

Sample ID		SFS-003-007-M			SFS-003-017-M			SFS-003-008-M			SFS-003-009-M			SFS-003-010-M			SFS-003-011-M		
FSS Unit		**03**			**03**			**03**			**03**			**03**			**03**		
Sample Date		**04/27/2009**			**04/27/2009**			**04/28/2009**			**04/28/2009**			**04/27/2009**			**04/27/2009**		
Analyte	**SCO#**	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V
Aluminum	NA	10900	N		14200	N		11800	N	J	9560	N		11600	N		8480	N	
Antimony	1	0.38	BN	U	0.39	BN	U	0.38	BN	UJ	0.36	BN	U	**1.5**	**N**	**U**	0.22	BN	U
Arsenic	16	5.3	B		4.2	B		4.0	B	J	4.2	B		3.0	B		2.9	B	
Barium	350	96.3	N	J	84.6	N	J	72.6	N	J	60.7	N	J	66.9	N	J	44.8	N	J
Beryllium	14	0.98	U		1.0	U		0.97	U	UJ	0.91	U		1.0	U		0.91	U	
Cadmium	2.5	0.78	B	U	1.2	B		0.94	B	UJ	0.81	B	U	1.1	B		0.62	B	U
Calcium	NA	61900	N	J	15100	N	J	3780	N	J	12400	N	J	3840	N	J	51200	N	J
Chromium	36	18.1			23.3			19.7		J	16.3			18.9			13.5		
Cobalt	30	13.1	B		16.5	B		15.1	B	J	14.3	B		14.9	B		9.4	B	
Copper	270	27.6			33.3			34.1		J	30.6			27.5			28.7		
Iron	NA	27400	N*		40100	N*		32000	N*	J	28400	N*		31400	N*		24500	N*	
Lead	400	21.4			25.9			25.9		J	16.6			29.6			14.1		
Magnesium	NA	32800	N		13100	N		6340	N	J	7070	N		5830	N		13400	N	
Manganese	2000	547	N*		725	N*		663	N*	J	652	N*		786	N*		539	N*	
Mercury	0.73	0.037	BE	U	0.064	E		0.049	E	UJ	0.020	BE	U	0.054	E		0.010	BE	U
Nickel	130	29.6			38.9			35.9		J	31.0			31.3			20.8	B	
Potassium	NA	1350	N	J	2100	N	J	1820	N	J	1670	N	J	1630	N	J	1210	N	J
Selenium	4	1.7	U		1.7	U		1.7	U	UJ	1.6	U		1.8	U		1.6	U	
Silver	8.3	1.4	U		1.4	U		1.3	U	UJ	1.3	U		1.4	U		1.3	U	
Sodium	NA	13.9	U		43.9	B	U	19.3	B	UJ	27.9	B	U	14.8	U		25.8	B	U
Thallium	2	0.12	B	U	0.11	B	U	0.24	B	UJ	0.19	B	U	0.14	B	U	0.10	B	U
Vanadium	150	22.6	B		27.7	B		38.6		J	21.2	B		30.7			16.5	B	
Zinc	2200	88.0	NE	J	128	NE	J	148	NE	J	103	NE	J	143	NE	J	72.7	NE	J

Table 2 (continued)

Sample ID		SFS-003-012-M			SFS-003-013-M			SFS-003-014-M			SFS-003-015-M			SFS-003-016-M			SFS-J003-018-M		
FSS Unit		03			03			03			03			03			03		
Sample Date		04/27/2009			04/28/2009			04/27/2009			04/28/2009			04/28/2009			04/27/2009		
Analyte	**SCO#**	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V
Aluminum	NA	14200	N		9630	N		10100	N		13900	N		6280	N		6940	N	
Antimony	1	0.41	BN	U	0.38	BN	U	0.36	BN	U	0.21	BN	U	0.26	BN	U	0.19	BN	U
Arsenic	16	3.3	B		4.1	B		5.2	B		3.9	B		2.6	B		1.3	B	
Barium	350	60.8	N	J	57.4	N	J	58.6	N	J	78.3	N	J	43.1	N	J	39.4	N	J
Beryllium	14	0.97	U		0.98	U		0.91	U		0.93	U		0.97	U		0.94	U	
Cadmium	2.5	0.90	B	U	0.88	B	U	0.80	B	U	0.90	B	U	0.47	B	U	0.49	B	U
Calcium	NA	3100	N	J	9560	N	J	12200	N	J	5490	N	J	71000	N	J	14400	N	J
Chromium	36	21.6			15.7			18.3			22.3			11.0			10.8		
Cobalt	30	14.1	B		13.1	B		12.4	B		14.9	B		7.9	B		8.1	B	
Copper	270	34.0			33.0			33.7			30.7			19.0			15.2		
Iron	NA	33900	N*		28000	N*		30700	N*		37100	N*		19200	N*		18100	N*	
Lead	400	18.9			16.8			21.2			25.0			11.2			9.9		
Magnesium	NA	6900	N		7460	N		8690	N		7770	N		36900	N		6280	N	
Manganese	2000	635	N*		605	N*		450	N*		605	N*		400	N*		369	N*	
Mercury	0.73	0.028	BE	U	0.030	BE	U	0.048	E	U	0.037	E	U	0.021	BE	U	0.016	BE	U
Nickel	130	30.9			29.3			30.1			35.0			18.3	B		17.6	B	
Potassium	NA	1480	N	J	1520	N	J	1440	N	J	1630	N	J	1290	N	J	1030	BN	J
Selenium	4	1.7	U		1.7	U		1.6	U		1.6	U		1.7	U		1.6	U	
Silver	8.3	1.3	U		1.4	U		1.3	U		1.3	U		1.3	U		1.3	U	
Sodium	NA	16.5	B	U	17.7	B	U	13.0	B	U	49.6	B	U	13.8	U		34.0	B	U
Thallium	2	0.10	B	U	0.11	B	U	0.096	B	U	0.10	B	U	0.057	B	U	0.16	B	U
Vanadium	150	23.5	B		21.9	B		22.7	B		25.8	B		16.8	B		12.6	B	
Zinc	2200	94.2	NE	J	85.3	NE	J	89.9	NE	J	94.6	NE	J	61.9	NE	J	57.7	NE	J

Table 2 (continued)

Notes: SFS-003-017-M is the field duplicate of sample SFS-003-007-M.

= **Results in bold font and shaded with grey indicate the value exceeds the soil cleanup objective (SCO).**

= The SCO (mg/kg) is the more stringent under 6 NYCRR Part 375-6.8 for the protection of groundwater or residential exposure or TAGM-4046 when Part 375-6 does not reference a value.

NA = not applicable.

mg/kg = milligrams per kilogram.

L = Laboratory Flags:

- U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
- B = Result is between the method detection limit and the reporting limit.
- E = Serial dilution percent recovery not within limits. Reported value is estimated because of the presence of interference.
- N = Spike analyte recovery outside stated control limits.
- * = Relative percent difference is outside stated control limits.

V = Validation Flags:

- J: Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
- UJ: The material was analyzed for but not detected. The sample quantitation limit is an estimated value based on results from associated laboratory quality control analyses.
- U: Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

NYSDEC comments on laboratory and validation qualifiers for FSS-03 data (August 20, 2009):

- Sample location SFS-003-008M: J/UJ qualifiers can be removed.
- ICP-AES Data: Matrix spike/matrix spike duplicate (MS/MSD) percent recoveries were outside of the 75–125% QC limits for barium, potassium and calcium. The results for these metals must be considered estimated with a positive bias. The serial dilution results for zinc were beyond the 10% difference criteria and thus should be considered estimated (J)
- Mercury Data: The serial dilution was reported to have exceeded the 10% QC limit; however, as this is only required for ICP analysis, the E flag for mercury should be removed.
- ICP-MS Data: Since all of the antimony recoveries were within the USEPA National Functional Guidelines spike QC criteria for ICP/MS (75–125%), the N flag can be removed.

5.0 Data Quality Assessment

Data quality is examined to ensure adequacy for decision-making, and the data are compared to SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

One sample bottle (SFS-003-008-M) was broken upon receipt at the laboratory. Project personnel were advised that sufficient, unaltered sample material was available to perform the requested metals analyses. Because of its vapor pressure, mercury is the only target analyte metal potentially impacted by the broken container. Historically, mercury has not been detected in the K-5 area at concentrations that exceed the SCO; therefore, the impact of the broken container on metals concentration was deemed to be minimal, and the laboratory was instructed to proceed using the unaltered material. During validation (Portage 2009), all results associated with sample SFS-003-008-M have been qualified with a "J" flag (estimated) based on the broken container. The reported results for SFS-003-008-M are used in this report.

During validation, positive results reported for several metals have been qualified as undetected values and assigned a "U" flag based on corresponding levels of blank detections (Portage 2009). Antimony in all samples, thallium in all samples excluding SFS-003-002-M, mercury in all samples excluding SFS-003-001-M, SFS-003-004-M, SFS-003-010-M, and SFS-003-017-M were assigned a "U" flag based on detected blank levels. Analytical data for samples SFS-003-010-M reported antimony concentration of 1.5 mg/kg, which is greater than project's SCO of 1 mg/kg. However, during data validation, the antimony data for this sample was "U" flagged as not detected because of blank contamination. The "U" flag was assigned to sodium in all samples excluding SFS-003-001-M, SFS-003-005-M, SFS-003-006-M, SFS-003-007-M, SFS-003-010-M, and SFS-003-016-M. Selenium in sample SFS-003-001-M and cadmium in all samples excluding SFS-003-001-M, SFS-003-002-M, SFS-003-003-M, SFS-003-004-M, SFS-003-005-M, SFS-003-010-M, and SFS-003-017-M were assigned a "U" flag to denote false positive results based on corresponding blank detections.

All of the remaining validation qualifiers assigned "J" or "UJ" flags (estimated) denote evidence of matrix interferences in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

This section provides the concentration comparison of the FSS-03 data to the SCOs. The validated analytical data for antimony in sample SFS-003-010-M (sample location 10 on the map) qualified the reported concentration (1.5 mg/kg) as an undetected result, which is greater than project's SCO of 1 mg/kg. This reporting limit slightly exceeds the cleanup level, but given the closeness of this value to the cleanup objective, the absence of any other antimony values of concern, and the undetected "U" flagging added during data validation because of antimony detection in the laboratory blank, this sample location does not warrant re-excavation. The remainder of the COCs subject to RCRA requirements analyzed for in FSS-03 had concentrations below SCOs.

6.0 Conclusions

Analyses of the FSS-03 data were shown to be of sufficient quality and quantity for decision-making. A civil survey of the final excavated surface of FSS-03 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 521 yd^3 of materials was removed from FSS-03.

7.0 References

42 USC 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976," as amended.

42 USC 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980," as amended. (NOTE: The 1986 amendment is cited as "Superfund Amendments and Reauthorization Act of 1986," [SARA])

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

ARC-RPT-6007, *K5 Post-Excavation Sampling for Acetone,* Rev. 1, Accelerated Remediation Company, February 2009.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008.

NYSDEC, 2006, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, March 9, 2006.

Portage, 2009, *SPRU Metals,* SDG SFS-003-001-M (F9D290254), Portage, Inc., Idaho Falls, ID, June 5, 2009.

Test America, 2009, *Analytical Report*, Project No., 129223, Lot # F9D290254, Test America Laboratories, Inc., Earth City, MO, May 20, 2009.

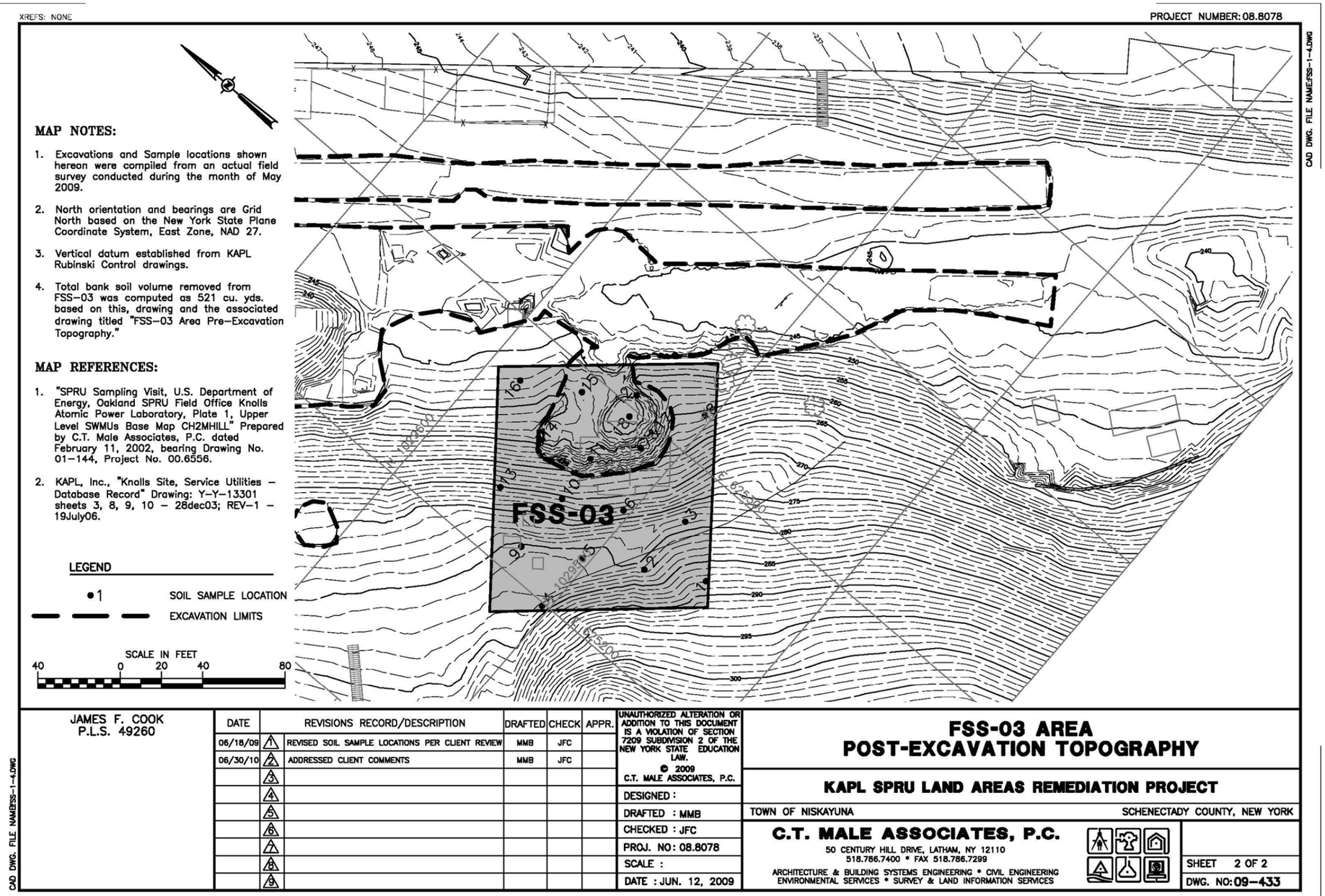

Figure 3 Topographical survey map of FSS-03

Appendix A
CD-ROM with Electronic Copy of
Analytical Report, Project No. 179223,
SDG # F9D290254, Final Status Survey Unit 03

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Report SDG # F9D290254, Final Status Survey Unit 03

Attachment 6
Interim RCRA ICM Data Report for Final Status Survey Unit 04
(ARC-RPT-6010)

Interim RCRA ICM Data Report for Final Status Survey Unit 04

ARC-RPT-6010
August 1, 2011
Revision 2

DOE Contract No. DE-AM09-05SR22399
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Interim RCRA ICM Data Report for Final Status Survey Unit 04

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Accelerated Remediation Company
A Portage-Shaw Joint Venture

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Acronyms

COC	constituent of concern
EPA	U.S. Environmental Protection Agency
FSS-04	Final Status Survey Unit 04
ICM	interim corrective measures
NYSDEC	New York State Department of Environmental Conservation
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	Target Analyte List

1.0 Executive Summary

This interim report documents completion of the Separations Process Research Unit (SPRU) Final Status Survey Unit 04 (FSS-04) in accordance with the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) and *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Lands Area Remediation* (ARC-PLN-6402).

Sampling locations were established following completion of the excavation in FSS-04. Sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the interim corrective measures (ICM) work plan (ARC-PLN-6106). Sixteen systematic, one judgmental, and one field duplicate soil samples were collected for offsite laboratory analysis of Target Analyte List (TAL) metals. The judgmental sample was collected from the portion of the excavation that was initially designed to be in Final Status Unit 05. The corner of Grid 1107 that extended into the FSS-04 excavation was added to expedite backfilling of FSS-04. Because the corner of Grid 1107 was added to FSS-04 after the sampling locations were established, the judgmental sample was added to ensure adequate sample coverage for this portion of FSS-04. The concentrations of all COCs that are subject to RCRA requirements are below soil cleanup objectives (SCOs).

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of the chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a) and provides the cleanup approach for the SPRU-LL.

According to the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), the objectives of the ICM work plan are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from NYSDEC for chemicals in the SPRU land areas.

This interim report documents completion of the SPRU FSS-04 in accordance with the ICM work plan (ARC-PLN-6106) and quality assurance project plan (QAPjP) (ARC-PLN-6402). Figure 1 shows the location of FSS-04 in the SPRU-LL land areas.

3.0 Sampling Activities

3.1 Sampling Location

Sampling locations were established following completion of the excavation in FSS-04. Sampling locations for chemical COCs were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the ICM work plan (ARC-PLN-6106) was used to determine the number of samples required for the chemical COCs, i.e., a minimum of 12 samples. To expedite sampling, the same 16 locations determined for the radiological COCs were sampled for the chemical COCs for FSS-04. The locations were chosen using a random starting point, with subsequent samples located using a triangular pattern and each sample location being 37.6 ft from the previous location. In addition, one judgmental sample was collected from the portion of the excavation that was initially designed to be in Final Status Unit 05. The corner of Grid 1107 that extended into the FSS-04 excavation was added to expedite backfilling of FSS-04. Because the corner of Grid 1107 was added to FSS-04 after the sampling locations were established, the judgmental sample at map location 18 was added in this area to ensure adequate sample coverage. Figure 2 shows the locations of the samples collected for FSS-04.

3.2 Sample Collection

Sample locations 1 and 2 are within Grid 1108 and inside the secure areas near the sewage lift station. Samples were collected from these two locations once the excavation in the secure area was completed on April 15, 2009. The rest of samples for FSS-04 were collected on May 19, 2009. After FSS-04 was sampled, additional excavation was required due to the reported results for one of the radiological judgmental samples. A 20-ft radius around this sampling point was excavated and this additional excavation included the systematic sampling location 15. Therefore, once the excavation was completed, the sampling location 15 was re-sampled on May 27, 2009, for metals analyses by the offsite laboratory. Seventeen soil samples and one field duplicate were collected and analyzed in accordance with the ICM work plan (ARC-PLN-6106) and QAPjP (ARC-PLN-6402). At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for TAL metals.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler containing Blue Ice®,[a] and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. Once the gamma analysis indicated that samples could be shipped, all chemical samples were transferred to an offsite analytical laboratory following chain-of-custody procedures.

a. References herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, do not necessarily constitute or imply endorsement, recommendation, favoring, or condemnation by Accelerated Remediation Company, LLC (aRc), or any company affiliated with aRc.

Figure 1 Final Status Survey Unit 04 location in the SPRU Lower Level land areas

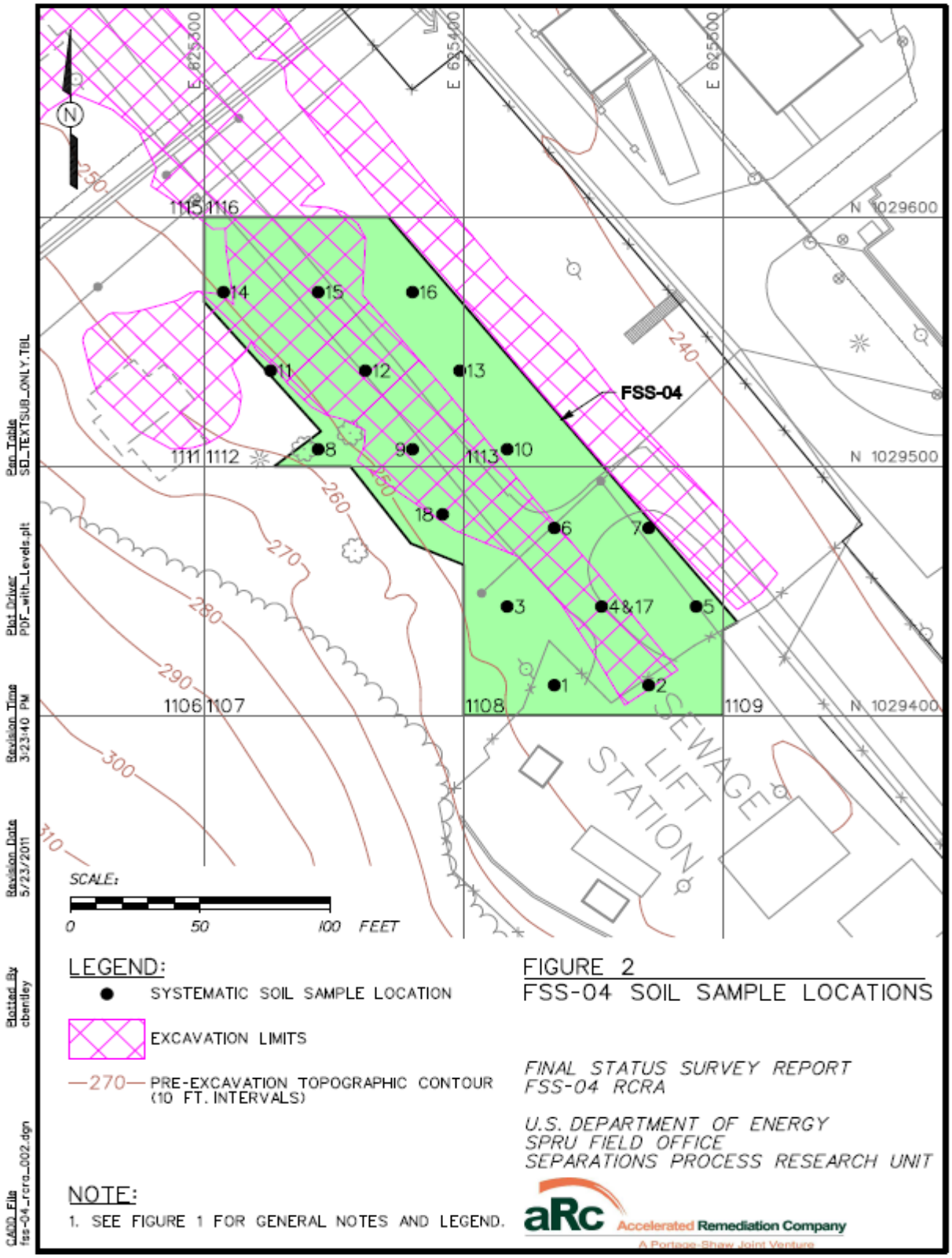

Figure 2 Sample locations for FSS-04

Table 1 Sample description

Sample ID	Map Location(s)	Sample Description
SFS-004-001-M	1	Top soil, silt/clay
SFS-004-002-M	2	Clay/shale in excavation
SFS-004-003-M	3	Top soil, silt/clay
SFS-004-004-M SFS-004-017-M	4 &17	Clay/shale in excavation, SFS-004-017-M is field duplicate of SFS-004-004-M
SFS-004-005-M	5	Top soil with some railroad cinders
SFS-004-006-M	6	Clay/shale in excavation
SFS-004-007-M	7	Top soil with some railroad cinders
SFS-004-008-M	8	Top soil, silt/clay
SFS-004-009-M	9	Clay/silt in excavation
SFS-004-010-M	10	Clay/shale in excavation
SFS-004-011-M	11	Top soil, silt/clay
SFS-004-012-M	12	Clay/shale in excavation
SFS-004-013-M	13	Top soil with some railroad cinders
SFS-004-014-M	14	Gravelly sandy clay fill from K-5
SFS-R004-015-M	15	Clay/shale in excavation. Re-sampled following additional excavation.
SFS-004-016-M	16	Top soil, silt/clay
SFS-J004-018-M	18	Clay/silt in excavation. Judgmental sample.

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency (EPA) SW-846 Methods 6010B for metals, 6020 for antimony, and 7471A for mercury (EPA 2008) protocols. Thallium was also analyzed using EPA Method 6020 to obtain detection limits below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results of the metals analyses. The laboratory analytical reports, *Analytical Report*, Project No., 129223, Lot # F9D230263 (Test America 2009a); *Analytical Report*, Project No., 129223, Lot # F9E210206 (Test America 2009b); and *Analytical Report*, Project No., 129223, Lot # F9E290157 (Test America 2009c are on a CD-ROM provided as Appendix A with this report).

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with its quality assurance manual (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses.

The validation reports, *SPRU Metals,* SDG SFS-004-001-M (Portage 2009a); *SPRU Metals,* SDG SFS-004-003-M (Portage 2009b); and *SPRU Metals,* SFS-R004-015-M (Portage 2009c) are on a CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Reported metals results from soil samples collected from SPRU FSS-04

Sample ID		**SFS-004-001-M**			**SFS-004-002-M**			**SFS-004-003-M**			**SFS-004-004-M**			**SFS-004-017-M[a]**			**SFS-004-005-M**		
FSS Unit		**04**			**04**			**04**			**04**			**04**			**04**		
Sample Date		**4/15/2009**			**4/15/2009**			**5/19/2009**			**5/19/2009**			**5/19/2009**			**5/19/2009**		
Analyte	**SCO[c]**	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V
Aluminum	NA	8430	N		14200	N		9900	N		14900	N		11500	N		10600	N	
Antimony	1	0.39	B	U	0.34	B	U	0.28	B	U	0.31	B	U	0.38	B	U	0.30	B	U
Arsenic	16	2.8			7.7			4.0	B		3.0	B	J	3.6	B		3.1	B	
Barium	350	29.4	N	J	97.7	N	J	47.8	BN		65.2	N		63.5	N		50.9	BN	
Beryllium	14	0.46	B		0.77	B		1.8	U		1.9	U		1.8	U		1.9	U	
Cadmium	2.5	0.50	U		0.44	U		0.92	B	U	0.82	B	U	0.92	B	U	0.91	B	U
Calcium	NA	10800	N*		26600	N*		18500	N		7320	N		10800	N		19800	N	
Chromium	36	13.0	E		16.7	E		16.9			21.8			17.2			17.7		
Cobalt	30	7.9	B		10.5			11.6	B		13.8	B		11.7	B		10.3	U	
Copper	270	24.6			24.3			27.6	E	J	26.2	BE	J	25.4	BE	J	25.3	BE	J
Iron	NA	25400	N		29900	N		28200	N		33100	N		30500	N		30000	N	
Lead	400	16.8	E	J	17.4	E	J	16.0			17.6			15.1			17.4		
Magnesium	NA	8530	N		9090	N		9560	N		7600	N		5780	N		10700	N	
Manganese	2000	571	N		587	N		554	N		608	N		438	N		677	N	
Mercury	0.73	0.11		J	0.028	B	J	0.04		U	0.036	B	U	0.03	B	U	0.026	B	U
Nickel	130	22.9			24.0			28.3	B		29.8	B		26.3	B		30.1	B	
Potassium	NA	1080	BN	J	1530	N	J	731	UN		995	BN	J	922	BN	J	820	BN	J
Selenium	4	3.4	U		3.0	U		3.1	U		3.3	U		3.1	U		3.2	U	
Silver	8.3	0.54	U		0.48	U		2.5	U		2.6	U		2.5	U		2.6	U	
Sodium	NA	14.0	U	UJ	2200			39.3	B	U	914			669			27.8	B	U
Thallium	2	0.25	B	U	0.14	B	U	0.38	B	U	0.56	B	U	0.20	B	U	0.23	B	U
Vanadium	150	24.2			25.0			20.9	B		30.8	B		25.6	B		26.5	B	
Zinc	2200	110			80.3			87.1			96.1			80.0			139		

Table 2 (continued)

Sample ID		**SFS-004-006-M**			**SFS-004-007-M**			**SFS-004-008-M**			**SFS-004-009-M**			**SFS-004-010-M**			**SFS-004-011-M**		
FSS Unit		**04**			**04**			**04**			**04**			**04**			**04**		
Sample Date		**5/19/2009**			**5/19/2009**			**5/19/2009**			**5/19/2009**			**5/19/2009**			**5/19/2009**		
Analyte	**SCO[c]**	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V
Aluminum	NA	13500	N		9780	N		15600	N		11200	N		11200	N		11000	N	
Antimony	1	0.45	B	U	0.49	B	U	0.40	B	U	0.36	B	U	0.34	B	U	0.32	B	U
Arsenic	16	3.8	B		8.8	B		5.0	B		4.7	B		5.6	B		2.8	B	J
Barium	350	137	N		75.6	N		65.3	N		68.9	N		198	N		58.3	N	
Beryllium	14	1.9	U		2.0	U		2.0	U		1.9	U		1.8	U		1.9	U	
Cadmium	2.5	0.94	B	U	0.79	B	U	1.2	B	U	0.66	B	U	0.72	B	U	0.70	B	U
Calcium	NA	17800	N		25200	N		2660	BN		4990	N		28100	N		2030	BN	
Chromium	36	20.2			26.5			26.4			17.7			17.9			18.0		
Cobalt	30	13.4	B		11.0	B		17.9	B		11.4	B		12.7	B		12.7	B	
Copper	270	25.2	BE	J	25.6	BE	J	34.3	E	J	24.0	BE	J	24.6	BE	J	22.6	BE	J
Iron	NA	30700	N		25900	N		39500	N		27700	N		28200	N		27600	N	
Lead	400	19.6			24.0			28.8			18.2			18.2			20.5		
Magnesium	NA	8100	N		13400	N		7730	N		5550	N		8980	N		5080	N	
Manganese	2000	602	N		674	N		751	N		569	N		614	N		577	N	
Mercury	0.73	0.036	B	U	0.087		U	0.061		U	0.053		U	0.033	B	U	0.052		U
Nickel	130	26.7	B		29.0	B		40.3	B		27.4	B		28.3	B		31.1	B	
Potassium	NA	1330	N	J	1490	N	J	1500	N	J	1010	BN	J	727	UN		1430	N	J
Selenium	4	3.2	U		3.4	U		3.5	U		3.2	U		3.1	U		3.2	U	
Silver	8.3	2.6	U		2.7	U		2.8	U		2.6	U		2.5	U		2.6	U	
Sodium	NA	1450			80.9	B	U	46.3	B	U	94.1	B	U	576			40.8	B	U
Thallium	2	0.20	B	U	0.26	B	U	0.22	B	U	0.17	B	U	0.15	B	U	0.12	B	U
Vanadium	150	28.4	B		42.8	B		42.6	B		27.1	B		25.8	B		29.7	B	
Zinc	2200	92.2			95.5			126			87.9			88.5			79.4		

Table 2 (continued)

Sample ID		**SFS-004-012-M**			**SFS-004-013-M**			**SFS-004-014-M**			**SFS-R004-015-M**			**SFS-004-016-M**			**SFS-J004-018-M[b]**		
FSS Unit		**04**			**04**			**04**			**04**			**04**			**04**		
Sample Date		**5/19/2009**			**5/19/2009**			**5/19/2009**			**5/27/2009**			**5/19/2009**			**5/19/2009**		
Analyte	**SCO[c]**	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V
Aluminum	NA	19000	N		8440	N		13100	N		8920	N		9380	N		8570	N	
Antimony	1	0.35	B	U	0.19	B	U	0.36	B	U	0.41	B		0.40	B	U	0.37	B	U
Arsenic	16	6.8	B		3.6	B		6.1	B		3.2			5.4	B		3.6	U	UJ
Barium	350	78.3	N		92.6	N		63.2	N		66.3			55.8	BN		65.9	BN	
Beryllium	14	2.0	U		1.9	U		1.9	U		0.53	B		2.0	U		2.8	U	
Cadmium	2.5	1.1	B	U	0.58	B	U	0.92	B	U	0.69	B		0.64	B	U	0.84	B	U
Calcium	NA	6410	N		20800	N		17000	N		15100	N*	J	4590	N		6010	N	
Chromium	36	27.4			15.1			23.1			13.3			16.7			14.8	B	
Cobalt	30	21.1	B		10.7	U		15.4	B		10.2	B		11.3	U		15.5	U	
Copper	270	31.1	E	J	18.9	BE	J	29.0	E	J	29.6			30.6	E	J	25.6	BE	J
Iron	NA	40500	N		24000	N		34300	N		27400	N		26900	N		22400	N	
Lead	400	25.7			13.1			23.2			15.3			23.2			20.9		
Magnesium	NA	7760	N		8500	N		11600	N		5700	N*		5360	N		4230	N	
Manganese	2000	814	N		466	N		623	N		636	N*		503	N		547	N	
Mercury	0.73	0.038	B	U	0.027	B	U	0.039		U	0.046		U	0.049		U	0.062		U
Nickel	130	34.9	B		23.5	B		35.7	B		23.7			31.8	B		26.9	B	
Potassium	NA	904	BN	J	943	BN	J	963	BN	J	1460	N	J	1090	BN	J	1320	BN	J
Selenium	4	3.4	U		3.3	U		3.3	U		1.7	U		3.5	U		4.8	U	
Silver	8.3	2.7	U		2.7	U		2.7	U		0.54	U		2.8	U		3.9	U	
Sodium	NA	592			62.4	B	U	33.8	B	U	376			54.0	B	U	66.0	B	
Thallium	2	0.17	B	U	0.081	B	U	0.11	B	U	0.29	B	U	0.11	B	U	0.18	B	U
Vanadium	150	41.3	B		20.3	B		28.3	B		17.2			41.6	B		32.3	B	
Zinc	2200	112			81.3			90.2			99.6	N		93.6			104		

Table 2 (continued)

Notes:

a. SFS-004-017-M is the field duplicate of sample SFS-004-004-M. SFS-R004-015-M was re-sampled following additional excavation.
b. SFS-J004-018-M is a judgmental sampling location.
c. The SCO (mg/kg) is the more stringent guideline under 6 NYCRR Part 375-6.8 (NYSDEC 2006c) for the protection of groundwater or residential exposure, or TAGM-4046 (NYSDEC 1994) when Part 375-6 does not reference a value.

NA = not applicable.
mg/kg = milligrams per kilogram.
L = Laboratory flags:
- U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
- B = Result is between the method detection limit and the reporting limit.
- E = Serial dilution percent recovery not within limits.
- N = Spike analyte recovery outside stated control limits.
- * = Relative percent difference is outside stated control limits.

V = Validation flags:
- J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
- UJ = The material was analyzed for but not detected. The sample quantitation limit is an estimated value based on results from associated laboratory quality control analyses.
- U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

5.0 Data Quality Assessment

Data quality is examined to ensure adequacy for decision-making, and the data are compared to SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation of the metals data (Portage 2009a, 2009b, 2009c), several positive results reported were qualified with a "U" (undetected) validation flag to denote the data are non-detect at the reported value based on levels detected in the associated blanks. All sample results reported for thallium, all sample results for antimony excluding SFS-R004-015-M, all sample results for mercury excluding SFS-004-001-M and SFS-004-002-M, all sample results for cadmium excluding SFS-R004-015-M, and all positive results for sodium excluding samples SFS-004-002-M, SFS-004-004-M, SFS-004-017-M, SFS-004-006-M, SFS-004-010-M, SFS-004-012-M, and SFS-R004-015-M have been qualified with a "U" flag.

Mercury results for samples SFS-004-001-M and SFS-004-002-M, sodium results for SFS-004-001-M, arsenic in SFS-004-004-M and SFS-J004-018M were all qualified with a "J" or "UJ" flag due to negative blank detections.

All of the remaining validation qualifiers assigned "J" or "UJ" flags (estimated) denote evidence of matrix interferences in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

All COCs subject to RCRA requirements analyzed for in FSS-04 had concentrations below the corresponding SCOs.

6.0 Conclusions

The FSS-04 data is shown to be of sufficient quality and quantity for decision-making. A civil survey of the final excavated surface of FSS-04 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 465 yd^3 of banked materials were removed from FSS-04.

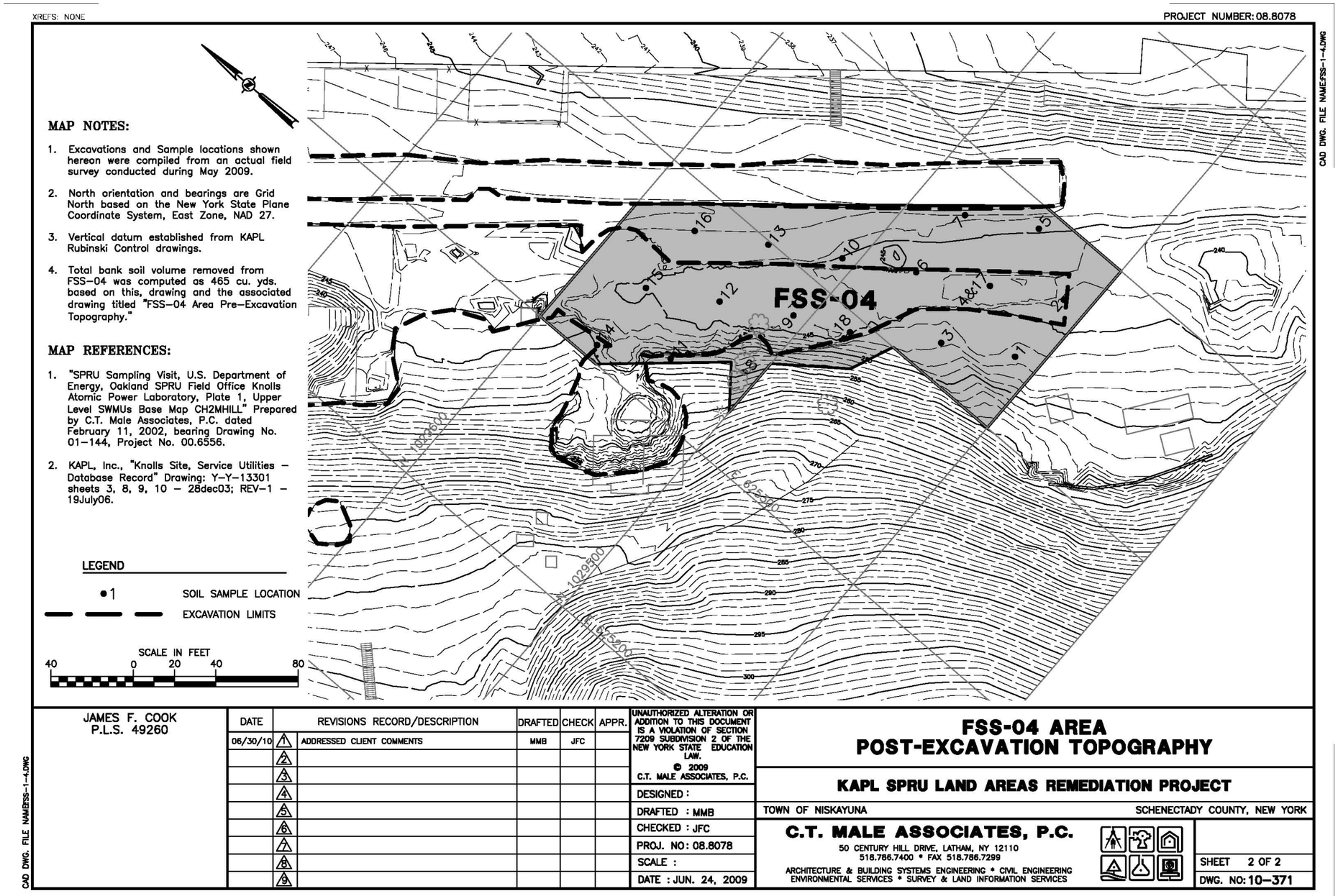

Figure 3 Topographical survey map of FSS-04

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008.

NYSDEC, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels (TAGM 4046)," New York State Department of Environmental Conservation, January 24, 1994.

NYSDEC, 2006a, "Remedial Program Soil Cleanup Objectives," Title 6, New York Code of Rules and Regulations (NYCRR), Part 375, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, New York State Department of Environmental Conservation, March 9, 2006.

NYSDEC, 2006c, "Hazardous Waste Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

Portage, 2009a, *SPRU Metals,* SFS-004-001-M (F9D230263), Portage, Inc., May 27, 2009a.

Portage, 2009b, *SPRU Metals,* SFS-004-003-M (F9E210206), Portage, Inc., June 26, 2009b.

Portage, 2009c, *SPRU Metals,* SFS-R004-015-M (F9E290157), Portage, Inc., June 22, 2009c.

Test America, 2009a, *Analytical Report*, Project No., 129223, Lot # F9D230263, Test America Laboratories, Inc., May 18, 2009.

Test America, 2009b, *Analytical Report*, Project No., 129223, Lot # F9E210206, Test America Laboratories, Inc., June 4, 2009.

Test America, 2009c, *Analytical Report*, Project No., 129223, Lot # F9E290157, Test America Laboratories, Inc., June 9, 2009.

Appendix A
CD-ROM with Electronic Copy of
Analytical Report, Project No. 179223, SDG # F9D230263,
SDG # F9E210206, and SDG # F9E290157, Final Status Survey Unit 04

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Reports SDG # F9D230263, SDG # F9E210206, and SDG # F9E290157, Final Status Survey Unit 04

Attachment 7

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 05 (ARC-RPT-6015)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 05

ARC-RPT-6015
August 1, 2011
Revision 3

DOE Contract No. DE-AM09-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 05

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
David Lodman Characterization Lead	08/01/11 Date
Berta Oates Project Quality Assurance Manager	08/01/11 Date

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Acronyms

COC	constituent of concern
FSS-05	Final Status Survey Unit 05
ICM	interim corrective measures
NYSDEC	New York State Department of Environmental Conservation
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	Target Analyte List

1.0 Executive Summary

This report documents the completion of the final status survey (FSS) performed by the Accelerated Remediation Company at the Separations Process Research Unit (SPRU) Land Areas Unit 05 (called FSS-05) in accordance with the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereinafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402).

FSS-05 encompasses the hillside geographically separated from all of the SPRU and railroad operations. No excavation was conducted in this unit; therefore, surface sample locations were established after the final radiological walkover in FSS-05. Sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sixteen systematic samples and one field duplicate soil sample were collected on June 10, 2009, for offsite laboratory analysis of Target Analyte List (TAL) metals by Test America Laboratories, Inc.

With the exception of manganese, all TAL metals were either non-detect at the reporting limit or reported at concentrations below their corresponding soil cleanup objectives (SCOs). The validated analytical results for manganese in samples SFS-005-009-M and SFS-005-012-M (Sample Locations 9 and 12 on Figure 2) were 2,290 and 2,310 mg/kg. The reported concentrations exceed the corresponding SCO of 2,000 mg/kg for manganese. However, manganese is not a RCRA hazardous constituent per the SPRU 6 NYCRR Part 373 Permit; hence, it is not subject to RCRA corrective action. In addition, manganese is not an ICM COC defined in the ICM work plan. The presence of manganese at concentrations slightly above the SCO is attributable to natural soil mineralogy and is not believed to be associated with historical SPRU operations.

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a), and provides the cleanup approach for the SPRU-LL.

According to the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), the objectives of the ICM work plan are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from the NYSDEC for chemicals in the SPRU land areas.

This report documents completion of FSS-05 in accordance with the ICM work plan (ARC-PLN-6106) and quality assurance project plan (QAPjP) (ARC-PLN-6402). Figure 1 shows the location of FSS-05 in the SPRU-LL land areas.

Figure 1 Final Status Survey Unit 05 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sampling Location

No excavation was conducted in this unit; therefore, surface sampling locations (0 to 6 in. in depth) were established following completion of the final radiological walkovers in FSS-05. Sampling locations for chemical COCs were determined using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the RCRA ICM work plan (ARC-PLN-6106) determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic sampling locations for the radiological samples were used to collect RCRA samples.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples located systematically on a triangular pattern 33 ft from each other. Figure 2 shows the sample locations at FSS-05.

3.2 Sample Collection

FSS-05 occupies portions of Characterization Grid Units 1106 and 1107. Figure 1 shows the SPRU-LL area with FSS-05 highlighted. Figure 2 shows details of FSS-05 with its boundaries and pertinent surface features within and adjacent to it. Sixteen soil samples (SFS-005-001-M through SFS-005-016-M) and one duplicate (SFS-005-017-M) were collected at FSS-05 on June 10, 2009, and analyzed in accordance with the ICM work plan (ARC-PLN-6106) and the QAPjP (ARC-PLN-6402). At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for total metals.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. When the gamma analysis indicated that samples could be shipped, chain-of-custody procedures outlined in the QAPjP were used to transfer all RCRA samples to Test America Laboratories, Inc., an offsite analytical laboratory.

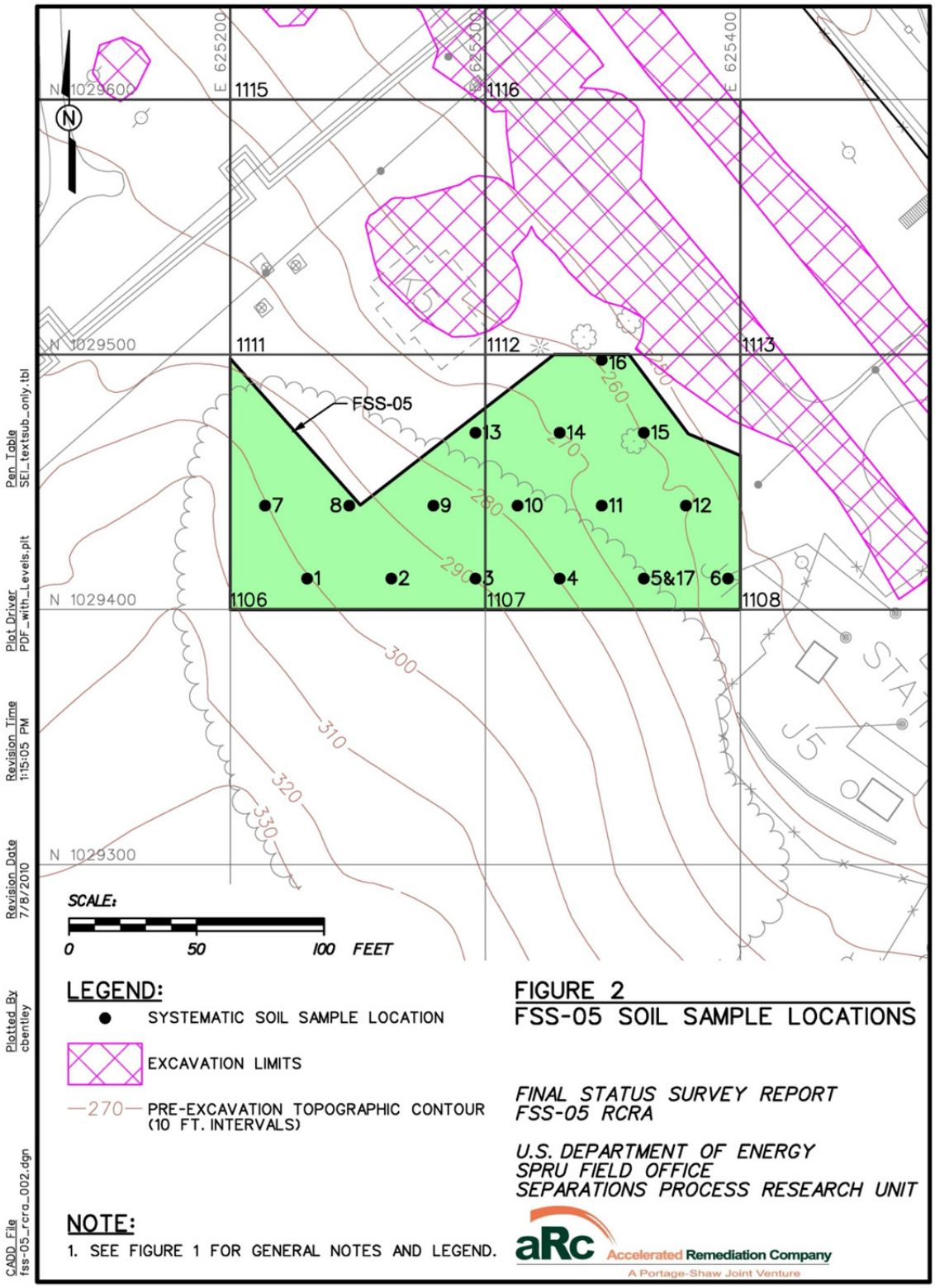

Figure 2 Sample locations for FSS-05

Table 1 Sample description

Sample ID	Map Location	Sample Description
SFS-005-001-M	1	Top soil silt and clay
SFS-005-002-M	2	Top soil clay (wet)
SFS-005-003-M	3	Top soil silt and clay
SFS-005-004-M	4	Top soil silt and clay
SFS-005-005-M SFS-005-017-M	5 & 17	Top soil silt and clay; SFS-005-017-M is the field duplicate of SFS-005-005-M
SFS-005-006-M	6	Top soil silt and clay
SFS-005-007-M	7	Top soil silt and clay
SFS-005-008-M	8	Top soil silt and clay
SFS-005-009-M	9	Top soil clay (wet)
SFS-005-010-M	10	Top soil silt and clay
SFS-005-011-M	11	Top soil silt and clay
SFS-005-012-M	12	Top soil with shale silt and clay sampled from disturbed soil in swale
SFS-005-013-M	13	Topsoil silt and clay
SFS-005-014-M	14	Damp top soil with shale silt and clay sampled from disturbed soil in swale
SFS-005-015-M	15	Top soil silt and clay
SFS-005-016-M	16	Top soil silt and clay

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals by Method SW6010B, antimony and thallium by SW6020, and mercury by SW7471A. Method SW6020 was specifically used to analyze for thallium and antimony in order to obtain detection limits with numerical values below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results for metals analyses. The laboratory analytical report, *Analytical Report*, Project No., 129223, Lot # F9F120172 (Test America 2009), is contained on a CD-ROM provided with this report as Appendix A.

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitations and validation report, *SPRU Metals FSS-05* (Portage 2009), is also contained on a CD-ROM provided with this report as Appendix B. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results in soil samples collected from SPRU FSS-05

Sample ID		**SFS-005-001-M**			**SFS-005-002-M**			**SFS-005-003-M**			**SFS-005-004-M**			**SFS-005-005-M**			**SFS-005-017-M[a]**		
FSS Unit		**05**			**05**			**05**			**05**			**05**			**05**		
Sample Date		**06/10/2009**			**06/10/2009**			**06/10/2009**			**06/10/2009**			**06/10/2009**			**06/10/2009**		
Analyte	**SCO[b]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	10400	N		13400	N		11300	N		10700	N		11900	N		10100	N	
Antimony	1	0.79	B	U	0.49	B	U	0.44	B	U	0.35	B	U	0.38	B	U	0.30	B	U
Arsenic	16	2.1	B		1.9	B		2.3	B		2.8			5.0			3.2		
Barium	350	73.8	N	J	172	N	J	82.4	N	J	60.4	N	J	65.6	N	J	52.8	N	J
Beryllium	14	0.66	B		1.2	B		0.71	B		0.67	B		0.79	B		0.64	B	
Cadmium	2.5	0.28	B	U	0.72	B	U	0.53	B	U	0.41	B	U	0.46	B	U	0.49	B	U
Calcium	NA	1040	N	J	8070	N	J	3020	N	J	2070	N	J	3460	N	J	4630	N	J
Chromium	36	11.1			16.2			14.3			14.2			15.3			15.0		
Cobalt	30	7.9	B		10.4	B		10.6	B		10.1	B		12.8			9.5	B	
Copper	270	13.6			17.1			19.0			18.8			25.8			24.7		
Iron	NA	17100	N		26800	N		24200	N		22700	N		28000	N		25200	N	
Lead	400	24.7			31.0			26.2			21.3			22.0			23.9		
Magnesium	NA	2870	N	J	3840	N	J	3710	N	J	3970	N	J	4780	N	J	4920	N	J
Manganese	2000	435	N*	J	1560	N*	J	787	N*	J	554	N*	J	683	N*	J	571	N*	J
Mercury	0.73	0.067			0.15			0.100			0.072			0.055			0.061		
Nickel	130	18.5			29.2			21.9			23.3			28.4			23.2		
Potassium	NA	964	BN	J	1280	UN		1100	BN	J	1200	BN	J	1580	BN	J	901	BN	J
Selenium	4	1.7	U		2.8	U		1.8	U		1.8	U		1.8	U		1.9	U	
Silver	8.3	0.57	U		0.89	U		0.59	U		0.57	U		0.59	U		0.60	U	
Sodium	NA	27.2	B		69.8	B		15.2	U		14.8	U		22.7	B	U	28.7	B	U
Thallium	2	0.29	BN	UJ	0.92	BN	J	0.31	BN	UJ	0.22	BN	UJ	0.22	BN	UJ	0.12	BN	UJ
Vanadium	150	24.5			34.7			36.6			36.2			31.0			32.0		
Zinc	2200	71.3	N	J	97.9	N	J	79.0	N	J	68.1	N	J	92.3	N	J	89.5	N	J

Table 2 (continued)

Sample ID		**SFS-005-006-M**			**SFS-005-007-M**			**SFS-005-008-M**			**SFS-005-009-M**			**SFS-005-010-M**			**SFS-005-011-M**		
FSS Unit		**05**			**05**			**05**			**05**			**05**			**05**		
Sample Date		**06/10/2009**			**06/10/2009**			**06/10/2009**			**06/10/2009**			**06/10/2009**			**06/10/2009**		
Analyte	**SCO[b]**	Results (mg/kg)	L	V	Results (mg/kg)	L	V	Results (mg/kg)	L	V	Results (mg/kg)	L	V	Results (mg/kg)	L	V	Results (mg/kg)	L	V
Aluminum	NA	11000	N		12100	N		12300	N		13600	N		13200	N		11600	N	
Antimony	1	0.37	B	U	0.26	B	U	0.74	B	U	0.58	B	U	0.42	B	U	0.38	B	U
Arsenic	16	3.2			2.2	B		2.6			3.4			3.0			3.0		
Barium	350	61.5	N	J	63.3	N	J	59.2	N	J	169	N	J	74.5	N	J	67.0	N	J
Beryllium	14	0.69	B		0.72	B		0.71	B		1.0	B		0.77	B		0.69	B	
Cadmium	2.5	0.29	B	U	0.35	B	U	0.36	B	U	0.65	B	U	0.54	B	U	0.40	B	U
Calcium	NA	8950	N	J	1220	N	J	1550	N	J	6770	N	J	3730	N	J	3730	N	J
Chromium	36	14.3			13.7			16.3			19.0			17.6			14.5		
Cobalt	30	11.4	B		12.5	B		15.4			12.2	B		11.9	B		12.1		
Copper	270	24.6			13.2			18.3			22.5			26.7			24.3		
Iron	NA	25200	N		21500	N		25200	N		32200	N		29700	N		25800	N	
Lead	400	16.1			29.5			25.2			28.6			24.0			23.3		
Magnesium	NA	5870	N	J	3340	N	J	4420	N	J	4400	N	J	5530	N	J	4420	N	J
Manganese	2000	545	N*	J	791	N*	J	639	N*	J	**2290**	**N***	**J**	751	N*	J	682	N*	J
Mercury	0.73	0.036	B		0.064			0.063			0.15			0.073			0.054		
Nickel	130	25.9			18.7			23.7			32.4			29.9			28.7		
Potassium	NA	1460	BN	J	851	UN		1670	BN	J	1740	BN	J	1220	BN	J	1560	BN	J
Selenium	4	1.7	U		1.8	U		1.8	U		2.4	U		1.9	U		1.7	U	
Silver	8.3	0.55	U		0.59	U		0.57	U		0.77	U		0.62	U		0.55	U	
Sodium	NA	18.3	B	U	15.2	U		14.8	U		19.8	U		16.0	U		14.1	U	
Thallium	2	0.19	BN	UJ	0.21	BN	UJ	0.11	BN	UJ	0.40	BN	UJ	0.23	BN	UJ	0.24	BN	UJ
Vanadium	150	22.3			31.7			33.0			41.5			36.2			35.9		
Zinc	2200	78.6	N	J	77.0	N	J	75.4	N	J	105	N	J	119	N	J	83.5	N	J

Table 2 (continued)

Sample ID		**SFS-005-012-M**			**SFS-005-013-M**			**SFS-005-014-M**			**SFS-005-015-M**			**SFS-005-016-M**		
FSS Unit		**05**			**05**			**05**			**05**			**05**		
Sample Date		**06/10/2009**			**06/10/2009**			**06/10/2009**			**06/10/2009**			**06/10/2009**		
Analyte	**SCO[b]**	Results (mg/kg)	L	V	Results (mg/kg)	L	V	Results (mg/kg)	L	V	Results (mg/kg)	L	V	Results (mg/kg)	L	V
Aluminum	NA	13200	N		10500	N		12000	N		11600	N		11600	N	
Antimony	1	0.43	B	U	0.42	B	U	0.27	B	U	0.26	B	U	0.36	B	U
Arsenic	16	3.5			2.1	B		2.9			3.5			3.7		
Barium	350	125	N	J	54.4	N	J	88.4	N	J	68.1	N	J	55.6	N	J
Beryllium	14	0.88	B		0.60	B		0.76	B		0.71	B		0.71	B	
Cadmium	2.5	0.59	B	U	0.27	B	U	0.59	B	U	0.61	B	U	0.44	B	U
Calcium	NA	8320	N	J	5280	N	J	5890	N	J	3510	N	J	2070	N	J
Chromium	36	17.7			12.5			15.1			15.1			15.8		
Cobalt	30	13.9	B		10.3	B		11.9	B		10.4	B		11.9		
Copper	270	27.1			20.6			26.8			20.6			24.7		
Iron	NA	29400	N		23900	N		26200	N		27200	N		23900	N	
Lead	400	28.2			15.4			23.3			24.8			26.4		
Magnesium	NA	4780	N	J	5050	N	J	4620	N	J	4430	N	J	4530	N	J
Manganese	2000	**2310**	**N***	**J**	500	N*	J	846	N*	J	853	N*	J	484	N*	J
Mercury	0.73	0.091			0.046			0.055			0.052			0.058		
Nickel	130	33.5			23.1			28.6			26.3			27.7		
Potassium	NA	1890	BN	J	1590	BN	J	822	UN		1230	BN	J	1230	BN	J
Selenium	4	2.3	U		1.8	U		1.8	U		1.7	U		1.6	U	
Silver	8.3	0.73	U		0.57	U		0.57	U		0.56	U		0.52	U	
Sodium	NA	125	B		18.8	B	U	39.1	B	U	14.4	U		13.5	U	
Thallium	2	0.27	BN	UJ	0.13	BN	UJ	0.18	BN	UJ	0.14	BN	UJ	0.15	BN	UJ
Vanadium	150	32.3			17.8			27.4			37.2			37.6		
Zinc	2200	127	N	J	84.8	N	J	104	N	J	85.5	N	J	78.1	N	J

Table 2 (continued)

Notes:

a. SFS-005-017-M is the field duplicate of sample SFS-005-005-M.

b. The SCO (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8 (NYSDEC 2006a) for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.

Results in bold font and shaded with grey indicate the value exceeds the soil cleanup objective (SCO).

NA = Not applicable.

mg/kg = Milligrams per kilogram.

L = Laboratory flags:

- U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
- B = Result is between the method detection limit and the reporting limit.
- E = Serial dilution percent recovery not within limits. Reported value is estimated because of the presence of interference.
- N = Spike analyte recovery outside stated control limits.
- * = Relative percent difference is outside stated control limits.

V = Validation flags:

- J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
- UJ = The material was analyzed for but not detected. The sample quantitation limit is an estimated value based on results from associated laboratory quality control analyses.
- U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation, false positive results reported for several metals were identified based on corresponding levels of blank detections, and these results have been qualified accordingly as undetected values and assigned a "U" flag. Antimony and cadmium were assigned a "U" flag based on detected blank levels. Sodium results for samples SFS-005-002-M, SFS-005-006-M, SFS-005-013-M, SFS-007-014-M, and SFS-005-017-M have been qualified as undetected values and assigned a "U" flag based on corresponding levels of blank detections.

All of the remaining validation qualifiers assigned "J" or "UJ" flags (estimated) corroborate laboratory observations of heterogeneity visible within the sample matrix (dirt, roots, and large and small rocks) and denote evidence of matrix interferences in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

The validated analytical data for manganese in samples SFS-005-009-M and SFS-005-012-M (Sample Locations 9 and 12 on the map) had concentrations of 2,290 and 2,310 mg/kg. The reported concentrations exceed the project's SCO of 2,000 mg/kg. However, manganese is not a RCRA hazardous constituent per the SPRU 6 NYCRR Part 373 Permit; hence, it is not subject to RCRA corrective action. In addition, manganese is not an ICM COC defined in the ICM work plan. The exceedances are attributable to natural soil mineralogy and not believed to be associated with historical SPRU operations. The remainder of the COCs in FSS-05 had concentrations below SCOs.

6.0 Conclusions

Evaluation of the FSS-05 laboratory data package and the data validation report show the data to be of sufficient quality and quantity for decision-making purposes. All COCs in FSS-05 had concentrations below SCOs, with the exception of manganese, which is not a RCRA hazardous constituent, not subject to RCRA corrective action, and the exceedances are attributed to natural soil mineralogy. A civil survey of surface soil sampling locations at FSS-05 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. No excavation is recommended in FSS-05.

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008,

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, New York State Department of Environmental Conservation, March 9, 2006.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels" TAGM 4046.

Portage, 2009, *SPRU Metals FSS-05,* Rev. 2, SDG SFS-005-001-M (F9F120172), Portage, Inc., July 2, 2009.

Test America, 2009, *Analytical Report*, Project No., 129223, Lot # F9F120172, Test America Laboratories, Inc., June 23, 2009.

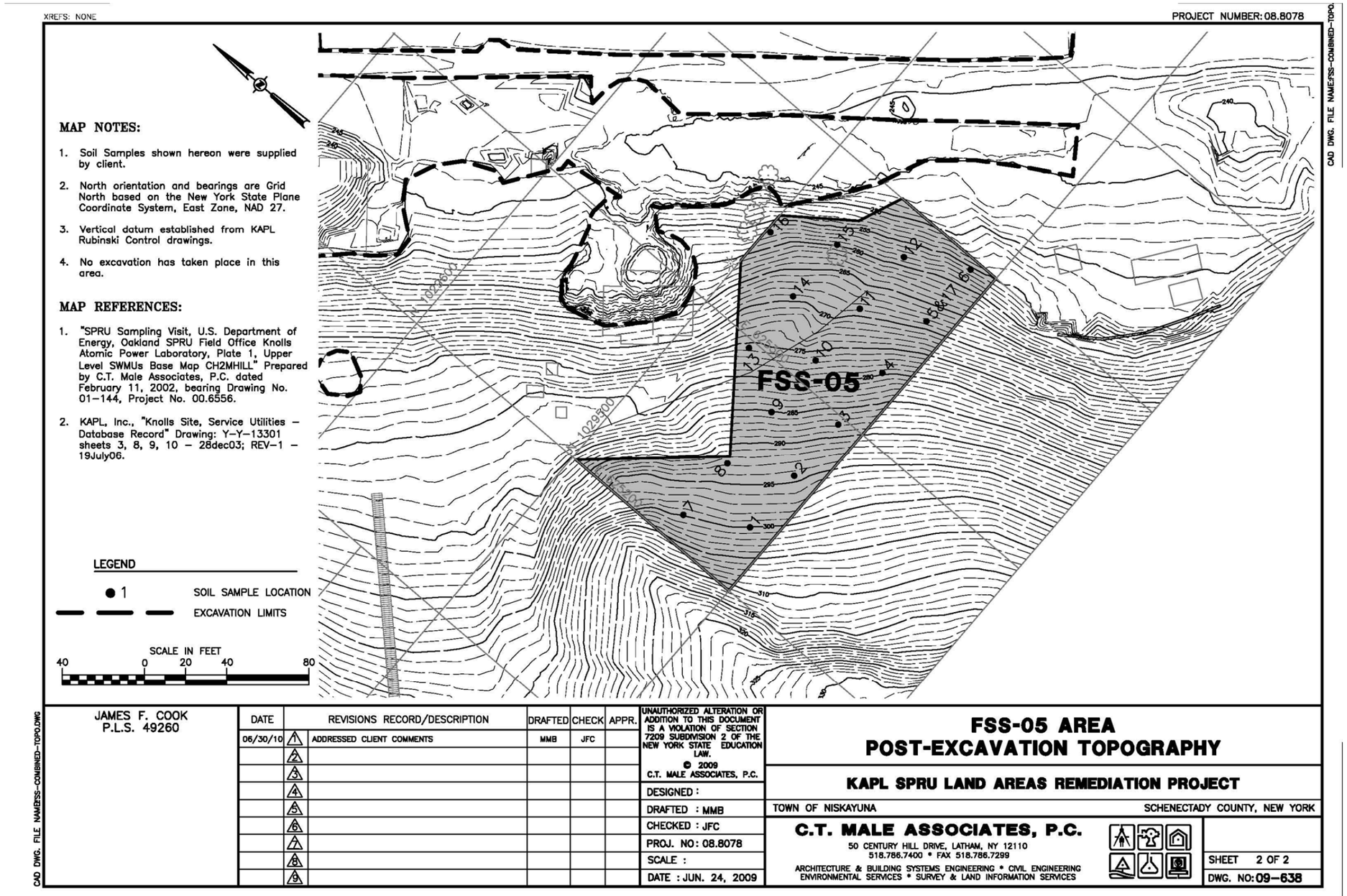

Figure 3 Topographical survey map of FSS-05

Appendix A
CD-ROM with Electronic Copy of
Analytical Report, Project No. 129223,
SDG # F9F120172 Final Status Survey Unit 05

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Report SDG # F9F120172
SPRU Metals Final Status Survey Unit 05

Attachment 8

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 06 (ARC-RPT-6016)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 06

ARC-RPT-6016
August 1, 2011
Revision 4

DOE Contract No. DE-AM09-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 06

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
David Lodman Characterization Lead	08/01/11 Date
Berta Oates Project Quality Assurance Manager	08/01/11 Date

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Appendix A, CD-ROM with Electronic Copy of Analytical Report, Project No. 179223, SDG #F9F260128, Final Status Survey Unit 06 19

Appendix B, CD-ROM with Electronic Copy of Data Limitations and Validation Report SDG #F9F260128 SPRU Metals Final Status Survey Unit 06 21

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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
EPA	U.S. Environmental Protection Agency
FSS-06	Final Status Survey Unit 06
ICM	interim corrective measures
NYSDEC	New York State Department of Environmental Conservation
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	target analyte list

1.0 Executive Summary

This interim report documents the completion of the final status survey (FSS) performed by the Accelerated Remediation Company (aRc) at the Separations Process Research Unit (SPRU) Land Areas Unit 06 (called FSS-06) in accordance with requirements in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) and *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402).

Sampling locations in FSS-06 were established following completion of the excavation, which was radiological in nature and not related to the Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.). Sampling locations for RCRA constituents of concern (COCs) were determined using the methodology described in the interim corrective measures (ICM) work plan (ARC-PLN-6106). Sixteen systematic surface soil samples and one field duplicate sample were collected for offsite laboratory analysis of target analyte list (TAL) metals by Test America Laboratories, Inc.

Validated analytical data for antimony at Sample Location 1 indicate a non-detect result at a concentration of 1.2 mg/kg, which exceeds the project soil cleanup objective (SCO) of 1 mg/kg. The reporting limit for this sample slightly exceeds the SCO, but this sample location does not warrant re-excavation given the closeness of this value to the cleanup objective, the absence of any other antimony exceedances, the sample location being uphill of and not near any waste management areas, and the undetected "U" flagging added during data validation. The concentrations of the remaining COCs that are subject to RCRA requirements are below their corresponding SCOs.

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of the chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a) and provides the cleanup approach for the SPRU-LL.

According to the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), the objectives of the ICM work plan are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from NYSDEC for chemicals in the SPRU land areas.

This interim report documents completion of the SPRU FSS-06 in accordance with the ICM work plan (ARC-PLN-6106) and quality assurance project plan (QAPjP) (ARC-PLN-6402). Figure 1 shows the location of FSS-06 in the SPRU-LL land areas.

Figure 1 Final Status Survey Unit FSS-06 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sampling Location

Sampling locations were established following completion of the excavation in FSS-06. Sampling locations for chemical COCs were determined using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the RCRA ICM work plan determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic sampling locations that were used for the radiological samples were also used to collect RCRA samples.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples being located systematically on a triangular pattern 34 ft from each other. Figure 2 shows the locations of the samples collected for FSS-06.

3.2 Sample Collection

FSS-06 occupies portions of Characterization Grid Units 1110, 1111, and 1114. It also includes a portion of the unnamed grid northwest of Characterization Grid Unit 1110. Figure 1 shows SPRU-LL land areas with FSS-06 highlighted. Figure 2 shows details of FSS-06 with its boundaries and pertinent surface features within and adjacent to it. Sixteen soil samples (SFS-006-001M through SFS-006-016-M) and one duplicate sample (SFS-006-017-M) were collected at FSS-06 on June 24, 2009, and analyzed for TAL metals in accordance with the ICM work plan (ARC-PLN-6106) and QAPjP (ARC-PLN-6402). At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for TAL metals.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. Once the gamma analysis indicated that samples could be shipped, all chemical samples were transferred following chain-of-custody procedures outlined in the QAPjP to Test America Laboratories, Inc., an offsite analytical laboratory.

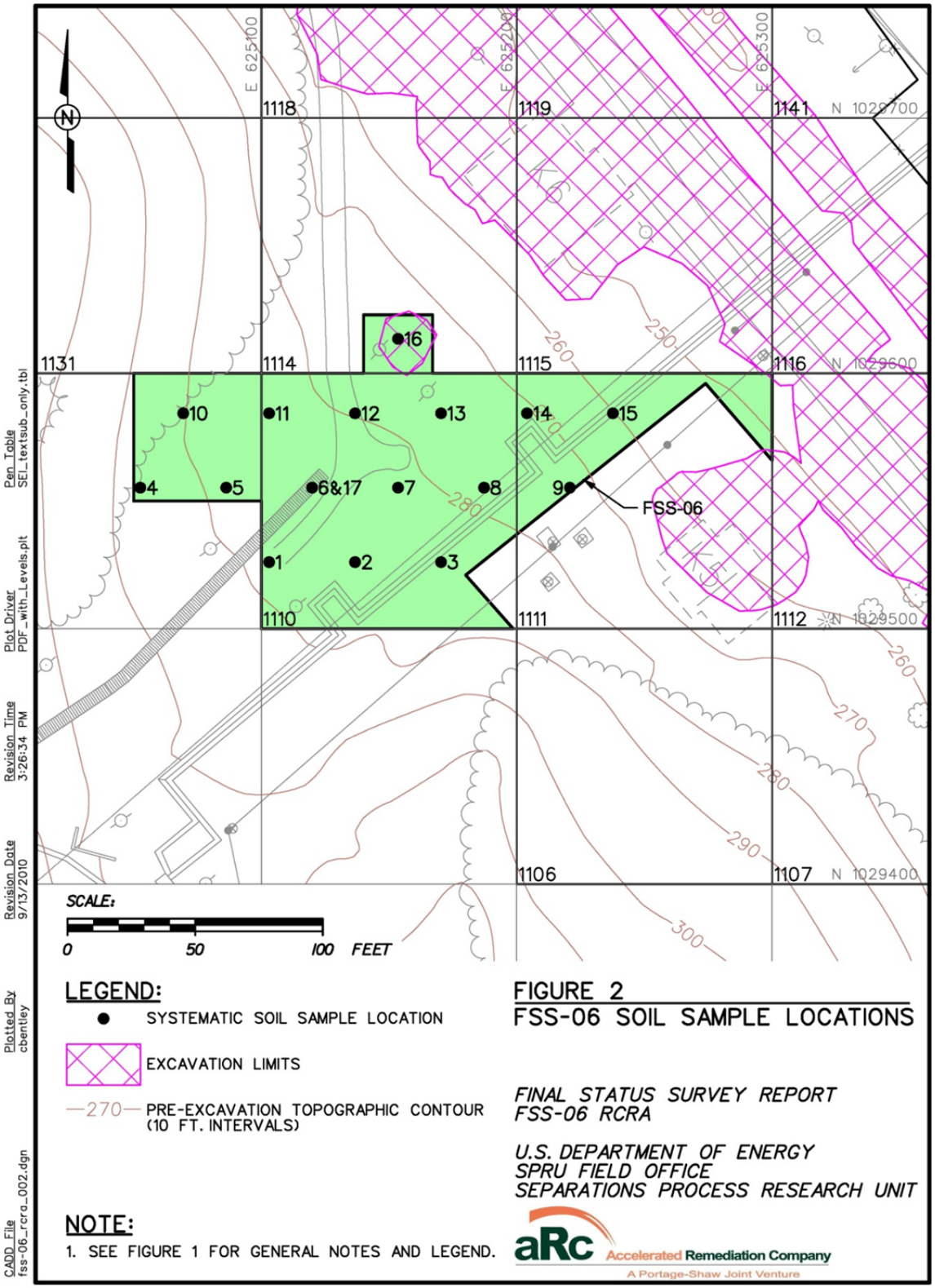

Figure 2 FSS-06 soil sample locations

Table 1 Sample description

Sample ID	Map Location(s)	Sample Description
SFS-006-001-M	1	Topsoil, silt/clay with gravel intermixed
SFS-006-002-M	2	Topsoil, sandy/clay
SFS-006-003-M	3	Dark brown topsoil, silt/clay
SFS-006-004-M	4	Dark brown topsoil, silt/clay
SFS-006-005-M	5	Topsoil, sandy/clay
SFS-006-006-M SFS-006-017-M	6 & 17	Topsoil, silt/clay with gravel intermixed; SFS-006-017-M is field duplicate of SFS-006-006-M
SFS-006-007-M	7	Topsoil, silt/clay
SFS-006-008-M	8	Topsoil, silt/clay
SFS-006-009-M	9	Topsoil, silt/clay
SFS-006-010-M	10	Topsoil, silt/clay
SFS-006-011-M	11	Topsoil, silt/clay
SFS-006-012-M	12	Topsoil, silt/clay with gravel intermixed next to asphalt path
SFS-006-013-M	13	Topsoil, silt/clay
SFS-006-014-M	14	Topsoil, silt/clay
SFS-006-015-M	15	Topsoil, silt/clay next to steam line
SFS-006-016-M	16	Clay sandy backfill from excavation

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency (EPA) SW-846 (EPA 2008) protocols for TAL metals by Method 6010B, antimony and thallium by 6020A, and mercury by 7471A. Method 6020A was specifically used to analyze for thallium and antimony in order to obtain detection limits with numerical values below the required SCOs stated in the QAPjP. Table 2 provides the results for metals analyses. The laboratory analytical report, *Analytical Report*, Project No. 179223, Lot #F9F260128 (Test America 2009), is contained on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*

(EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses.

The limitations and validation report, *SPRU Metals, FSS Unit #6,* SDG SFS-006-001-M (F9F260128) (Portage 2009), is contained on a CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results for soil samples collected from SPRU FSS-06

Sample ID		**SFS-006-001-M**			**SFS-006-002-M**			**SFS-006-003-M**			**SFS-006-004-M**			**SFS-006-005-M**			**SFS-006-006-M**		
FSS Unit		**06**			**06**			**06**			**06**			**06**			**06**		
Sample Date		**6/24/2009**			**6/24/2009**			**6/24/2009**			**6/24/2009**			**6/24/2009**			**6/24/2009**		
Analyte	**SCO[b]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	10100	N		10700	N		11600	N		11700	N		10500	N		6270	N	
Antimony	1	**1.2**	**B**	**U**	0.56	B	U	0.52	B	U	0.46	B	U	0.40	B	U	0.23	B	U
Arsenic	16	4.0			3.6			4.5			3.7			3.7			4.9		
Barium	350	58.8	N	J	44.1	N	J	65.2	N	J	70.8	N	J	57.6	N	J	46.2	N	J
Beryllium	14	0.53	B		0.52	B		0.58	B		0.61	B		0.59	B		0.40	U	
Cadmium	2.5	0.58	U		1.1	B		0.49	U		0.51	U		0.49	U		0.51	U	
Calcium	NA	13100	N		13800	N		17300	N		4300	N		3360	N		35800	N	
Chromium	36	15.4			14.3			15.4			16.4			14.1			10.5		
Cobalt	30	11.7	B		12.8			11.8			12.0			11.1	B		6.1	B	
Copper	270	30.4			26.7			31.8			28.8			25.7			17.0		
Iron	NA	27800	N		30200	N		31700	N		31100	N		26500	N		16000	N	
Lead	400	21.6			22.2			20.1			25.9			20.2			15.8		
Magnesium	NA	8130	N		8660	N		6950	N		5220	N		4070	N		17100	N	
Manganese	2000	550			561			531			592			521			346		
Mercury	0.73	0.046			0.038	B		0.029	B	U	0.072			0.054			0.034	B	
Nickel	130	27.2			24.0			28.4			29.6			25.7			14.1		
Potassium	NA	1830	N	J	1420	N	J	1700	N	J	1870	N	J	1420	N	J	1390	N	J
Selenium	4	3.9	U		3.5	U		3.3	U		3.4	U		3.3	U		3.4	U	
Silver	8.3	0.63	U		0.56	U		0.53	U		0.56	U		0.54	U		0.56	U	
Sodium	NA	25.1	B	U	14.4	U		13.7	U		14.3	U		13.8	U		14.3	U	
Thallium	2	0.22	B	U	0.54	B		0.26	B	U	0.20	B	U	0.35	B	U	0.11	B	U
Vanadium	150	24.3			24.1			22.0			26.7			25.1			17.5		
Zinc	2200	87.4	E		83.1	E		92.5	E		91.6	E		77.2	E		71.0	E	

Table 2 (continued)

Sample ID		SFS-006-017-M[a]			SFS-006-007-M			SFS-006-008-M			SFS-006-009-M			SFS-006-010-M			SFS-006-011-M		
FSS Unit		**06**			**06**			**06**			**06**			**06**			**06**		
Sample Date		**6/24/2009**			**6/24/2009**			**6/24/2009**			**6/24/2009**			**6/24/2009**			**6/24/2009**		
Analyte	**SCO[b]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	6880	N		8800	N		11200	N		11600	N		11500	N		11800	N	
Antimony	1	0.23	B	U	0.35	B	U	0.40	B	U	0.38	B	U	0.40	B	U	0.40	B	U
Arsenic	16	6.1			2.7			3.7			4.2			3.0			3.3		
Barium	350	45.0	N	J	44.0	N	J	59.7	N	J	58.2	N	J	69.0	N	J	56.6	N	J
Beryllium	14	0.40	U		0.41	U		0.49	B		0.56	B		0.59	B		0.53	B	
Cadmium	2.5	0.51	U		0.52	U		0.55	U		0.50	U		0.55	U		0.53	U	
Calcium	NA	45600	N		15500	N		4190	N		8400	N		4800	N		4240	N	
Chromium	36	10.7			12.7			14.7			16.4			15.3			16.2		
Cobalt	30	6.0	B		8.6	B		11.3	B		11.5	B		11.7	B		11.9	B	
Copper	270	18.1			24.8			25.6			37.0			25.1			28.2		
Iron	NA	17100	N		23400	N		26400	N		30800	N		27900	N		28900	N	
Lead	400	15.4			14.4			19.9			15.9			26.0			22.4		
Magnesium	NA	22700	N		9090	N		4360	N		6160	N		4650	N		5110	N	
Manganese	2000	338			414			553			568			604			498		
Mercury	0.73	0.035	B		0.035	B		0.060			0.046			0.076			0.048		
Nickel	130	13.9			20.9			25.5			28.3			26.8			27.2		
Potassium	NA	1180	BN	J	1400	N	J	1690	N	J	1900	N	J	1600	N	J	2400	N	J
Selenium	4	3.4	U		3.5	U		3.7	U		3.4	U		3.7	U		3.5	U	
Silver	8.3	0.55	U		0.57	U		0.60	U		0.55	U		0.60	U		0.57	U	
Sodium	NA	14.2	U		30.2	B	U	15.3	U		73.8	B		15.5	U		14.7	U	
Thallium	2	0.15	B	U	0.17	B	U	0.13	B	U	0.13	B	U	0.16	B	U	0.14	B	U
Vanadium	150	14.2			18.7			25.7			23.0			28.5			27.7		
Zinc	2200	70.3	E		69.9	E		87.9	E		78.5	E		80.7	E		76.0	E	

Table 2 (continued)

Sample ID		SFS-006-012-M			SFS-006-013-M			SFS-006-014-M			SFS-006-015-M			SFS-006-016-M		
FSS Unit		06			06			06			06			06		
Sample Date		6/24/2009			6/24/2009			6/24/2009			6/24/2009			6/24/2009		
Analyte	SCO[b]	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	4500	N		10400	N		12300	N		10400	N		11900	N	
Antimony	1	0.39	B	U	0.38	B	U	0.34	B	U	0.40	B	U	0.38	B	U
Arsenic	16	4.4			2.7			2.5			3.8			3.7		
Barium	350	27.4	N	J	50.9	N	J	70.9	N	J	57.2	N	J	63.4	N	J
Beryllium	14	0.40	U		0.53	B		0.64	B		0.55	B		0.58	B	
Cadmium	2.5	0.51	U		0.54	U		0.52	U		0.51	U		0.48	U	
Calcium	NA	51700	N		13400	N		2960	BN		5810	N		13800	N	
Chromium	36	10.5			14.1			16.8			14.8			15.0		
Cobalt	30	4.5	B		9.9	B		12.7			11.7	B		12.6		
Copper	270	46.7			25.8			28.4			26.5			28.9		
Iron	NA	12700	N		25300	N		34400	N		27100	N		30300	N	
Lead	400	23.3			16.5			22.6			17.0			15.9		
Magnesium	NA	23400	N		7630	N		3720	N		5260	N		6520	N	
Manganese	2000	297			495			1760			572			620		
Mercury	0.73	0.032	B	U	0.053			0.064			0.050			0.042		
Nickel	130	15.2			24.3			22.6			27.3			27.8		
Potassium	NA	1030	BN	J	1610	N	J	1500	N	J	2020	N	J	1800	N	J
Selenium	4	3.5	U		3.7	U		3.5	U		3.4	U		3.2	U	
Silver	8.3	0.56	U		0.59	U		0.57	U		0.55	U		0.52	U	
Sodium	NA	23.0	B	U	31.5	B	U	14.6	U		17.8	B	U	74.9	B	
Thallium	2	0.060	B	U	0.12	B	U	0.14	B	U	0.16	B	U	0.13	B	U
Vanadium	150	21.9			21.1			27.8			24.2			20.4		
Zinc	2200	182	E		79.7	E		71.7	E		73.3	E		86.0	E	

Table 2 (continued)

Notes:

a. SFS-006-017-M is the field duplicate of sample SFS-006-006-M.

b. The SCO (mg/kg) is the more stringent guideline under 6 NYCRR Part 375-6.8 (NYSDEC 2006a) for the protection of groundwater or residential exposure, or Technical and Administrative Guidance 4046 (O'Toole 1994) when Part 375-6 does not reference a value.

Results in bold font and shaded with grey indicate the value exceeds the soil cleanup objective (SCO).

NA = Not applicable.

mg/kg = Milligrams per kilogram.

L = Laboratory flags:

- U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
- B = Result is between the method detection limit and the reporting limit.
- E = Serial dilution percent recovery not within limits.
- N = Spike analyte recovery outside stated control limits.
- * = Relative percent difference is outside stated control limits.

V = Validation flags:

- J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
- UJ = The material was analyzed for but not detected. The sample quantitation limit is an estimated value based on results from associated laboratory quality control analyses.
- U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation, false positive results reported for several metals were identified based on corresponding levels of blank detections. Sodium results in SFS-006-001-M, SFS-006-007-M, SFS-006-012-M, SFS-006-013-M, and SFS-006-015-M; thallium in all samples except SFS-006-002-M; and mercury in SFS-006-003-M and SFS-006-012-M have been qualified accordingly as undetected values and assigned a "U" flag.

Antimony in sample SFS-006-001-M was reported at a concentration of 1.2 mg/kg, which is greater than project's SCO of 1 mg/kg. However, this result was determined to be a false positive during data validation and was "U" flagged as undetected. All of the remaining antimony results were less than 1 mg/kg and were also qualified as undetected and assigned a "U" flag.

All of the remaining validation qualifiers assigned, "J" flags (estimated), denote evidence of matrix interferences in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

The validated analytical data for antimony in sample SFS-006-001-M (Sample Location 1 on Figure 2) qualified the reported concentration (1.2 mg/kg) as an undetected result with a reporting limit slightly greater than the project's SCO of 1 mg/kg. This sample location does not warrant re-excavation, however, given the closeness of this value to the cleanup objective, the absence of any other antimony values of concern, and the undetected "U" flagging added during data validation. The remainder of the COCs subject to RCRA requirements analyzed for in FSS-06 had concentrations below the corresponding SCOs.

6.0 Conclusions

The FSS-06 data are shown to be of sufficient quality and quantity for decision-making purposes. A civil survey of the final excavated surface of FSS-06 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 17 yd^3 of materials were removed from FSS-06. No further excavation is recommended in FSS-06.

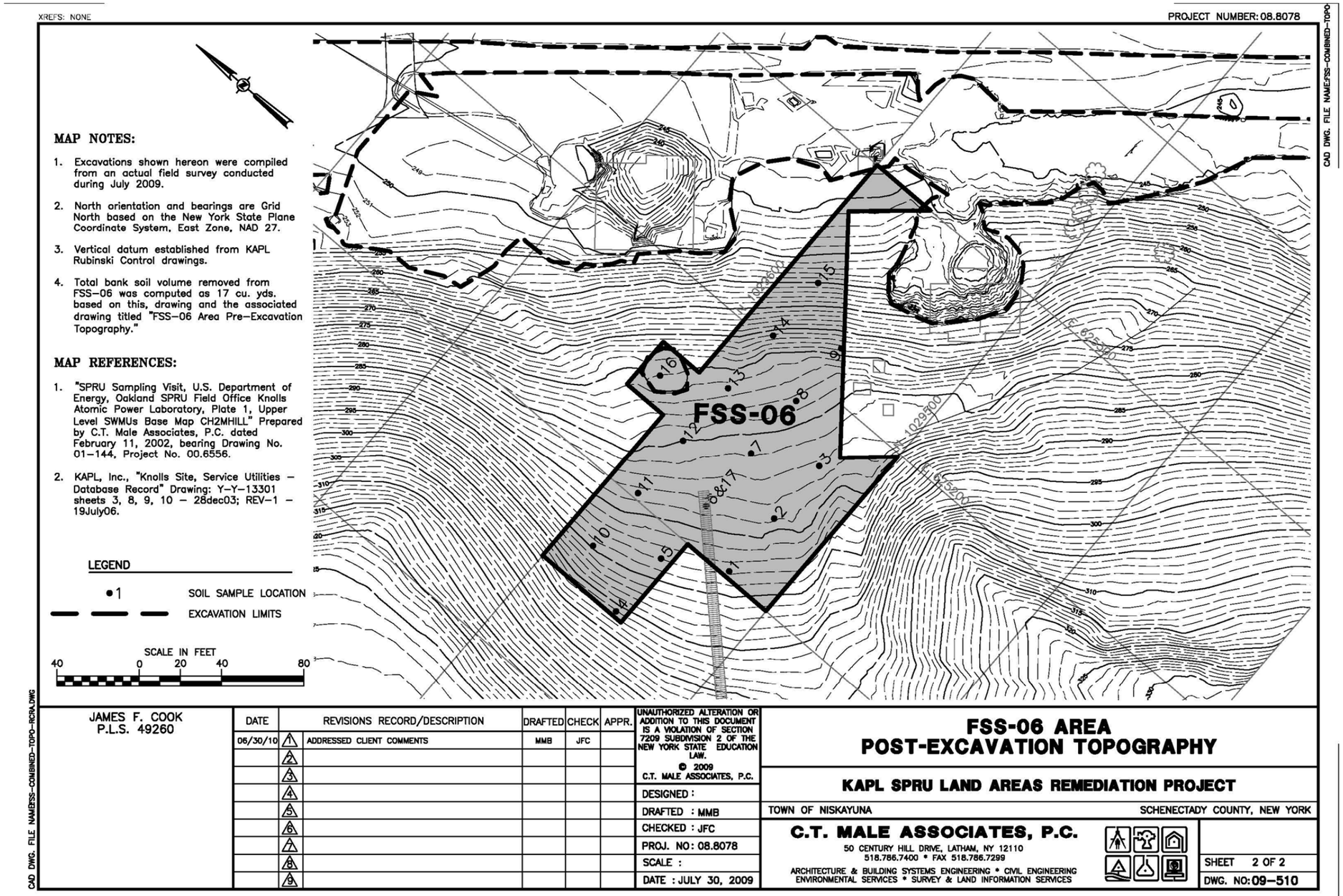

Figure 3 Post-excavation topography of the FSS-06 area

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008,

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, New York State Department of Environmental Conservation, March 9, 2006.

Portage, 2009, *SPRU Metals, FSS Unit #6,* SFS-006-001-M (F9F260128), Portage, Inc., July 17, 2009.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels" TAGM 4046.

Test America, 2009, *Analytical Report*, Project No., 179223, Lot # F9F260128, Test America Laboratories, Inc., July 08, 2009.

Appendix A
CD-ROM with Electronic Copy of Analytical Report, Project No. 179223, SDG #F9F260128, Final Status Survey Unit 06

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Report SDG #F9F260128
SPRU Metals Final Status Survey Unit 06

Attachment 9

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 07 (ARC-RPT-6017)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 07

ARC-RPT-6017
August 1, 2011
Revision 4

DOE Contract No. DE-AM09-05SR22399
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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 07

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
David Lodman Characterization Lead	08/01/11 Date
Berta Oates Project Quality Assurance Manager	08/01/11 Date

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Appendix A, CD-ROM with Electronic Copy of Analytical Report, Project No. 179223, SDG #F9G170211, Final Status Survey Unit 07 17

Appendix B, CD-ROM with Electronic Copy of Data Limitations and Validation Report SDG #F9G170211 SPRU Metals Final Status Survey Unit 07 19

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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
FSS-07	Final Status Survey Unit 07
ICM	interim corrective measures
NYSDEC	New York State Department of Environmental Conservation
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	target analyte list

1.0 Executive Summary

This report documents the completion of the final status survey (FSS) performed by the Accelerated Remediation Company (aRc) at the Separations Process Research Unit (SPRU) Land Areas Unit 07 (called FSS-07) in accordance with requirements specified in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402).

FSS-07 occupies Characterization Grid Unit 1131 and portions of Characterization Grid Unit 1114. No excavation was planned in this unit; however Figure 2 shows a small amount of excavation, located in the northwest corner of SPRU Grid Unit 1114. This excavation was performed as a result of benching and overlap from the excavation of EX-10 in FSS-09 that was radiological in nature. Surface sample locations were established after completion of the final radiological walkover in FSS-07. Sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC §6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sixteen systematic samples and one field duplicate soil sample were collected on July 15, 2009 for offsite laboratory analysis of target analyte list (TAL) metals by Test America Laboratories, Inc.

The concentrations of all COCs that are subject to RCRA requirements are below soil cleanup objectives (SCOs).

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a) and provides the cleanup approach for the SPRU-LL.

The objectives of the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b) are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs, and to achieve a no further action determination from the NYSDEC for chemicals in the SPRU land areas.

This report documents completion of FSS-07 in accordance with the ICM work plan (ARC-PLN-6106) and quality assurance project plan (QAPjP) (ARC-PLN-6402). The completion of the voluntary cleanup was accomplished by meeting SCOs and/or obtaining concurrence from NYSDEC for levels of constituents greater than SCOs. Figure 1 shows the location of FSS-07 in the SPRU-LL land areas.

Figure 1 Final Status Survey Unit FSS-07 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sampling Location

No excavation was planned in this unit; however figure 2 shows a small amount of excavation due to benching and overlap from EX-10 in FSS-09. Surface sample locations (0–6 in. in depth) were established following completion of the final radiological walkovers in FSS-07. Sampling locations for RCRA COCs were determined using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the RCRA ICM work plan (ARC-PLN-6106) determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic sampling locations for the radiological samples were used to collect RCRA samples.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples located systematically on a triangular pattern 37 ft. from each other. Figure 2 shows the sampling locations at FSS-07.

3.2 Sample Collection

FSS-07 occupies Characterization Grid Unit 1131 and portions of Characterization Grid Unit 1114. Figure 1 shows the SPRU-LL area with FSS-07 highlighted. Figure 2 shows details of FSS-07 with its boundaries and pertinent surface features within and adjacent to it. Sixteen soil samples (SFS-007-001-M through SFS-007-016-M) and one duplicate (SFS-007-017-M) were collected at FSS-07 on July 15, 2009, and analyzed in accordance with the ICM work plan (ARC-PLN-6106) and the QAPjP (ARC-PLN-6402). At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for total metals.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. When the gamma analyses indicated that samples could be shipped, all RCRA samples were transferred, according to chain-of-custody procedures outlined in the QAPjP, to Test America Laboratories, Inc., an offsite analytical laboratory.

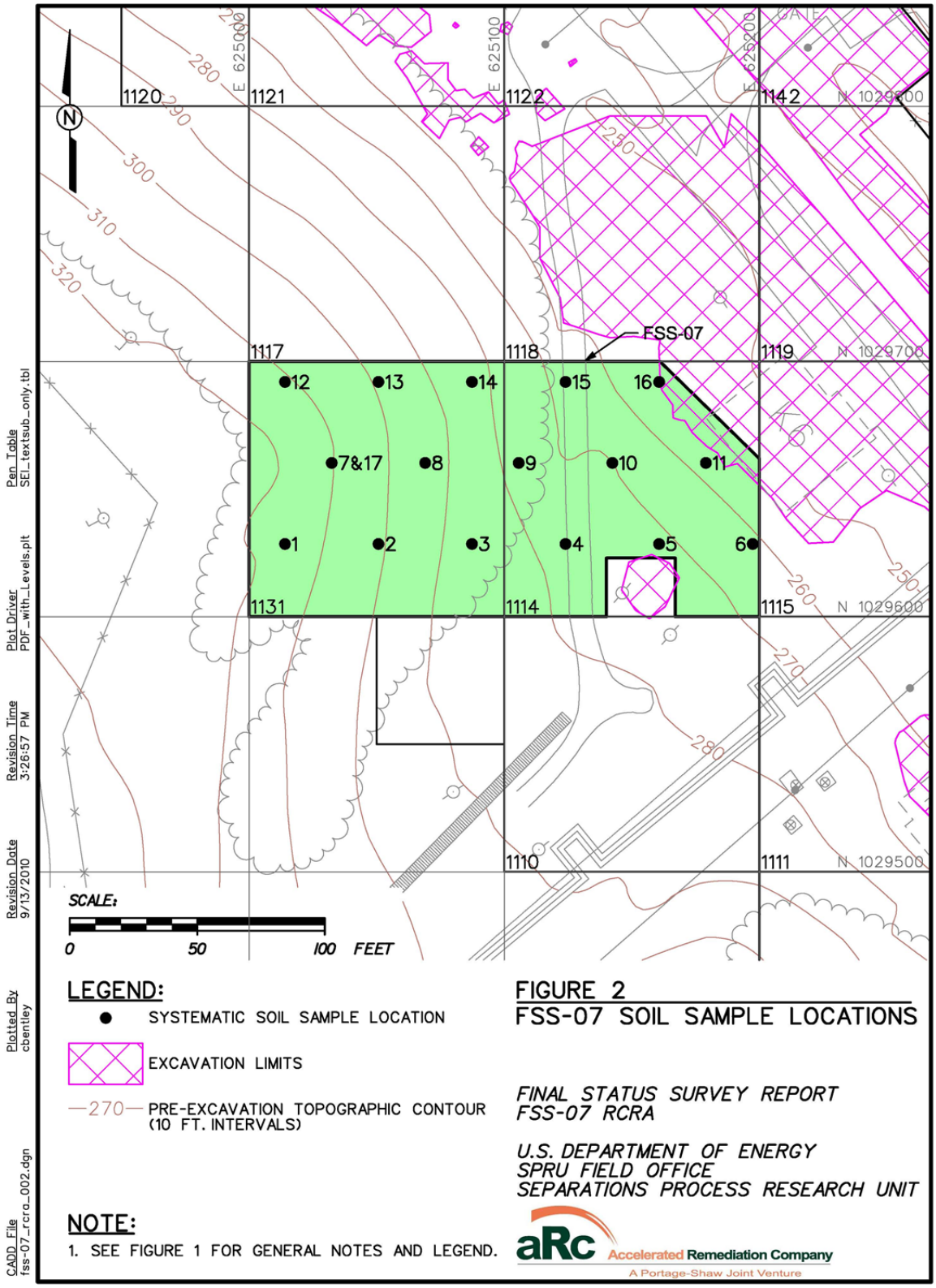

Figure 2 FSS-07 soil sample locations

Table 1 Sample description

Sample ID	Map Location(s)	Sample Description
SFS-007-001-M	1	Top soil silt and clay
SFS-007-002-M	2	Top soil silt and clay
SFS-007-003-M	3	Top soil silt and clay
SFS-007-004-M	4	Top soil silt and clay
SFS-007-005-M	5	Top soil silt and clay
SFS-007-006-M	6	Top soil silt and clay
SFS-007-007-M, SFS-007-017-M	7 & 17	Top soil silt and clay; SFS-007-017-M is the field duplicate of SFS-007-007-M
SFS-007-008-M	8	Top soil silt and clay
SFS-007-009-M	9	Top soil silt and clay
SFS-007-010-M	10	Top soil silt and clay
SFS-007-011-M	11	Top soil silt and clay
SFS-007-012-M	12	Top soil silt and clay
SFS-007-013-M	13	Top soil silt and clay
SFS-007-014-M	14	Top soil silt and clay
SFS-007-015-M	15	Next to asphalt; some gravel with brown top soil
SFS-007-016-M	16	Top soil silt and clay

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals by Method 6010B, antimony and thallium by 6020A, and mercury by 7471A. Method SW6020 was specifically used to analyze for thallium and antimony in order to obtain detection limits with numerical values below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results for metals analyses. The laboratory analytical report, *Analytical Report*, Project No. 129223, Final Status Soils #7, Lot #F9G170211 (Test America 2009), is contained on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitations and validation report, *SPRU Metals FSS #7,* SDG SFS-007-001-M (F9G170211) (Portage 2009), is contained on a CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results for soil samples collected from SPRU FSS-07

Sample ID		**SFS-007-001-M**			**SFS-007-002-M**			**SFS-007-003-M**			**SFS-007-004-M**			**SFS-007-005-M**			**SFS-007-006-M**		
FSS Unit		**07**			**07**			**07**			**07**			**07**			**07**		
Sample Date		**7/15/2009**			**7/15/2009**			**7/15/2009**			**7/15/2009**			**7/15/2009**			**7/15/2009**		
Analyte	**SCO[b]**	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V
Aluminum	NA	11100	N		10600	N		9440	N		8530	N		8760	N		9080	N	
Antimony	1	0.40	B	U	0.80	B	U	0.45	B	U	0.30	B	U	0.40	B	U	0.43	B	U
Arsenic	16	4.5	B		3.7	B		4.9	B		3.3	B		5.6	B		4.0	B	
Barium	350	55.5	N		60.3	N		62.1	N		47.5	N		61.8	N		61.4	N	
Beryllium	14	0.96	U		1.0	U		1.0	U		0.94	U		1.6	B	U	1.0	U	
Cadmium	2.5	0.44	B	U	0.33	B	U	0.30	U		0.28	U		1.2	B	U	0.30	B	U
Calcium	NA	2200	N	J	2510	N	J	4280	N	J	6170	N	J	5560	N	J	5420	N	J
Chromium	36	18.0			17.3			16.1			13.9			15.5			15.0		
Cobalt	30	11.5	B		10.9	B		12.2	B		9.2	B		11.5	B		12.0	B	
Copper	270	25.0			25.0			25.6			19.3			24.6			25.2		
Iron	NA	28900	N		27900	N		25700	N		22300	N		23800	N		24300	N	
Lead	400	19.0			21.6			20.5			19.4			19.6			20.3		
Magnesium	NA	5060	N		4930	N		5100	N		6260	N		5370	N		5380	N	
Manganese	2000	554	N		588	N		607	N		450	N		538	N		542	N	
Mercury	0.73	0.032	BN*	UJ	0.045	N*	UJ	0.037	BN*	UJ	0.028	BN*	UJ	0.037	BN*	UJ	0.038	BN*	UJ
Nickel	130	27.6			27.7			28.2			22.1	B		26.6			27.6		
Potassium	NA	1920	UN*	UJ	2000	UN*	UJ	2040	UN*	UJ	1870	UN*	UJ	1990	UN*	UJ	2000	UN*	UJ
Selenium	4	1.7	U		1.7	U		1.8	U		1.6	U		1.7	U		1.7	U	
Silver	8.3	1.3	U		1.4	U		1.4	U		1.3	U		1.4	U		1.4	U	
Sodium	NA	269	U		279	U		286	U		261	U		278	U		280	U	
Thallium	2	0.23	B	U	0.53	B	U	0.13	B	U	0.077	B	U	0.050	U		0.050	U	
Vanadium	150	26.7	B		26.4	B		26.2	B		23.3	B		24.6	B		26.2	B	
Zinc	2200	81.6	E		89.7	E		80.5	E		73.7	E		147	E		80.8	E	

Sample ID		SFS-007-007-M			SFS-007-017-M[a]			SFS-007-008-M			SFS-007-009-M			SFS-007-010-M			SFS-007-011-M		
FSS Unit		07			07			07			07			07			07		
Sample Date		7/15/2009			7/15/2009			7/15/2009			7/15/2009			7/15/2009			7/15/2009		
Analyte	SCO[b]	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V
Aluminum	NA	11600	N		11300	N		9420	N		10100	N		8800	N		11500	N	
Antimony	1	0.35	B	U	0.31	B	U	0.30	B	U	0.29	B	U	0.36	B	U	0.31	B	U
Arsenic	16	5.7	B		5.4	B		4.6	B		6.8			4.1	B		6.0	B	
Barium	350	56.1	N		53.5	N		83.2	N		67.0	N		51.6	N		78.6	N	
Beryllium	14	1.1	U		1.0	U		1.0	U		1.1	U		1.0	U		1.1	U	
Cadmium	2.5	0.31	U		0.31	U		0.31	U		0.31	U		0.45	B	U	0.44	B	U
Calcium	NA	1910	N	J	1720	N	J	851	BN	J	2500	N	J	8950	N	J	4130	N	J
Chromium	36	17.1			16.0			14.9			17.9			15.7			19.5		
Cobalt	30	8.7	B		8.3	B		10.3	B		12.1	B		9.6	B		15.5	B	
Copper	270	23.4			20.8			17.2			28.5			22.4			35.9		
Iron	NA	26600	N		24400	N		21600	N		28900	N		24200	N		31900	N	
Lead	400	25.3			24.8			23.1			25.0			17.0			28.0		
Magnesium	NA	3970	N		3840	N		3660	N		4930	N		6560	N		5730	N	
Manganese	2000	454	N		352	N		684	N		635	N		571	N		728	N	
Mercury	0.73	0.063	N*	J	0.038	BN*	UJ	0.065	N*	J	0.055	N*	UJ	0.031	BN*	UJ	0.053	N*	UJ
Nickel	130	21.5	B		20.2	B		19.1	B		29.3			24.0			33.7		
Potassium	NA	2100	UN*	UJ	2070	UN*	UJ	2060	UN*	UJ	2110	UN*	UJ	2000	UN*	UJ	2170	UN*	UJ
Selenium	4	1.8	U		1.8	U		1.8	U		1.8	U		1.7	U		1.9	U	
Silver	8.3	1.5	U		1.4	U		1.4	U		1.5	U		1.4	U		1.5	U	
Sodium	NA	293	U		289	U		288	U		295	U		280	U		303	U	
Thallium	2	0.052	U		0.052	U		0.051	U		0.053	U		0.050	U		0.054	U	
Vanadium	150	31.2			30.0	B		25.7	B		32.6			23.7	B		34.6		
Zinc	2200	87.9	E		79.0	E		73.5	E		113	E		104	E		92.8	E	

Sample ID		SFS-007-012-M			SFS-007-013-M			SFS-007-014-M			SFS-007-015-M			SFS-007-016-M		
FSS Unit		07			07			07			07			07		
Sample Date		7/15/2009			7/15/2009			7/15/2009			7/15/2009			7/15/2009		
Analyte	SCO[b]	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V	mg/kg	L	V
Aluminum	NA	12000	N		9510	N		10100	N		2380	N		11200	N	
Antimony	1	0.22	B	U	0.25	B	U	0.28	B	U	0.44	B	U	0.19	B	U
Arsenic	16	4.7	B		4.5	B		4.3	B		7.9			5.4	B	
Barium	350	70.7	N		50.9	N		74.6	N		34.0	N		63.7	N	
Beryllium	14	1.0	U		1.0	U		1.0	U		0.97	U		1.0	U	
Cadmium	2.5	0.41	B	U	0.30	U		0.31	U		0.29	U		0.35	B	U
Calcium	NA	1400	BN	J	741	BN	J	1120	BN	J	104000	N	J	7850	N	J
Chromium	36	18.7			15.2			16.5			7.1			20.1		
Cobalt	30	16.6	B		8.6	B		13.6	B		5.4	U		13.9	B	
Copper	270	22.0			16.4			16.5			11.8	B		32.4		
Iron	NA	27200	N		22700	N		24100	N		10400	N		31700	N	
Lead	400	28.9			26.6			34.2			11.8			24.0		
Magnesium	NA	4830	N		3410	N		4020	N		53800	N		6730	N	
Manganese	2000	1270	N		575	N		1150	N		312	N		736	N	
Mercury	0.73	0.038	BN*	UJ	0.074	N*	J	0.046	N*	UJ	0.0067	BN*	UJ	0.037	BN*	UJ
Nickel	130	23.2	B		18.4	B		20.5	B		12.9	B		34.3		
Potassium	NA	2080	UN*	UJ	2040	UN*	UJ	2060	UN*	UJ	1940	UN*	UJ	2790	BN*	J
Selenium	4	1.8	U		1.8	U		1.8	U		1.7	U		1.7	U	
Silver	8.3	1.4	U		1.4	U		1.4	U		1.4	U		1.4	U	
Sodium	NA	291	U		285	U		288	U		271	U		280	U	
Thallium	2	0.052	U		0.098	B	U	0.051	U		0.048	U		0.050	U	
Vanadium	150	32.3			30.1	B		30.9			17.1	B		30.0		
Zinc	2200	94.4	E		71.3	E		75.9	E		50.4	E		94.9	E	

Notes:

a. SFS-007-017-M is the field duplicate of sample SFS-007-007-M.

b. The SCO (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8 (NYSDEC 2006a) for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.

Results in bold font and shaded with grey indicate the value exceeds the soil cleanup objective (SCO).

NA = not applicable.

mg/kg = milligrams per kilogram.

L = Laboratory flags:

- U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
- B = Result is between the method detection limit and the reporting limit.
- E = Serial dilution percent recovery not within limits. Reported value is estimated because of the presence of interference.
- N = Spike analyte recovery outside stated control limits.
- * = Relative percent difference is outside stated control limits.

V = Validation flags:

- J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
- UJ = The material was analyzed for but not detected. The sample quantitation limit is an estimated value based on results from associated laboratory quality control analyses.
- U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation, false positive results reported for several metals were identified based on corresponding levels of blank detections. These results were qualified accordingly as undetected values. The reported results for thallium in samples SFS-007-001-M, SFS-007-002-M, SFS-007-003-M, SFS-007-004-M, and SFS-007-013-M; beryllium in sample SFS-007-005-M; and cadmium in samples SFS-007-001-M, SFS-007-002-M, SFS-007-005-M, SFS-007-006-M, SFS-007-010-M, SFS-007-011-M, SFS-007-012-M, and SFS-007-016-M; and all antimony results have been assigned a "U" flag. The results reported for mercury were also identified as false positive detections in all samples except SFS-007-007-M, SFS-007-008-M, and SFS-007-013M and were qualified "UJ" based on evidence of matrix interference.

All of the remaining validation qualifiers assigned "J" or "UJ" flags (estimated) denote evidence of matrix interferences in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

All COCs subject to RCRA requirements analyzed for in FSS-07 did not exceed the corresponding SCOs.

6.0 Conclusions

Evaluation of the FSS-07 laboratory data package and the data validation report show the data to be of sufficient quality and quantity for decision-making purposes. The results of all COCs subject to RCRA requirements in FSS-07 were below SCOs. A civil survey of surface soil sampling locations at FSS-07 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. No excavation is recommended in FSS-07.

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008.

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 375, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, New York State Department of Environmental Conservation, March 9, 2006.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels," TAGM 4046.

Portage, 2009, *SPRU Metals FSS #7,* Rev. 2, SDG SFS-007-001-M (F9G170211), Portage, Inc., August 5, 2009.

Test America, 2009, *Analytical Report*, Project No., 179223, Final Status Soils #7 Lot #F9G170211, Test America Laboratories, Inc., July 28, 2009.

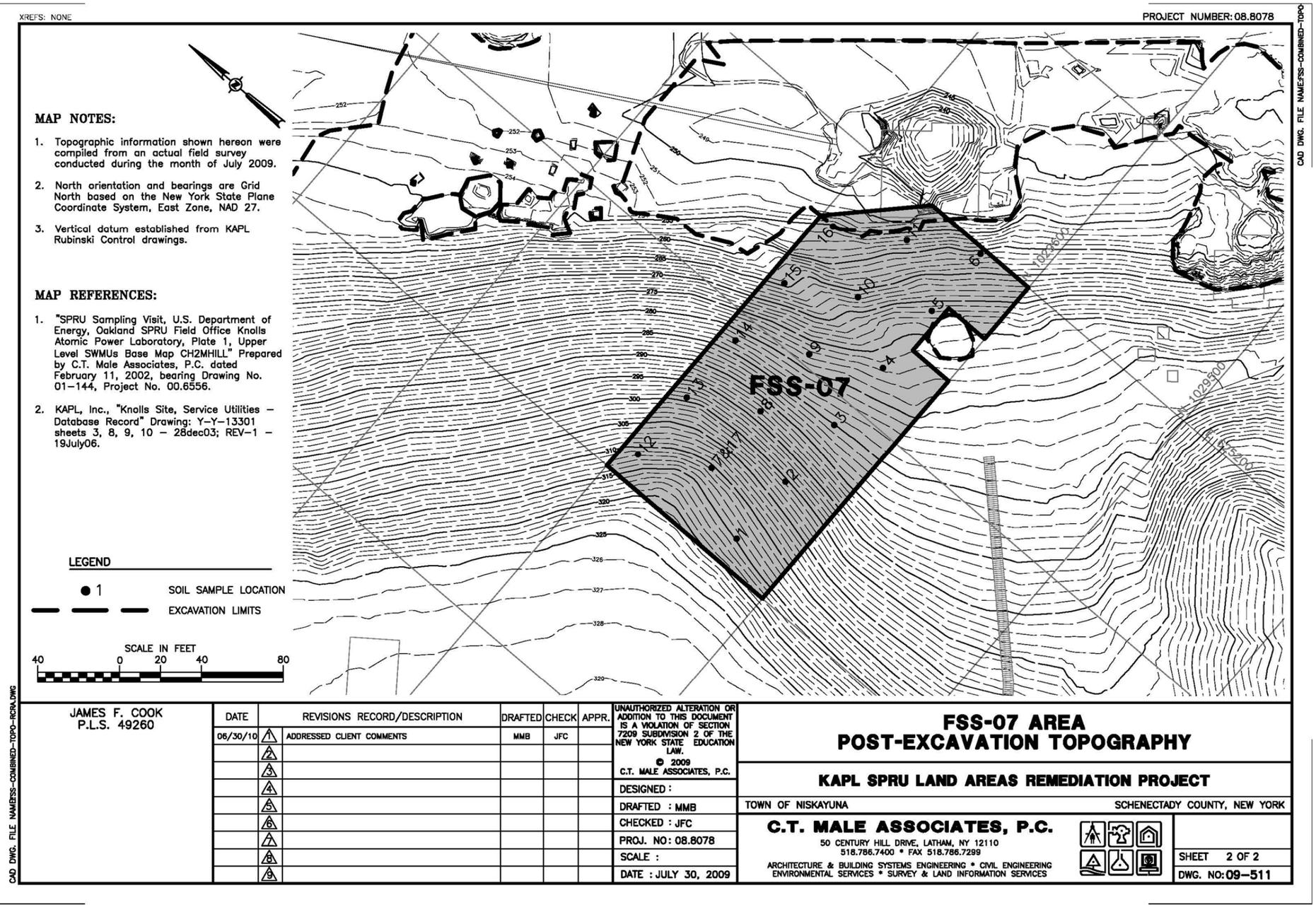

Figure 3 FSS-07 topographic survey

Appendix A
CD-ROM with Electronic Copy of
Analytical Report, Project No. 179223,
SDG #F9G170211, Final Status Survey Unit 07

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Report SDG #F9G170211
SPRU Metals Final Status Survey Unit 07

Attachment 10

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 08 (ARC-RPT-6018)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 08

ARC-RPT-6018
August 1, 2011
Revision 4

DOE Contract No. DE-AM09-05SR22399
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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 08

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
FSS-08	Final Status Survey Unit 08
ICM	interim corrective measures
L&V	limitations & validation
NYSDEC	New York State Department of Environmental Conservation
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	target analyte list

1.0 Executive Summary

This interim report documents completion of the voluntary cleanup area defined as the Separations Process Research Unit (SPRU) Final Status Survey Unit 08 (FSS-08) performed by the Accelerated Remediation Company (aRc) in accordance with the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereinafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402).

Sample locations were established following completion of the excavation at FSS-08. Sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sixteen systematic samples and one field duplicate soil sample were collected on June 30, 2009, for offsite laboratory analysis of target analyte list (TAL) metals by Test America Laboratories, Inc., St. Louis, Missouri.

The concentrations of all COCs that are subject to RCRA requirements are below soil cleanup objectives (SCOs). Only compounds (arsenic and antimony) associated with historical railroad activities, as reported in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002), have concentrations above SCOs.

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of the chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a), and provides the cleanup approach for the SPRU land areas.

According to the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), the objectives of the ICM work plan are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from NYSDEC for chemicals in the SPRU land areas. The ICM work plan requires that NYSDEC be notified when cleanup levels of non-COCs exceed SCOs. Several metals (arsenic, antimony, lead, and copper) associated with historical rail activities in the SPRU-LL (DOE/CH2M HILL 2002) are not subject to cleanup requirements under RCRA.

This interim report documents completion of the SPRU FSS-08 in accordance with the ICM work plan (ARC-PLN-6106) and quality assurance project plan (QAPjP) (ARC-PLN-6402). The completion of the voluntary cleanup was accomplished by meeting SCOs and/or obtaining concurrence from NYSDEC for levels of constituents greater than SCOs. Subsequent to issuance of the ICM work plan, the boundaries of

the voluntary area were modified to include only the voluntary cleanup area inside the SPRU railroad staging area boundary fence. Figure 1 shows the location of FSS-08 in relation to SPRU-LL land areas.

3.0 Sampling Activities

3.1 Sampling Location

Soil sampling locations for chemical COCs were determined using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). Sampling depths were limited to 0 to 6 in. below ground surface (bgs). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the RCRA ICM work plan (ARC-PLN-6106) determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic radiological sampling locations were used to collect RCRA samples.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples located systematically on a triangular pattern 27 ft from each other. Figure 2 shows the sample locations at FSS-08.

During excavation of FSS-02, Sample Point 15 near the border with FSS-08 required additional excavation, because preliminary data evaluation discovered chromium concentrations above SCOs. Per the ICM work plan, the additional excavation consisted of a 20-ft radius around Sampling Point 15 being excavated an additional 2 ft in depth. Because of the proximity of Sample Point 15 to the border between FSS-02 and FSS-08, approximately one-half of the additional excavation extended into FSS-08. The *Interim RCRA ICM Data Report for Final Status Survey Unit 02* (ARC-RPT-6006) stated that this portion of the additional excavation would be evaluated during compliance sampling of the adjacent FSS unit. During the compliance sampling of FSS-08, systematic Sample Point 2 fell within the additional excavation from FSS-02.

As shown in Figure 2, the location of the security fence did not match the as-built diagrams on which the survey unit design was based; therefore, a mismatch between the as-built diagram and the field location of the security fence resulted in the following consequence: The coordinates for sample SFS-008-015-R fell in a location on the inaccessible side of the security fence. Accordingly, this sample was collected approximately 12 ft away from its design coordinates, as shown in Figure 2.

3.2 Sample Collection

FSS-08 occupies portions of Characterization Grid Units 1127, 1128, and 1130. FSS-08 also includes a portion of the unnamed grid east of Characterization Grid Unit 1130. Figure 1 shows the SPRU-LL area with FSS-08 highlighted. Figure 2 shows details of FSS-08 with its boundaries and pertinent surface features within and adjacent to it. Sixteen soil samples (SFS-008-001-M through SFS-008-016-M) and one duplicate (SFS-008-017-M) were collected at FSS-08 on June 30, 2009, and analyzed in accordance with the ICM work plan (ARC-PLN-6106) and the QAPjP (ARC-PLN-6402). At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for total metals.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite

radiological laboratory for gamma analysis. When the gamma analysis indicated that samples could be shipped, all RCRA samples were transferred, following chain-of-custody procedures outlined in the QAPjP, to Test America Laboratories, Inc., an offsite analytical laboratory.

Figure 1 Final Status Survey Unit FSS-08 location in the SPRU Lower Level land areas

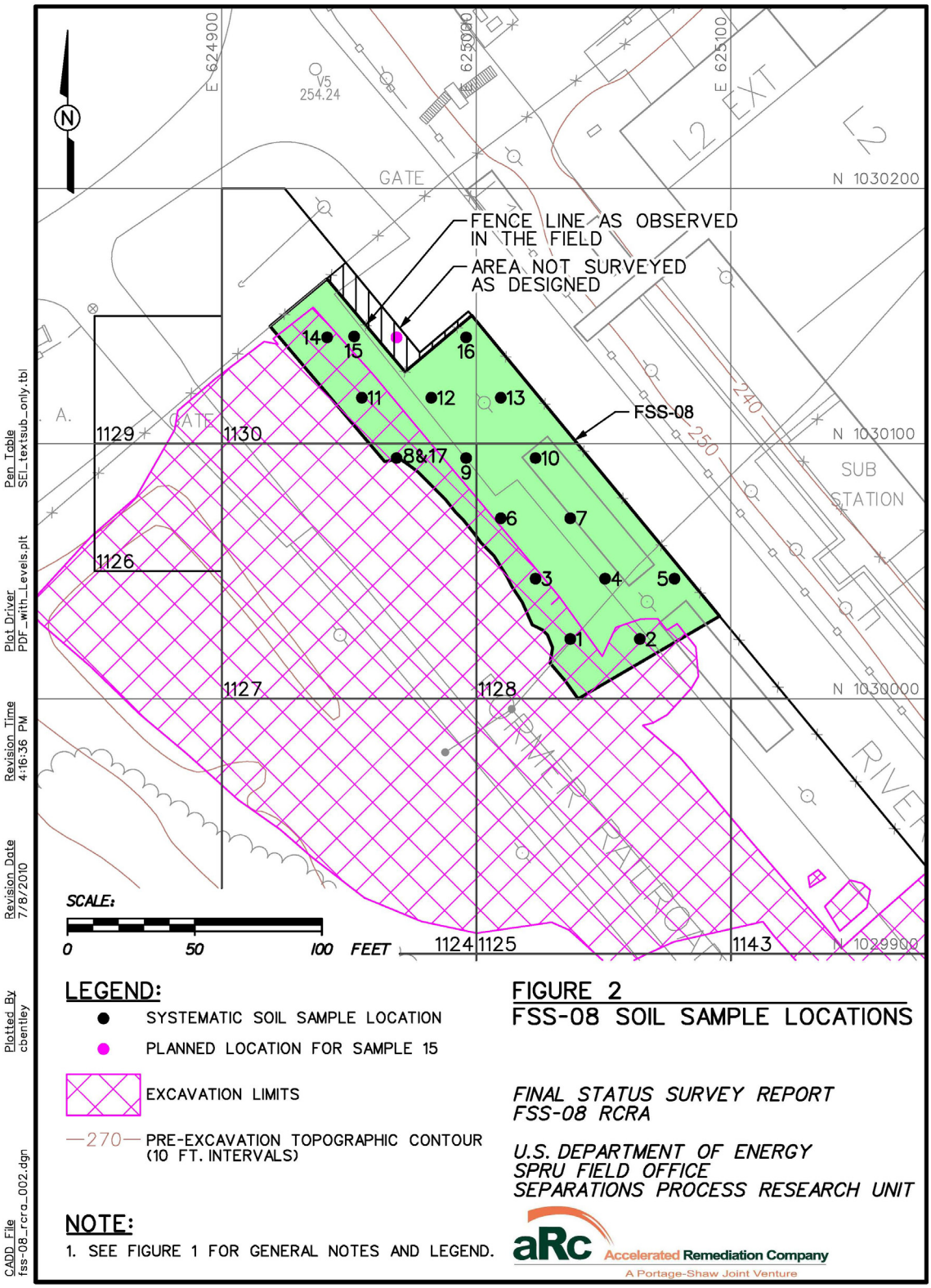

Figure 2 FSS-08 soil sample locations

Table 1 Soil sample description

Sample ID	Map Location(s)	Sample Description
SFS-008-001-M	1	Hardpan with clay and shale in excavation
SFS-008-002-M	2	Wet clay in excavation
SFS-008-003-M	3	Hardpan with clay and shale in excavation
SFS-008-004-M	4	Clay and gravel fill under asphalt
SFS-008-005-M	5	Clay and gravel fill under asphalt
SFS-008-006-M	6	Topsoil silt/clay with rail road cinders
SFS-008-007-M	7	Clay and gravel fill under asphalt
SFS-008-008-M, SFS-008-017-M	8 & 17	Clay/silt with some railroad cinders; SFS-008-017-M is the duplicate of SFS-008-008-M
SFS-008-009-M	9	Sandy gravel fill under asphalt
SFS-008-010-M	10	Clay and gravel fill under asphalt
SFS-008-011-M	11	Hardpan with clay and shale in excavation
SFS-008-012-M	12	Sandy gravel fill under asphalt
SFS-008-013-M	13	Sandy gravel fill under asphalt
SFS-008-014-M	14	Hardpan with clay and shale in excavation
SFS-008-015-M	15	Topsoil clay/silt with gravel
SFS-008-016-M	16	Sandy gravel fill under asphalt

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals by Method 6010B, antimony and thallium by 6020A, and mercury by 7471A. Method 6020A was specifically used to analyze for thallium and antimony in order to obtain detection limits with numerical values below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results of the metals analyses. The laboratory analytical report, *Analytical Report Final Status Survey 08*, Project No. 179223, Lot #F9G020244 (Test America 2009), is provided on a CD-ROM as Appendix A of this report.

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitation and validation report (L&V), *SPRU Metals, FSS Unit #8,* SDG SFS-008-001-M (F9G020244) (Portage 2009), is provided on a CD-ROM as Appendix B of this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results from soil samples collected from FSS-08

Sample ID		**SFS-008-001-M**			**SFS-008-002-M**			**SFS-008-003-M**			**SFS-008-004-M**			**SFS-008-005-M**			**SFS-008-006-M**		
FSS Unit		**08**			**08**			**08**			**08**			**08**			**08**		
Sample Date		**6/30/2009**			**6/30/2009**			**6/30/2009**			**6/30/2009**			**6/30/2009**			**6/30/2009**		
Analyte	**SCO[b]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	11500	N		11300	N		11700	N		1280	N		2280	N		4440	N	
Antimony	1	0.62	B	U	0.39	B	U	0.42	B	U	0.47	B	U	0.58	B	U	**2.1**		
Arsenic	16	4.0	B		2.2	B		5.1	B		5.5			7.1			**120**		
Barium	350	74.3	N	J	68.5	N	J	84.6	N	J	43.8	N	J	80.7	N	J	83.4	N	J
Beryllium	14	0.92	U		0.99	U		0.95	U		0.91	U		0.92	U		1.0	U	
Cadmium	2.5	0.57	B		0.58	B		0.70	B		1.5	B		0.53	B		0.78	B	
Calcium	NA	26900	N		5850	N		18300	N		153000	N		124000	N		25800	N	
Chromium	36	18.4	E	J	16.4	E	J	18.7	E	J	5.7	E	J	5.5	E	J	8.8	E	J
Cobalt	30	11.9	B		14.2	B		16.2	B		5.0	U		5.3	B		6.0	B	
Copper	270	32.6			28.8			37.2			13.1	B		13.7			52.4		
Iron	NA	31400	N		29000	N		33500	N		9020	N		10500	N		27400	N	
Lead	400	18.2	E	J	17.8	E	J	18.4	E	J	31.8	E	J	14.1	E	J	77.9	E	J
Magnesium	NA	9740	N		5620	N		9010	N		68200	N		55700	N		4420	N	
Manganese	2000	524	N		528	N		683	N		355	N		387	N		214	N	
Mercury	0.73	0.024	B	U	0.046		U	0.041		U	0.036		U	0.012	B	U	0.098		
Nickel	130	30.1	E	J	29.7	E	J	36.1	E	J	9.5	BE	J	10.8	BE	J	15.9	BE	J
Potassium	NA	1890	N	J	998	BN	J	1880	N	J	723	UN		1000	BN	J	798	UN	
Selenium	4	1.6	U		1.7	U		1.6	U		1.6	U		1.6	U		1.7	U	
Silver	8.3	1.3	U		1.4	U		1.3	U		1.3	U		1.3	U		1.4	U	
Sodium	NA	57.4	B	U	119	B	U	79.8	B	U	39.0	B	U	110	B	U	99.4	B	U
Thallium	2	0.57	B	U	0.69	B	U	0.37	B	U	0.22	B	U	0.23	B	U	0.50	B	U
Vanadium	150	22.9	B		22.8	B		23.3	B		22.2	B		17.7	B		38.4		
Zinc	2200	88.2			85.3			94.5			223			127			313		

Table 2 (continued)

Sample ID		**SFS-008-007-M**			**SFS-008-008-M**			**SFS-008-017-M[a]**			**SFS-008-009-M**			**SFS-008-010-M**			**SFS-008-011-M**		
FSS Unit		**08**			**08**			**08**			**08**			**08**			**08**		
Sample Date		**6/30/2009**			**6/30/2009**			**6/30/2009**			**6/30/2009**			**6/30/2009**			**6/30/2009**		
Analyte	**SCO[b]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	3130	N		9060	N		9860	N		7840	N		6750	N		11500	N	
Antimony	1	0.66	B	U	**1.1**	**B**	**U**	**1.3**			0.14	U		0.25	B	U	0.45	B	U
Arsenic	16	8.5			4.7	B		5.7			1.9	B		1.7	B		3.3	B	
Barium	350	49.0	N	J	49.7	N	J	50.3	N	J	52.4	N	J	59.0	N	J	103	N	J
Beryllium	14	0.92	U		0.94	U		0.95	U		0.91	U		0.91	U		0.92	U	
Cadmium	2.5	1.0	B		0.50	B		0.30	B	U	0.24	B	U	0.26	B	U	0.53	B	
Calcium	NA	128000	N		17800	N		6950	N		18800	N		33300	N		20800	N	
Chromium	36	6.2	E	J	14.7	E	J	15.8	E	J	9.8	E	J	9.3	E	J	17.6	E	J
Cobalt	30	5.1	U		11.7	B		10.0	B		6.2	B		6.1	B		18.2	B	
Copper	270	22.8			47.7			61.7			17.9			19.9			31.7		
Iron	NA	12100	N		29600	N		27800	N		20100	N		18100	N		31600	N	
Lead	400	30.0	E	J	26.9	E	J	33.5	E	J	11.8	E	J	12.4	E	J	18.1	E	J
Magnesium	NA	58400	N		6790	N		6730	N		8260	N		13200	N		9400	N	
Manganese	2000	441	N		617	N		424	N		632	N		560	N		744	N	
Mercury	0.73	0.062			0.023	B	U	0.041		U	0.022	B	U	0.036		U	0.032	B	U
Nickel	130	12.4	BE	J	26.1	E	J	26.4	E	J	13.4	BE	J	13.1	BE	J	35.9	E	J
Potassium	NA	985	BN	J	1300	N	J	1260	N	J	854	BN	J	722	UN		2170	N	J
Selenium	4	1.6	U		1.6	U		1.6	U		1.6	U		1.6	U		1.6	U	
Silver	8.3	1.3	U		1.3	U		1.3	U		1.3	U		1.3	U		1.3	U	
Sodium	NA	57.1	B	U	77.5	B	U	96.9	B	U	176	B		104	B	U	94.0	B	U
Thallium	2	0.20	B	U	0.20	B	U	0.14	B	U	0.19	B	U	0.27	B	U	0.29	B	U
Vanadium	150	23.5	B		19.3	B		20.4	B		26.0	B		34.0			23.0	B	
Zinc	2200	173			89.9			82.0			65.4			66.2			90.1		

Table 2 (continued)

Sample ID		**SFS-008-012-M**			**SFS-008-013-M**			**SFS-008-014-M**			**SFS-008-015-M**			**SFS-008-016-M**		
FSS Unit		**08**			**08**			**08**			**08**			**08**		
Sample Date		**6/30/2009**			**6/30/2009**			**6/30/2009**			**6/30/2009**			**6/30/2009**		
Analyte	**SCO[b]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	7580	N		7600	N		11400	N		6830	N		8370	N	
Antimony	1	0.14	U		0.14	U		0.44	B	U	0.35	B	U	0.14	U	
Arsenic	16	2.8	B		1.3	B		3.7	B		**29.1**			3.2	B	
Barium	350	58.4	N	J	61.3	N	J	94.2	N	J	91.0	N	J	143	N	J
Beryllium	14	0.90	U		0.91	U		0.92	U		0.99	U		1.0	B	
Cadmium	2.5	0.23	U		0.27	B	U	0.49	B	U	0.89	B		0.41	B	U
Calcium	NA	32100	N		29900	N		17400	N		41000	N		36800	N	
Chromium	36	10.1	E	J	9.5	E	J	18.1	E	J	10.9	E	J	9.9	E	J
Cobalt	30	6.7	B		6.9	B		16.8	B		6.5	B		6.7	B	
Copper	270	15.8			16.8			47.0			18.7			19.4		
Iron	NA	18800	N		19700	N		32500	N		19400	N		19600	N	
Lead	400	9.9	E	J	12.7	E	J	20.4	E	J	40.9	E	J	16.4	E	J
Magnesium	NA	8650	N		7820	N		9490	N		10400	N		8420	N	
Manganese	2000	670	N		569	N		657	N		714	N		636	N	
Mercury	0.73	0.024	B	U	0.051			0.033	B	U	0.031	B	U	0.035	B	U
Nickel	130	13.5	BE	J	14.3	BE	J	36.4	E	J	16.4	BE	J	15.4	BE	J
Potassium	NA	1190	N	J	1020	BN	J	1800	N	J	1140	BN	J	1060	BN	J
Selenium	4	1.5	U		1.6	U		1.6	U		1.7	U		1.6	U	
Silver	8.3	1.3	U		1.3	U		1.3	U		1.4	U		1.3	U	
Sodium	NA	180	B		342			85.0	B	U	247			576		
Thallium	2	0.21	B	U	0.19	B	U	0.21	B	U	0.20	B	U	0.16	B	U
Vanadium	150	26.2	B		32.6			21.9	B		29.5			29.0		
Zinc	2200	56.4			69.0			87.4			1790			63.3		

Table 2 (continued)

Notes:

a. SFS-008-017-M is the field duplicate of sample SFS-008-008-M.

b. The SCO (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8 (NYSDEC 2006a) for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.

Results in bold font and shaded with grey indicate the value exceeds the soil cleanup objective (SCO).

NA = not applicable.

mg/kg = milligrams per kilogram.

L = Laboratory flags:

- U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
- B = Result is between the method detection limit and the reporting limit.
- E = Serial dilution percent recovery not within limits.
- N = Spike analyte recovery outside stated control limits.

V = Validation flags:

- J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
- U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making purposes, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for all analytes with the exception of calcium, which had concentrations greater than the associated quantitation limit. The impact to data usability is deemed to be minimal as calcium is not a RCRA COC and the imprecision likely reflects the heterogeneity inherent to the matrix.

During validation, false positive results reported for several metals were identified and have been qualified accordingly as undetected values with a "U" flag. All thallium results; sodium in all samples except SFS-008-009-M, SFS-008-012-M, SFS-008-013M, and SFS-008-016-M; cadmium in SFS-008-009-M, SFS-008-010-M, SFS-008-013-M, SFS-008-014-M, SFS-008-016-M, and SFS-008-017-M; mercury in all samples except SFS-008-006M, SFS-008-007M and SFS-008-013M; and antimony in all samples except SFS-008-006M and FSF-008-017M have been assigned a "U" flag as undetected results.

All of the remaining validation qualifiers assigned "J" flags (estimated) denote evidence of matrix interferences bias in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

All COCs subject to RCRA requirements analyzed for in FSS-08 had concentrations below SCOs, with the exception of arsenic and antimony. The presence of these two COCs is associated with historical railroad activities in the SPRU-LL land areas, and is therefore not subject to cleanup requirements under RCRA. Table 3 lists by sampling location the concentrations of arsenic and antimony that exceeded SCOs.

Table 3 Soil cleanup objective exceedances for non-COCs at FSS-08

Sample Location		**6**	**8/17[a]**	**15**
Sample Date		**6/30/2009**	**6/30/2009**	**6/30/2009**
Metal results (mg/kg)	**SCO**			
Arsenic	16	120	N/A	29.1
Antimony	1	2.1	1.1 U, 1.3	N/A

a. Sample Location 17 is a field duplicate of Sampling Location 8.
N/A = not applicable.

FSS-08 systematic Sample Point 2 fell within the additional excavation from FSS-02 and served to evaluate the additional excavation from FSS-02 as well as being one of the systematic samples for FSS-08. Table 2 shows the metals results from Sample Point 2. These results demonstrate that all metal results, including chromium, are below SCOs and no additional excavation is required.

6.0 Conclusions

Evaluation of the FSS-08 laboratory data package and the L&V report (Portage 2009) show the data to be of sufficient quality and quantity for decision-making purposes. The SCOs for arsenic and antimony were exceeded at three sampling locations, all of which are associated with historical railroad activities. Arsenic concentrations were detected at levels greater than the SCO in two samples, and concentrations of antimony exceeded the SCO in two samples. The remaining RCRA COCs had concentrations below their corresponding SCOs.

A civil survey of the final excavated surface of FSS-08 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 258 yd^3 of banked materials were removed from FSS-08. No further excavation is recommended at FSS-08.

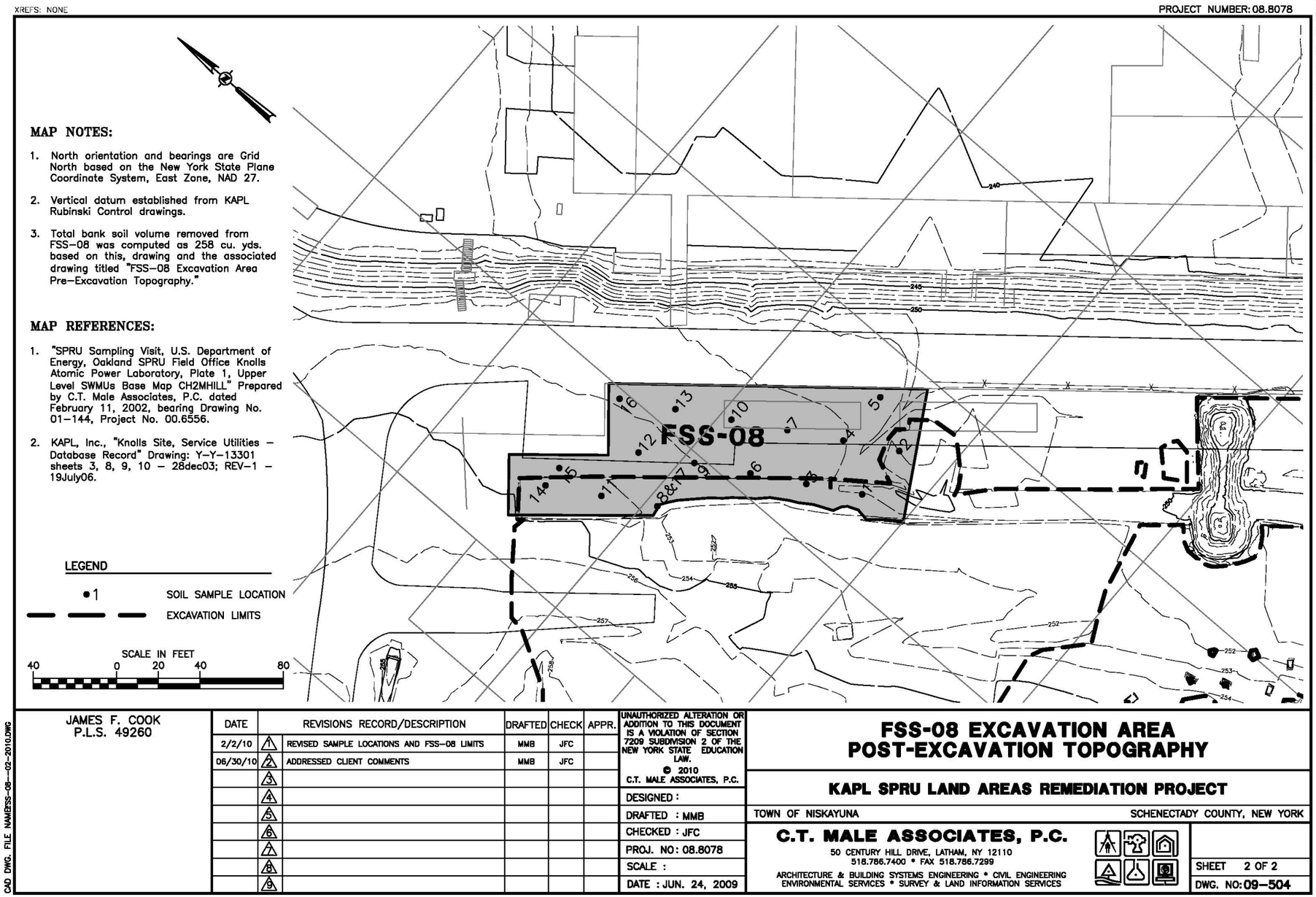

Figure 3 FSS-08 excavation area post-excavation topography

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, current revision.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, current revision.

ARC-RPT-6006, *Interim RCRA ICM Data Report for Final Status Survey Unit 02,* Accelerated Remediation Company, current revision.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008.

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, New York State Department of Environmental Conservation, March 9, 2006.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels," TAGM 4046.

Portage, 2009, *SPRU Metals FSS Unit #8,* SFS-008-001-M (F9G020244), Portage, Inc., July 23, 2009.

Test America, 2009, *SPRU Final Status Survey Unit 08 Analytical Report*, Project No., 179223, Lot #F9G020244, Test America Laboratories, Inc., July 17, 2009.

Appendix A
CD-ROM with Electronic Copy of Analytical Report, Project No. 179223, SDG #F9G020244, Final Status Survey Unit 08

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Report SDG #F9G020244
SPRU Metals Final Status Survey Unit 08

Attachment 11

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 09 (ARC-RPT-6019)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 09

ARC-RPT-6019
August 1, 2011
Revision 3

DOE Contract No. DE-AM09-05SR22399
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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 09

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
David Lodman Characterization Lead	08/01/11 Date
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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
DOE-SPRU	U.S. Department of Energy Separations Process Research Unit Field Office
FSS-09	Final Status Survey Unit 09
ICM	interim corrective measures
L&V	limitations and validation
NYSDEC	New York State Department of Environmental Conservation
ORISE	Oak Ridge Institute for Science and Education
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	target analyte list

1.0 Executive Summary

This report documents the completion of the final status survey (FSS) performed by the Accelerated Remediation Company (aRc) at the Separations Process Research Unit (SPRU) Land Areas Unit 09 (called FSS-09) in accordance with requirements specified in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402).

Sample locations were established following completion of the excavation at FSS-09. Sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sixteen systematic samples and one field duplicate soil sample were collected on August 13, 2009, for offsite laboratory analysis of target analyte list (TAL) metals by Test America Laboratories, Inc., St. Louis, Missouri.

Upon completion of FSS-09, the Oak Ridge Institute for Science and Education (ORISE), which is the independent verification contractor for the U.S. Department of Energy SPRU Field Office (DOE-SPRU), conducted independent sampling for metals in FSS-09. Six samples were collected in FSS-09. Analytical results from this sampling showed arsenic concentration greater than the corresponding soil cleanup objectives (SCOs) in one location. Additional excavation was conducted, and subsequent sampling and analyses indicated no RCRA COCs above SCOs.

The concentrations of all COCs that are subject to RCRA requirements are below SCOs.

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit," (NYSDEC 2006a) and provides the cleanup approach for the SPRU-LL.

The objectives of the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from the NYSDEC for chemicals in the SPRU-LL land areas.

This report documents completion of FSS-09 in accordance with the ICM work plan (ARC-PLN-6106) and quality assurance project plan (QAPjP) (ARC-PLN-6402). Figure 1 shows the location of FSS-09 in the SPRU-LL land areas.

Figure 1 Final Status Survey Unit FSS-09 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sampling Location

FSS-09 occupies portions of Characterization Grid Units 1114, 1115, 1116, and 1119. Figure 1 shows the SPRU-LL land area with FSS-09 highlighted. Figure 2 shows details of FSS-09, most notably its boundaries, sample locations, and pertinent surface features. Soil sampling locations for chemical COCs were determined using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). Sampling depths were limited to 0 to 6 in. below ground surface. Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the RCRA ICM work plan determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic radiological sampling locations were used to collect RCRA samples.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples located systematically on a triangular pattern 36 ft from each other. Figure 2 shows the sample locations at FSS-09.

Upon completion of FSS-09, ORISE, the independent verification contractor for DOE-SPRU, conducted independent sampling for metals in FSS-09. Six samples were collected in FSS-09. Analytical results from this sampling showed arsenic concentration greater than the corresponding SCOs in one location (S045). Additional excavation was conducted, and subsequent sampling and analyses indicated no RCRA COCs above SCOs.

3.2 Sample Collection

Soil samples were collected for chemical COCs using the methodology described in the RCRA ICM work plan. Sixteen soil samples (SFS-009-001-M through SFS-009-016-M) and one duplicate (SFS-009-017-M) were collected at FSS-09 on August 13, 2009, and soil sample S045 was collected on May 5, 2010. At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for total metals.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. When the gamma analysis indicated that samples could be shipped, all RCRA samples were transferred, following chain-of-custody procedures outlined in the QAPjP, to Test America Laboratories, Inc., an offsite analytical laboratory.

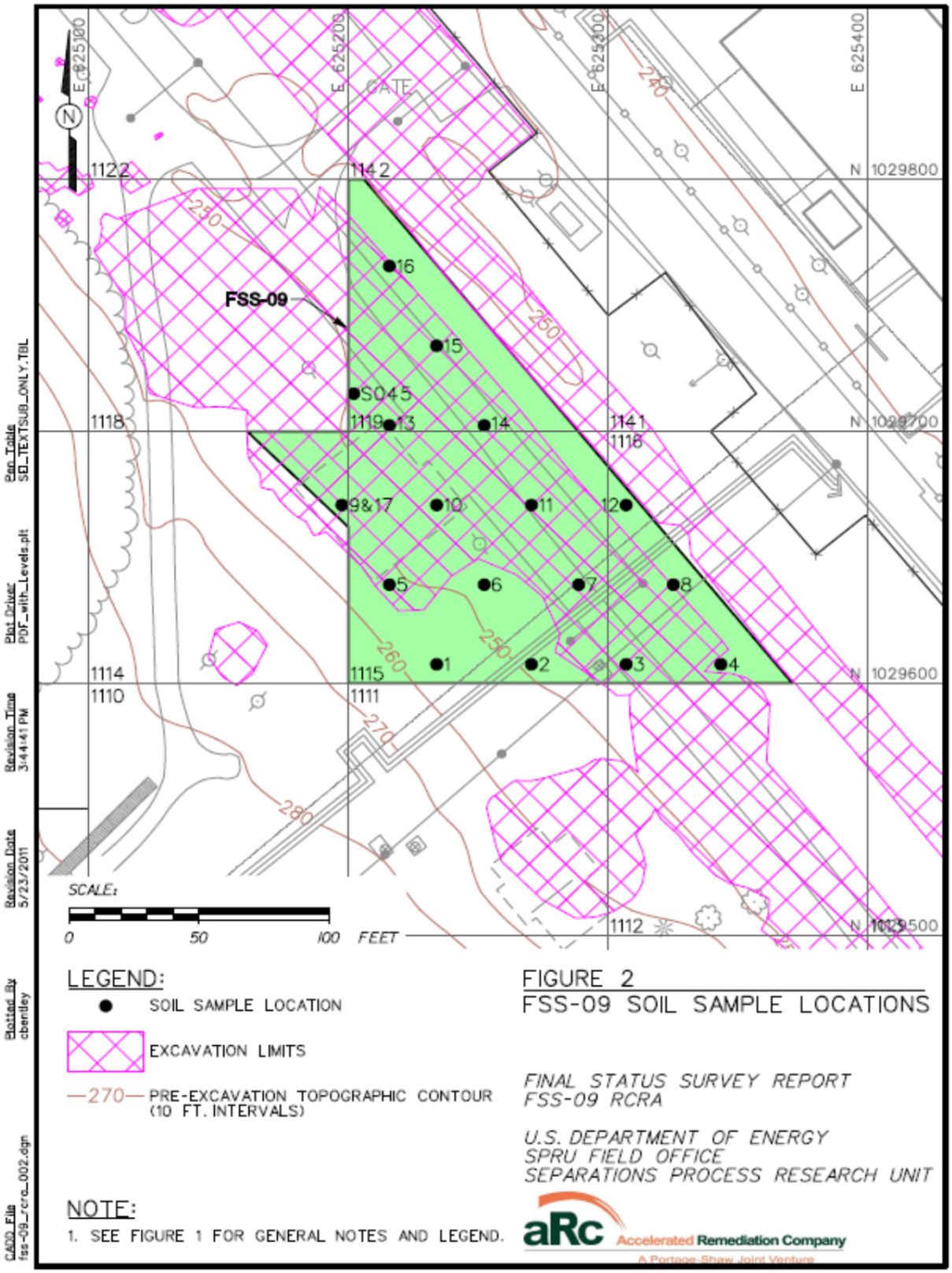

Figure 2 FSS-09 soil sample locations

Table 1 Soil sample description

Sample ID	Map Location(s)	Sample Description
SFS-009-001-M	1	Topsoil silt/clay
SFS-009-002-M	2	Topsoil silt/clay
SFS-009-003-M	3	Hardpan clay from excavation
SFS-009-004-M	4	Topsoil silt/clay
SFS-009-005-M	5	Sandy/clay from excavation
SFS-009-006-M	6	Topsoil silt/clay
SFS-009-007-M	7	Hardpan clay from excavation
SFS-009-008-M	8	Topsoil silt/clay
SFS-009-009-M, SFS-009-017-M	9 and 17	Clay/silt from Excavation 10; SFS-009-017-M is the duplicate of SFS-009-009-M
SFS-009-010-M	10	Clay/silt from sidewall of Excavation 10
SFS-009-011-M	11	Hardpan clay from excavation
SFS-009-012-M	12	Topsoil silt/clay
SFS-009-013-M	13	Clay/silt from sidewall of Excavation 10
SFS-009-014-M	14	Clay/silt from excavation
SFS-009-015-M	15	Clay/silt from excavation
SFS-009-016-M	16	Topsoil silt/clay
SFS-S045-001A-M	S045	Gray clay with some brown clay; ORISE sample location

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals by Method 6010B, antimony by 6020A, and mercury by 7471A. An exception to the QAPjP (ARC-PLN-6402) included analyzing thallium using analytical Method 6020A instead of Method 6010B. Method 6020A was specifically used to analyze for thallium to obtain detection limits with numerical values below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results of the metals analyses. The laboratory analytical report, *SPRU Final Status Survey Unit 09 Analytical Report*, Project No. 179223, Lot #F9H180228 (Test America 2009), and the *SPRU Final Status Survey Unit 09 Analytical Report*, Project No. 179223, SDG #F0E060429 (Test America 2010), are on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitations and validation (L&V) report,

SPRU Metals, FSS Unit #9, SDG SFS-009-001-M (F9H180228) (Portage 2009), and *SPRU Metals, FSS Unit #9,* SDG SFS-S045-01A-M (F0E060429) (Portage 2010), are on the CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results from soil samples collected from FSS-09

Sample ID		**SFS-009-001-M**			**SFS-009-002-M**			**SFS-009-003-M**			**SFS-009-004-M**			**SFS-009-005-M**			**SFS-009-006-M**		
FSS Unit		**09**			**09**			**09**			**09**			**09**			**09**		
Sample Date		**8/13/2009**			**8/13/2009**			**8/13/2009**			**8/13/2009**			**8/13/2009**			**8/13/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	11400	N		8360	N		10600	N		4520	N		8810	N		9130	N	
Antimony	1	0.16	U		0.15	U		0.14	U		0.15	U		0.14	U		0.14	U	
Arsenic	16	4.2	NE		3.3	NE		5.5	NE		4.4	NE		3.2	NE		3.4	NE	
Barium	350	79.1	N	J	54.3	N	J	64.3	N	J	52.8	N	J	50.2	N	J	56.2	N	J
Beryllium	14	0.85	B	U	0.59	B	U	0.67	B	U	0.59	B	U	0.65	B	U	0.62	B	U
Cadmium	2.5	0.72	B	U	0.54	B	U	0.51	B	U	0.55	B	U	0.53	B	U	0.54	B	U
Calcium	NA	9830	N		4070	N		9850	N		4980	N		18700	N		7590	N	
Chromium	36	20.6	NE		14.5	NE		16.9	NE		16.6	NE		14.4	NE		15.9	NE	
Cobalt	30	15.1	N		10.7	BN		12.2	N		11.5	N		10.0	BN		10.2	BN	
Copper	270	34.8	N	J	29.8	N	J	32.4	N	J	40.0	N	J	29.5	N	J	28.4	N	J
Iron	NA	37300	N		25700	N		30300	N		26800	N		26500	N		30100	N	
Lead	400	82.4	N		48.7	N		18.5	N		27.4	N		22.0	N		23.2	N	
Magnesium	NA	6530	N		4280	N		7280	N		5210	N		8270	N		6230	N	
Manganese	2000	931	N		598	N		667	N		542	N		685	N		655	N	
Mercury	0.73	0.041	B	U	0.050		U	0.049		U	0.048		U	0.056		U	0.035	B	U
Nickel	130	34.9	N		26.7	N		28.0	N		28.1	N		22.5	N		24.5	N	
Potassium	NA	2250	N	J	1500	N	J	1410	N	J	1540	N	J	1170	N	J	1580	N	J
Selenium	4	1.8	U		1.7	U		1.6	U		1.7	U		1.6	U		1.6	U	
Silver	8.3	0.59	UN	UJ	0.54	UN	UJ	0.51	UN	UJ	0.53	UN	UJ	0.52	UN	UJ	0.51	UN	UJ
Sodium	NA	119	U		109	U		102	U		107	U		105	U		102	U	
Thallium	2	1.1	BN*	J	1.0	BN*	J	0.23	BN*	UJ	0.21	BN*	UJ	0.18	BN*	UJ	0.14	BN*	UJ
Vanadium	150	43.2	N	J	25.9	N	J	21.6	N	J	32.0	N	J	22.6	N	J	23.9	N	J
Zinc	2200	89.2	E		86.4	E		79.4	E		88.0	E		77.1	E		82.1	E	

Table 2 (continued)

Sample ID		**SFS-009-007-M**			**SFS-009-008-M**			**SFS-009-009-M**			**SFS-009-017-M[b]**			**SFS-009-010-M**			**SFS-009-011-M**		
FSS Unit		**09**			**09**			**09**			**09**			**09**			**09**		
Sample Date		**8/13/2009**			**8/13/2009**			**8/13/2009**			**8/13/2009**			**8/13/2009**			**8/13/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	9830	N		8030	N		15900	N		13500	N		15400	N		10800	N	
Antimony	1	0.14	U		0.14	U		0.15	U		0.15	U		0.15	U		0.14	U	
Arsenic	16	5.5	NE		10.3	NE		6.4	NE		5.2	NE		6.8	NE		4.0	NE	
Barium	350	62.2	N	J	54.1	N	J	114	N	J	101	N	J	100	N	J	97.9	N	J
Beryllium	14	0.59	B	U	0.61	B	U	1.0	B	U	0.93	B	U	1.2		U	0.70	B	U
Cadmium	2.5	0.40	B	U	0.62	B	U	0.93	B	U	0.67	B	U	0.95	B	U	0.60	B	U
Calcium	NA	28600	N		51500	N		3630	N		5200	N		2750	N		7970	N	
Chromium	36	14.1	NE		15.1	NE		22.6	NE		20.3	NE		23.7	NE		16.3	NE	
Cobalt	30	11.1	N		10.2	BN		17.4	N		15.2	N		17.9	N		12.6	N	
Copper	270	25.6	N	J	83.8	N	J	28.5	N	J	25.7	N	J	37.5	N	J	29.4	N	J
Iron	NA	25500	N		25200	N		41400	N		35800	N		40900	N		29700	N	
Lead	400	15.7	N		23.9	N		22.8	N		22.8	N		23.9	N		21.9	N	
Magnesium	NA	7070	N		5330	N		5670	N		5830	N		6190	N		5570	N	
Manganese	2000	609	N		590	N		1490	N		1240	N		1040	N		591	N	
Mercury	0.73	0.027	B	U	0.054		U	0.064		U	0.053		U	0.049		U	0.035	B	U
Nickel	130	23.7	N		24.1	N		35.2	N		32.0	N		36.0	N		27.5	N	
Potassium	NA	1020	N	J	1280	N	J	1510	N	J	1690	N	J	1890	N	J	1600	N	J
Selenium	4	1.5	U		1.6	U		2.1	B	U	1.7	U		2.2	B	U	1.5	U	
Silver	8.3	0.49	UN	UJ	0.51	UN	UJ	0.55	UN	UJ	0.54	UN	UJ	0.53	UN	UJ	0.50	UN	UJ
Sodium	NA	460			103	U		110	U		109	U		107	U		1060		
Thallium	2	0.13	BN*	UJ	0.13	BN*	UJ	0.17	BN*	UJ	0.15	BN*	UJ	0.15	BN*	UJ	0.15	BN*	UJ
Vanadium	150	20.7	N	J	25.1	N	J	29.1	N	J	26.5	N	J	30.5	N	J	22.4	N	J
Zinc	2200	67.1	E		81.2	E		102	E		92.8	E		110	E		78.1	E	

Table 2 (continued)

Sample ID		**SFS-009-012-M**			**SFS-009-013-M**			**SFS-009-014-M**			**SFS-009-015-M**			**SFS-009-016-M**			**SFS-S045-01A-M**		
FSS Unit		**09**			**09**			**09**			**09**			**09**			**09**		
Sample Date		**8/13/2009**			**8/13/2009**			**8/13/2009**			**8/13/2009**			**8/13/2009**			**5/15/2010**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	9340	N		13900	N		9270	N		8830	N		9680	N		12500	NE	J
Antimony	1	0.14	U		0.14	U		0.14	U		0.14	U		0.15	U		0.18	U	
Arsenic	16	13.7	NE		6.8	NE		3.7	NE		4.2	NE		8.7	NE		3.3	E	UJ
Barium	350	63.9	N	J	89.9	N	J	71.1	N	J	77.3	N	J	69.6	N	J	124	NE	J
Beryllium	14	0.66	B	U	0.96	B	U	0.61	B	U	0.63	B	U	0.69	B	U	0.94		U
Cadmium	2.5	0.54	B	U	0.62	B	U	0.59	B	U	0.53	B	U	0.55	B	U	0.70	U	
Calcium	NA	5500	N		2390	N		13400	N		16100	N		9420	N		5010	NE*	J
Chromium	36	14.3	NE		20.3	NE		14.4	NE		15.3	NE		17.1	NE		17.8	E	
Cobalt	30	11.1	N		13.5	N		12.7	N		14.6	N		12.6	N		12.1		J
Copper	270	32.7	N	J	26.4	N	J	27.8	N	J	31.7	N	J	35.6	N	J	22.9	E	
Iron	NA	30800	N		35200	N		26000	N		28500	N		28900	N		22800	NE	J
Lead	400	24.5	N		20.2	N		19.1	N		16.6	N		38.7	N		19.8		
Magnesium	NA	4850	N		5040	N		6190	N		7260	N		6940	N		4730	NE*	J
Manganese	2000	733	N		1010	N		611	N		703	N		658	N		437	N	
Mercury	0.73	0.029	B	U	0.033	B	U	0.023	B	U	0.030	B	U	0.068		U	0.097		
Nickel	130	26.4	N		28.7	N		25.9	N		31.9	N		31.1	N		23.2	N	J
Potassium	NA	1530	N	J	1850	N	J	1400	N	J	1540	N	J	1530	N	J	1470	N	J
Selenium	4	1.5	U		1.6	U		1.5	U		1.5	U		1.6	U		4.0	U	
Silver	8.3	0.50	UN	UJ	0.52	UN	UJ	0.49	UN	UJ	0.50	UN	UJ	0.53	UN	UJ	0.33	U	
Sodium	NA	100	U		104	U		435			259			106	U		95.2	BN	
Thallium	2	0.12	BN*	UJ	0.16	BN*	UJ	0.11	BN*	UJ	0.12	BN*	UJ	0.14	BN*	UJ	0.30	B	
Vanadium	150	31.7	N	J	25.7	N	J	20.3	N	J	20.4	N	J	32.2	N	J	23.8	E	
Zinc	2200	77.8	E		80.1	E		67.8	E		79.6	E		106	E		82.5	N	J

Table 2 (continued)

Notes: a. The SCO (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8, (NYSDEC 2006a) for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.
b. SFS-009-017-M is the field duplicate of sample SFS-009-009-M.

NA = not applicable.
mg/kg = milligrams per kilogram.
L = Laboratory flags:
U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
B = Result is between the method detection limit and the reporting limit.
E = Serial dilution percent recovery not within limits.
N = Spike analyte recovery outside stated control limits.
* = Relative percent difference is outside stated control limits.
V = Validation flags:
J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making purposes, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation, the results reported for mercury, cadmium, and beryllium in all samples, arsenic in SFS-S045-01A-M, and selenium in samples SFS-009-009-M and SFS-009-010-M were identified as false positives and have been qualified accordingly as undetected values with a "U" or "UJ" flag.

Thallium in SFS-009-001-M and SFS-009-002-M has been qualified with a "J" validation flag to denote potential high bias reflected in high recovery in the matrix spike duplicate result. Thallium in the remaining samples was identified as a false positive, and the reported results were qualified with a "UJ" validation flag to denote an undetected value with a potential high bias. The high bias does not negatively impact project decisions.

All of the remaining results assigned with validation flags "J" (estimated) and "UJ" (estimated non-detect) denote bias due to evidence of matrix interferences in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

All COCs subject to RCRA requirements analyzed for in FSS-09 had concentrations below the corresponding SCOs.

6.0 Conclusions

Evaluation of the FSS-09 laboratory data package (Test America 2009; Test America 2010) and the L&V report (Portage 2009; Portage 2010) show the data to be of sufficient quality and quantity for decision-making purposes. All RCRA COCs had concentrations below their corresponding SCOs.

A civil survey of the final excavated surface of FSS-09 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 1,645 yd^3 of banked materials were removed from FSS-09. No further excavation is recommended at FSS-09.

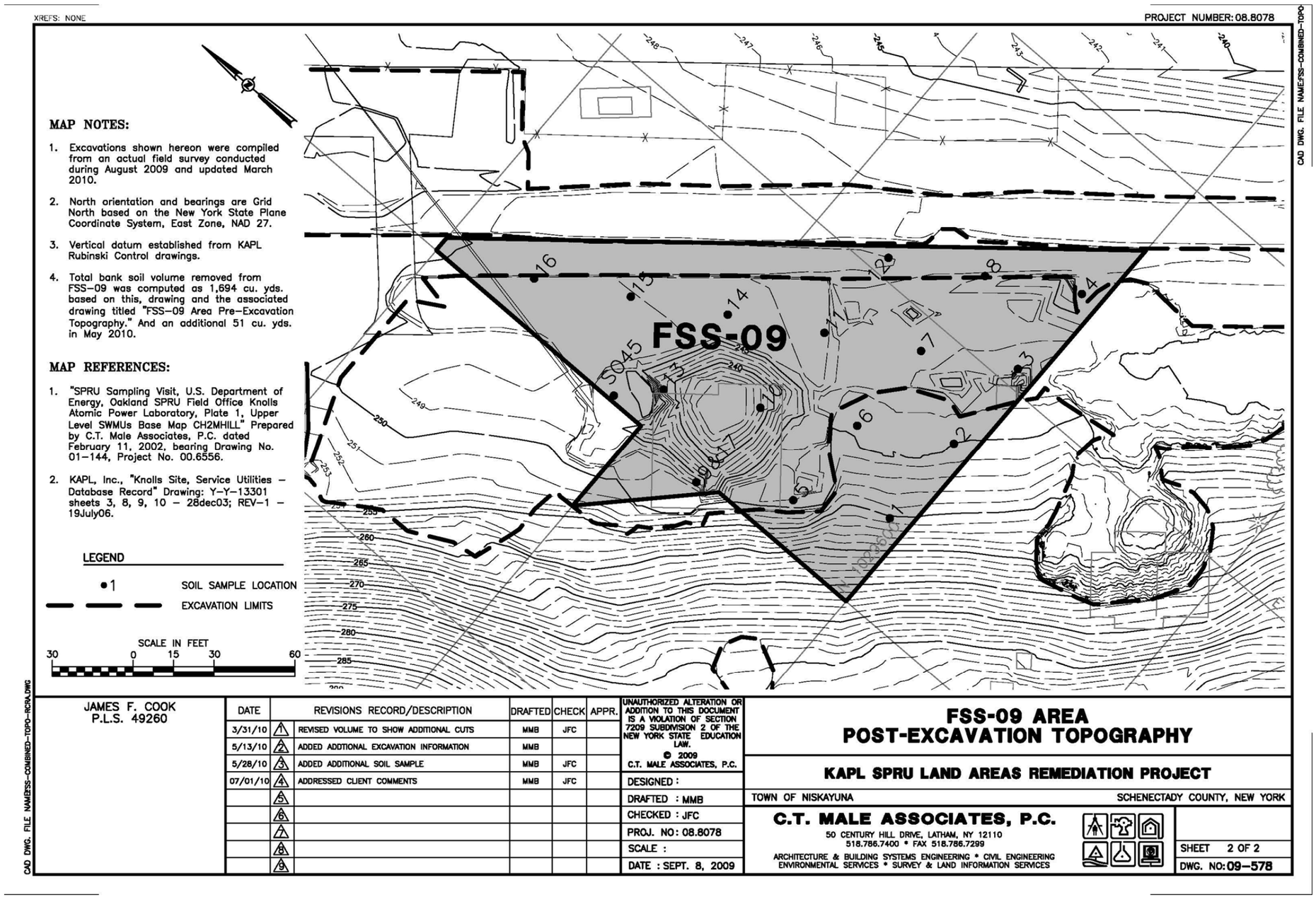

Figure 3 FSS-09 excavation area post-excavation topography

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008.

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002, New York State Department of Environmental Conservation, March 9, 2006.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels" TAGM 4046.

Portage, 2009, SPRU Metals FSS Unit #9, SFS-009-001-M (F9H180228), Portage, Inc., September 24, 2009.

Portage, 2010, SPRU Metals FSS Unit #9, SFS-S045-001-M (F0E060429), Portage, Inc., June 11, 2010.

Test America, 2009, SPRU Final Status Survey Unit 09 Analytical Report, Project No. 179223, Lot # F9H180228, Rev. 1, Test America Laboratories, Inc., September 22, 2009.

Test America, 2010, SPRU Final Status Survey Unit 09 Analytical Report, Project No. 179223, SDG # F0E060429, Test America Laboratories, Inc., May 25, 2010.

Appendix A

CD-ROM with Electronic Copy of Analytical Report, Project No. 179223, SDG #F9H180228 and F0E060429, Final Status Survey Unit 09

Appendix B

CD-ROM with Electronic Copy of Data Limitations and Validation Report SDG #F9H180228 and F0E060429, SPRU Metals Final Status Survey Unit 09

Attachment 12

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 10 (ARC-RPT-6020)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 10

ARC-RPT-6020
August 1, 2011
Revision 5

DOE Contract No. DE-AM09-05SR22399
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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 10

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
David Lodman Characterization Lead	08/01/11 Date
Berta Oates Project Quality Assurance Manager	08/01/11 Date

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Appendix B—CD-ROM with Electronic Copy of Data Limitations and Validation Report SDG #F9J020214, SDG #F0C120425 SPRU, and SDG #F0D130439 Final Status Survey Unit 10 21

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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
DOE-SPRU	U.S. Department of Energy Separations Process Research Unit Field Office
FSS-10	Final Status Survey Unit 10
ICM	interim corrective measures
L&V	limitation and validation
NYSDEC	New York State Department of Environmental Conservation
ORISE	Oak Ridge Institute for Science and Education
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	target analyte list

1.0 Executive Summary

This report documents the completion of the final status survey (FSS) performed by the Accelerated Remediation Company (aRc) at the Separations Process Research Unit (SPRU) Land Areas Unit 10 (called FSS-10) in accordance with requirements specified in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402).

Sample locations were established following completion of the excavation at FSS-10. Sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). A portion of FSS-10 could not be sampled because of the presence of water tanks used for storage of groundwater. Sampling location 14 fell within the water tank area, which could not be sampled. This location was scheduled for sampling once the water storage tanks were removed. Ultimately, it was determined to exclude this area from FSS-10. Because the decision to exclude this area was made after the initial soil sampling had been conducted, the excluded sample location was randomly relocated in the remaining FSS-10 area. The area under the water tanks that was excluded from FSS-10 was designated as Unit 15. Any remediation or sampling required was documented as part of the Unit 15 interim report. Location 14 was sampled on February 2, 2010, but results had arsenic concentrations above soil cleanup objectives (SCOs) so this location required further excavation.

Fourteen systematic samples and one field duplicate soil sample were collected on September, 30, 2009, and Locations 5 and 14 were collected on March 10, 2010. Sample Location 5 was offset 11 ft to the north of original systematic sampling location because of the presence of a utility pole. Samples were shipped for offsite laboratory analysis of target analyte list (TAL) metals by Test America Laboratories, Inc., St. Louis, Missouri.

With the exception of manganese and antimony, all TAL metals were either non-detect at the reporting limit or reported at concentrations below their corresponding SCOs. The validated analytical result for manganese in Sample Location 5 was 3,560 mg/kg. The reported concentration exceeds the corresponding SCO of 2,000 mg/kg for manganese. This sample location does not warrant further excavation, given that (a) manganese is not a RCRA hazardous constituent as defined in the SPRU Part 373 Permit, (b) manganese is not an ICM COC, and (c) the absence of any other manganese exceedances in FSS-10. The presence of manganese at a concentration above the SCO is attributable to natural soil mineralogy and is not believed to be associated with historical operations. Validated analytical data for antimony at Sample Location S040 indicate a non-detect result at a concentration of 1.1 mg/kg, which exceeds the project SCO of 1 mg/kg. The reporting limit for this sample slightly exceeds the SCO, but this sample location does not warrant further excavation, given the closeness of this value to the cleanup objective, the absence of any other antimony exceedances, and the undetected "U" flagging added during data validation.

Upon completion of FSS-10, the Oak Ridge Institute for Science and Education (ORISE), the independent verification contractor for the U.S. Department of Energy SPRU Field Office (DOE-SPRU), conducted independent sampling for metals in FSS-10. Six samples were collected in FSS-10. Analytical results from this sampling showed arsenic concentration greater than the corresponding SCOs in one

location. Additional excavation was conducted, and subsequent sampling and analyses indicated no RCRA COCs above SCOs.

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a), and provides the cleanup approach for the SPRU-LL.

The objectives of the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from the NYSDEC for chemicals in the SPRU-LL land areas. This report documents completion of FSS-10 in accordance with the ICM work plan (ARC-PLN-6106) and quality assurance project plan (QAPjP) (ARC-PLN-6402). Figure 1 shows the location of FSS-10 in the SPRU-LL land areas.

Figure 1 Final Status Survey Unit 10 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sampling Location

FSS-10 occupies Characterization Grid Units 1117 and 1118. Figure 1 shows the SPRU-LL land area with FSS-10 highlighted. Figure 2 shows details of FSS-10 with its boundaries and pertinent surface features within and adjacent to it. Soil sampling locations for chemical COCs were determined using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the RCRA ICM work plan determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic radiological sampling locations were used to collect RCRA samples.

Because of the presence of water tanks used for storage of groundwater, sampling of the impacted portion of FSS-10 was postponed until removal of the tanks was completed. Therefore, the sampling of FSS-10 was conducted with the exception of one impacted location within the water tank area. Sampling of this particular area was planned to be conducted following removal of the water storage tanks. Ultimately, it was determined to exclude this area from FSS-10. Because the decision to exclude this area was made after the initial soil sampling had been conducted, Sample Location 14 was randomly relocated in the remaining FSS-10 area, and sampled on February 2, 2010. The results of the February sampling had arsenic concentrations above SCOs; therefore, additional excavation and re-sampling was performed in this area.

aRc relocated Sample Location 5, because it was within the immediate area of a utility pole. This sample was offset 11 ft to the north of the original systematic sampling location.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples located systematically on a triangular pattern 36 ft from each other. Location 14 was randomly relocated in the remaining FSS-10 area using the same methodology used for the original FSS-10 samples and was chosen within the new FSS unit configuration. Figure 2 shows the sample locations at FSS-10.

Upon completion of FSS-10, ORISE, the independent verification contractor for the DOE-SPRU, conducted independent sampling for metals in FSS-10. Six samples were collected in FSS-10. Analytical results from this sampling showed arsenic concentration greater than the corresponding SCOs in one location (S040). Additional excavation and sampling was conducted.

3.2 Sample Collection

Fourteen systematic samples and one field duplicate soil sample were collected on September 30, 2009; Locations 5 and 14 were sampled on March 10, 2010; and Location S040 was sampled on April 12, 2010. At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. All collected samples were analyzed for total metals.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. When the gamma analysis indicated that samples could be shipped, all RCRA samples were transferred, following chain-of-custody procedures outlined in the QAPjP, to Test America Laboratories, Inc., an offsite analytical laboratory.

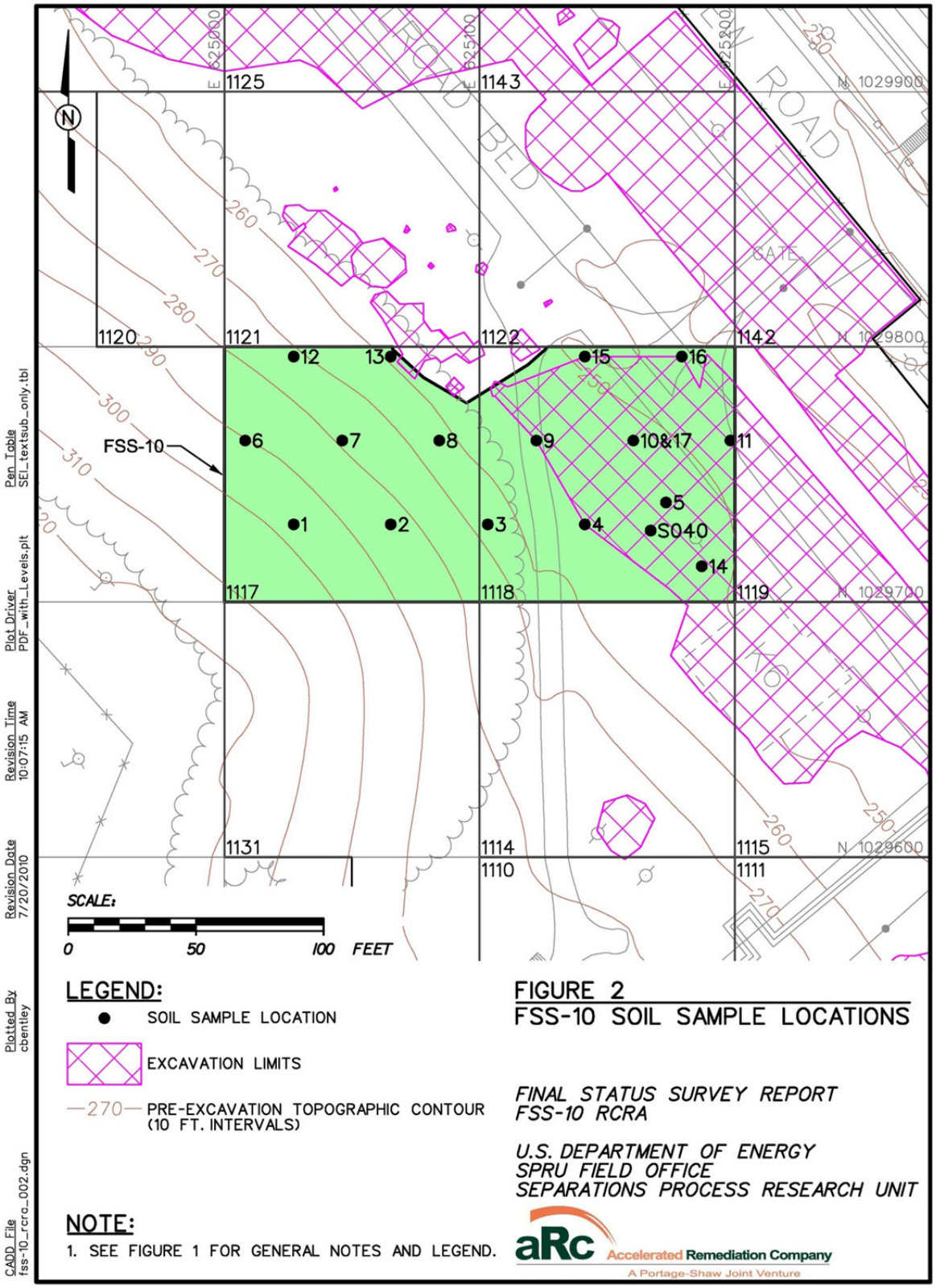

Figure 2 FSS-10 soil sample locations

Table 1 Soil sample description

Sample ID	Map Location(s)	Sample Description
SFS-010-001-M	1	Brown topsoil silt/clay
SFS-010-002-M	2	Brown topsoil silt/clay
SFS-010-003-M	3	Brown topsoil silt/clay
SFS-010-004-M	4	Gravel/sand mix
SFS-010-005-M	5	Gray silt/clay wet, offset due to utility pole location
SFS-010-006-M	6	Brown topsoil silt/clay
SFS-010-007-M	7	Brown topsoil silt/clay
SFS-010-008-M	8	Brown topsoil silt/clay
SFS-010-009-M	9	Gravel/sand mix
SFS-010-010-M, SFS-010-017-M	10 & 17	Clay/silt from Excavation; SFS-010-017-M is the duplicate of SFS-010-010-M
SFS-010-011-M	11	Clay/silt from excavation
SFS-010-012-M	12	Brown topsoil silt/clay
SFS-010-013-M	13	Brown topsoil silt/clay
SFS-010-014A-M	14	Re-sample of SFS-010-014-M gray silt/clay wet
SFS-010-015-M	15	Gravel/sand mix
SFS-010-016-M	16	Clay/silt from excavation
SFS-S040-001-M	S040	Brown clay with gravel mix; ORISE sample location

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals by Method 6010B, antimony by 6020A, and mercury by 7471A. An exception to the QAPjP (ARC-PLN-6402) included analyzing thallium using analytical Method 6020A instead of Method 6010B. Method 6020A was specifically used to analyze for thallium to obtain detection limits with numerical values below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results of the metals analyses. The laboratory analytical reports, *SPRU Final Status Survey Unit 10 Analytical Report*, Project No. 179223, Lot # F9J020214, October 14, 2009 (Test America 2009); *SPRU Final Status Survey Unit 10 Analytical Report*, Project No. 179223, Lot # F0C120425, March 18, 2010 (Test America 2010a); and *SPRU-LL Analytical Report*, Project No. 179223, Lot # F0D130439, April 30, 2010 (Test America 2010b) are on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitation and validation (L&V) reports, *SPRU Metals, FSS Unit 10,* SDG SFS-010-001-M (F9J020214), November 06, 2009 (Portage 2009); *SPRU Metals, FSS Unit 10,* SDG F0C120425, April 16, 2010 (Portage 2010a); and *SPRU Metals FSS Unit #10,* F0D130439, May 07, 2010 (Portage 2010b), are on the CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results from soil samples collected from FSS-10

Sample ID		**SFS-010-001-M**			**SFS-010-002-M**			**SFS-010-003-M**			**SFS-010-004-M**			**SFS-010-005-M**			**SFS-010-006-M**		
FSS Unit		**10**			**10**			**10**			**10**			**10**			**10**		
Sample Date		**9/30/2009**			**9/30/2009**			**9/30/2009**			**9/30/2009**			**3/10/2010**			**9/30/2009**		
Analyte[a]	**SCO[b]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	7670	NE	J	6690	NE	J	11100	NE	J	11300	NE	J	4790	NE	J	9910	NE	J
Antimony	1	0.57	B	U	0.51	B	U	0.53	B	U	0.67	B	U	0.33	B		0.56	B	U
Arsenic	16	3.7			4.2			6.8	B		7.5	B		3.8	U		5.3		
Barium	350	57.6	NE	J	59.6	NE	J	65.2	NE	J	60.2	NE	J	30.1	NE	J	91.8	NE	J
Beryllium	14	0.50	B	U	0.46	B	U	0.60	B	U	0.67	B	U	0.37	B		0.61	B	U
Cadmium	2.5	0.75	B	U	0.70	B	U	1.0	B		1.3			0.71	E		0.93	B	U
Calcium	NA	1480			1480			774			37300			29200	N*	J	3300		
Chromium	36	11.0			10.3			16.1			18.2			7.5			14.2		
Cobalt	30	7.3	B		8.2	B		9.7	B		11.6			6.0			10.6	B	
Copper	270	13.2			12.6			16.1			29.1			14.5			17.6		
Iron	NA	17600	NE	J	15600	NE	J	24600	NE	J	27400	NE	J	15600	N		20400	NE	J
Lead	400	26.6	E	J	22.2	E	J	23.1	E	J	15.5	E	J	6.7	B		26.0	E	J
Magnesium	NA	2770	NE	J	2650	NE	J	4020	NE	J	19300	NE	J	6890	N*	J	3580	NE	J
Manganese	2000	407	NE	J	725	NE	J	629	NE	J	632	NE	J	**3560**	**N***		870	NE	J
Mercury	0.73	0.088			0.11			0.078			0.066			0.016	B		0.099		
Nickel	130	15.1			15.7			21.1			28.8			10.9			19.9		
Potassium	NA	822	UN		865	UN		1610	N	J	1440	N	J	938			1390	N	J
Selenium	4	0.71	U		0.92	B		3.5	U		3.3	U		3.5	U		0.70	U	
Silver	8.3	0.57	U		0.60	U		0.56	U		0.53	U		0.28	U		0.57	U	
Sodium	NA	14.7	U		15.5	U		14.4	U		13.5	U		56.8	U		14.7	U	
Thallium	2	0.76	BN	J	1.1	BN	J	0.52	BN	UJ	0.31	BN	UJ	0.31	B	U	0.29	BN	UJ
Vanadium	150	24.1			21.7			29.0			24.4			9.4			26.6		
Zinc	2200	65.3	N	J	57.2	N	J	84.7	N	J	85.1	N	J	43.6			80.9	N	J

Table 2 (continued)

Sample ID		SFS-010-007-M			SFS-010-008-M			SFS-010-009-M			SFS-010-010-M			SFS-009-017-M[b]			SFS-010-011-M		
FSS Unit		**10**			**10**			**10**			**10**			**10**			**10**		
Sample Date		**9/30/2009**			**9/30/2009**			**9/30/2009**			**9/30/2009**			**9/30/2009**			**9/30/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	10700	NE	J	10900	NE	J	9440	NE	J	6960	NE	J	7090	NE	J	11600	NE	J
Antimony	1	0.50	B	U	0.44	B	U	0.59	B	U	0.56	B	U	0.42	B	U	0.53	B	U
Arsenic	16	5.5			5.0			9.1	B		7.7	B		9.1	B		8.3	B	
Barium	350	84.7	NE	J	55.4	NE	J	55.6	NE	J	66.7	NE	J	62.7	NE	J	71.7	NE	J
Beryllium	14	0.68	B	U	0.62	B	U	0.66	B	U	0.51	B	U	0.47	B	U	0.71	B	U
Cadmium	2.5	1.0	B		0.94	B	U	1.2			0.91	B	U	0.90	B	U	1.2		
Calcium	NA	1420			647			13700			14300			15700			11300		
Chromium	36	16.3			15.8			15.7			11.9			13.0			17.9		
Cobalt	30	13.3			11.3	B		12.7			11.0	B		9.6	B		13.7		
Copper	270	19.8			19.3	E		28.9			33.5			36.7			32.8		
Iron	NA	23700	NE	J	23500	NE	J	30300	NE	J	23300	NE	J	24000	NE	J	29800	NE	J
Lead	400	23.5	E	J	23.6	E	J	44.0	E	J	23.6	E	J	22.0	E	J	16.3	E	J
Magnesium	NA	4140	NE	J	4080	NE	J	6590	NE	J	6490	NE	J	7980	NE	J	6740	NE	J
Manganese	2000	833	NE	J	622	NE	J	1060	NE	J	467	NE	J	467	NE	J	588	NE	J
Mercury	0.73	0.091			0.064			0.070			0.055			0.044			0.017	B	
Nickel	130	23.4			20.7			27.3			21.8			20.9			29.5		
Potassium	NA	1160	BN	J	1310	N	J	1210	N	J	873	BN	J	940	BN	J	1840	N	J
Selenium	4	0.72	U		0.70	U		3.2	U		3.5	U		3.4	U		3.3	U	
Silver	8.3	0.58	U		0.57	U		0.52	U		0.56	U		0.56	U		0.53	U	
Sodium	NA	15.0	U		14.6	U		56.1	B		52.3	B	U	67.4	B	U	889		
Thallium	2	0.29	BN	UJ	0.17	BN	UJ	0.15	BN	UJ	0.15	BN	UJ	0.069	BN	UJ	0.14	BN	UJ
Vanadium	150	25.1			26.7			25.5			19.3			19.3			25.6		
Zinc	2200	76.0	N	J	79.0	N	J	81.9	N	J	84.2	N	J	78.6	N	J	97.5	N	J

Table 2 (continued)

Sample ID		SFS-010-012-M			SFS-010-013-M			SFS-010-014A-M			SFS-010-015-M			SFS-010-016-M			SFS-S040-001-M		
FSS Unit		**10**			**10**			**10**			**10**			**10**			**10**		
Sample Date		**9/30/2009**			**9/30/2009**			**3/10/2010**			**9/30/2009**			**9/30/2009**			**4/12/2010**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	9860	NE	J	12500	NE	J	7360	NE	J	2880	NE	J	12100	NE	J	8950	N	
Antimony	1	0.40	B	U	0.41	B	U	0.38	B		0.22	B	U	0.53	B	U	**1.1**		**U**
Arsenic	16	4.6			6.8	B		9.5	B		8.0			9.0	B		9.0		U
Barium	350	84.1	NE	J	94.5	NE	J	52.3	NE	J	49.2	NE	J	85.7	NE	J	65.8		
Beryllium	14	0.59	B	U	0.82	B	U	0.45	B		0.36	U		0.77	B	U	0.81		
Cadmium	2.5	0.95	B	U	1.3			0.80	E		0.45	B	U	1.3			0.63	U	
Calcium	NA	3110			2480			23200	N*	J	96700			12400			24700	N	
Chromium	36	14.4			19.0			12.2			7.5			18.6			17.8		
Cobalt	30	10.8	B		15.2			9.5			3.9	B		13.9			10.6		
Copper	270	17.5			25.1			30.8			12.2			34.7			57.4		
Iron	NA	20700	NE	J	27800	NE	J	22800	N		10500	NE	J	32100	NE	J	46300	N	
Lead	400	22.6	E	J	36.8	E	J	16.1			14.6	E	J	16.9	E	J	55.9	N	
Magnesium	NA	3840	NE	J	5030	NE	J	9120	N*	J	46600	NE	J	7130	NE	J	6510	N*	
Manganese	2000	804	NE	J	954	NE	J	479	N*		221	NE	J	601	NE	J	422	N	J
Mercury	0.73	0.100			0.080			0.035	B		0.016	B		0.079			0.37	NE*	J
Nickel	130	20.8			25.1			21.7			12.3			32.6			24.3		
Potassium	NA	1590	N	J	1450	N	J	1120			904	BN	J	1530	N	J	1030	N	J
Selenium	4	0.74	U		3.4	U		3.4	U		0.62	U		3.3	U		0.37	U	
Silver	8.3	0.60	U		0.55	U		0.27	U		0.50	U		0.53	U		0.30	U	
Sodium	NA	49.3	B	U	14.3	U		55.0	U		12.9	U		870			59.7	U	
Thallium	2	0.17	BN	UJ	0.11	BN	UJ	0.23	B	U	0.048	BN	UJ	0.12	BN	UJ	0.36	B	U
Vanadium	150	25.2			31.9			15.5			48.8			25.5			26.1		
Zinc	2200	73.5	N	J	94.2	N	J	70.9			33.4	N	J	94.8	N	J	88.2	N*	

Table 2 (continued)

Notes: a. Although the E flags shown on the reporting forms for Ca, Cr, Co, Cu, Hg, Ni, V and Zn were not removed during validation, it was noted in the validation report that these were assigned in error and are not included in this table.
b. The soil cleanup objective (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8, (NYSDEC 2006a) for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.
c. SFS-010-017-M is the field duplicate of sample SFS-010-010-M.

= Results in **bold** font and shaded with grey indicate the value exceeds the soil cleanup objective (SCO).
NA = not applicable.
mg/kg = milligrams per kilogram.

L = Laboratory flags:
U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
B = Result is between the method detection limit and the reporting limit.
E = Serial dilution percent recovery not within limits.
N = Spike analyte recovery outside stated control limits.
* = Relative percent difference is outside stated control limits.
V = Validation flags:
J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.
UJ= The material was analyzed for but was not detected. The quantitation limit is an estimated quantity.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making purposes, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation, the results reported for all antimony excluding SFS-010-005-M and SFS-010-014A-M; cadmium results for samples SFS-010-001-M, SFS-010-002-M, SFS-010-006-M, SFS-010-008-M, SFS-010-010-M, SFS-010-012-M, SFS-010-015-M, and SFS-010-017-M; beryllium in all samples excluding SFS-010-005-M, SFS-010-014A-M, and SFS-010-015-M; sodium results for samples SFS-010-010-M, SFS-010-012-M, and SFS-010-017-M; and arsenic in sample SFS-S040-001-M were identified as false positives and have been qualified accordingly as undetected values with a "U" flag.

Thallium in SFS-010-001-M and SFS-010-002-M has been qualified with a "J" validation flag to denote potential high bias reflected in high recovery in the matrix spike duplicate result. Thallium was identified as a false positive in all remaining samples due to positive blank detections, and the results have been qualified with a "U" or "UJ" validation flag to denote an undetected value or an undetected, estimated value with potential high bias reflected in the matrix spike/matrix spike duplicate recoveries, respectively. All of the remaining validation qualifiers assigned "J" flags (estimated) denote evidence of matrix interference bias in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

With the exception of manganese and antimony, all TAL metals were either non-detect at the reporting limit or reported at concentrations below their corresponding SCOs. The validated analytical result for manganese in Sample Location 5 was 3,560 mg/kg. The reported concentration exceeds the corresponding SCO of 2,000 mg/kg for manganese. This sample location does not warrant further excavation, given that (a) manganese is not a RCRA hazardous constituent as defined in the SPRU Part 373 Permit, (b) manganese is not an ICM COC, and (c) the absence of any other manganese exceedances in the FSS-10. The presence of manganese at concentration above the SCO is attributable to natural soil mineralogy and is not believed to be associated with historical operations. Validated analytical data for antimony at Sample Location S040 indicate a non-detect result at a concentration of 1.1 mg/kg, which exceeds the project SCO of 1 mg/kg. The reporting limit for this sample slightly exceeds the SCO, but this sample location does not warrant further excavation, given the closeness of this value to the cleanup objective, the absence of any other antimony exceedances, and the undetected "U" flagging added during data validation.

6.0 Conclusions

Evaluation of the FSS-10 laboratory data package (Test America 2009, 2010a, and 2010b) and the L&V reports (Portage 2009, 2010a, and 2010b) show the data to be of sufficient quality and quantity for decision-making purposes. With the exception of manganese, all TAL metals were either non-detect at the reporting limit or reported at concentrations below their corresponding SCOs. The presence of manganese, which is not a RCRA hazardous constituent as defined in the SPRU Part 373 Permit, or an

ICM COC, is attributable to natural soil mineralogy and not believed to be associated with historical operations.

A civil survey of the final excavated surface of FSS-10 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 658 yd^3 of banked materials were removed from FSS-10. No further excavation is recommended at FSS-10.

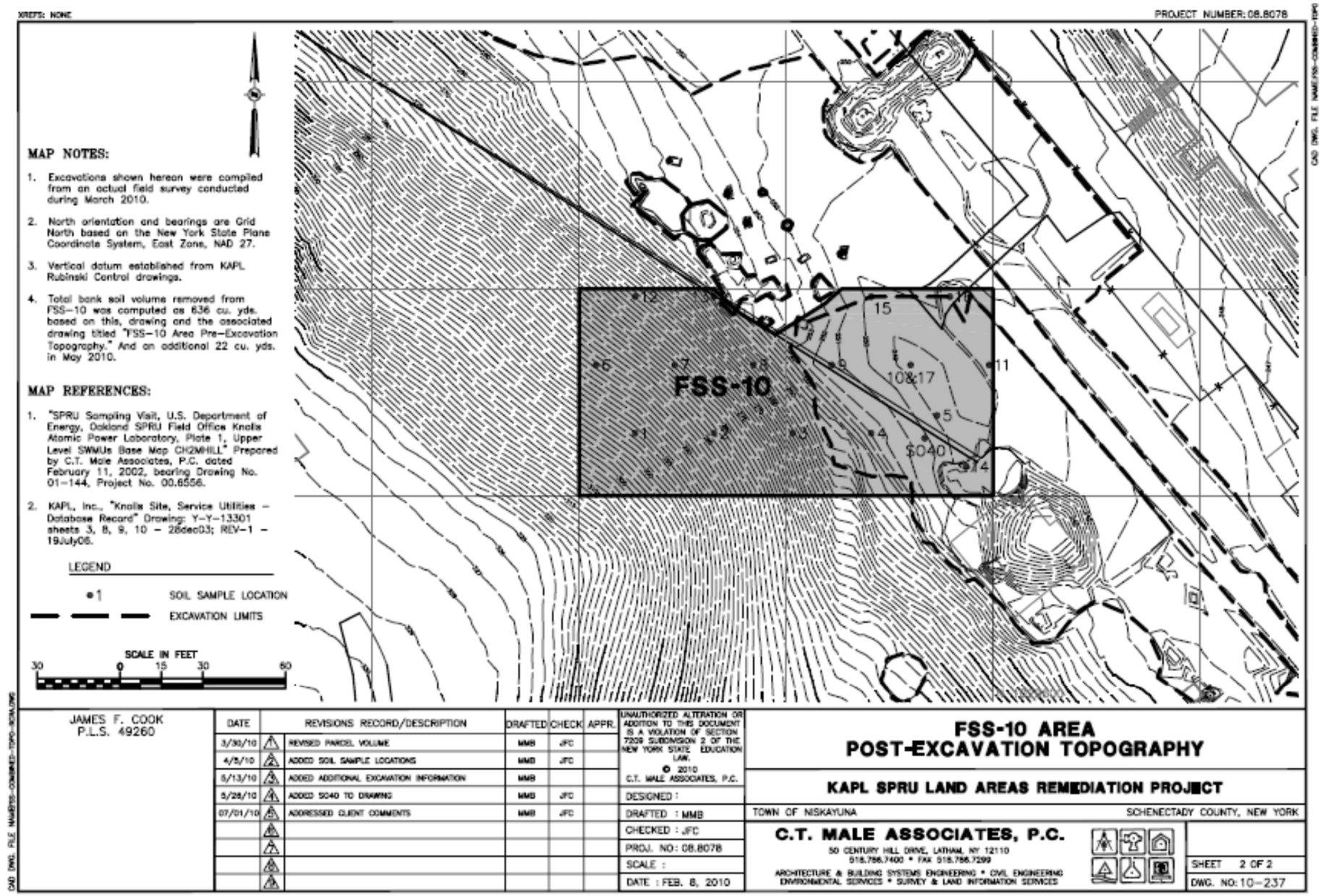

Figure 3 FSS-10 excavation area post-excavation topography

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008.

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002, New York State Department of Environmental Conservation, March 9, 2006.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels" TAGM 4046.

Portage, 2009, *SPRU Metals FSS Unit #10,* SFS-010-001-M (F9J020214), Portage, Inc., November 6, 2009.

Portage, 2010a, *SPRU Metals FSS Unit #10,* SFS-010-005-M (F0C120425), Portage, Inc., April 16, 2010.

Portage, 2010b, *SPRU Metals FSS Unit #10,* F0D130439, Portage, Inc., May 7, 2010.

Test America, 2009, *SPRU Final Status Survey Unit 10 Analytical Report*, Project No. 179223, Lot # F9J020214, Test America Laboratories, Inc., October 14, 2009.

Test America, 2010a, *SPRU Analytical Report*, Project No. 179223, Lot # F0C120425, Test America Laboratories, Inc., March 18, 2010.

Test America, 2010b, *SPRU-LL Analytical Report*, Project No. 179223, Lot # F0D130439, Test America Laboratories, Inc., April 30, 2010.

Appendix A
CD-ROM with Electronic Copy of
Analytical Report, Project No. 179223,
SDG # F9J020214, SDG #F0C120425, and SDG #F0D130439[a]
Final Status Survey Unit 10

a. Per the aRc QAPjP (ARC-PLN-6402), the analytical laboratory will carry certification by the New York State Department of Health Environmental Laboratory Approval Program. The Environmental Laboratory Approval Program (ELAP) currently grants certification to commercial, facility self-monitoring and government operated environmental laboratories, in categories covering Public potable (drinking) water, Non-potable water, Solid/hazardous Waste and ambient Air and Emissions. The posted list of currently certified commercial laboratories (see http://www.wadsworth.org/labcert/elap/com.html) shows that Test America St. Louis is listed as one of the 168 out-of-state labs and is identified as LABID: 11616 as an ELAP certified commercial laboratory. That list includes each laboratory's level of accreditation as well as those matrices and analyses subject to ELAP accreditation. New York is not noted in the case narrative of data package SDG FOD130439 becaues Test America has primary National Environmental Laboratory Approval Program (NELAP) accreditation by the state of Florida. Per the ELAP application process, Test America sought and was granted secondary NELAP accreditation in New York (hence, the listing on the posting of ELAP certified laboratories). Test America lists the primary NELAP accrediting bodies in their narratives.

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Report SDG #F9J020214,
SDG #F0C120425 SPRU, and SDG #F0D130439
Final Status Survey Unit 10

Attachment 13

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 11 (ARC-RPT-6021)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 11

ARC-RPT-6021
August 1, 2011
Revision 7

DOE Contract No. DE-AM09-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 11

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
David Lodman Characterization Lead	08/01/11 Date
Berta Oates Project Quality Assurance Manager	08/01/11 Date

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Appendix B, CD-ROM with Electronic Copy of Data Limitations and Validation Reports SDG # F9J150187, SDG # F9L110585 and FSS-11 Selenium Re-analyses by 6020, SPRU Metals Final Status Survey Unit 11 21

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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
EPA	U.S. Environmental Protection Agency
FSS-11	Separations Process Research Unit Land Areas Final Status Survey Unit 11
ICM	interim corrective measures
ICP	inductively coupled plasma
L&V	limitation and validation
MS	mass spectrometry
NYSDEC	New York State Department of Environmental Conservation
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	target analyte list

1.0 Executive Summary

This report documents the completion of the final status survey (FSS) performed by the Accelerated Remediation Company (aRc) at the Separations Process Research Unit (SPRU) Land Areas Final Status Survey Unit 11 (referred to as FSS-11) in accordance with requirements in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereinafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (QAPjP) (ARC-PLN-6402).

Sample locations were established following completion of the excavation at FSS-11. Sample locations for Resource Conservation and Recovery Act (RCRA) (42 USC 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). A portion of FSS-11 could not be sampled because of the presence of water tanks used for storage of groundwater. Three sample locations fell within the water tank area, which could not be sampled. These locations were scheduled for sampling once the water storage tanks were removed. Ultimately, it was determined to exclude this area from FSS-11. Because the decision to exclude this area was made after the initial soil sampling had been conducted, the excluded sample locations were randomly relocated in the remaining FSS-11 area. The area under the water tanks that was excluded from FSS-11 was designated as Unit 15. Any remediation or sampling required will be documented as part of the Unit 15 interim report. Thirteen systematic soil samples were collected on October 13, 2009, and three random samples and one sample duplicate were sampled on December 10, 2009, for offsite laboratory analysis of target analyte list (TAL) metals by Test America Laboratories, Inc., St. Louis, Missouri.

The concentrations of all COCs that are subject to RCRA requirements are below soil cleanup objectives (SCO), with the exception of arsenic. Validated analytical data for arsenic at Sample Locations 5 and 13 (17.2 and 26.8 mg/kg, respectively) exceed the project's SCO of 16 mg/kg. Both of these sample locations are near the railbed, where arsenic presence is associated with historical railroad construction material (railroad ballast) in the SPRU Lower Level (SPRU-LL) land areas and, therefore, are not subject to cleanup requirements under RCRA.

2.0 Introduction

SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU-LL land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a), and provides the cleanup approach for the SPRU-LL.

The objectives of the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no-further-action determination from NYSDEC for chemicals in the SPRU-LL land areas.

This report documents completion of FSS-11 in accordance with the ICM work plan (ARC-PLN-6106) and the QAPjP (ARC-PLN-6402). Figure 1 shows the location of FSS-11 in the SPRU-LL land areas.

Figure 1 FSS-11 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sample Location

Soil sample locations for chemical COCs were determined using the methodology described in the ICM work plan (ARC-PLN-6106). FSS-11 occupies portions of Characterization Grid Units 1120, 1121, 1122, and small corners of 1142 and 1143. Figure 1 shows the SPRU-LL land area with FSS-11 highlighted. Figure 2 shows details of FSS-11, most notably its boundaries, sample locations, and pertinent surface features. Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the ICM work plan determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic radiological sampling locations were used to collect RCRA samples.

Because of the presence of water tanks used for storage of groundwater, sampling of the impacted portion of FSS-11 was postponed until removal of the tanks was completed. Therefore, the sampling of FSS-11 was conducted with the exception of three locations within the water tank area. Sampling of these impacted locations was planned following removal of the water storage tanks. Ultimately, it was determined to exclude this area from FSS-11. The area under the water tanks that was excluded from FSS-11 was designated as Unit 15. Any remediation or sampling required will be documented as part of the Unit 15 interim report. Because the decision to exclude this area was made after the initial soil sampling had been conducted, the three sample locations, identified as Sample Locations 4, 5, and 11 & 17 (field duplicates) on Figure 2, were randomly relocated in the remaining FSS-11 area.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples located systematically on a triangular pattern 37.5 ft from each other. The three relocated sampling point locations were randomly chosen using the same methodology used for the original FSS-11 samples; however, they were chosen using the new FSS unit configuration. Figure 2 shows the sample locations at FSS-11.

3.2 Sample Collection

Soil samples were collected for chemical COCs using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). Thirteen systematic soil samples were collected on October 13, 2009, and three random samples (one with an associated field duplicate) were collected on December 10, 2009. At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. When the gamma analysis indicated that samples could be shipped, all RCRA samples were transferred, following chain-of-custody procedures outlined in the QAPjP (ARC-PLN-6402), to Test America Laboratories, Inc., an offsite analytical laboratory.

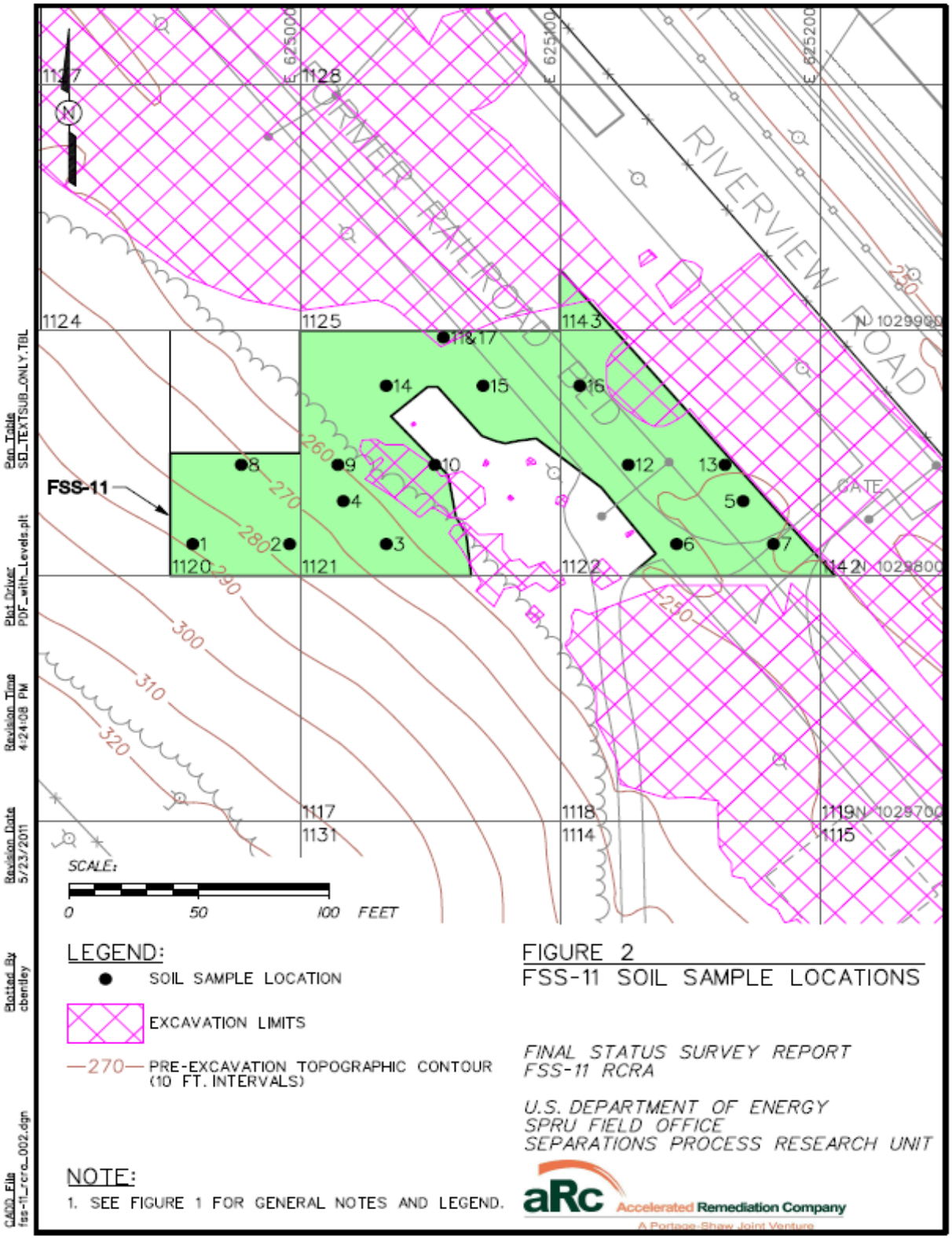

Figure 2 FSS-11 soil sample locations

Table 1 Soil sample description

Sample ID	Map Location(s)	Sample Description
SFS-011-001-M	1	Topsoil silt/clay
SFS-011-002-M	2	Topsoil silt/clay
SFS-011-003-M	3	Sandy topsoil silt/clay
SFS-011-004-M	4	Topsoil silt/clay (relocated)
SFS-011-005-M	5	Topsoil silt/clay (relocated)
SFS-0011-006-M	6	Gravel/clay mix hardpan
SFS-0011-007-M	7	Gravel/clay mix
SFS-0011-008-M	8	Brown topsoil silt/clay
SFS-0011-009-M	9	Sandy topsoil silt/clay
SFS-011-010-M	10	Clay/silt from excavation
SFS-011-011-M, SFS-011-017-M	11 & 17	SFS-011-017-M is the duplicate of SFS-011-011-M Gravel clay fill (relocated)
SFS-011-012-M	12	Gravel clay fill
SFS-011-013-M	13	Topsoil silt/clay
SFS-011-014-M	14	Topsoil silt/clay
SFS-011-015-M	15	Gravel/sand mix
SFS-011-016-M	16	Topsoil silt/clay

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America Laboratories, Inc., following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals by Method 6010B, antimony by Method 6020A, and mercury by Method 7471A. Method 6020A was specifically used to analyze for thallium to obtain detection limits with numerical values below the required SCOs stated in ARC-PLN-6402. Exception to the QAPjP (ARC-PLN-6402) included reporting selenium and thallium results from analytical Method 6020A instead of Method 6010B, as called for in the QAPjP. The samples were analyzed for selenium using inductively coupled plasma (ICP) by Method 6010; however, spectral interferences from target and non-target analytes resulted in high relative standard deviation between scans at the wavelength for selenium determination. Therefore, the selenium data are reported from ICP/mass spectrometry (MS) Method 6020A, thereby eliminating the spectral interference.

Table 2 provides the results of the metals analyses. The laboratory analytical reports for FSS-11 are *SPRU Final Status Survey Unit 11 Analytical Report*, Project No. 179223, SDG #s F9J150187 and F9L110585 (Test America 2009a, 2009b). In addition, the reports *SPRU Final Status Survey Unit 11 Analytical Report*, Project No. 179223, SDG #s F9J150187 Revised and F9L110585 Revised (Test America 2010a, 2010b) are included with the selenium data reported from U.S. Environmental Protection Agency (EPA) Method 6020A. All analytical reports are on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

The laboratory data were validated internally by Test America Laboratories, Inc., in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitation and validation (L&V) reports *SPRU Metals, FSS Unit 11,* SDG # SFS-011-001-M (F9J150187) (Portage 2009); *SPRU Metals, FSS Unit 11,* SDG # SFS-011-004-M (F9L110585) (Portage 2010a); and *SPRU Metals, FSS Unit 11 Selenium Re-analysis by 6020 for SDGs SFS-011-001-M (F9J150187) and SFS-011-004 (F9L110585),* SDG # SFS-011-001-M (F9J150187) SDG # SFS-011-004-M (F9L110585) (Portage 2010b) are included on CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results from soil samples collected from FSS-11

Sample ID		**SFS-011-001-M**			**SFS-011-002-M**			**SFS-011-003-M**			**SFS-011-004-M**			**SFS-011-005-M**			**SFS-011-006-M**		
FSS Unit		**11**			**11**			**11**			**11**			**11**			**11**		
Sample Date		**10/13/2009**			**10/13/2009**			**10/13/2009**			**12/10/2009**			**12/10/2009**			**10/13/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	9890			10300			11300			10000	N		9520	N		9400		
Antimony	1	0.48	B	J	0.17	U	UJ	0.16	U	UJ	0.32	BN	UJ	0.54	BN	UJ	0.14	U	UJ
Arsenic	16	7.6	B		6.4	B		5.4	B		6.7	BN	J	**17.2**	**N**	**J**	9.3	B	
Barium	350	91.6			85.0			76.9			67.5	N	J	75.2	N	J	112		
Beryllium	14	0.80	B		0.72	B		0.72	B		0.73	N	J	0.67	N	J	0.88	B	
Cadmium	2.5	1.1	B		1.1	B		1.0	B		1.1	N	J	1.2	N	J	0.88	B	
Calcium	NA	3790	N	J	3010	BN	J	2560	BN	J	2780	N	J	24700	N	J	90300	N	J
Chromium	36	16.6	E	J	16.1	E	J	18.4	E	J	14.9	N	J	16.9	N	J	14.7	E	J
Cobalt	30	11.3	B		10.3	B		14.3			10.9	N	J	12.5	N	J	9.9	B	
Copper	270	23.0			20.5			23.0			23.3	N	J	37.2	N	J	22.2		
Iron	NA	21900			23100			25000			23900	NE	J	26000	NE	J	24600		
Lead	400	27.0	E	J	24.0	E	J	26.2	E	J	26.6	NE	J	36.6	NE	J	12.9	E	J
Magnesium	NA	4010	N	J	4050	N	J	4550	N	J	4180	N	J	7430	N	J	11000	N	J
Manganese	2000	674			599			810			667	N		536	N		561		
Mercury	0.73	0.099			0.086			0.030	B	U	0.10	E		0.074	E		0.035	B	U
Nickel	130	23.8			21.8			22.9			20.5	N	J	30.2	N	J	19.9		
Potassium	NA	1380	N	J	1010	BN	J	843	UN		2410	UN*		2200	UN*		1490	N	J
Selenium	4	1.1	B		1.0	B		1.0	B		0.37	B	J	0.43	B	J	1.7		
Silver	8.3	0.61	UN	UJ	0.62	UN	UJ	0.59	UN	UJ	0.33	U		0.31	U		0.52	UN	UJ
Sodium	NA	124	U		126	U		118	U		337	U		307	U		767		
Thallium	2	0.35	B	U	0.91	B	U	0.43	B	U	0.45	B	U	0.33	B	U	0.27	B	U
Vanadium	150	29.3			26.7			29.4			27.0	N	J	31.7	N	J	35.0		
Zinc	2200	84.3			81.7			88.3			80.7	N	J	105	N	J	65.9		

Table 2 (continued)

Sample ID		SFS-011-007-M			SFS-011-008-M			SFS-011-009-M			SFS-011-010-M			SFS-011-011-M			SFS-011-017-M[b]		
FSS Unit		**11**			**11**			**11**			**11**			**11**			**11**		
Sample Date		**10/13/2009**			**10/13/2009**			**10/13/2009**			**10/13/2009**			**12/10/2009**			**12/10/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	3320			9420			8800			8440			10800	N		8440	N	
Antimony	1	0.14	U	UJ	0.18	U	UJ	0.17	U	UJ	0.15	U	UJ	0.15	UN		0.15	UN	
Arsenic	16	5.0	B		5.4	B		8.5	B		8.7	B		7.6	BN	J	7.2	N	J
Barium	350	61.3			77.4			55.1			51.9			320	N	J	72.2	N	J
Beryllium	14	0.36	U		0.64	B		0.65	B		0.58	B		1.6	N	J	0.58	N	J
Cadmium	2.5	0.32	B	U	0.83	B		0.77	B		0.92	B		0.90	N	J	1.1	N	J
Calcium	NA	187000	N	J	3450	N	J	3220	BN	J	24600	N	J	56100	N	J	36500	N	J
Chromium	36	8.1	E	J	14.9	E	J	12.7	E	J	13.9	E	J	13.7	N	J	14.8	N	J
Cobalt	30	3.9	B		10.6	B		8.9	B		12.5			8.2	N	J	10.3	N	J
Copper	270	7.6			19.7			18.5			24.8			25.5	N	J	28.4	N	J
Iron	NA	7640			20200			19200			23700			21400	NE	J	24300	NE	J
Lead	400	5.8	BE	J	25.1	E	J	22.4	E	J	14.7	E	J	18.6	NE	J	20.8	NE	J
Magnesium	NA	13100	N	J	3820	N	J	3220	N	J	11700	N	J	16000	N	J	15900	N	J
Manganese	2000	327			552			382			617			928	N		520	N	
Mercury	0.73	0.011	U		0.069			0.089			0.056		U	0.044	E	U	0.061	E	
Nickel	130	10.5			21.1			18.8			26.6			21.6	N	J	23.0	N	J
Potassium	NA	1280	N	J	1590	N	J	1620	N	J	1610	N	J	1900	UN*		1910	UN*	
Selenium	4	0.79	B		1.0	B		1.4			1.0	B		0.49			0.15	B	J
Silver	8.3	0.50	UN	UJ	0.64	U	UJ	0.61	UN	UJ	0.52	UN	UJ	0.26	U		0.26	U	
Sodium	NA	100	U		129	U		123	U		106	U		1020			266	U	
Thallium	2	0.14	B	U	0.22	B	U	0.22	B	U	0.20	B	U	0.17	B	U	0.15	B	U
Vanadium	150	10.3	B		25.9			27.6			20.3			27.6	N	J	24.0	N	J
Zinc	2200	38.1			78.9			83.1			83.2			84.0	N	J	90.7	N	J

Table 2 (continued)

Sample ID		**SFS-011-012-M**			**SFS-011-013-M**			**SFS-011-014-M**			**SFS-011-015-M**			**SFS-011-016-M**		
FSS Unit		**11**			**11**			**11**			**11**			**11**		
Sample Date		**10/13/2009**			**10/13/2009**			**10/13/2009**			**10/13/2009**			**10/13/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	10900			9580			7860			2950			7660		
Antimony	1	0.15	U	UJ	0.42	B	J	0.15	U	UJ	0.14	U	UJ	0.16	U	UJ
Arsenic	16	11.4	B		**26.8**			7.3	B		5.6	B		6.4	B	
Barium	350	77.6			62.6			54.5			39.9			55.4		
Beryllium	14	0.74	B		0.65	B		0.57	B		0.35	U		0.56	B	
Cadmium	2.5	1.0	B		1.1	B		0.95	B		0.39	B	U	0.98	B	
Calcium	NA	14900	N	J	7070	N	J	45600	N	J	140000	N	J	19800	N	J
Chromium	36	18.3	E	J	16.7	E	J	14.1	E	J	6.2	E	J	13.9	E	J
Cobalt	30	15.5			13.3			10.0	B		4.9	B		9.0	B	
Copper	270	63.2			36.1			26.6			9.1			24.5		
Iron	NA	29200			27400			22600			10500			19700		
Lead	400	29.6	E	J	26.2	E	J	16.7	E	J	7.0	BE	J	34.6	E	J
Magnesium	NA	8870	N	J	6160	N	J	15400	N	J	51100	N	J	9390	N	J
Manganese	2000	669			628			599			279			454		
Mercury	0.73	0.041		U	0.012	U		0.070			0.016	B	U	0.069		
Nickel	130	30.4			31.4			22.2			15.2			21.0		
Potassium	NA	1400	N	J	999	BN	J	1450	N	J	705	UN		1230	BN	J
Selenium	4	1.5			1.5			1.1			0.65	B		1.0	B	
Silver	8.3	0.54	UN	UJ	0.57	UN	UJ	0.53	UN	UJ	0.49	UN	UJ	0.72	BN	J
Sodium	NA	109	U		114	U		107	U		98.5	U		118	U	
Thallium	2	0.20	B	U	0.18	B	U	0.15	B	U	0.087	B	U	0.12	B	U
Vanadium	150	29.0			28.3			19.8			43.4			25.3		
Zinc	2200	104			134			91.1			37.6			88.6		

Table 2 (continued)

Notes: a. The soil cleanup objective (SCO) (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8, (NYSDEC 2006a) for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.
b. SFS-011-017-M is the field duplicate of sample SFS-011-011-M.

= Results in **bold** font and shaded with grey indicate the value exceeds the SCO.
NA = not applicable.
mg/kg = milligrams per kilogram.
L = Laboratory flags:
U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
B = Result is between the method detection limit and the reporting limit.
E = Serial dilution percent recovery not within limits.
N = Spike analyte recovery outside stated control limits.
* = Relative percent difference is outside stated control limits.
V = Validation flags:
J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making purposes, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit except for barium, beryllium, manganese, and sodium. The impact to data usability is deemed to be minimal because all of the sample results are below SCOs or do not have SCOs. The imprecision likely reflects the difficulty in homogenizing the hard gravel/clay fill material and represents the heterogeneity inherent to the matrix.

During validation, the results reported for thallium in all samples; mercury in samples SFS-011-003-M, SFS-011-006-M, SFS-011-010-M, SFS-011-011-M, SFS-011-012-M, and SFS-011-015-M; cadmium in samples SFS-011-007 and SFS-011-015-M; and antimony in samples SFS-011-004-M and SFS-011-005-M were identified as false positives based on corresponding levels in the blank analyses and have been qualified accordingly as undetected values with a "U" flag.

All of the remaining validation qualifiers assigned "J" flags (estimated) denote evidence of matrix interferences bias in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

All COCs subject to RCRA requirements analyzed for in FSS-11 had concentrations below the corresponding SCOs, with the exception of arsenic. Validated analytical data for arsenic at Sample Locations 5 and 13 (17.2 and 26.8 mg/kg, respectively) exceed the project's SCO of 16 mg/kg. Both of these sample locations are near the railbed where arsenic presence is associated with historical railroad construction material (railroad ballast) in the SPRU-LL land areas and, therefore, are not subject to cleanup requirements under RCRA.

6.0 Conclusions

Evaluation of the FSS-11 laboratory data packages (Test America 2009a, 2009b, 2010a, and 2010b) and the L&V reports (Portage 2009, 2010a, and 2010b) show the data to be of sufficient quality and quantity for decision-making purposes. All COCs subject to RCRA requirements analyzed for in FSS-11 had concentrations below the corresponding SCOs, with the exception of arsenic. The presence of arsenic in the two sample locations near the railbed is associated with historical railroad construction material (railroad ballast) in the SPRU-LL land areas and, therefore, is not subject to cleanup requirements under RCRA.

A civil survey of the final excavated surface of FSS-11 was conducted after completion of the FSS efforts. These data are presented in Figure 3. An estimated total of 47 yd^3 of banked materials was removed from FSS-11. No further excavation is recommended at FSS-11.

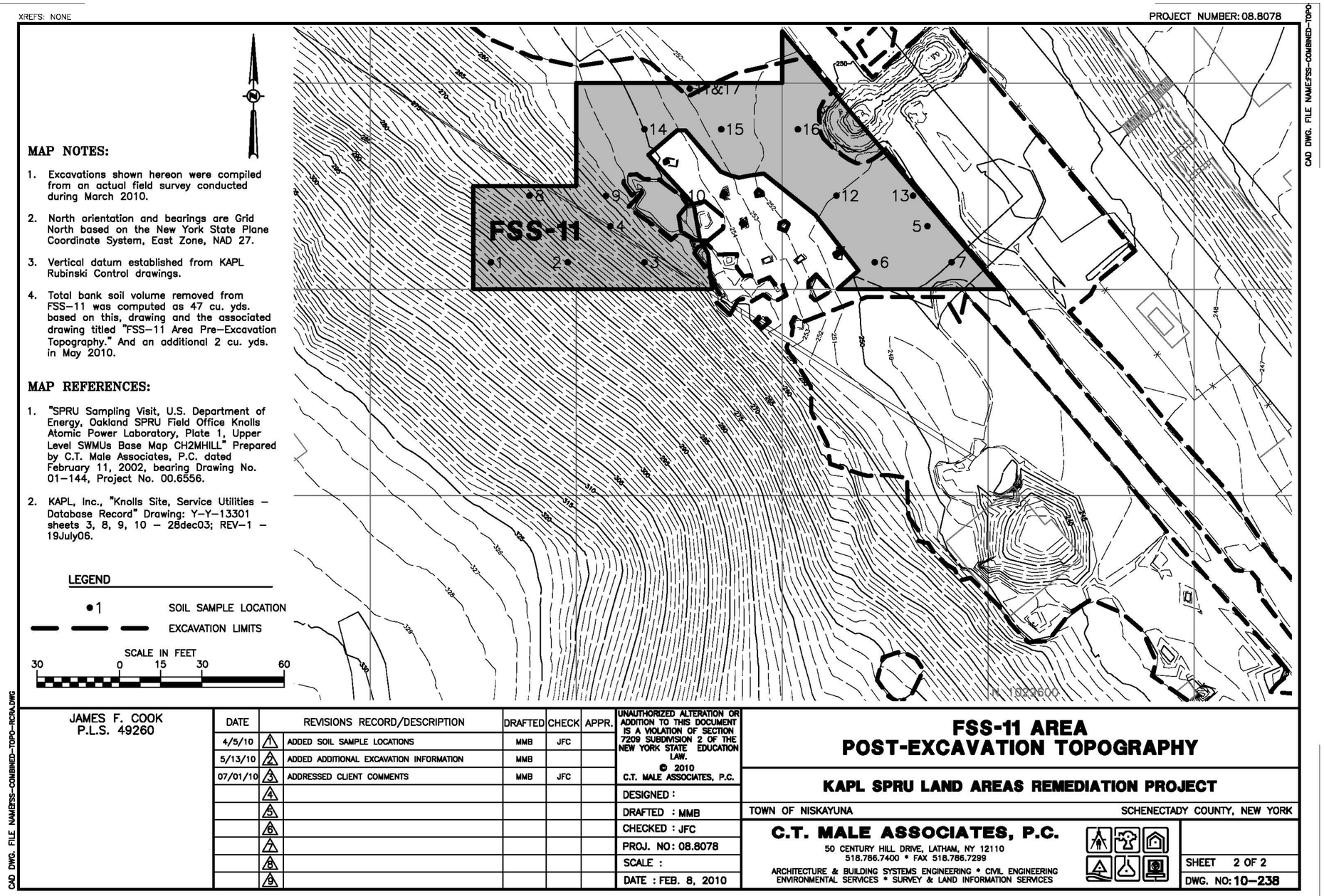

Figure 3 FSS-11 excavation area post-excavation topography

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated December 3, 2008, Web page visited May 24, 2010.

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, New York State Department of Environmental Conservation, March 9, 2006.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels," TAGM 4046.

Portage, 2009, *SPRU Metals FSS Unit #11,* SFS-011-001-M (F9J150187), Portage, Inc., November 5, 2009.

Portage, 2010a, *SPRU Metals FSS Unit #11,* SFS-011-004-M (F9L110585), Portage, Inc., January 15, 2010.

Portage, 2010b, *SPRU Metals FSS Unit #11 Selenium Re-analysis by 6020 for SDG SFS-011-001-M* (F9J150187) *and* SFS-011-004-M (F9L110585), Portage, Inc., May 6, 2010.

Test America, 2009a, *SPRU Final Status Survey Unit 11 Analytical Report*, Project No. 179223, Lot # F9J150187, Test America Laboratories, Inc., St. Louis, Missouri, October 23, 2009.

Test America, 2009b, *SPRU Analytical Report*, Project No. 179223, Lot # F9L110585, Test America Laboratories, Inc., St. Louis, Missouri, December 29, 2009.

Test America, 2010a, *SPRU Final Status Survey Unit 11 Analytical Report*, Project No. 179223, Lot # F9J150187 Revised, Test America Laboratories, Inc., St. Louis, Missouri, May 4, 2010.

Test America, 2010b, *SPRU Analytical Report*, Project No. 179223, Lot # F9L110585 Revised, Test America Laboratories, Inc., St. Louis, Missouri, May 4, 2010.

Appendix A

CD-ROM with Electronic Copy of Analytical Reports, Project No. 179223, SDG # F9J150187 Revised and SDG # F9L110585 Revised, Final Status Survey Unit 11

Appendix B

CD-ROM with Electronic Copy of
Data Limitations and Validation Reports SDG # F9J150187,
SDG # F9L110585 and FSS-11 Selenium Re-analyses by 6020, SPRU Metals
Final Status Survey Unit 11

Attachment 14

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 12 (ARC-RPT-6027)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 12

ARC-RPT-6027
August 1, 2011
Revision 4

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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 12

Approval for Use

Doug Collins Deputy Project Manager	08/01/11 Date
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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
FSS-12	Final Status Survey Unit 12
ICM	interim corrective measures
ICP-MS	inductively coupled plasma mass spectrometry
L&V	limitation and validation
NYSDEC	New York State Department of Environmental Conservation
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	target analyte list

1.0 Executive Summary

This report documents the completion of the final status survey (FSS) performed by the Accelerated Remediation Company (aRc) at the Separations Process Research Unit (SPRU) Land Areas Final Status Survey Unit 12 (referred to as FSS-12) in accordance with requirements specified in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereinafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (i.e., QAPjP) (ARC-PLN-6402).

Sample locations were established following completion of the excavation at FSS-12. Sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sixteen systematic samples and one field duplicate soil sample were collected on April 2, 2010, for offsite laboratory analysis of target analyte list (TAL) metals by Test America Laboratories, Inc., St. Louis, Missouri.

The results of all COCs that are subject to RCRA requirements are below soil cleanup objectives (SCOs) except for the following. Examination of validated data indicates elevated concentrations of antimony at Sample Locations 2 and 13, both at 1.1 mg/kg. However, antimony results were "U" flagged (i.e., undetected), based on levels of antimony in associated laboratory blanks. The reporting limit for antimony slightly exceeds the SCO, but these sample locations do not warrant further excavation, given the closeness of the values to the cleanup objective, the absence of any other antimony exceedances, and the undetected "U" flagging added during data validation. Selenium from Sample Location 1 was reported at 4.3 mg/kg from a ten-fold dilution analysis and the corresponding method detection limit was adjusted for dilution. The reported concentration for that undetected result is slightly greater than the SCO (4 mg/kg). However, raw data for this sample indicate analyses were performed both by Method 6010 at lesser dilutions (1x and 5x dilutions) and by Method 6020, using inductively coupled plasma mass spectrometry (ICP-MS). A review of the raw data from Method 6010 found each measurement yielded a calculated concentration less than zero. During validation, the ICP-MS data for this sample were reviewed and also found the measurement produced similar results, supporting the conclusion that selenium is not present. All three values have all been determined to be undetected at reported concentration, and they are not viewed as actionable concentrations; therefore, no further excavation is required in this unit.

2.0 Introduction

SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a), and provides the cleanup approach for the SPRU-LL.

The objectives of the ICM work plan, as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), are to

remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no-further-action determination from NYSDEC for chemicals in the SPRU-LL land areas.

This report documents completion of FSS-12 in accordance with the ICM work plan and the QAPjP (ARC-PLN-6402). Figure 1 shows the location of FSS-12 in the SPRU-LL land areas.

Figure 1 Final Status Survey Unit 12 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sample Location

Soil sampling locations for chemical COCs were determined using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). FSS-12 occupies portions of Characterization Grid Units 1120, 1124, 1125, and small corners of 1127 and 1128. Figure 1 shows the SPRU-LL land area with FSS-12 highlighted. Figure 2 shows details of FSS-12, most notably its boundaries, sample locations, and pertinent surface features. Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the RCRA ICM work plan determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic radiological sampling locations were used to collect RCRA samples.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples located systematically on a triangular pattern 38.5 ft from each other. As noted above, Figure 2 shows the sample locations at FSS-12.

3.2 Sample Collection

Soil samples were collected for chemical COCs using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). Sixteen systematic soil samples and one duplicate sample were collected on April 2, 2010. At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. When the gamma analysis indicated that samples could be shipped, all RCRA samples were transferred, following chain-of-custody procedures outlined in the QAPjP, to Test America Laboratories, Inc., an offsite analytical laboratory.

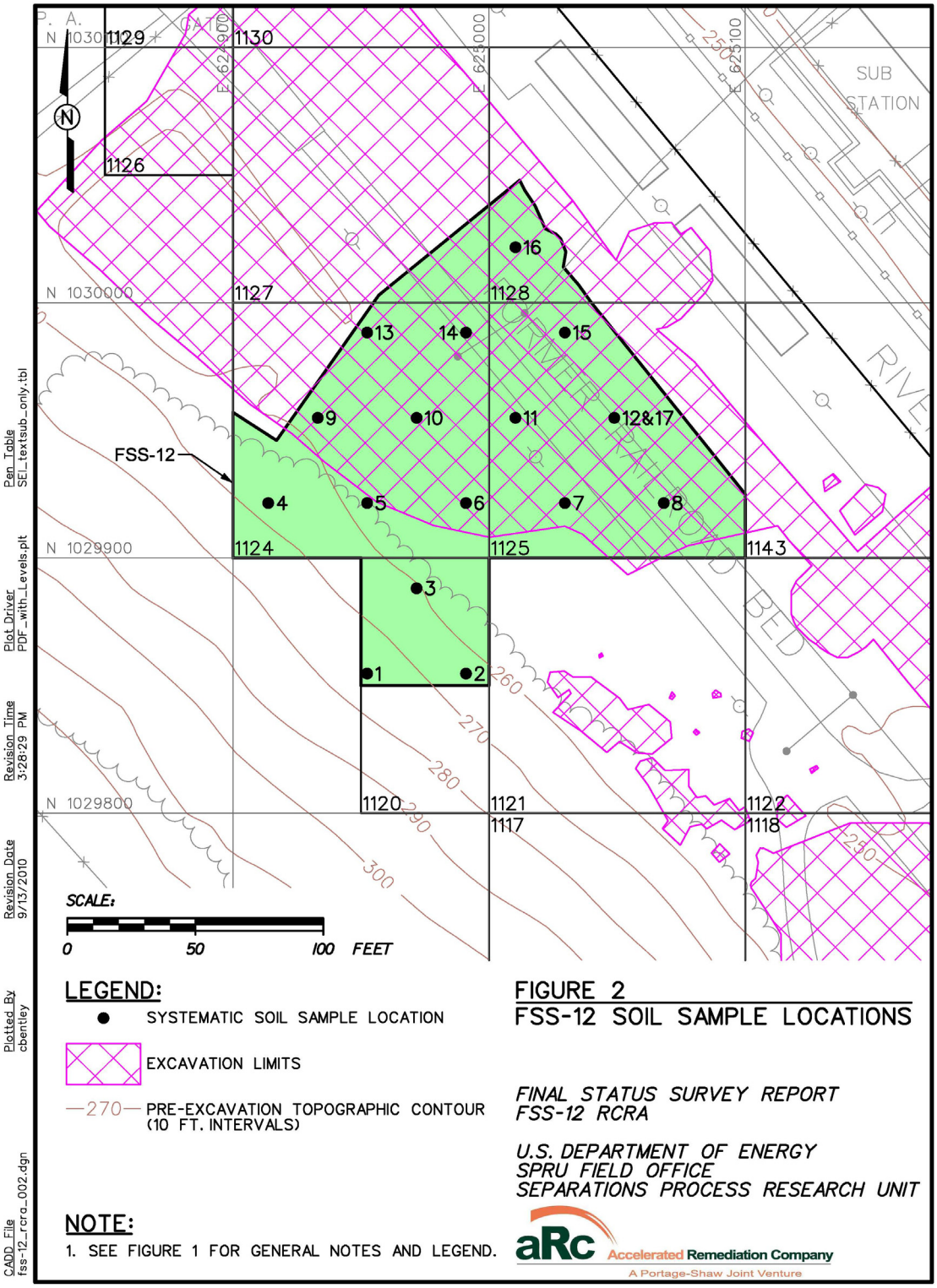

Figure 2 FSS-12 soil sample locations

Table 1 Soil sample description

Sample ID	Map Location(s)	Sample Description
SFS-012-001-M	1	Black Topsoil
SFS-012-002-M	2	Black topsoil
SFS-012-003-M	3	Brown Topsoil
SFS-012-004-M	4	Brown clay
SFS-012-005-M	5	Brown topsoil with brown clay mix
SFS-012-006-M	6	Brown clay and gravel mix moist
SFS-012-007-M	7	Brown clay with gravel fill
SFS-012-008-M	8	Brown sandy gray clay mix
SFS-012-009-M	9	Brown clay and gravel mix
SFS-012-010-M	10	Brown gravel clay mix
SFS-012-011-M,	11	Brown clay and gravel mix, wet
SFS-012-012-M SFS-012-017-M	12 & 17	SFS-012-017-M is the duplicate of SFS-012-012-M Gray clay and gravel fill
SFS-012-013-M	13	Gray clay and brown fill
SFS-012-014-M	14	Sandy brown clay fill
SFS-012-015-M	15	Sandy gravel fill
SFS-012-016-M	16	Sandy gravel brown clay mix

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America Laboratories, Inc., following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals by Method 6010B, antimony by Method 6020A, and mercury by Method 7471A. An exception to the QAPjP (ARC-PLN-6402) included analyzing thallium using analytical Method 6020A instead of Method 6010B. Method 6020A was specifically used to analyze for thallium to obtain detection limits with numerical values below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results of the metals analyses. The laboratory analytical report, *SPRU-LL Final Status Survey Unit 12 Analytical Report*, Project No. 179223, SDG #s F0D070434 (Test America 2010) is on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

The laboratory data were validated internally by Test America Laboratories, Inc., in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitation and validation (L&V) report, *SPRU Metals, FSS Unit 12,* SDG # SFS-012-001-M (F0D070434) (Portage 2010) is on the

CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results from soil samples collected from FSS-12

Sample ID		**SFS-012-001-M**			**SFS-012-002-M**			**SFS-012-003-M**			**SFS-012-004-M**			**SFS-012-005-M**			**SFS-012-006-M**		
FSS Unit		**12**			**12**			**12**			**12**			**12**			**12**		
Sample Date		**4/2/2010**			**4/2/2010**			**4/2/2010**			**4/2/2010**			**4/2/2010**			**4/2/2010**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	11100	N		11000	N		11700	N		12600	N		9970	N		10300	N	
Antimony	1	0.92	B	U	**1.1**	**B**	**U**	0.92	B	U	0.98	B	U	0.65	B	U	0.70	B	U
Arsenic	16	4.4			4.2			2.9			4.4			4.2			4.7		
Barium	350	123	N	J	83.6	N	J	59.0	N	J	72.3	N	J	59.7	N	J	72.5	N	J
Beryllium	14	0.82			0.71	B		0.67			0.80			0.63			0.69		
Cadmium	2.5	0.75	U		0.72	U		0.60	U		0.60	U		0.63	U		0.59	U	
Calcium	NA	7520			6490			5950			1490			11800			16900		
Chromium	36	16.2			14.9			17.8			19.3			16.2			15.0		
Cobalt	30	12.2			11.1			21.6			14.2			10.3			11.1		
Copper	270	23.1	E		23.4	E		31.2	E		30.7	E		25.9	E		26.3	E	
Iron	NA	24200	N		23200	N		28500	N		31500	N		24700	N		23400	N	
Lead	400	30.0	E		33.1	E		17.0	E		17.7	E		18.8	E		17.7	E	
Magnesium	NA	4580	N	J	4310	N	J	6880	N	J	5880	N	J	6270	N	J	6270	N	J
Manganese	2000	1310	N		700	N		932	N		570	N		555	N		714	N	
Mercury	0.73	0.14	E	J	0.10	E	J	0.091	E	J	0.068	E	UJ	0.15	E	J	0.20	E	J
Nickel	130	25.0			24.2			28.2			31.4			23.2			23.8		
Potassium	NA	1100	N	J	951	N	J	829	N	J	1530	N	J	1360	N	J	852	N	J
Selenium	4	**4.3**	**U**		0.41	U		3.5	U		3.5	U		0.36	U		0.34	U	
Silver	8.3	0.35	U		0.34	U		0.28	U		0.28	U		0.30	U		0.28	U	
Sodium	NA	157			67.6	U		56.4	U		56.6	U		59.4	U		55.9	U	
Thallium	2	0.69	B	U	0.24	B	U	0.14	U		0.14	U		0.15	U		0.18	B	U
Vanadium	150	28.3			35.7			23.8			26.4			22.7			23.5		
Zinc	2200	85.3	NE		82.5	NE		80.9	NE		84.4	NE		75.7	NE		97.8	NE	

Table 2 (continued)

Sample ID		SFS-012-007-M			SFS-012-008-M			SFS-012-009-M			SFS-012-010-M			SFS-012-011-M			SFS-012-017-M[b]		
FSS Unit		**12**			**12**			**12**			**12**			**12**			**12**		
Sample Date		**4/2/2010**			**4/2/2010**			**4/2/2010**			**4/2/2010**			**4/2/2010**			**4/2/2010**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	8640	N		8620	N		10700	N		10100	N		5790	N		9770	N	
Antimony	1	0.51	B	U	0.66	B	U	0.56	B	U	0.43	B	U	0.53	B	U	0.69	B	U
Arsenic	16	4.3			4.0			4.3			4.1			3.5			3.7		
Barium	350	51.1	N	J	44.8	N	J	55.5	N	J	65.8	N	J	37.6	N	J	47.5	N	J
Beryllium	14	0.55			0.51	B		0.65			0.64			0.47	B		0.65		
Cadmium	2.5	0.55	U		0.54	U		0.55	U		0.55	U		0.61	U		0.56	U	
Calcium	NA	65200			41400			16900			29900			6870			18200		
Chromium	36	14.7			11.3			15.2			14.7			10.5			15.3		
Cobalt	30	9.9			10.1			12.5			10.7			7.5			11.4		
Copper	270	28.5	E		26.3	E		29.0	E		27.5	E		20.9	E		24.6	E	
Iron	NA	26100	N		23300	N		27500	N		27700	N		16500	N		29700	N	
Lead	400	13.9	E		10.9	E		25.1	E		15.6	E		16.0	E		13.8	E	
Magnesium	NA	18300	N	J	9100	N	J	8880	N	J	11200	N	J	3870	N	J	7050	N	J
Manganese	2000	619	N		520	N		536	N		602	N		228	N		582	N	
Mercury	0.73	0.055	E	UJ	0.047	E	UJ	0.055	E	UJ	0.16	E	J	0.026	BE	UJ	0.038	E	UJ
Nickel	130	23.3			20.4			23.2			23.2			16.8			25.1		
Potassium	NA	922	N	J	906	N	J	1120	N	J	1110	N	J	656	N	J	961	N	J
Selenium	4	0.32	U		0.31	U		0.32	U		0.32	U		0.35	U		0.33	U	
Silver	8.3	0.26	U		0.25	U		0.26	U		0.26	U		0.28	U		0.26	U	
Sodium	NA	51.4	U		50.9	U		51.9	U		60.2	B		72.8	B		53.1	U	
Thallium	2	0.13	U		0.13	U		0.13	U		0.13	U		0.14	U		0.13	U	
Vanadium	150	19.6			16.9			21.8			23.5			21.4			25.8		
Zinc	2200	88.7	NE		65.6	NE		79.7	NE		85.9	NE		46.5	NE		78.0	NE	

Table 2 (continued)

Sample ID		**SFS-012-012-M**			**SFS-012-013-M**			**SFS-012-014-M**			**SFS-012-015-M**			**SFS-012-016-M**		
FSS Unit		**12**			**12**			**12**			**12**			**12**		
Sample Date		**4/2/2010**			**4/2/2010**			**4/2/2010**			**4/2/2010**			**4/2/2010**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	9600	N		7790	N		9230	N		8300	N		10400	N	
Antimony	1	0.51	B	U	**1.1**	**B**	**U**	0.57	B	U	0.55	B	U	0.53	B	U
Arsenic	16	4.3			3.2			6.0			3.5			4.0		
Barium	350	51.2	N	J	54.8	N	J	43.4	N	J	45.4	N	J	54.5	N	J
Beryllium	14	0.58			0.51	B		0.57			0.59			0.62		
Cadmium	2.5	0.55	U		0.55	U		0.56	U		0.53	U		0.58	U	
Calcium	NA	20200			94400			30100			35200			3880		
Chromium	36	13.7			13.1			12.6			11.9			15.7		
Cobalt	30	10.3			8.8			9.8			9.2			9.0		
Copper	270	26.9	E		21.2	E		23.8	E		23.2	E		21.7	E	
Iron	NA	24600	N		20300	N		24600	N		21500	N		21800	N	
Lead	400	12.9	E		10.7	E		13.6	E		17.5	E		35.0	E	
Magnesium	NA	7410	N	J	7560	N	J	7670	N	J	10300	N	J	4340	N	J
Manganese	2000	509	N		481	N		467	N		469	N		458	N	
Mercury	0.73	0.052	E	UJ	0.037	E	UJ	0.027	BE	UJ	0.027	BE	UJ	0.12	E	J
Nickel	130	22.5			19.9			21.5			18.6			21.3		
Potassium	NA	1090	N	J	906	N	J	695	N	J	1020	N	J	901	N	J
Selenium	4	0.32	U		0.32	U		0.32	U		0.31	U		0.34	U	
Silver	8.3	0.26	U		0.26	U		0.26	U		0.25	U		0.27	U	
Sodium	NA	52.2	U		111			179			57.4	B		54.6	U	
Thallium	2	0.13	U		0.13	U		0.13	U		0.12	U		0.16	B	U
Vanadium	150	19.5			16.2			16.6			17.3			25.1		
Zinc	2200	78.5	NE		71.4	NE		76.3	NE		65.9	NE		85.6	NE	

Table 2 (continued)

Notes: a. The soil cleanup objective (SCO) (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8 (NYSDEC 2006a) for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.
b. SFS-012-017-M is the field duplicate of sample SFS-012-012-M.

= Results in **bold** font and shaded with grey indicate the value exceeds the SCO.
NA = Not applicable.
mg/kg = Milligrams per kilogram.
L = Laboratory flags:
U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
B = Result is between the method detection limit and the reporting limit.
E = Serial dilution percent recovery not within limits.
N = Spike analyte recovery outside stated control limits.
* = Relative percent difference is outside stated control limits.
V = Validation flags:
J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.
UJ = The material was analyzed for but was not detected. The quantitation limit is an estimated quantity.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making purposes, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation, the results reported for antimony in all samples, thallium in samples SFS-012-001-M, SFS-012-002-M, SFS-012-006-M, and SFS-012-016-M, and mercury in all samples except SFS-012-001-M, SFS-012-002-M, SFS-012-003-M, SFS-012-005-M, SFS-012-006-M, SFS-012-010-M, and SFS-012-016-M were identified as false positives based on analyte values in the blank and have been qualified with either a "U" (undetected) or "UJ" (undetected estimated value).

Selenium was undetected in sample SFS-012-001-M. Because this result was reported from a ten-fold dilution analysis and the corresponding method detection limit (4.3 mg/Kg) was adjusted for dilution, the reported concentration for that undetected result is slightly greater than the SCO (4 mg/kg). However, raw data for this sample indicate analyses were performed both by Method 6010 at lesser dilutions (1x and 5x dilutions) and by Method 6020, using ICP-MS. A review of the raw data from Method 6010 found each measurement yielded a calculated concentration less than zero. During validation, the ICP-MS data for this sample were reviewed and also found the measurement produced similar results, supporting the conclusion that selenium is not present. Based on these determinations, the SCO for selenium clearly has been met.

All of the remaining validation qualifiers assigned with "J" flags (estimated) denote evidence of matrix interferences bias in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

The results of all COCs that are subject to RCRA requirements are below SCOs except for the following. The reporting limit for antimony slightly exceeds the SCO, but these sample locations do not warrant further excavation, given the closeness of the values to the cleanup objective, the absence of any other antimony exceedances, and the undetected "U" flagging added during data validation. Selenium from Sample Location 1 was reported at 4.3 mg/kg from a 10-fold dilution analysis, and the corresponding method detection limit was adjusted for dilution. The reported concentration for that undetected result is slightly greater than the SCO (4 mg/kg). However, raw data for this sample indicate analyses were performed both by Method 6010 at lesser dilutions (1x and 5x dilutions) and by Method 6020, using ICP-MS. A review of the raw data from Method 6010 found each measurement yielded a calculated concentration less than zero. During validation, the ICP-MS data for this sample were reviewed and also found the measurement produced similar results, supporting the conclusion that selenium is not present. All three values have been determined to be undetected at reported concentration, and they are not viewed as actionable concentrations.

6.0 Conclusions

Evaluation of the FSS-12 laboratory data package (Test America 2010) and the L&V report (Portage 2010) show the data to be of sufficient quality and quantity for decision-making purposes. All COCs subject to RCRA requirements analyzed for in FSS-12 had concentrations below the corresponding SCOs.

A civil survey of the final excavated surface of FSS-12 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 478 yd^3 of banked material was removed from FSS-12. No further excavation is recommended at FSS-12.

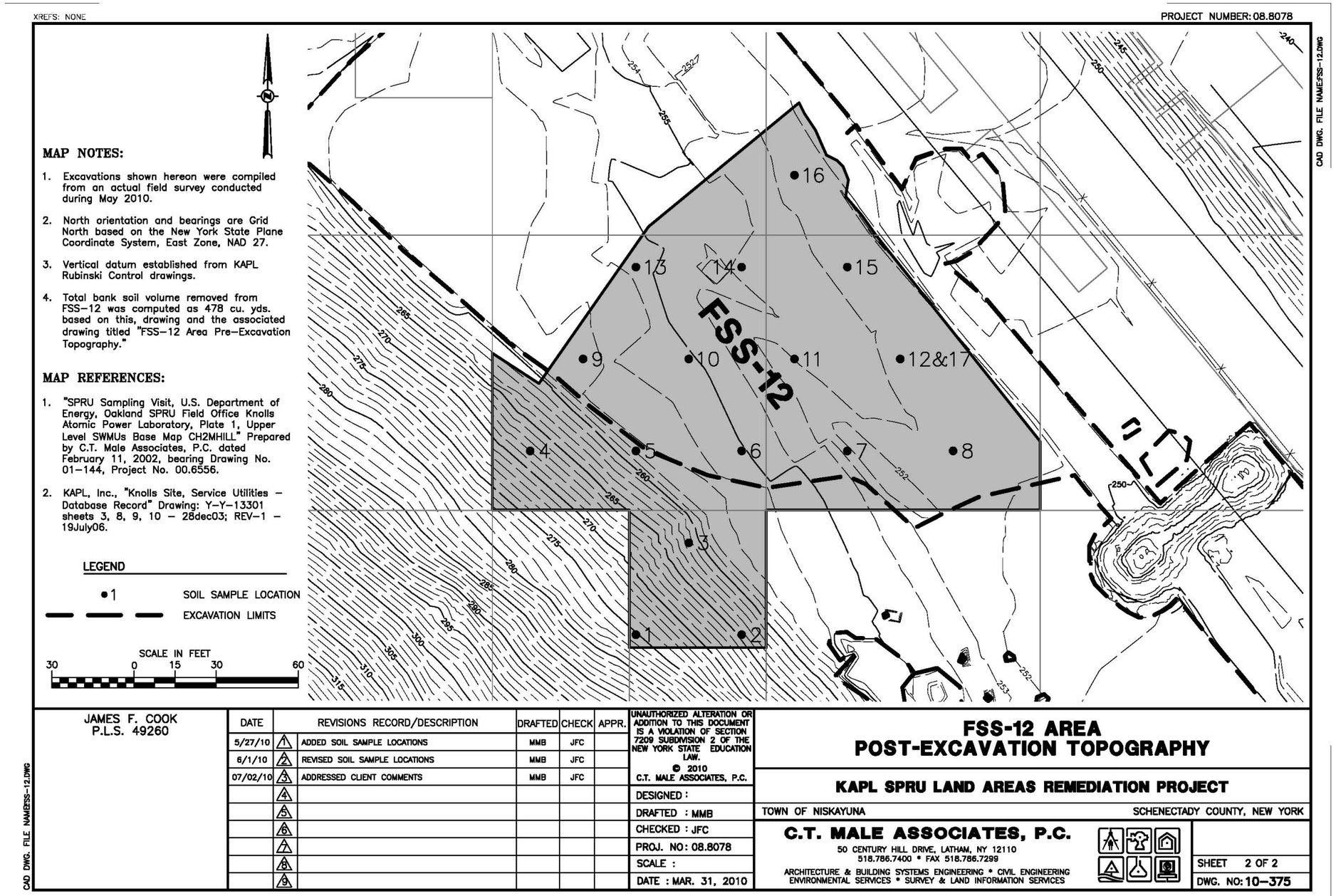

Figure 3 FSS-12 excavation area post-excavation topography

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated December 3, 2008, Web page visited June 8, 2010.

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, New York State Department of Environmental Conservation, March 9, 2006.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels," TAGM 4046.

Portage, 2010, *SPRU Metals, FSS Unit 12,* SDG # SFS-012-001-M (F0D070434), Portage, Inc., May 10, 2010.

Test America, 2010, *SPRU-LL Final Status Survey Unit 12 Analytical Report*, Project No. 179223, SDG #s F0D070434, Test America Laboratories, Inc., St. Louis, Missouri, April 26, 2010.

Appendix A
CD-ROM with Electronic Copy of Analytical Report, Project No. 179223, SDG # F0D070434, Final Status Survey Unit 12

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Report SDG # F0D070434, SPRU Metals
Final Status Survey Unit 12

Attachment 15

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Lower Level Parking Lot Excavations (ARC-RPT-6023)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Lower Level Parking Lot Excavations

ARC-RPT-6023
August 2, 2011
Revision 4

DOE Contract No. DE-AM09-05SR22399
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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Lower Level Parking Lot Excavations

Approval for Use

Doug Collins Deputy Project Manager	08/02/11 Date
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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
DOE	U.S. Department of Energy
FSS	final status survey
ICM	interim corrective measures
LLPL	Lower Level Parking Lot
L&V	limitation and validation
NYSDEC	New York State Department of Environmental Conservation
ORISE	Oak Ridge Institute for Science and Education
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	target analyte list

1.0 Executive Summary

This report documents the completion of the Lower Level Parking Lot (LLPL) excavations performed by the Accelerated Remediation Company (aRc) at the Separations Process Research Unit (SPRU) land areas in accordance with requirements specified in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereinafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (QAPjP) (ARC-PLN-6402). The excavations in the LLPL are located within two of the designated final status survey (FSS) units, FSS-13 and FSS-14, and this report includes the Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) sampling results for both units.

The LLPL is located in the northwestern portion of the lower level land area, consists primarily of an asphalt parking area bounded by vegetation to the west and north and the lower level road to the south, and slopes toward the Mohawk River to the east. At least three phases of site investigative activities within, and proximal to, the LLPL have been conducted previously. The sampling activities and analytical results from the most recent investigation conducted in January 2009 are documented in the *Direct-Push Summary Report Lower Level Parking Lot Separations Process Research Unit* (ARC-RPT-6008).

Based on the recommendations included in ARC-RPT-6008, excavations were initiated in three separate areas within the LLPL (Excavations A, B, and C); however, the extent of radiological contamination between Excavation A and Excavation B led the excavation activities until Areas A and B combined to form one excavation area (AB). In addition, chemical contamination found between Excavation AB and Excavation C ultimately led to the three separate excavation areas merging into one large excavation area within the LLPL. Once excavation was completed, sampling locations were established and sampled. Sampling locations for RCRA constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106), Section 3.2, following the guidance for excavations specified in the *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002). All RCRA samples collected by aRc during the excavation of the LLPL were sent to Test America Laboratories for offsite laboratory analysis of target analyte list (TAL) metals.

Analytical data for samples initially collected from Excavation AB indicated metals concentrations greater than the project's soil cleanup objective (SCO) in one sidewall and two bottom samples. The vanadium concentration reported for the sidewall sample at Sampling Location 1 and the mercury and cobalt results from the bottom Sampling Locations EXAB-17 and EXAB-20 were greater than corresponding SCOs. Additional excavation and re-sampling were conducted at these locations. The additional analytical data indicated a continued level of mercury above the SCO at Sample Location EXAB-20, and additional excavations and sampling were conducted at this location until all metals concentration were below the SCO.

Analytical data for three samples collected in Excavation C indicated antimony concentrations greater than the SCO of 2 mg/kg. This required further excavation and sampling in these areas. The additional analytical data indicated continued antimony above the SCO in the sample location on the west side of the excavation. Additional excavation and sampling continued on the west side until Excavation C merged with Excavation AB. At the point where Excavation AB merged with Excavation C, a bottom sample was collected. Results from this bottom sample had no RCRA COCs above SCOs, and excavation in the LLPL was considered completed.

Upon completion of the combined Excavations A and B in the LLPL, the Oak Ridge Institute for Science and Education (ORISE), the independent verification contractor for the U.S. Department of Energy SPRU Office, conducted independent sampling for metals in the LLPL excavations. Twelve samples were collected in Excavation AB, and one sample was collected in Excavation C. Analytical results from this sampling showed antimony, mercury, and arsenic concentrations greater than the corresponding SCOs in four locations within Excavation AB. Additional excavation was conducted at these locations, and subsequent sampling and analyses indicated no RCRA COCs above SCOs.

2.0 Introduction

The SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land area known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit," (NYSDEC 2006a) and provides the cleanup approach for the SPRU-LL.

The objectives of the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from the NYSDEC for chemicals in the SPRU-LL land areas. This report documents completion of LLPL excavations in accordance with the ICM work plan (ARC-PLN-6106) and the QAPjP (ARC-PLN-6402). Figure 1 shows the location of LLPL in the SPRU-LL land areas.

The LLPL is located in the northwestern portion of the lower level land area, consists primarily of an asphalt parking area bounded by vegetation to the west and north and the lower level road to the south, and slopes toward the Mohawk River to the east. At least three phases of site investigative activities within, and proximal to, the LLPL have been conducted previously. The most recent sampling activities and analytical results conducted in January 2009 are documented in the *Direct-Push Summary Report Lower Level Parking Lot Separations Process Research Unit* (ARC-RPT-6008). Figure 2 shows the designated excavation areas in the LLPL based on the recommendations in ARC-RPT-6008. The excavations in the LLPL are located within two of the designated FSS units, FSS-13 and FSS-14. This report includes the RCRA sampling results for both units.

Figure 1 Location of LLPL in the SPRU-LL

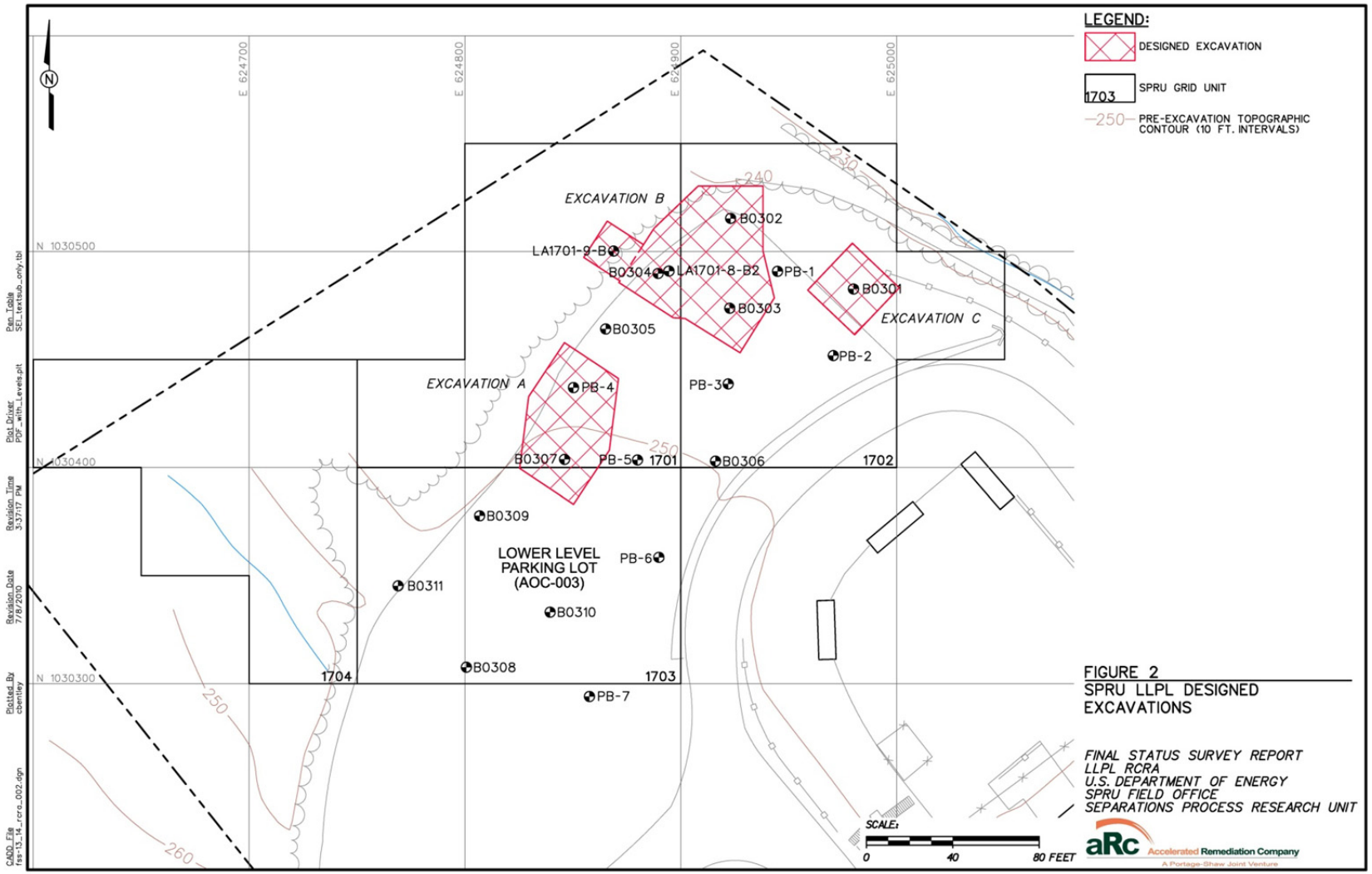

Figure 2 SPRU LLPL designed excavation

3.0 Sampling Activities

3.1 Excavation Activities

The LLPL excavations occupy portions of Characterization Grid Units 1701, 1702, and 1703. As shown in Figure 2, three excavation areas were planned based on the recommendations included in ARC-RPT-6008. Excavations were initiated in three separate areas within the LLPL (Excavations A, B, and C); however, the extent of radiological contamination between Excavation A and Excavation B led the excavation activities until Areas A and B combined to form one excavation area (AB). In addition, chemical contamination found between Excavation AB and Excavation C ultimately led to the three separate excavation areas merging into one large excavation area within the LLPL. Sampling locations were initially established and sampled as the excavation was completed in the planned areas. As additional excavation was conducted, the sampling process was repeated.

3.2 Sampling Location

The LLPL is located in the northwestern portion of the lower level land area, consists primarily of an asphalt parking area bounded by vegetation to the west and north and the lower level road to the south, and slopes toward the Mohawk River to the east. RCRA sampling of the SPRU LLPL excavations was conducted as outlined in the ICM work plan (ARC-PLN-6106). In previous FSS units, the post-excavation sample locations were determined utilizing a random starting point and laid out in a triangular pattern with each sample location being "L" distance away from the previous location. However, confirmation sampling locations within each excavation area of the LLPL were determined in accordance with the approach outlined in the ICM work plan (ARC-PLN-6106), Section 3.2, and based on the perimeter of the excavation and nature of contamination, as prescribed by the *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002).

Specifically, for excavations with perimeters of less than 20 ft, one bottom sample and one sidewall sample biased in the direction of the surface runoff were collected. For excavations with perimeters between 20 and 300 ft, one sample was collected for every 900 ft^2 of bottom area and one sample every 30 linear ft of sidewall from the bottom perimeter of the excavation for subsurface spills. Sidewall samples were collected 1 ft up from the bottom of the excavation on the sidewall. If a sidewall sample location was located in a section of the excavation that was less than 1 ft deep, the sample was taken from approximately 1 ft from the outer edge of the excavation and listed as a bottom/edge sample in Table 2. Upon completion of the combined Excavations A and B in the LLPL, ORISE (the DOE-SPRU independent verification contractor) conducted independent sampling for metals in the LLPL excavations. Twelve samples were collected in Excavation AB, and one sample was collected in Excavation C. Four of these 12 ORISE sampling locations were identified as areas with metals concentrations greater than the corresponding SCO. Additional excavation was conducted, and re-sampling was performed in these areas.

As discussed in Section 3.1, the extent of radiological contamination between Excavations A and B led the excavation activities until they combined to form one excavation area (AB). The original sample configuration, when "sidewall" and "bottom" samples were designated, was established with the combined Excavation AB and a separate Excavation C. Additional excavation on the northwest side of Excavation C led to the combining of Excavations C and AB into one excavation. With the exception of sample location EXC-04, the original sample configuration was not changed. EXC04 was originally a sidewall sample but became a bottom sample when Excavation C joined with Excavation AB. Due to the additional excavation, the perimeter and depth of the excavation changed between the original and the

final sampling configuration, but not significantly enough to require any changes to the sampling configuration. It should also be noted that even though samples are named as "sidewall" and "bottom" samples to be consistent with DER-10 terminology, the sample locations might be more accurately described as "perimeter" and "interior" sample locations in terms of describing their physical location within the excavation area. Finally, the final sampling configuration was consistent with the NYSDEC DER-10 and the ARC-PLN-6106.

3.3 Sample Collection

At each sampling location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected, transferred to an appropriate sample container, and shipped to the offsite laboratory for metals analyses with a 48-hr turnaround time for preliminary data. These preliminary data were used to determine whether further excavation was required to meet SCOs. If analytical data indicated metals COC concentrations were above the SCOs, then additional excavation at the failed sampling location was conducted. In accordance with approved plans, an additional 12-in. lift of soil was removed from the floor (or sidewall) spanning the distance from the failed sampling location to approximately halfway to the nearest passing sampling location. Once the additional excavation was completed, another sample was collected from the original failed sampling location and sent to the offsite laboratory for metals analysis. This process was repeated as required until all COCs were below SCOs at all sampling locations. Four of the samples collect by ORISE had concentrations of COCs above SCOs. These locations required additional excavation which was conducted and the locations re-sampled. Table 1 summarizes each of the sampling events associated with the LLPL excavations. Figure 3 shows the details of the final excavations in the LLPL with its boundaries, sample locations, and pertinent surface features.

Table 1 Chronological summary of the sampling events during excavation of the LLPL

Date Sampled	Excavation Area	Sample Type	Total Number of Sampling Locations	Failed Sampling Locations
10/08/2009	EXC	RCRA Confirmation	5	EXC-02, EXC-03, EXC-04
10/27/2009	EXC	RCRA Re-sample	3	EXC-4
12/3/2009	EXC	RCRA Re-sample	1	EXC-04
12/17/2009	EXC	RCRA Re-sample	1	EXC-04
01/20/2010	EXC	RCRA Re-sample	1	EXC-04
02/22/2010	EXC	RCRA Re-sample	1	None
12/3/2009	EXAB	RCRA Confirmation	20	EXAB-01, EXAB-17, EXAB-20
12/17/2009	EXAB	RCRA Re-sample	3	EXAB-20
01/20/2010	EXAB	RCRA Re-sample	1	None
12/22/2009	EXC EXAB	ORISE Verification ORISE Verification	1 12	EXAB-50, 51, 52, 53
01/20/2010	EXAB	ARC confirmation of ORISE sample location	2	None
01/21/2010	EXAB	ARC confirmation of ORISE sample location	2	None

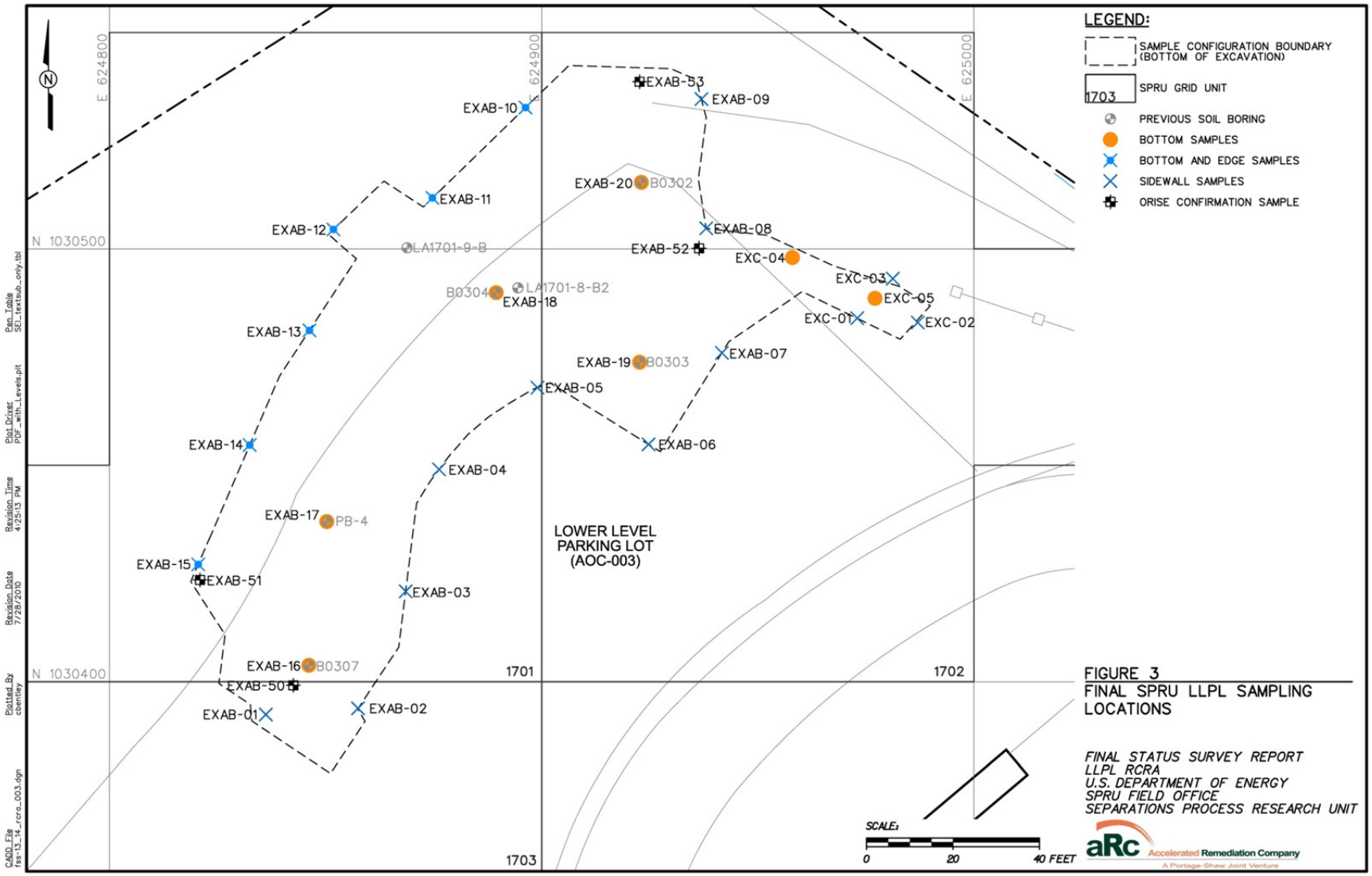

Figure 3 Final SPRU LLPL excavations and sampling locations

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals by Method 6010B, antimony and thallium by 6020A, and mercury by 7471A. Method 6020A was specifically used to analyze for thallium and antimony to obtain detection limits with numerical values below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results of the metals analyses for the LLPL RCRA confirmation sampling. Appendix A (provided on a CD-ROM with this report) includes the associated laboratory analytical reports, as follows:

- *SPRU Excavation C Analytical Report*, Project No. 179223, Lot # F9J090121, October 20, 2009 (Test America 2009a)
- *SPRU EXC-15C Analytical Report*, Project No. 179223, Lot # F9J280131, November 2, 2009 (Test America 2009b)
- *SPRU EXC-15C Analytical Report,* Project No. 179223, Lot # F9K020446, November 6. 2009 (Test America 2009c)
- *SPRU SPL-EXAB Analytical Report,* Project No. 179223, Lot # F9L040437, December 16, 2009 (Test America 2009d)
- *SPRU Analytical Report,* Project No. 179223, Lot # F9L180423, December 28, 2009 (Test America 2009e)
- *SPRU Analytical Report,* Project No. 179223, Lot # F0A210488, January 26, 2010 (Test America 2010a)
- *SPRU Analytical Report,* Project No. 179223, Lot # F0A220435, January 28, 2010 (Test America 2010b)
- *SPRU Analytical Report,* Project No. 179223, Lot # F0B230439, March 2, 2010 (Test America 2010c).

4.2 Data Validation

The laboratory data were validated internally by Test America in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. Appendix B (provided on a CD-ROM with this report) includes the following limitation and validation (L&V) reports:

- *SPRU Metals, LLPL*, SDG SPL-EXC-001-M (F9J090121), January 13, 2010 (Portage 2010a)
- *SPRU Metals, LLPL*, SDG SPL-EXC-007-M (F9J280131), January 14, 2010 (Portage 2010b)
- *SPRU Metals, LLPL*, SDG SPL-EXC-007-M (F9K020446), January 15, 2010 (Portage 2010c)
- *SPRU Metals, LLPL*, SDG SPL-EXAB-001-M (F9L040437), Revision 1, January 7, 2010 (Portage 2010d)
- *SPRU Metals, LLPL*, SDG SPL-EXC-011-M (F9L180423), January 15, 2010 (Portage 2010e)
- *SPRU Metals, LLPL*, SDG SPL-EXC-051-M (F0A220435), February 18, 2010 (Portage 2010f)
- *SPRU Metals, LLPL*, SDG SPL-EXC-052-M (F0A210488), March 3, 2010 (Portage 2010g)
- *SPRU Metals, LLPL*, SDG SPL-EXC-012-M (F0B230439), March 26, 2010 (Portage 2010h).

Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2 for RCRA final confirmation sampling.

Table 2 Summary of metals results from final confirmation soil samples collected from LLPL

Sample ID		**SPL-EXAB-022-M**			**SPL-EXAB-002-M**			**SPL-EXAB-003-M**			**SPL-EXAB-004-M**			**SPL-EXAB-005-M**			**SPL-EXAB-006-M**		
Sample Location		**EXAB-01**			**EXAB-02**			**EXAB-03**			**EXAB-04**			**EXAB-05**			**EXAB-06**		
Sample Type		**Sidewall**			**Sidewall**			**Sidewall**			**Sidewall**			**Sidewall**			**Sidewall**		
Date Sampled		**12/17/2009**			**12/3/2009**			**12/3/2009**			**12/3/2009**			**12/3/2009**			**12/3/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	14800	NE	J	13300	NE	J	5920	NE	J	8400	NE	J	8260	NE	J	3140	NE	J
Antimony	1	0.34	BE	U	0.55	BN	UJ	0.37	BN	UJ	0.31	BN	UJ	0.32	BN	UJ	0.25	BN	UJ
Arsenic	16	5.8	BE		4.0	BN		5.5	N		5.3	N		5.8	N		3.0	N	
Barium	350	95.3	NE	J	52.1	E	J	30.2	E	J	53.1	E	J	52.0	E	J	27.3	E	J
Beryllium	14	0.91	B		0.69	B	U	0.39	U		0.77	B	U	0.49	B	U	0.37	U	
Cadmium	2.5	1.1	B		0.85	B	U	0.54	B	U	1.1	B		0.66	B	U	0.38	B	U
Calcium	NA	4680	NE*	J	3740	NE*	J	57100	NE*	J	18900	NE*	J	24500	NE*	J	115000	NE*	J
Chromium	36	18.6	E		17.9	NE	J	8.8	NE	J	12.3	NE	J	11.6	NE	J	6.4	NE	J
Cobalt	30	11.9	B		11.8	BN		5.7	BN		8.4	BN		7.3	BN		3.2	BN	
Copper	270	22.5	E		15.8	NE	J	14.7	NE	J	20.1	NE	J	30.1	NE	J	11.0	NE	J
Iron	NA	29600	NE	J	24800	NE	J	14600	NE	J	19600	NE	J	18700	NE	J	9300	NE	J
Lead	400	14.3	E		13.0	E	J	9.6	E	J	22.8	E	J	15.7	E	J	7.0	E	J
Magnesium	NA	5430	NE	J	4880	NE*	J	27500	NE*	J	9420	NE*	J	10500	NE*	J	52800	NE*	J
Manganese	2000	430	NE*	J	429	NE*	J	308	NE*	J	500	NE*	J	295	NE*	J	260	NE*	J
Mercury	0.73	0.055	NE*	J	0.026	BN*	J	0.074	N*	J	0.11	N*	J	0.092	N*	J	0.066	N*	J
Nickel	130	22.7	E		18.8	NE	J	13.4	NE	J	18.9	NE	J	19.3	NE	J	9.8	NE	J
Potassium	NA	1410	N	J	1140	BN	J	917	BN	J	1310	N	J	798	BN	J	1030	BN	J
Selenium	4	3.6	U		1.8	U		0.67	U		0.68	U		0.67	U		0.64	U	
Silver	8.3	0.58	U		0.59	UN		0.54	UN		0.55	UN		0.54	UN		0.52	UN	
Sodium	NA	2470	E		1250			307			585			729			76.1	B	
Thallium	2	0.12	B	U	1.1	B		0.39	B		0.32	B		0.21	B		0.13	B	U
Vanadium	150	28.9			23.5	NE	J	12.0	NE	J	20.7	NE	J	18.7	NE	J	22.7	NE	J
Zinc	2200	90.9	E		73.5	E	J	46.2	E	J	72.1	E	J	64.6	E	J	43.9	E	J

Table 2 (continued)

Sample ID		**SPL-EXAB-007-M**			**SPL-EXAB-008-M**			**SPL-EXAB-009-M**			**SPL-EXAB-010-M**			**SPL-EXAB-011-M**			**SPL-EXAB-012-M**		
Sample Location		**EXAB-007**			**EXAB-08**			**EXAB-09**			**EXAB-10**			**EXAB-11**			**EXAB-12**		
Sample Type		**Sidewall**			**Sidewall**			**Sidewall**			**Bottom/Edge**			**Bottom/Edge**			**Bottom/Edge**		
Date Sampled		**12/3/2009**			**12/3/2009**			**12/3/2009**			**12/3/2009**			**12/3/2009**			**12/3/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	7040	NE	J	6960	NE	J	7070	NE	J	7100	NE	J	6960	NE	J	9870	NE	J
Antimony	1	0.35	BN	UJ	0.21	BN	UJ	0.27	BN	UJ	0.32	BN	UJ	0.38	BN	UJ	0.24	BN	UJ
Arsenic	16	6.3	N		3.6	N		9.1	N		3.9	N		3.9	N		4.8	N	
Barium	350	39.2	E	J	36.1	E	J	40.0	E	J	89.0	E	J	62.2	E	J	70.3	E	J
Beryllium	14	0.45	B	U	0.40	B	U	0.49	B	U	0.57	U		0.51	U		0.58	B	U
Cadmium	2.5	0.77	B	U	0.58	B	U	1.0	B		0.77	B	U	0.90	B	U	0.69	B	U
Calcium	NA	60800	NE*	J	8200	NE*	J	63900	NE*	J	11200	NE*	J	24100	NE*	J	2330	NE*	J
Chromium	36	10.0	NE	J	9.0	NE	J	15.4	NE	J	10.9	NE	J	11.9	NE	J	12.8	NE	J
Cobalt	30	6.7	BN		6.1	BN		6.3	BN		6.6	BN		5.9	BN		8.4	BN	
Copper	270	21.1	NE	J	14.9	NE	J	23.9	NE	J	12.1	NE	J	17.4	NE	J	10.4	NE	J
Iron	NA	20600	NE	J	15500	NE	J	16000	NE	J	14700	NE	J	16200	NE	J	19000	NE	J
Lead	400	18.0	E	J	12.6	E	J	21.5	E	J	20.8	E	J	24.7	E	J	21.1	E	J
Magnesium	NA	9310	NE*	J	3720	NE*	J	9250	NE*	J	6230	NE*	J	11800	NE*	J	3040	NE*	J
Manganese	2000	387	NE*	J	300	NE*	J	302	NE*	J	1490	NE*	J	324	NE*	J	586	NE*	J
Mercury	0.73	0.020	BN*	J	0.054	N*	J	0.62	N*	J	0.13	N*	J	0.16	N*	J	0.091	N*	J
Nickel	130	17.7	NE	J	14.4	NE	J	17.9	NE	J	14.4	NE	J	16.2	NE	J	17.5	NE	J
Potassium	NA	1310	N	J	781	BN	J	1260	BN	J	1140	BN	J	1020	UN		1230	BN	J
Selenium	4	0.66	U		0.65	U		0.73	U		1.4	B		0.87	U		0.88	U	
Silver	8.3	0.53	UN		0.53	UN		0.59	UN		0.78	UN		0.71	UN		0.71	UN	
Sodium	NA	818			287			41.7	B		213	B		349			328		
Thallium	2	0.12	B	U	0.10	B	U	0.099	B	U	0.16	B	U	0.13	B	U	0.11	B	U
Vanadium	150	19.9	NE	J	22.6	NE	J	27.7	NE	J	42.8	NE	J	50.5	NE	J	34.5	NE	J
Zinc	2200	74.6	E	J	50.8	E	J	68.0	E	J	68.4	E	J	104	E	J	56.3	E	J

Table 2 (continued)

Sample ID		**SPL-EXAB-013-M**			**SPL-EXAB-014-M**			**SPL-EXAB-015-M**			**SPL-EXAB-016-M**			**SPL-EXAB-023-M**			**SPL-EXAB-018-M**		
Sample Location		**EXAB-13**			**EXAB-14**			**EXAB-15**			**EXAB-16**			**EXAB-17**			**EXAB-18**		
Sample Type		**Bottom/Edge**			**Bottom/Edge**			**Bottom/Edge**			**Bottom**			**Bottom**			**Bottom**		
Date Sampled		**12/3/2009**			**12/3/2009**			**12/3/2009**			**12/3/2009**			**12/17/2009**			**12/3/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	5850	NE	J	5270	NE	J	5500	NE	J	8550	NE	J	13100	NE	J	8960	NE	J
Antimony	1	0.42	BN	UJ	0.39	BN	UJ	0.36	BN	UJ	0.38	BN	UJ	0.23	BE	U	0.18	BN	UJ
Arsenic	16	4.4	N		3.7	BN		3.6	N		5.4	N		3.9	UE		5.9	N	
Barium	350	51.6	E	J	50.3	E	J	57.0	E		51.0	E	J	70.9	NE	J	53.6	E	J
Beryllium	14	0.55	U		0.64	U		0.71	B	J	0.69	B		0.72	B		0.56	B	
Cadmium	2.5	0.52	B	U	0.61	B	U	0.91	BN		0.85	BN		0.89	B		0.86	BN	
Calcium	NA	62900	NE*	J	53000	NE*	J	109000	NE*	J	34700	NE*	J	1290	NE*	J	8810	NE*	J
Chromium	36	8.5	NE	J	10.5	NE	J	11.1	NE	J	12.1	NE	J	16.1	E		12.8	NE	J
Cobalt	30	5.6	BN		4.5	BN		4.8	BN	J	8.9	BN	J	14.3			10.3	BN	J
Copper	270	10.0	NE	J	20.5	NE	J	15.5	N		21.3	N		14.6	E		22.5	N	
Iron	NA	12800	NE	J	11200	NE	J	12700	NE	J	21300	NE	J	24600	NE	J	23000	NE	J
Lead	400	18.0	E	J	21.3	E	J	23.5	E	J	15.8	E	J	16.0	E		17.9	E	J
Magnesium	NA	30200	NE*	J	23600	NE*	J	50200	NE*	J	18000	NE*	J	3850	NE	J	6240	NE*	J
Manganese	2000	479	NE*	J	233	NE*	J	452	NE*	J	529	NE*	J	776	NE*	J	439	NE*	J
Mercury	0.73	0.11	N*	J	0.13	N*	J	0.15	N*	J	0.13	N*	J	0.029	BNE*	J	0.012	UN*	UJ
Nickel	130	11.5	BNE	J	14.2	BNE	J	14.8	NE	J	18.4	NE	J	18.4	E		22.8	NE	J
Potassium	NA	1090	UN		1270	UN		1060	UN	UJ	1430	N	J	1960	N	J	1240	N	J
Selenium	4	0.94	U		1.1	U		0.90	U		0.77	B		3.5	U		0.83	B	
Silver	8.3	0.76	UN		0.88	UN		0.73	UN		0.54	UN	UJ	0.57	U		0.58	UN	UJ
Sodium	NA	94.6	B		267	B		81.9	B		579			566	E		758		
Thallium	2	0.091	B	U	0.079	U		0.85	B		0.88	B		0.15	B	U	0.24	B	
Vanadium	150	43.1	NE	J	35.7	NE	J	47.6	E	J	27.2	E	J	25.2			30.8	E	J
Zinc	2200	59.7	E	J	77.7	E	J	83.7	E	J	76.7	E	J	75.4	E		80.7	E	J

Table 2 (continued)

Sample ID		**SPL-EXAB-019-M**			**SPL-EXAB-026-M**			**SPL-EXC-001-M**			**SPL-EXC-006-M[b]**			**SPL-EXC-007-M**			**SPL-EXC-008-M**		
Sample Location		**EXAB-19**			**EXAB-20**			**EXC-01**			**EXC-01**			**EXC-02**			**EXC-03**		
Sample Type		**Bottom**			**Bottom**			**sidewall**			**Duplicate of 01**			**sidewall**			**sidewall**		
Date Sampled		**12/3/2009**			**1/20/2010**			**10/8/2009**			**10/8/2009**			**10/27/2009**			**10/27/2009**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	8490	NE	J	14100	N		10700	N		3750	N		8780	NE	J	7800	NE	J
Antimony	1	0.28	BN	UJ	0.88	B	U	0.83	B	U	0.18	B	U	0.74	BN	U	1.0	BN	U
Arsenic	16	6.3	N		7.1			4.0	B		2.9	B		8.6	B		6.2		
Barium	350	44.3	E	J	90.1			49.6	N*	J	40.6	N*	J	57.9	NE	J	60.1	NE	J
Beryllium	14	0.52	B		1.0			0.95	U		0.93	U		0.57	B		0.50	B	
Cadmium	2.5	0.83	BN		1.2			1.0	B		0.52	B		0.95	B		1.4		
Calcium	NA	28700	NE*	J	2160	NE	J	26300	N*		124000	N*		51600	NE	J	25100	NE	J
Chromium	36	12.9	NE	J	20.1			18.7	E	J	8.2	E	J	20.8	E		17.8	E	
Cobalt	30	9.2	BN	J	8.8			10.2	B		5.2	U		13.0	E		9.3	BE	
Copper	270	25.2	N		29.4			26.0	E	J	13.5	BE	J	31.1	E		60.7	E	
Iron	NA	22200	NE	J	34300	NE	J	27100	N		11200	N		24300	NE	J	20100	NE	J
Lead	400	14.9	E	J	15.6	E		27.8			12.7			77.9	NE	J	60.3	NE	J
Magnesium	NA	11100	NE*	J	5190	NE	J	13300	N*	J	57200	N*	J	13900	NE	J	8200	NE	J
Manganese	2000	481	NE*	J	323	N		538	N*	J	320	N*	J	591	NE	J	441	NE	J
Mercury	0.73	0.042	N*	J	0.015	BNE	J	0.22	N	J	0.15	N	J	0.10	N*	J	0.10	N*	J
Nickel	130	21.9	NE	J	24.2	N	J	26.4			11.9	B		24.1	E		33.7	E	
Potassium	NA	1110	BN	J	1190	N	UJ	1480	N	J	744	UN		1060	BN*	J	810	BN*	J
Selenium	4	0.67	U		1.9	U		1.6	U		1.6	U		3.2	U		0.63	U	
Silver	8.3	0.54	UN	UJ	0.30	U		1.3	U		1.3	U		0.52	U		0.59	B	
Sodium	NA	1280			533	E	J	514	E	J	164	BE	J	304			203	B	
Thallium	2	0.16	B	U	0.71	B		0.40	B		0.14	B	U	0.10	BN*	J	0.71	BN*	J
Vanadium	150	22.7	E	J	33.1			24.9	B		13.0	B		22.8	E		39.1	E	
Zinc	2200	83.7	E	J	86.0			54.1	NE	J	81.1	NE	J	99.8	E		136	E	

Table 2 (continued)

Sample ID		SPL-EXC-012-M			SPL-EXC-005-M			SPL-EXAB-051-M			SPL-EXAB-050-M			SPL-EXAB-053-M			SPL-EXAB-052-M		
Sample Location		**EXC-04**			**EXC-05**			**EXAB-51**			**EXAB-50**			**EXAB-53**			**EXAB-52**		
Sample Type		**Bottom**			**Bottom**			**Bottom/edge**			**Bottom**			**Bottom/edge**			**Sidewall**		
Date Sampled		**2/22/2010**			**10/8/2009**			**1/21/2010**			**1/21/2010**			**1/20/2010**			**1/20/2010**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	9330	N		8710	N		5290	N		13200	N		13900	N		9280	N	
Antimony	1	0.42	B	U	0.21	B	U	0.39	B		0.17	U		0.71	B	U	0.97	B	U
Arsenic	16	11.0	B		5.6			8.0	E		5.2	BE		5.3	B		5.3	B	
Barium	350	62.3	E	J	63.6	N*	J	37.8	N	J	103	N	J	97.5			62.4		
Beryllium	14	0.64			0.94	U		0.38	B		0.89			0.93			0.56	B	
Cadmium	2.5	1.2			1.1	B		0.49	B		0.98			1.1			1.2		
Calcium	NA	20600	N*		18200	N*		35400	NE*	J	10900	NE*	J	1820	NE	J	16900	NE	J
Chromium	36	14.1			14.1	E	J	10.6			19.4			19.1			14.4		
Cobalt	30	10.3			14.1	B		3.8	B		13.1			12.1			10.6		
Copper	270	31.9	E		23.2	E	J	15.5			26.6			26.0			41.1		
Iron	NA	25100	N*		22300	N		12100			30000			29800	NE	J	24600	NE	J
Lead	400	15.8			19.5			22.6			15.0			12.5	E		21.1	E	
Magnesium	NA	7050	NE	J	7770	N*	J	17800	NE*	J	7110	NE*	J	4750	NE	J	7760	NE	J
Manganese	2000	572	N		679	N*	J	193			594			379	N		647	N	
Mercury	0.73	0.56	NE*	J	0.077	N	J	0.026	BNE	J	0.15	NE	J	0.012	UNE	UJ	0.55	NE	J
Nickel	130	24.6			24.4			12.2			25.4			23.3	N	J	26.7	N	J
Potassium	NA	1130	N	J	924	BN	J	1010	NE	J	1510	NE	J	1340	N	UJ	1230	N	UJ
Selenium	4	3.4	U		1.6	U		0.36	U		1.9	U		1.8	U		1.8	U	
Silver	8.3	0.28	U		1.3	U		0.29	U		0.30	U		0.29	U		0.3	U	
Sodium	NA	368			407	E	J	183	E	U	1260	E		347	E	J	493	E	J
Thallium	2	0.39	B		0.22	B		1.0	B	U	0.93	B	U	0.38	B	U	0.5	B	U
Vanadium	150	21.0	E		20.4	B		23.7			31.7			26.5			25.3		
Zinc	2200	95.9			79.9	NE	J	59.5			86.7			85.0			96.8		

Table 2 (continued)

Notes: a. The SCO (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8, (NYSDEC 2006a) for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.
b. SPL-EXC-006-M is a duplicate of SPL-EXC-001-M.

NA = not applicable.
mg/kg = milligrams per kilogram.
L = Laboratory flags:
U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
B = Result is between the method detection limit and the reporting limit.
E = Serial dilution percent recovery not within limits.
N = Spike analyte recovery outside stated control limits.
* = Relative percent difference is outside stated control limits.
V = Validation flags:
J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.
UJ= The material was analyzed for but was not detected. The quantitation limit is an estimated quantity.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making purposes, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

Throughout the excavation activities in the LLPL, three sets of field duplicate samples were collected; however, only one pair reflects a final RCRA confirmation sampling location. The precision demonstrated by the relative percent difference between the duplicate results for several analytes with concentrations greater than the associated quantitation limit was greater than 50%. The duplicate results reflect the heterogeneity of the sample matrix—a mixture of rock and soil.

During validation, the results reported for several analytes were identified as false positives and have been qualified accordingly. Antimony in all samples except SPL-EXAB-051-M were identified as false positives and have been qualified with a "U" flag as undetected values or a "UJ" flag as an undetected result with an estimated quantitation limit. The quantitation limit is estimated based on low matrix spike/matrix spike duplicate recovery resulting from matrix interference.

Thallium in samples SPL-EXAB-0022-M, SPL-EXAB-006-M, SPL-EXAB-007-M, SPL-EXAB-008-M, SPL-EXAB-009-M, SPL-EXAB-010-M, SPL-EXAB-011-M, SPL-EXAB-012-M, SPL-EXAB-013-M, SPL-EXAB-023-M, SPL-EXAB-019-M, SPL-EXC-006-M, SPL-EXAB-050-M, SPL-EXAB-051-M, SPL-EXAB-052-M, and SPL-EXAB-053-M was identified as a false positive, and the reported results were qualified with a "U" validation flag to denote an undetected value.

Beryllium in samples SPL-EXAB-002-M, SPL-EXAB-004-M, SPL-EXAB-005-M, SPL-EXAB-007-M, SPL-EXAB-008-M, SPL-EXAB-009-M, and SPL-EXAB-012-M; cadmium in samples SPL-EXAB-002-M, SPL-EXAB-003-M, SPL-EXAB-005-M, SPL-EXAB-006-M, SPL-EXAB-007-M, SPL-EXAB-008-M, SPL-EXAB-010-M, SPL-EXAB-011-M, SPL-EXAB-012-M, SPL-EXAB-013-M, and SPL-EXAB-014-M; and sodium in sample SPL-EXAB-051-M have been identified as false positive results and qualified "U" as undetected values.

All of the remaining validation qualifiers "J" (estimated) or "UJ" (undetected estimated) flags denote evidence of matrix interferences as bias in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

All COCs subject to RCRA requirements in LLPL excavations were analyzed for and reported at concentrations below the corresponding SCOs.

6.0 Conclusions

Evaluation of the LLPL laboratory data packages (Test America 2009a–e and 2010a–c) and the L&V reports (Portage 2010a–h) show the data to be of sufficient quality and quantity for decision-making purposes. All RCRA COCs had concentrations below their corresponding SCOs.

A civil survey of the final LLPL excavated surface was conducted after completion of the excavation efforts, and the data are presented in Figure 4. An estimated total of 3,226 yd^3 of banked materials was removed from the LLPL excavations. No further excavation is recommended at LLPL.

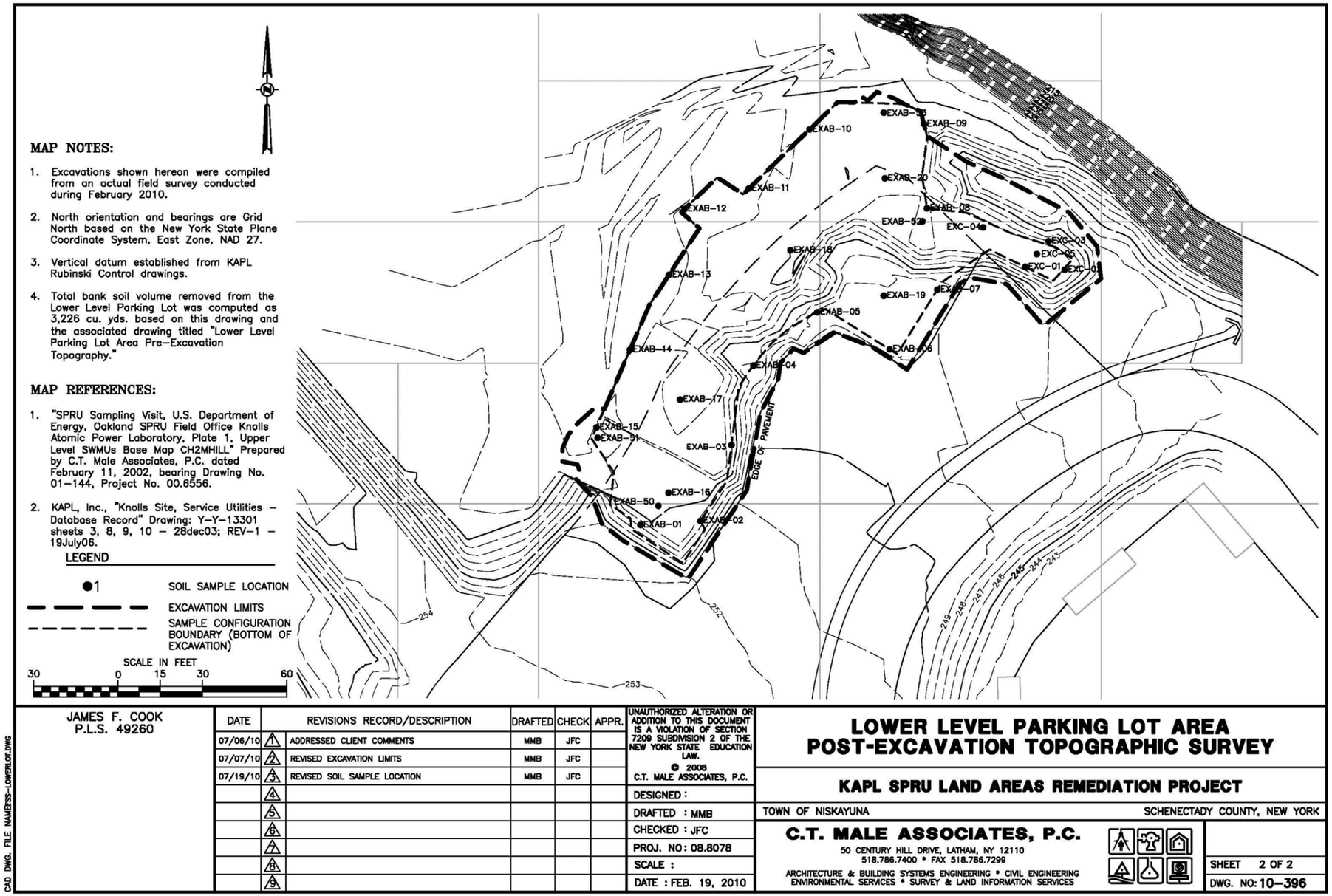

Figure 4 LLPL post-excavation topography

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

ARC-RPT-6008, *Direct-Push Summary Report Lower Level Parking Lot Separations Process Research Unit*, Rev. 4, Accelerated Remediation Company, January 28, 2010.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008.

NYSDEC, 2002, Draft DER-10 Technical Guidance for Site Investigation and Remediation, New York State Department of Environmental Conservation, December 25, 2002.

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002, New York State Department of Environmental Conservation, March 9, 2006.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels" TAGM 4046.

Portage, 2010a, *SPRU Metals, LLPL,* SDG SPL-EXC-001-M (F9J090121), January 13, 2010.

Portage, 2010b, *SPRU Metals, LLPL,* SDG SPL-EXC-007-M (F9J280131), January 14, 2010.

Portage, 2010c, *SPRU Metals, LLPL,* SDG SPL-EXC-007-M (F9K020446), January 15, 2010.

Portage, 2010d, *SPRU Metals, LLPL,* SDG SPL-EXAB-001-M (F9L040437), Revision 1, January 7, 2010.

Portage, 2010e, *SPRU Metals, LLPL,* SDG SPL-EXC-011-M (F9L180423), January 15, 2010.

Portage, 2010f, *SPRU Metals, LLPL,* SDG SPL-EXC-051-M (F0A220435), February 18, 2010.

Portage, 2010g, *SPRU Metals, LLPL,* SDG SPL-EXC-052-M (F0A210488), March 3, 2010.

Portage, 2010h, *SPRU Metals, LLPL,* SDG SPL-EXC-012-M (F0B230439), March 26, 2010.

Test America, 2009a, *SPRU Excavation C Analytical Report*, Project No. 179223, Lot # F9J090121, Test America Laboratories, Inc., October 20, 2009.

Test America, 2009b, *SPRU EXC-15C Analytical Report*, Project No. 179223, Lot # F9J280131, Test America Laboratories, Inc., November 2, 2009.

Test America, 2009c, *SPRU EXC-15C Analytical Report,* Project No. 179223, Lot # F9K020446, Test America Laboratories, Inc., November 6, 2009.

Test America, 2009d, *SPRU SPL-EXAB Analytical Report,* Project No. 179223, Lot # F9L040437, Test America Laboratories, Inc., December 16, 2009.

Test America, 2009e, *SPRU Analytical Report,* Project No. 179223, Lot # F9L180423, Test America Laboratories, Inc., December 28, 2009.

Test America, 2010a, *SPRU Analytical Report,* Project No. 179223, Lot # F0A210488, Test America Laboratories, Inc., January 26, 2010.

Test America, 2010b, *SPRU Analytical Report,* Project No. 179223, Lot # F0A220435, Test America Laboratories, Inc., January 28, 2010.

Test America, 2010c, *SPRU Analytical Report,* Project No. 179223, Lot # F0B230439, Test America Laboratories, Inc., March 2, 2010.

Appendix A
CD-ROM with Electronic Copy of
Analytical Reports, Project No. 179223,
SDGs #F9J090121, F9J280131, F9K020446, F9L040437, F9L180423,
F0A210488, F0A220435 and F0B230439, SPRU LLPL Excavations

Appendix B
CD-ROM with Electronic Copy of Data Limitations and Validation Reports SDGs #F9J090121, F9J280131, F9K020446, F9L040437, F9L180423, F0A210488, F0A220435 and F0B230439, SPRU LLPL Excavations

Attachment 16
Separations Process Research Unit Lower Level Land Areas Interim Data Report for Unit 15 (ARC-RPT-6028)

Separations Process Research Unit Lower Level Land Areas Interim Data Report for Unit 15

ARC-RPT-6028
August 2, 2011
Revision 3

DOE Contract No. DE-AM09-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

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Separations Process Research Unit Lower Level Land Areas
Interim Data Report for Unit 15

Approval for Use

Doug Collins Deputy Project Manager	08/02/11 Date
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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
DOE	Department of Energy
ICP	inductively coupled plasma
ICM	interim corrective measures
L&V	limitation and validation
MS	matrix spike
MSD	matrix spike duplicate
NYSDEC	New York State Department of Environmental Conservation
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAGM	technical and administrative guidance memorandum
TAL	target analyte list

1.0 Executive Summary

This report documents sampling performed by the Accelerated Remediation Company (aRc) at the Separations Process Research Unit (SPRU) Land Areas Unit 15, in accordance with requirements specified in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereinafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402).

Unit 15 is located at the site of the Former K7 Storage Pad. During the remediation of the SPRU Lower Level (SPRU-LL) Railroad Staging area, the asphalt pad in Unit 15 was used for the water storage tanks that collected and stored groundwater pumped from deep excavations in other units. Upon completion of the remediation requiring storage of groundwater, the tanks were removed and the area was scanned for radiological contamination and released for sampling. To be consistent with other SPRU-LL units, Unit 15 was sampled for Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) metals per protocol outlined in the ICM work plan (ARC-PLN-6106).

The majority of Unit 15 is covered with two layers of asphalt. Upon penetration of the first layer of asphalt during sampling efforts, a second layer of asphalt was discovered from 1 to 12 in. beneath the top layer of asphalt. When enough material between the asphalt layers was available, soil samples were collected in the top 6 in. of the fill material beneath the top asphalt layer. Three locations (5, 9, and 10) were sampled below the second layer of asphalt. Because of their location near a power pole where sufficient material above the top asphalt layer was present, Sample Locations 12 and 15/17 were collected in soil above the top layer of asphalt. Unit 15 is located at the site of the Former K7 Storage Pad and the soils underlying the storage pad were previously chemically characterized and found to meet New York State Department of Environmental Conservation (NYSDEC) Technical and Administrative Guidance Memorandum (TAGM) 4046 (O'Toole 1994) soil cleanup objectives (SCOs) (DOE/CH2M Hill 2002). The U.S. Department of Energy (DOE) and NYSDEC have determined that there is no further action necessary to address chemical contamination at the Former K7 Storage Pad (NYSDEC 2008). The two layers of pavement were a pre-existing condition for both DOE-SPRU sampling programs: the 2002 sampling visit that was the basis for the NYSDEC no-further-action determination and the current FSS program. Given that determination, the data collected in Unit 15 is not submitted in support of a final status survey but is presented as supporting information only.

Sample locations for constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). Sixteen systematic soil samples and one duplicate sample were collected on March 15, 2010. However, due to the discovery of radiological contamination, two locations (10 and 3) required excavation, and once the excavation was completed these two locations were resampled on March 17, 2010, and April 1, 2010, respectively. All samples were sent for offsite laboratory analysis of target analyte list (TAL) metals by Test America Laboratories, Inc., St. Louis, Missouri.

2.0 Introduction

SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU-LL land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.). The

NYSDEC is overseeing cleanup of chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a), and provides the cleanup approach for the SPRU-LL.

The objectives of the ICM work plan, as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no-further-action determination from NYSDEC for chemicals in the SPRU-LL land areas. Unit 15 is located at the site of the Former K7 Storage Pad and the soils underlying the storage pad were previously chemically characterized and found to meet NYSDEC TAGM 4046 (O'Toole 1994) SCOs (DOE/CH2M Hill 2002). DOE and NYSDEC have determined that there is no further action necessary to address chemical contamination at the Former K7 Storage Pad (NYSDEC 2008). Given that determination, the data collected in Unit 15 is not submitted in support of a final status survey but is presented as supporting information only. All analytical results were less than the site cleanup objectives, which is consistent with the Sampling Visit Report and the no further action conclusion.

This report documents completion of Unit 15 in accordance with the ICM work plan and the quality assurance project plan (QAPjP) (ARC-PLN-6402). Figure 1 shows the location of Unit 15 in the SPRU-LL land areas.

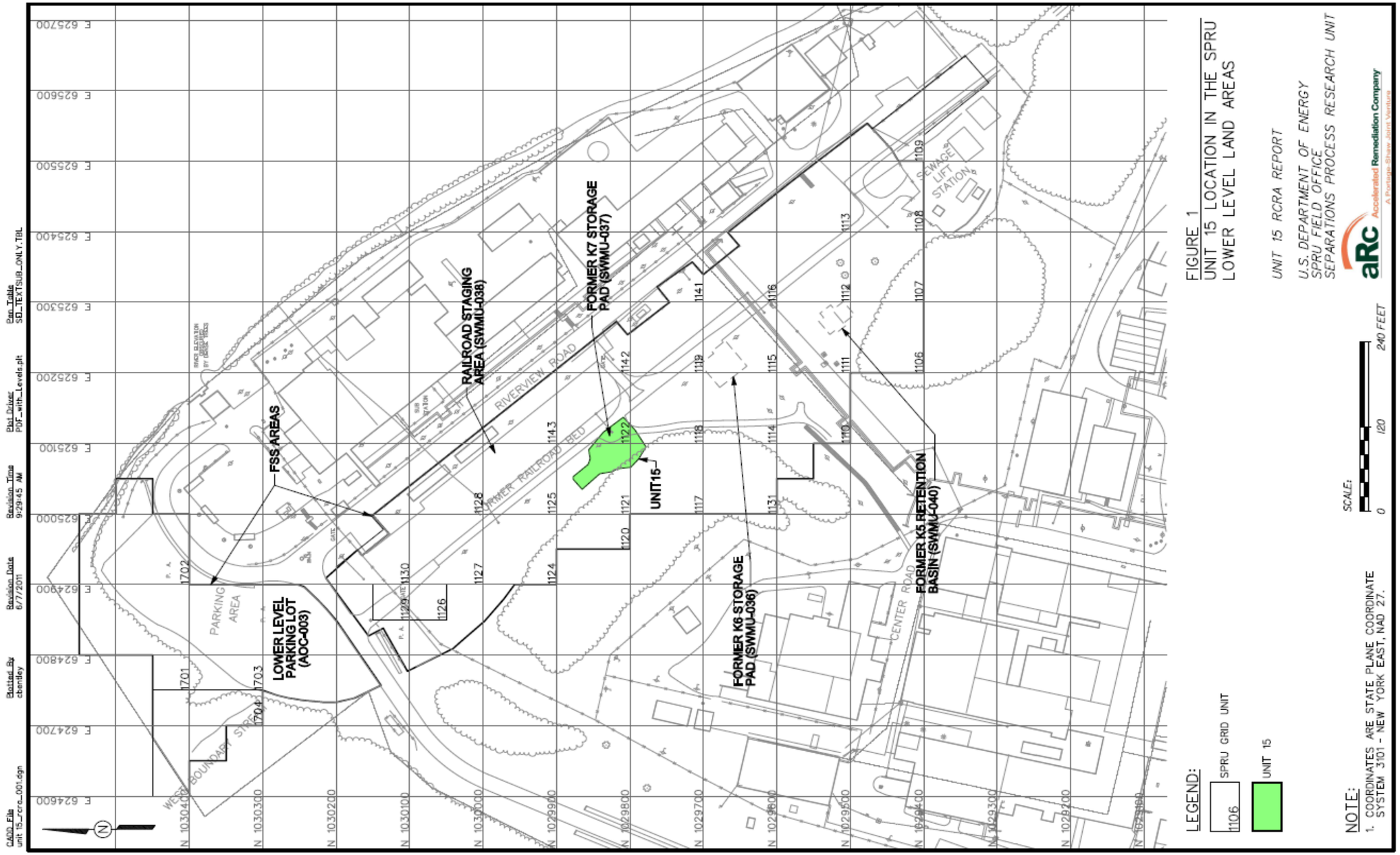

Figure 1 Unit 15 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sample Location

Unit 15 is located at the site of the Former K7 Storage Pad. During the remediation of the SPRU Lower Level (SPRU-LL) Railroad Staging Area, the asphalt pad in Unit 15 was used for the water storage tanks that collected and stored groundwater pumped from deep excavations in other units. Upon completion of the remediation requiring storage of groundwater, the tanks were removed and the area was scanned for radiological contamination and released for sampling. To be consistent with other SPRU-LL units, Unit 15 was sampled for RCRA metals per protocol outlined in the ICM work plan (ARC-PLN-6106).

Unit 15 occupies portions of Characterization Grid Units 1121, 1122, 1117, and a small corner of 1118. Figure 1 shows the SPRU-LL land area with Unit 15 highlighted. Figure 2 shows details of Unit 15 sample locations, including the unit's boundaries and pertinent surface features. Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per unit. The methodology described in the ICM work plan determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic radiological sampling locations were used to collect RCRA samples.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples located systematically on a triangular pattern 18.1 ft from each other. Figure 2 shows the sample locations at Unit 15.

3.2 Sample Collection

Soil samples for chemical COCs were collected using the methodology described in the ICM work plan (ARC-PLN-6106). The majority of Unit 15 is covered with two layers of asphalt. Upon penetration of the first layer of asphalt during sampling efforts, a second layer of asphalt was discovered from 1 to 12 in. beneath the top layer of asphalt. When enough material between the asphalt layers was available, soil samples were collected in the top 6 in. of the fill material beneath the top asphalt layer. Because of their location near a power pole where sufficient material above the top asphalt layer was present, Sample Locations 12 and 15/17 were collected in soil above the top layer of asphalt. Samples were collected at Locations 5 and 9 below the second layer of asphalt because insufficient material for sample collection was available between the two layers of asphalt. At Location 10, excavation for radiological contamination penetrated both layers of asphalt so this sample was collected below all existing asphalt.

At each location, a soil sample was collected and transferred to appropriate sample containers. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1. Sixteen systematic soil samples and one duplicate sample were collected on March 15, 2010. However, due to the discovery of additional radiological contamination which required excavation, Locations 10 and 3 were resampled on March 17, 2010, and April 1, 2010, respectively.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. When the gamma analysis indicated that samples could be shipped, all RCRA samples were transferred, following chain-of-custody procedures outlined in the QAPjP (ARC-PLN-6402), to Test America Laboratories, Inc., an offsite analytical laboratory. All samples were analyzed for total metals in accordance with the ICM work plan and the QAPjP.

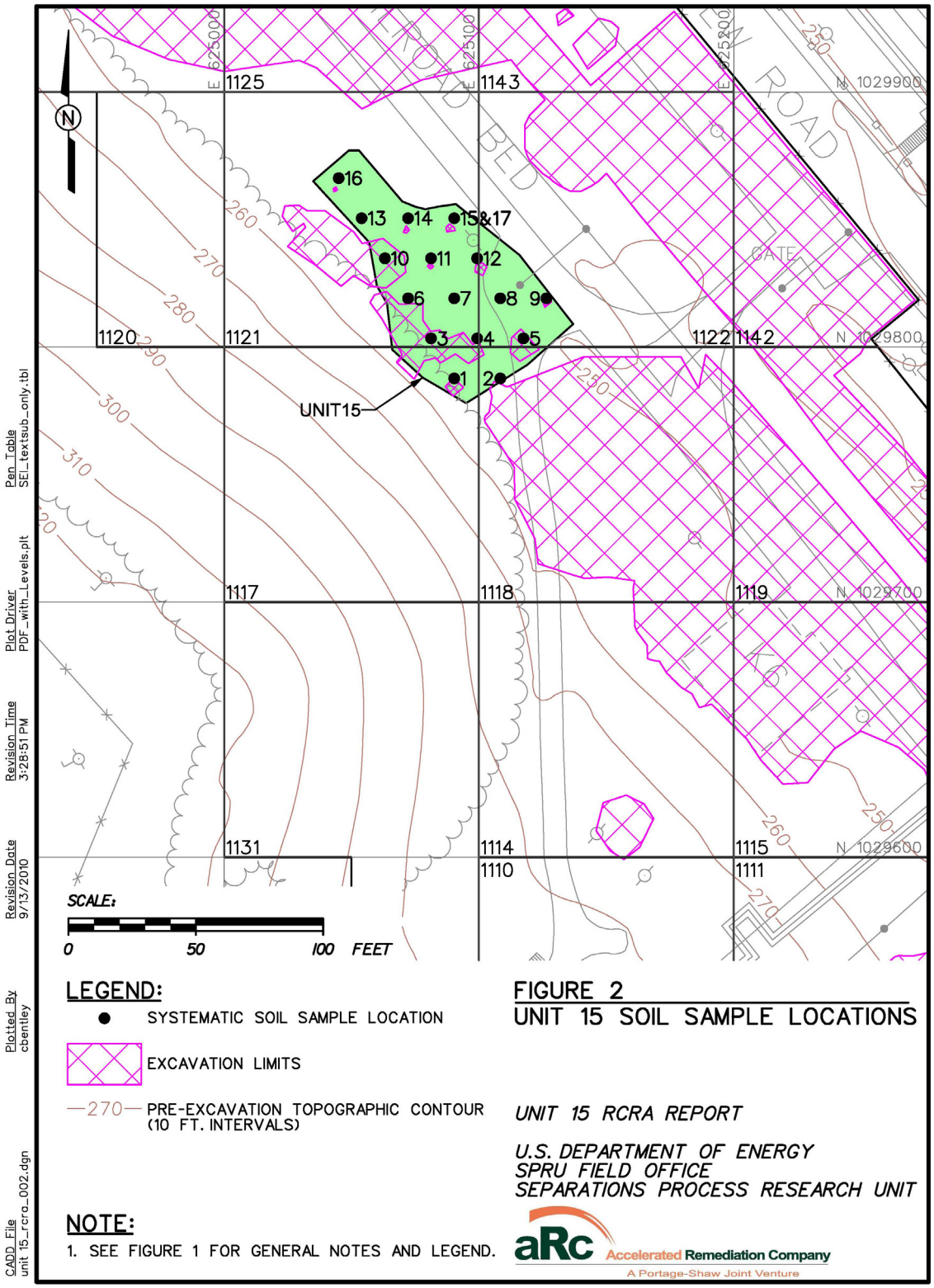

Figure 2 Unit 15 soil sample locations

Table 1 Soil sample description

Sample ID	Map Location(s)	Sample Description
SFS-015-001-M	1	Sandy/rocky fill 5 in. thick, taken between two asphalt layers
SFS-015-002-M	2	Sandy/rocky fill 4.5 in. thick, taken between two asphalt layers
SFS-R015-003A-M	3	Brown sandy/rocky fill, resampled because of radiological contamination between layer of asphalt.
SFS-015-004-M	4	Sandy/rocky fill 6 in. thick, taken between two asphalt layers
SFS-015-005-M	5	Brown/sandy mixture with some reddish cinder material, taken below both layers of asphalt
SFS-015-006-M	6	Sandy/rocky fill 6 in. thick, taken between two asphalt layers
SFS-015-007-M	7	Sandy/rocky fill 4 in. thick, taken between two asphalt layers
SFS-015-008-M	8	Sandy/rocky fill 4 in. thick, taken between two asphalt layers
SFS-015-009-M	9	Sandy rock material, taken below second layer of asphalt (no material between layers)
SFS-R015-010-M	10	Subgrade sandy/rocky fill, taken 3 ft below both layers of asphalt. Resampled because of excavation for radiological contamination.
SFS-015-011-M	11	Sandy/rocky fill 8.5 in thick, taken between two asphalt layers in top 6 in. of material
SFS-015-012-M	12	Taken above asphalt layer, dark topsoil material near utility pole
SFS-015-013-M	13	Sandy/rocky fill 10 in thick, taken between two asphalt layers in top 6 in. of material
SFS-015-014-M	14	Sandy/rocky fill 12 in thick, taken between two asphalt layers in top 6 in. of material
SFS-015-015-M, SFS-015-017-M	15	SFS-015-017-M is the duplicate of SFS-015-015-M. Dark topsoil material near utility pole
SFS-015-016-M	16	Sandy/rocky fill 10 in thick, taken between two asphalt layers in top 6 in. of material

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), the samples were analyzed by Test America Laboratories, Inc., following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals by Method 6010B, antimony by Method 6020A, and mercury by Method 7471A. An exception to the QAPjP (ARC-PLN-6402) was analyzing thallium and selenium using analytical Method 6020A instead of Method 6010B. Method 6020A was specifically used to analyze for thallium to obtain detection limits with numerical values below the required SCOs stated in the QAPjP. The samples were analyzed for selenium using inductively coupled plasma (ICP) by Method 6010; however, spectral interferences from target and non-target analytes resulted in high relative standard deviation between scans at the wavelength for selenium determination. Therefore, the selenium data for all samples with the exception of SFS-R015-03A-M are reported from ICP/mass spectrometry Method 6020A, thereby eliminating the spectral interference. Table 2 provides the results of the metals analyses. The laboratory

analytical reports, *SPRU LL Final Status Survey Unit 15 Analytical Report*, Project No. 179223, SDG # F0C190485, Rev 1; and *SPRU LL Final Status Survey Unit 15 Analytical Report,* Project No. 179223, SDG # F0D020550 (Test America 2010a, 2010b) are on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

The laboratory data were validated internally by Test America Laboratories, Inc., in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals data was performed by Portage, Inc., in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitation and validation (L&V) reports, *SPRU Metals, FSS Unit 15, SDG# F0C190485* (Portage 2010a); *SPRU Metals, FSS Unit 15 Metals Re-sampling, SDG # SFS-R015-003A-M (F0D020550)* (Portage 2010b); and *SPRU Metals FSS-15, Selenium Re-analyses by 6020 for SDG SFS-015-001-M (F0C190485)* (Portage 2010c) are on the CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results from soil samples collected from Unit 15

Sample ID		**SFS-015-001-M**			**SFS-015-002-M**			**SFS-R015-003A-M**			**SFS-015-004-M**			**SFS-015-005-M**			**SFS-015-006-M**		
Unit		**15**			**15**			**15**			**15**			**15**			**15**		
Sample Date		**3/15/2010**			**3/15/2010**			**4/1/2010**			**3/15/2010**			**3/15/2010**			**3/15/2010**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	8530	N		10100	N		7880	NE	J	10100	N		10500	N		9420	N	
Antimony	1	0.48	B	U	0.21	B	U	0.51	B	U	0.23	B	U	0.51	B	U	0.14	U	
Arsenic	16	6.9	B		6.3	B		4.9	E		8.8	B		9.9	B		6.8	B	
Barium	350	58.0	N	J	53.4	N	J	55.4			54.1	N	J	80.6	N	J	58.5	N	J
Beryllium	14	0.54	B		0.61			0.55		U	0.66			0.90			0.57		
Cadmium	2.5	0.95	E		1.1	E		0.54	U		0.98	E		1.7	E		0.95	E	
Calcium	NA	24200	N*	R	32800	N*	R	41800	NE*	J	21300	N*	R	21100	N*	R	53300	N*	R
Chromium	36	13.5			14.5			12.5			16.5			20.9			13.0		
Cobalt	30	10.1			11.3			9.6			11.7			14.2			11.1		
Copper	270	23.5	E		28.5	E		25.1	E		29.4	E		49.6	E		26.1	E	
Iron	NA	24300	N		25000	N		24000	NE	J	28000	N		43700	N		25000	N	
Lead	400	11.4	E		13.3	E		13.6	E	J	14.2	E		27.0	E		11.0	BE	
Magnesium	NA	13100	N		14000	N		18600	NE*	J	8660	N		14300	N		9990	N	
Manganese	2000	548	N		584	N		662	N		543	N		600	N		809	N	
Mercury	0.73	0.025	B		0.028	B		0.025	BE	U	0.026	B		0.065			0.019	B	
Nickel	130	24.5			26.0			21.7			28.4			32.9			25.4		
Potassium	NA	1080	N	J	977	N	J	1060	N	J	1110	N	J	1290	N	J	1070	N	J
Selenium	4	0.68			0.86			3.1	U		0.79			1.5			0.78		
Silver	8.3	0.26	U		0.26	U		0.25	U		0.26	U		0.28	U		0.26	U	
Sodium	NA	143			51.9	U		50.5	U		51.9	U		69.8	B		52.1	U	
Thallium	2	0.51	B	U	0.37	B	U	0.12	U		0.18	B	U	0.23	B	U	0.15	B	U
Vanadium	150	17.4	E		19.6	E		21.8			21.7	E		31.4	E		19.2	E	
Zinc	2200	69.1			73.2			66.7			78.0			84.8			70.2		

Table 2 (continued)

Sample ID		**SFS-015-007-M**			**SFS-015-008-M**			**SFS-015-009-M**			**SFS-R015-010-M**			**SFS-015-011-M**			**SFS-015-012-M**		
Unit		**15**			**15**			**15**			**15**			**15**			**15**		
Sample Date		**3/15/2010**			**3/15/2010**			**3/15/2010**			**3/17/2010**			**3/15/2010**			**3/15/2010**		
Analyte	**SCO[a]**	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	10900	N		10900	N		11400	N		11200	N		3470	N		8320	N	
Antimony	1	0.14	U		0.30	B	U	0.16	B	U	0.17	U		0.14	U		0.16	U	
Arsenic	16	5.8	B		7.1	B		11.7			6.5	B		3.5	U		7.6	B	
Barium	350	53.0	N	J	49.8	N	J	75.2	N	J	71.7	N	J	23.1	N	J	83.7	N	J
Beryllium	14	0.68			0.70			0.83			0.68			0.25	B		0.82		
Cadmium	2.5	1.1	E		1.2	E		1.3	E		1.1	E		0.41	BE		1.7	E	
Calcium	NA	24700	N*	R	14400	N*	R	15600	N*	R	20100	N*	R	34600	N*	R	54800	N*	R
Chromium	36	16.5			18.8			20.4			16.2			6.1			14.1		
Cobalt	30	13.2			11.7			20.4			12.8			4.9	B		6.4		
Copper	270	30.1	E		34.8	E		36.2	E		29.0	E		9.3	E		25.9	E	
Iron	NA	26000	N		29500	N		32800	N		26000	N		9900	N		19000	N	
Lead	400	14.6	E		14.8	E		26.8	E		14.1	E		5.7	BE		39.9	E	
Magnesium	NA	10600	N		7080	N		9800	N		10300	N		16800	N		20200	N	
Manganese	2000	612	N		517	N		526	N		600	N		268	N		479	N	
Mercury	0.73	0.024	B		0.019	B		0.035	B		0.028	B		0.012	B	U	0.027	B	
Nickel	130	28.6			31.6			34.1			28.7			9.9			23.9		
Potassium	NA	1340	N	J	1110	N	J	1340	N	J	1410	N	J	416	BN	J	963	N	
Selenium	4	0.81			0.81			1.2			0.88			0.50	B		1.1		
Silver	8.3	0.26	U		0.26	U		0.26	U		0.30	U		0.26	U		0.29	U	
Sodium	NA	52.3	U		300			275			60.8	U		52.4	U		225		
Thallium	2	0.16	B	U	0.12	B	U	0.11	B	U	0.11	B	U	0.067	B	U	0.072	B	U
Vanadium	150	20.8	E		21.6	E		31.3	E		24.0	E		10.2	E		31.7	E	
Zinc	2200	74.7			92.9			77.3			77.1			25.4			144		

Table 2 (continued)

Sample ID		**SFS-015-013-M**			**SFS-015-014-M**			**SFS-015-015-M**			**SFS-015-017-M** [b]			**SFS-015-016-M**		
Unit		**15**			**15**			**15**			**15**			**15**		
Sample Date		**3/15/2010**			**3/15/2010**			**3/15/2010**			**3/15/2010**			**3/15/2010**		
Analyte	**SCO**[a]	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	9800	N		10600	N		4820	N		7920	N		11200	N	
Antimony	1	0.14	U		0.14	U		0.15	U		0.15	U		0.14	U	
Arsenic	16	8.4	B		3.5	U		5.9	B		8.5	B		9.7	B	
Barium	350	54.2	N	J	51.0	N	J	52.9	N	J	51.5	N	J	53.5	N	J
Beryllium	14	0.65			0.65			0.37	B		0.50	B		0.73		
Cadmium	2.5	1.2	E		1.0	E		0.61	E		1.1	E		1.1	E	
Calcium	NA	43100	N*	R	36900	N*	R	179000	N*	R	67200	N*	R	14900	N*	R
Chromium	36	17.6			16.1			7.8			11.8			19.7		
Cobalt	30	11.8			12.5			5.2	B		8.0			12.6		
Copper	270	30.2	E		28.1	E		15.0	E		24.1	E		30.0	E	
Iron	NA	29200	N		26400	N		13600	N		27700	N		31400	N	
Lead	400	14.4	E		14.6	E		13.5	E		16.7	E		14.0	E	
Magnesium	NA	17700	N		9400	N		19400	N		26800	N		9450	N	
Manganese	2000	580	N		692	N		382	N		726	N		628	N	
Mercury	0.73	0.027	B		0.020	B		0.023	B		0.015	B		0.029	B	
Nickel	130	29.3			29.6			13.6			21.1			32.9		
Potassium	NA	921	N	J	1050	N	J	490	BN	J	974	N	J	1300	N	J
Selenium	4	0.75			0.78			0.60			0.81			0.83		
Silver	8.3	0.26	U		0.26	U		0.26	U		0.26	U		0.26	U	
Sodium	NA	51.8	U		74.5	B		52.8	U		52.9	U		51.9	U	
Thallium	2	0.10	B	U	0.093	B	U	0.065	U		0.12	B	U	0.13	B	U
Vanadium	150	20.7	E		19.6	E		14.2	E		21.6	E		23.8	E	
Zinc	2200	78.2			77.5			63.7			99.4			82.6		

Table 2 (continued)

Notes: a. The SCO (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8 (NYSDEC 2006a) for the protection of groundwater or residential exposure, or TAGM 4046 (O'Toole 1994) when Part 375-6 does not reference a value.
b. SFS-015-017-M is the field duplicate of sample SFS-015-015-M.

NA = not applicable.
mg/kg = milligrams per kilogram.

L = Laboratory flags:
- U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
- B = Result is between the method detection limit and the reporting limit.
- E = Serial dilution percent recovery not within limits.
- N = Spike analyte recovery outside stated control limits.
- * = Relative percent difference is outside stated control limits.

V = Validation flags:
- J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
- R = Rejected
- U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.
- UJ= The material was analyzed for but was not detected. The quantitation limit is an estimated quantity.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making purposes, and sample results were compared to the corresponding SCOs.

One field sample was collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit except for cadmium, calcium, iron, manganese, and potassium. The impact to data usability is deemed to be minimal because all of the sample results are below SCOs or do not have SCOs. The imprecision likely reflects the difficulty in homogenizing the gravel/clay fill material and represents the heterogeneity inherent to the matrix.

Similarly, heterogeneity inherent to the sample matrix was reflected as imprecision between the matrix spike (MS) and matrix spike duplicate (MSD) results for calcium. During validation, the reported results for calcium were qualified with an "R" validation flag (rejected) based on the relative percent difference between the MS/MSD results.

During validation, the results reported for antimony in samples SFS-015-001-M, SFS-015-002-M, SFS-R015-003A-M, SFS-015-004-M, SFS-015-005-M, SFS-015-008-M, and SFS-015-009-M; mercury in samples SFS-R015-003A-M and SFS-015-011-M; beryllium in sample SFS-R015-003A-M; and thallium results in all samples except SFS-R015-003A-M and SFS-015-015-M were identified as false positives and have been qualified accordingly as undetected values with a "U" flag.

All of the remaining validation qualifiers assigned "J" flags (estimated) denote evidence of matrix interferences bias in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

6.0 Conclusions

Evaluation of the Unit 15 laboratory data packages (Test America 2010a, 2010b) and the L&V reports (Portage 2010a, 2010b, 2010c) show the data to be of sufficient quality and quantity for decision-making purposes.

A civil survey of the final excavated surface of Unit 15 was conducted after completion of the sampling efforts, and the data are presented in Figure 3. An estimated total of 64 yd^3 of banked materials was removed from Unit 15.

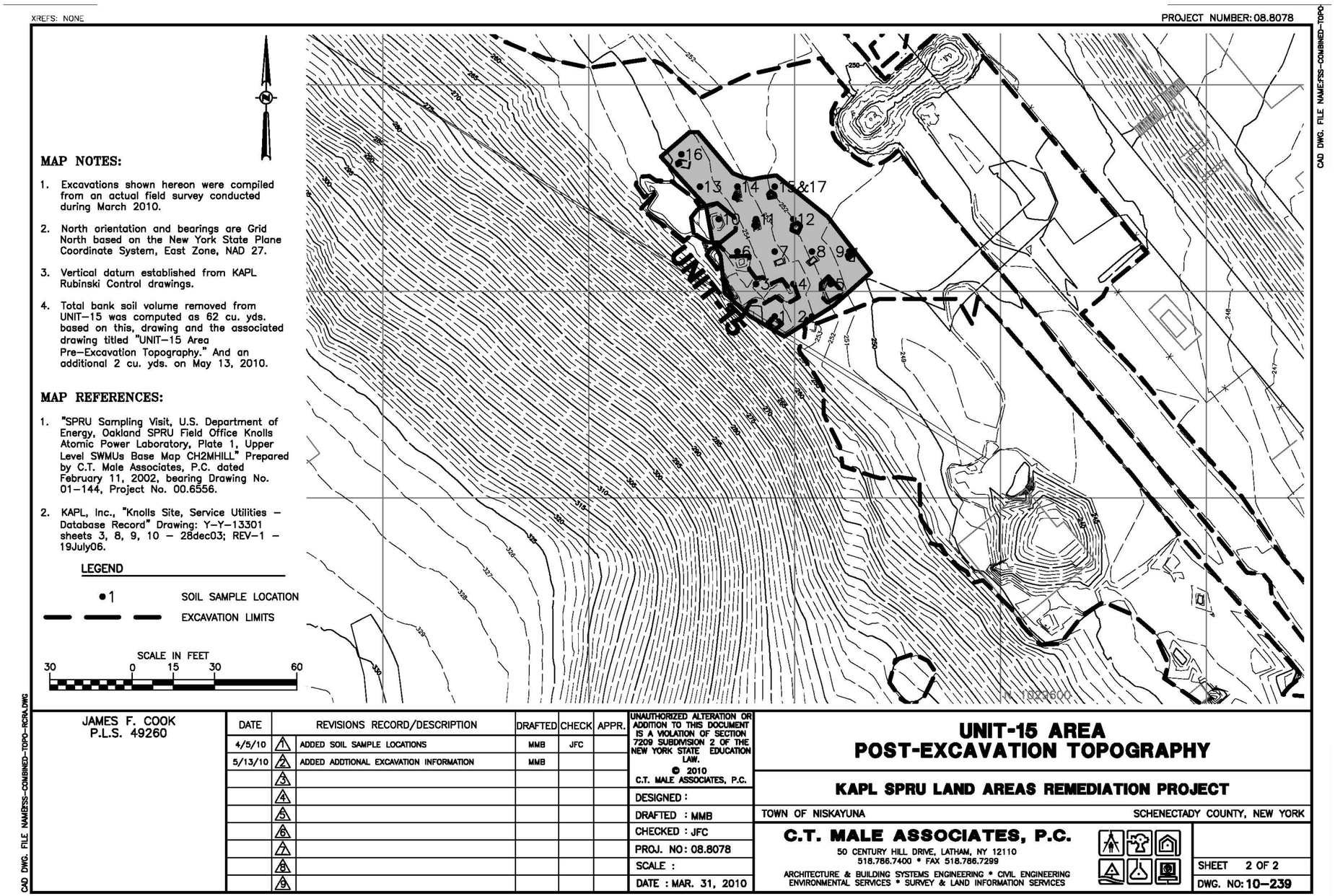

Figure 3 Unit 15 excavation area post-excavation topography

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008.

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, New York State Department of Environmental Conservation, March 9, 2006.

NYSDEC, 2008, DEC # 4-4224-00024/00042, "DOE-EM Separations Process Research Unit (SPRU) EPA I.D. #NYR000096859, 6 NYCRR Part 373 Final Permit," New York State Department of Environmental Conservation, October 1, 2008.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels," TAGM 4046.

Portage, 2010a, *SPRU Metals, FSS Unit 15,* SDG# F0C190485 (Portage 2010a) Portage, Inc., April 13, 2010.

Portage, 2010b, *SPRU Metals, FSS Unit 15,* SDG # SFS-R015-003A-M (F0D020550), Portage, Inc., April 27, 2010.

Portage, 2010c, *SPRU Metals, selenium Re-analyses by 6020 for SDG F0C190485 FSS Unit 15*, Portage, Inc., May 6, 2010.

Test America, 2010a, *SPRU LL Final Status Survey Unit 15 Analytical Report*, Project No. 179223, SDG # F0C190485, Rev 1, Test America Laboratories, Inc., St. Louis, Missouri, April 26, 2010.

Test America, 2010b, *SPRU Final Status Survey Unit 15 Analytical Report*, Project No. 179223, SDG # F0D020550, Test America Laboratories, Inc., St. Louis, Missouri, April 15, 2010.

Appendix A

CD-ROM with Electronic Copies of Analytical Reports, Project No. 179223, SDG #F0C190485 and SDG #F0D020550, Unit 15

Appendix B

CD-ROM with Electronic Copies of Data Limitations and Validation Reports SDG #F0C190485 and SDG #F0D020550, SPRU Metals Unit 15

Attachment 17

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 16 (ARC-RPT-6029)

Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 16

ARC-RPT-6029
August 2, 2011
Revision 2

DOE Contract No. DE-AM09-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

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Separations Process Research Unit Lower Level Land Areas Interim RCRA ICM Data Report for Final Status Survey Unit 16

Approval for Use

Doug Collins Deputy Project Manager	08/02/11 Date
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Acronyms

aRc	Accelerated Remediation Company, LLC
COC	constituent of concern
FSS-16	Final Status Survey Unit 16
ICM	interim corrective measures
L&V	limitations and validation
NYSDEC	New York State Department of Environmental Conservation
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SCO	soil cleanup objective
SPRU	Separations Process Research Unit
SPRU-LL	Separations Process Research Unit Lower Level
TAL	target analyte list
VOC	volatile organic compound

1.0 Executive Summary

This report documents the completion of the final status survey (FSS) performed by the Accelerated Remediation Company (aRc) at the Separations Process Research Unit (SPRU) Land Areas Unit 16 (called FSS-16) in accordance with requirements specified in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6106) (hereafter referred to as the interim corrective measures [ICM] work plan) and the *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ARC-PLN-6402).

Sample locations were established following completion of the excavation and removal of the soil pile storage area in FSS-16. Systematic sampling locations for Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) constituents of concern (COCs) were determined using the methodology described in the ICM work plan (ARC-PLN-6106). At the request of the New York State Department of Environmental Conservation (NYSDEC) and as outlined in a letter from aRc to the U.S. Department of Energy (O'Hearn 2009) samples were collected for volatile organic compounds (VOCs). Systematic Sample Locations 2, 5, and 9 and judgmental samples collected at Sample Locations 18 and 19 were analyzed for VOCs. All sample locations for VOCs were within the soil staging area where trace amounts of VOCs had been detected as described in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002).

In addition to the FSS-16 sampling, a small portion of SPRU Characterization Grid Unit 1130 in FSS Unit N was included in this report. FSS Unit N (now FSS-17) originally did not require sampling for metals. However, a small portion in FSS Unit N was determined to require sampling for metals. The area is located outside the Lower Level staging area and is designated Subunit N-1. FSS N was set up using the random-start triangular pattern grid system for radiological systematic sampling used by all of the FSS units. One sample location from the systematic sample design for FSS Unit N fell within Subunit N-1 and was sampled for RCRA metals. The data from Subunit N-1 are captured in this report.

Eighteen soil samples and one field duplicate sample were collected on May 11, 2010, from FSS-16 and Subunit N-1 for target analyte list (TAL) metals. In addition, five samples and one duplicate sample were collected for VOCs analyses. All samples were sent for offsite laboratory analysis by Test America Laboratories, Inc., St. Louis, Missouri.

During review of preliminary laboratory data, it was determined that Sample Location 11 had a concentration of 1.1 mg/kg mercury, which is greater than the soil cleanup objective (SCO) of 0.73 mg/kg. As detailed in the ICM work plan (ARC-PLN-6106), additional excavation of the failed confirmation sample location consisted of a 20-ft radius around the sample location being excavated an additional 12 in. in depth. The required excavation and re-sampling of this area occurred on June 2, 2010.

All COCs subject to RCRA requirements analyzed for in FSS-16 had concentrations below the corresponding SCOs.

2.0 Introduction

SPRU is located on the Knolls Atomic Power Laboratory at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU Lower Level (SPRU-LL) land areas known as the Railroad Staging Area is being addressed under RCRA, and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC

§ 9601 et seq.). The NYSDEC is overseeing cleanup of chemical contamination at the SPRU-LL under the RCRA corrective action program. The ICM work plan (ARC-PLN-6106) was developed in accordance with the requirements of Title 6, New York Code of Rules and Regulations, Part 373, "Hazardous Management Permit" (NYSDEC 2006a), and provides the cleanup approach for the SPRU-LL.

The objectives of the ICM work plan (ARC-PLN-6106), as recommended in the SPRU *RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and as agreed to by NYSDEC via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006b), are to remove soil contaminated with COCs associated with SPRU waste releases that are above SCOs and to achieve a no further action determination from the NYSDEC for chemicals in the SPRU-LL land areas. This report documents completion of FSS-16 in accordance with the ICM work plan (ARC-PLN-6106) and quality assurance project plan (QAPjP) (ARC-PLN-6402). Figure 1 shows the location of FSS-16 in the SPRU-LL land areas.

Figure 1 Final Status Survey Unit 16 location in the SPRU Lower Level land areas

3.0 Sampling Activities

3.1 Sampling Location

FSS-16 occupies Characterization Grid Units 1126, 1127, 1129, 1130, 1124, a small portion of 1128, and a portion of the L5 revetment area to the south of Grid 1126 not included in any SPRU grid unit. Figure 1 shows the SPRU-LL land area with FSS-16 highlighted. Figure 2 shows details of FSS-16 and Subunit N-1, most notably its boundaries, sample locations, and pertinent surface features. Soil sampling locations for chemical COCs were determined using the methodology described in the RCRA ICM work plan (ARC-PLN-6106). Sample density for the radiological confirmation sampling was determined to be a minimum of 16 samples per FSS unit. The methodology described in the RCRA ICM work plan determined the need for a minimum of 12 samples for RCRA COCs. Therefore, to expedite sampling, the same 16 systematic radiological sampling locations were used to collect RCRA samples.

In addition to the FSS-16 sampling, a small portion of SPRU Characterization Grid Unit 1130 in FSS Unit N was included in this report. FSS Unit N (now FSS-17) originally did not require sampling for metals. However, a small portion in FSS N was determined to require sampling for metals. The area is located outside the Lower Level staging area and is designated Subunit N-1. FSS N was set up using the random-start triangular pattern grid system for radiological systematic sampling used by all of the FSS units. One sample location from the systematic sample design for FSS Unit N fell within Subunit N-1 and was sampled for RCRA metals. The data from Subunit N-1 are captured in this report.

Systematic samples are so named because they are obtained on a systematic pattern to provide uniform coverage of the survey unit. The initial location of the first sample was chosen randomly, with subsequent samples located systematically on a triangular pattern 39 ft from each other. Figure 2 shows the sample locations at FSS-16.

3.2 Sample Collection

Sixteen systematic samples, one judgmental sample, and one field duplicate soil sample from FSS-16, as well as one sample from Subunit N-1, were collected for metals analyses on May 11, 2010. At each location, a soil sample approximately 6 in. deep by 6 in. in diameter was collected and transferred to appropriate sample containers. In addition, two sample locations were sampled on May 11, 2010, and three locations were sampled on May 12, 2010, for VOC analysis. All of the VOC samples were collected as grab samples at a depth below 6 in. All systematic sample locations were collected and analyzed for total metals. In addition, systematic Sample Locations 2, 5, 9 and judgmental samples collected at Sample Locations 18 and 19 were analyzed for VOCs. However, at Sample Location 18 a sample for metals analyses was inadvertently collected and analyzed by the laboratory; the additional data resulting from that sample is reported in this document. The soil samples collected for VOC analyses were grab samples taken directly from each sample location after the soil was removed for metals analysis. These samples were placed directly into pre-cleaned, laboratory-supplied 125-mL glass containers, with samplers completely filling jars to minimize headspace. Descriptions of the sample matrix were recorded at the time of sampling and are listed in Table 1.

During review of preliminary laboratory data, it was determined that Sample Location 11 had a concentration of 1.1 mg/kg mercury, which is greater than the SCO of 0.73 mg/kg. As detailed in the ICM work plan (ARC-PLN-6106), additional excavation of the failed confirmation sample location consisted of a 20-ft radius around the sample location being excavated an additional 12 in. in depth. The required excavation and re-sampling of this area occurred on June 2, 2010. Analytical results of the re-sampling indicated all COCs subject to RCRA requirements had concentrations below the corresponding SCOs.

Following collection, the soil samples for chemical analyses were placed under custody seal in a cooler and kept chilled, and the remaining samples were transferred under chain of custody to the onsite radiological laboratory for gamma analysis. When the gamma analysis indicated that samples could be shipped, all RCRA samples were transferred, following chain-of-custody procedures outlined in the QAPjP, to Test America Laboratories, Inc., an offsite analytical laboratory.

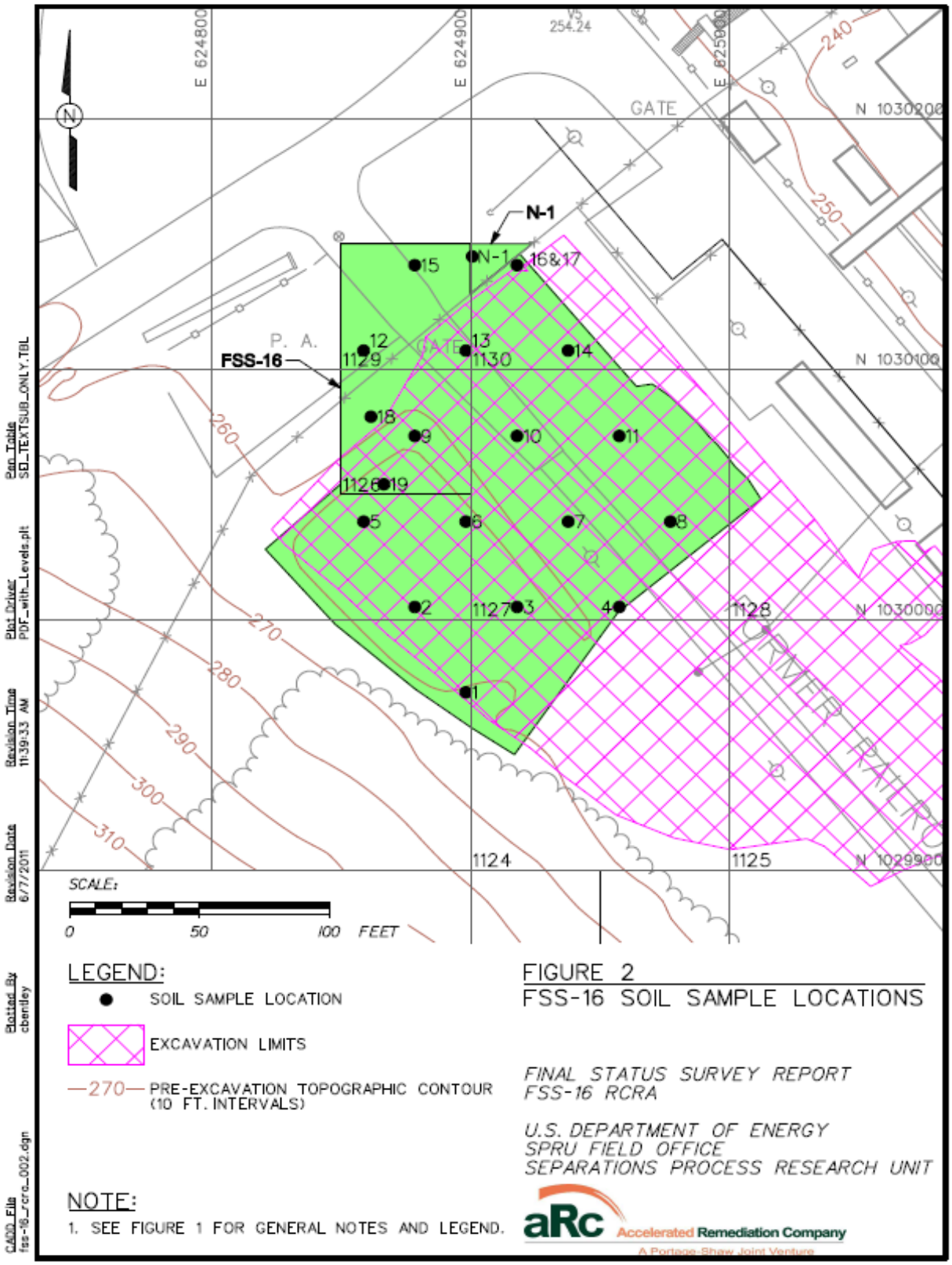

Figure 2 FSS-16 soil sample locations

Table 1 Soil sample description

Sample ID	Map Location(s)	Sample Description
SFS-016-001-M	1	Brown hard pan
SFS-016-002-M & V	2	Brown clay, very wet
SFS-016-003-M	3	Brown hard pan
SFS-016-004-M	4	Brown gravel/clay, very wet
SFS-016-005-M & V SFS-016-005A-V	5	Brown, hard gravel. SFS-016-005A-V is a field duplicate of SFS-016-005-V for VOCs
SFS-016-006-M	6	Brown hard pan
SFS-016-007-M	7	Brown top soil
SFS-016-008-M	8	Dark brown silt
SFS-016-009-M & V	9	Brown hard pan
SFS-016-010-M,	10	Brown clay /fill material
SFS-016-011-M	11	Brown sand/gravel
SFS-016-012-M	12	Gravel/ gray clay mix
SFS-016-013-M	13	Gray till/clay mix
SFS-016-014-M	14	Brown top soil
SFS-016-015-M	15	Brown/gray clay and gravel mix
SFS-016-016-M SFS-016-017-M	16 & 17	SFS-016-017-M is the duplicate of SFS-016-016-M. Brown top soil
SFS-016-018-M & V	18	Black top soil
SFS-016-019-V	19	Brown hard pan
SFS-N1-001-M	N-1	Dark brown top soil

4.0 Sample Analysis

4.1 Analysis

In accordance with the QAPjP (ARC-PLN-6402), samples were analyzed by Test America following U.S. Environmental Protection Agency SW-846 (EPA 2008) protocols for TAL metals. The samples were analyzed for TAL metals in accordance with Methods 6010B, 6020A, 7471A and for VOCs following 8260B. An exception to the QAPjP (ARC-PLN-6402) was analyzing thallium using analytical Method 6020A instead of Method 6010B. Method 6020A was specifically used to analyze for thallium to obtain detection limits with numerical values below the required SCOs stated in ARC-PLN-6402. Table 2 provides the results of the metals analyses. The laboratory analytical reports *SPRU Final Status Survey Unit 16 and Subunit N-1 Analytical Report SPRU/LL*, Project No. 179223, Lot # F0E130473 Rev 1., June 17, 2010 (Test America 2010a); and *SPRU Final Status Survey Unit 16 Analytical Report Metals SPRU/LL*, Project No. 179223, Lot # F0F030436, June 14, 2010 (Test America 2010b), are on a CD-ROM provided as Appendix A with this report.

4.2 Data Validation

Laboratory data were validated internally by Test America in accordance with the QAPjP (ARC-PLN-6402). Independent validation of the TAL metals and VOC data was performed by Portage, Inc., in

accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004) and *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1999), respectively (see Table 3). Validation flags were assigned to reported results based on laboratory performance on the associated quality control analyses. The limitations and validation (L&V) reports, *SPRU Metals, FSS Unit 16,* SDG F0E130473 June 15, 2010 (Portage 2010a); *SPRU Metals, FSS Unit 16,* SDG F0F030436, June 18, 2010 (Portage 2010b); and *SPRU FSS16 VOC analyses,* SDG F0E130473 Rev. 1 (SFS-016-009-V), June 18, 2010 (Portage 2010c); are on the CD-ROM provided as Appendix B with this report. Analytical results reported for metals and the corresponding laboratory and validation flags are shown in Table 2.

Table 2 Summary of metals results from soil samples collected from FSS-16

Sample ID		**SFS-016-001-M**			**SFS-016-002-M**			**SFS-016-003-M**			**SFS-016-004-M**			**SFS-016-005-M**		
FSS Unit		**16**			**16**			**16**			**16**			**16**		
Sample Date		**5/11/2010**			**5/11/2010**			**5/11/2010**			**5/11/2010**			**5/11/2010**		
Analyte	**SCO[a]** mg/kg	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	11300	N		10000	N		9660	N		9900	N		9230	N	
Antimony	1	0.47	B	U	0.90	B		0.53	B	U	0.35	B	U	0.39	B	U
Arsenic	16	7.3	B	U	6.0	B	U	7.2	B	U	8.8	B	U	3.8	B	U
Barium	350	70.4	NE	J	64.1	NE	J	62.2	NE	J	50.9	NE	J	68.3	NE	J
Beryllium	14	0.71	B		0.67	B		0.65	B		0.63	B		0.63	B	
Cadmium	2.5	0.55	U		0.59	U		0.54	U		0.59	U		0.53	U	
Calcium	NA	19300	N		16700	N		13700	N		33600	N		28100	N	
Chromium	36	17.2			14.9			16.0			15.9			14.7		
Cobalt	30	12.7			11.2	B		12.5			9.4	B		11.1		
Copper	270	27.4			27.4			31.8			29.4			27.5		
Iron	NA	29400	N		26700	N		26600	N		27700	N		25400	N	
Lead	400	16.0			15.4			27.1			19.4			17.4		
Magnesium	NA	6980	N		6830	N		6380	N		15600	N		6640	N	
Manganese	2000	630	NE	J	534	NE	J	593	NE	J	413	NE	J	518	NE	J
Mercury	0.73	0.050	E	UJ	0.051	E	UJ	0.066	E	UJ	0.059	E	UJ	0.18	E	J
Nickel	130	26.0	E	J	24.6	E	J	26.6	E	J	24.2	E	J	24.3	E	J
Potassium	NA	952	BN*	J	1130	BN*	J	954	BN*	J	842	BN*	J	865	BN*	J
Selenium	4	0.64	U		0.68	U		0.62	U		0.68	U		0.62	U	
Silver	8.3	0.52	U		0.55	U		0.50	U		0.55	U		0.80	B	
Sodium	NA	104	U		111	U		102	U		111	U		101	U	
Thallium	2	0.27	B	U	0.14	U		0.13	U		0.14	U		0.35	B	U
Vanadium	150	23.2			21.7			22.0			24.4			22.1		
Zinc	2200	75.1			73.8			88.4			116			69.8		

Table 2 (continued)

Sample ID		**SFS-016-006-M**			**SFS-016-007-M**			**SFS-016-008-M**			**SFS-016-009-M**			**SFS-016-010-M**		
FSS Unit		**16**			**16**			**16**			**16**			**16**		
Sample Date		**5/11/2010**			**5/11/2010**			**5/11/2010**			**5/11/2010**			**5/11/2010**		
Analyte	**SCO[a]** mg/kg	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	6850	N		7000	N		9220	N		9030	N		7830	N	
Antimony	1	0.61	B	U	0.32	B	U	0.35	B	U	0.34	B	U	0.24	B	U
Arsenic	16	6.1		U	4.8		U	6.3		U	6.1	B	U	6.0		U
Barium	350	50.9	NE	J	93.9	NE	J	57.3	NE	J	64.9	NE	J	45.3	NE	J
Beryllium	14	0.52	B		0.74	B		0.63	B		0.73	B		0.61	B	
Cadmium	2.5	0.10	U		0.12	U		0.12	U		0.53	U		0.11	U	
Calcium	NA	75400	N		77500	N		6520	N		28600	N		47600	N	
Chromium	36	11.6			24.4			18.6			25.5			11.8		
Cobalt	30	8.0	B		29.5			9.3	B		13.1			7.3	B	
Copper	270	20.9			74.4			26.4			35.4			19.8		
Iron	NA	17900	N		19600	N		22300	N		25300	N		21300	N	
Lead	400	12.7			78.5			47.3			25.1			11.4		
Magnesium	NA	8060	N		31200	N		5320	N		10300	N		20100	N	
Manganese	2000	397	NE	J	464	NE	J	476	NE	J	472	NE	J	818	NE	J
Mercury	0.73	0.072	E	J	0.042	E	UJ	0.12	E	J	0.11	E	J	0.040	E	UJ
Nickel	130	18.7	E	J	45.8	E	J	22.1	E	J	24.1	E	J	15.9	E	J
Potassium	NA	917	BN*	J	1150	BN*	J	839	BN*	J	756	BN*	J	791	BN*	J
Selenium	4	0.60	U		0.71	U		0.71	U		0.62	U		0.64	U	
Silver	8.3	0.49	U		0.57	U		0.57	U		0.58	B		0.52	U	
Sodium	NA	98.3	U		356			115	U		100	U		104	U	
Thallium	2	0.12	U		0.14	U		0.14	U		0.12	U		0.13	U	
Vanadium	150	16.3			26.2			25.5			20.5			32.8		
Zinc	2200	57.2			253			88.0			100			54.8		

Table 2 (continued)

Sample ID		**SFS-016-011A-M**			**SFS-016-012-M**			**SFS-016-013-M**			**SFS-016-014-M**			**SFS-016-015-M**		
FSS Unit		**16**			**16**			**16**			**16**			**16**		
Sample Date		**6/02/2010**			**5/11/2010**			**5/11/2010**			**5/11/2010**			**5/11/2010**		
Analyte	**SCO[a]** mg/kg	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	8370	N		6820	N		8690	N		8450	N		7210	N	
Antimony	1	0.59	BN	U	0.19	B	U	0.20	B	U	0.33	B	U	0.26	B	U
Arsenic	16	5.2	B		4.5		U	6.5	B	U	4.7		U	4.1		U
Barium	350	56.1	NE	J	37.7	NE	J	46.9	NE	J	52.6	NE	J	30.0	NE	J
Beryllium	14	0.56			0.52	B		0.65	B		0.57	B		0.50	B	
Cadmium	2.5	0.56	U		0.11	U		0.54	U		0.18	B		0.11	U	
Calcium	NA	21600	N*	J	13900	N		17300	N		5540	N		49500	N	
Chromium	36	16.4	E	J	19.3			12.6			15.1			9.9		
Cobalt	30	9.6	E		7.2	B		7.3	B		8.9	B		5.5	B	
Copper	270	102	NE	J	22.8			20.1			23.2			14.4		
Iron	NA	25300	N		19900	N		23400	N		21500	N		17100	N	
Lead	400	25.6			8.9			9.8			55.2			8.8		
Magnesium	NA	7460	N*		4970	N		5780	N		4820	N		8410	N	
Manganese	2000	464	NE	J	501	NE	J	592	NE	J	395	NE	J	487	NE	J
Mercury	0.73	0.21			0.041	E	UJ	0.038	E	UJ	0.17	E	J	0.021	BE	UJ
Nickel	130	25.1	E	J	24.2	E	J	15.4	E	J	22.4	E	J	12.4	E	J
Potassium	NA	710	N	J	714	UN*		868	BN*	J	804	UN*		740	UN*	
Selenium	4	3.2	U		0.61	U		0.62	U		0.69	U		0.63	U	
Silver	8.3	0.26	U		0.50	U		0.50	U		0.56	U		0.51	U	
Sodium	NA	52.4	U		580			101	U		112	U		226		
Thallium	2	0.70	B	U	0.12	U		0.12	U		0.14	U		0.13	U	
Vanadium	150	34.0	E		17.0			24.4			25.0			18.3		
Zinc	2200	89.1			57.6			57.2			92.3			44.6		

Table 2 (continued)

Sample ID		**SFS-016-016-M**			**SFS-006-017-M[b]**			**SFS-016-018-M**			**SFS-N1-001-M**		
FSS Unit		**16**			**16**			**16**			**Subunit N-1**		
Sample Date		**5/11/2010**			**5/11/2010**			**5/11/2010**			**5/11/2010**		
Analyte	**SCO[a]** mg/kg	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V	Results mg/kg	L	V
Aluminum	NA	8460	N		7480	N		8340	N		8090	N	
Antimony	1	0.41	B	U	0.41	B	U	0.31	B	U	0.40	B	U
Arsenic	16	5.3	B	U	10.0	B	U	4.9		U	8.0	B	U
Barium	350	50.2	NE	J	48.4	NE	J	64.2	NE	J	55.2	NE	J
Beryllium	14	0.56	B		0.56	B		0.64	B		0.58	B	
Cadmium	2.5	0.57	U		0.57	U		0.13	U		0.61	U	
Calcium	NA	8940	N		10500	N		10000	N		12100	N	
Chromium	36	13.5			14.4			13.1			16.1		
Cobalt	30	10.1	B		9.8	B		9.3	B		10.5	B	
Copper	270	25.6			28.2			23.7			25.8		
Iron	NA	23100	N		25700	N		20900	N		27200	N	
Lead	400	27.2			24.8			58.1			24.0		
Magnesium	NA	6270	N		5700	N		6310	N		7040	N	
Manganese	2000	467	NE	J	542	NE	J	500	NE	J	629	NE	J
Mercury	0.73	0.091	E	J	0.080	E	J	0.13	E	J	0.077	E	J
Nickel	130	23.4	E	J	22.0	E	J	21.7	E	J	23.5	E	J
Potassium	NA	820	BN*	J	906	BN*	J	876	UN*		1060	BN*	J
Selenium	4	0.66	U		0.66	U		0.75	U		0.71	U	
Silver	8.3	0.53	U		0.54	U		0.61	U		0.57	U	
Sodium	NA	107	U		108	U		122	U		965		
Thallium	2	0.13	U		0.13	U		0.15	U		0.14	U	
Vanadium	150	21.2			26.4			25.0			27.7		
Zinc	2200	83.4			79.5			74.3			81.3		

Table 2 (continued)

Notes: a. The soil cleanup objective (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8 (NYSDEC 2006a), for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.
b. SFS-016-017-M is the field duplicate of sample SFS-016-016-M.
c. SFS-N1-001-M is from a small portion of Grid Unit 1130. Because Unit N is not being sampled for RCRA metals, the data from Subunit N-1 are being reported with this interim report.

NA = not applicable.
mg/kg = milligrams per kilogram.

L = Laboratory flags:
U = The analyte was analyzed for but not detected. The reported concentration is the method detection limit.
B = Result is between the method detection limit and the reporting limit.
E = Serial dilution percent recovery not within limits.
N = Spike analyte recovery outside stated control limits.
* = Relative percent difference is outside stated control limits.
V = Validation flags:
J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.
UJ = The material was analyzed for but was not detected. The quantitation limit is an estimated quantity.

Table 3 VOC results for FSS-16

Sample ID		**SFS-016-002-V**			**SFS-016-005-V**			**SFS-016-005A-V**			**SFS-016-009-V**			**SFS-016-018-V**			**SFS-016-019-V**			**SFS-TB16-001-V**		
Sample Date	**SCO[a]**	**5/11/2010**			**5/11/2010**			**5/11/2010**			**5/12/2010**			**5/12/2010**			**5/12/2010**			**5/12/2010**		
Parameter	**(mg/kg)**	(mg/kg)	L	V	(mg/kg)	L	V	(mg/kg)	L	V	(mg/kg)	L	V	(mg/kg)	L	V	(mg/kg)	L	V	(mg/L	L	V
1,1,1-Trichloroethane	0.68	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	U	
1,1,2,2-Tetrachloroethane	0.60	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	
1,1,2-Trichloroethane	NA	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	
1,1-Dichloroethane	0.27	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	U	
1,1-Dichloroethene	0.33	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	U	
1,2-Dichloroethane	0.02	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	
1,2-Dichloropropane	NA	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	
2-Butanone	0.12	0.024	U	R	0.025	U	R	0.024	U	R	0.022	U	R	0.024	U	R	0.021	U	R	0.0050	U	R
2-Hexanone	NA	0.024	U		0.025	U		0.024	U		0.022	U		0.024	U		0.021	U		0.0050	U	
4-Methyl-2-pentanone	1.0	0.024	U		0.025	U		0.024	U		0.022	U		0.024	U		0.021	U		0.0050	U	
Acetone	0.05	0.024	U	R	0.025	U	R	0.024	U	R	0.022	U	R	0.024	U	R	0.021	U	R	0.0012	U	R
Benzene	0.06	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	U	
Bromodichloromethane	NA	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	UJ
Bromoform	NA	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	
Bromomethane	NA	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	J B	UJ
Carbon disulfide	2.7	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0020	U	
Carbon tetrachloride	0.76	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	U	UJ
Chlorobenzene	1.1	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	J B	U
Chloroethane	1.9	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0020	U	
Chloroform	0.37	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	U	
Chloromethane	NA	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0020	U	
cis-1,2-Dichloroethene	0.25	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	U	UJ
cis-1,3-Dichloropropene	NA	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	
Dibromochloromethane	NA	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	
Ethylbenzene	1.0	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	U	
Methylene chloride	0.05	0.0058	J	J	0.0053	J	J	0.0049	J	J	0.0045	J	J	0.005	J	J	0.0050	J	J	0.0015	B	U
Styrene	NA	0.006	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	J B	U
Tetrachloroethene	1.3	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	U	UJ
Toluene	0.70	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0010	J B	U
trans-1,2-Dichloroethene	0.19	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	
trans-1,3-Dichloropropene	NA	0.0060	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0010	U	
Trichloroethene	0.47	0.012	J B	U	0.012	U		0.012	J B	U	0.011	U		0.012	J B	U	0.010	J B	U	0.0010	U	U
Vinyl chloride	0.02	0.006	U		0.0062	U		0.0061	U		0.0055	U		0.0061	U		0.0052	U		0.0020	U	
Xylenes (total)	1.6	0.012	U		0.012	U		0.012	U		0.011	U		0.012	U		0.010	U		0.0050	U	UJ

Notes: a. The soil cleanup objective (mg/kg) is the more stringent guideline under Title 6, New York Code of Rules and Regulations, Part 375-6.8 (NYSDEC 2006a), for the protection of groundwater or residential exposure, or Technical and Administrative Guidance Memorandum 4046 (O'Toole 1994) when Part 375-6 does not reference a value.
b. SFS-016-005A-V is the field duplicate of sample SFS-016-005-V.
c. SFS-TB16-001-V is a trip blank sample collected for quality control purposes.

L = Laboratory flags:
U = The analyte was analyzed for but was undetected. The reported value is the quantitation limit.
B = Compound is found in the associated blank as well as in the sample.
J = The analyte was positively detected and the reported concentration is below the quantitation limit.

V =Validation flags:
J = Estimated value. The analyte was positively identified in the sample, but the reported value may not be an accurate representation of the concentration actually present in the sample.
U = Undetected. The reported concentration was determined to be a false positive based on associated laboratory blank analyses.
UJ = The material was analyzed for but was not detected. The quantitation limit is an estimated quantity.
R = Rejected.

5.0 Data Quality Assessment

Data quality was examined to ensure adequacy for decision-making purposes, and sample results were compared to the corresponding SCOs.

5.1 Evaluation of Data Quality

One field sample for metals analyses and one field sample for VOC analyses were each collected in duplicate. Acceptable field precision was demonstrated by relative percent difference between field duplicate results less than 50% for analytes with concentrations greater than the associated quantitation limit.

During validation of the metals data, the positive results reported for arsenic in all samples excluding SFS-016-011A-M; antimony in all samples excluding SFS-016-002-M; and thallium in samples SFS-016-001-M, SFS-016-005-M, and SFS-016-011A-M; were identified as false positives based on detections in the associated blank analyses and have been qualified accordingly as undetected values with a "U" flag.

The positive results reported for mercury in samples SFS-016-005-M, SFS-016-006-M, SFS-016-008-M, SFS-016-009-M, SFS-016-014-M, SFS-016-016-M, SFS-016-017-M, SFS-016-018-M, and SFS-N1-001-M have been qualified with a "J" validation flag to denote an estimated concentration based on poor precision in the serial dilution analysis. Mercury was identified as a false positive in all remaining samples due to positive blank detections, and the results have been qualified with a "UJ" validation flag to denote an undetected, estimated value.

All of the remaining validation qualifiers assigned "J" flags (estimated) denote evidence of matrix interference bias in the laboratory quality control results. Neither severe quality control discrepancies nor uncommon interferences for a soil matrix were noted, and the impact of the validation flags on data usability is minimal.

During validation of the volatile organic compound data, the undetected results reported for acetone and 2-butanone were assigned the qualification flag "R" (rejected) based on minimum relative response factors for initial and continuing calibration (Portage 2010c). Although the relative response factors for these compounds were low, both acetone and 2-butanone were detected in the initial calibration analysis and all continuing calibration analyses. Also, the quality control results associated with these samples indicate no bias in the quantitation of these compounds. The solid matrix laboratory control sample associated with this batch of samples (with a known concentration of 50 µg/kg acetone and 2-butanone) had a percent recovery of 91% and 86%, respectively. Had either compound been present in the samples at comparable concentrations to the calibration analyses, a detection would have been made. Therefore, the impact of the response factor on data usability is negligible and the undetected results are adequate for decision making purposes. The results reported for trichloroethene in samples SFS-016-018-V, SFS-016-019-V, SFS-016-002-V, and SFS-016-005A-V were identified as false positives and assigned a "U" (undetected) validation flag based on corresponding positive blank detections. Also, results reported for bromomethane, chlorobenzene, methylene chloride, styrene, and toluene in the trip blank were identified as false positives based on method blank detections and flagged accordingly. All remaining qualifiers are common based on national functional guidelines, and the impact on data usability is minimal.

5.2 Comparison of Data to Site Cleanup Objectives

All COCs subject to RCRA requirements analyzed for in FSS-16 had concentrations below the corresponding SCOs.

6.0 Conclusions

Evaluation of the FSS-16 laboratory data packages (Test America 2010a, 2010b) and the L&V reports (Portage 2010a, 2010b, and 2010c) show the data to be of sufficient quality and quantity for decision-making purposes. All RCRA COCs had concentrations below their corresponding SCOs.

A civil survey of the final excavated surface of FSS-16 was conducted after completion of the FSS efforts, and the data are presented in Figure 3. An estimated total of 530 yd^3 of banked material was removed from FSS-16. No further excavation is recommended at FSS-16.

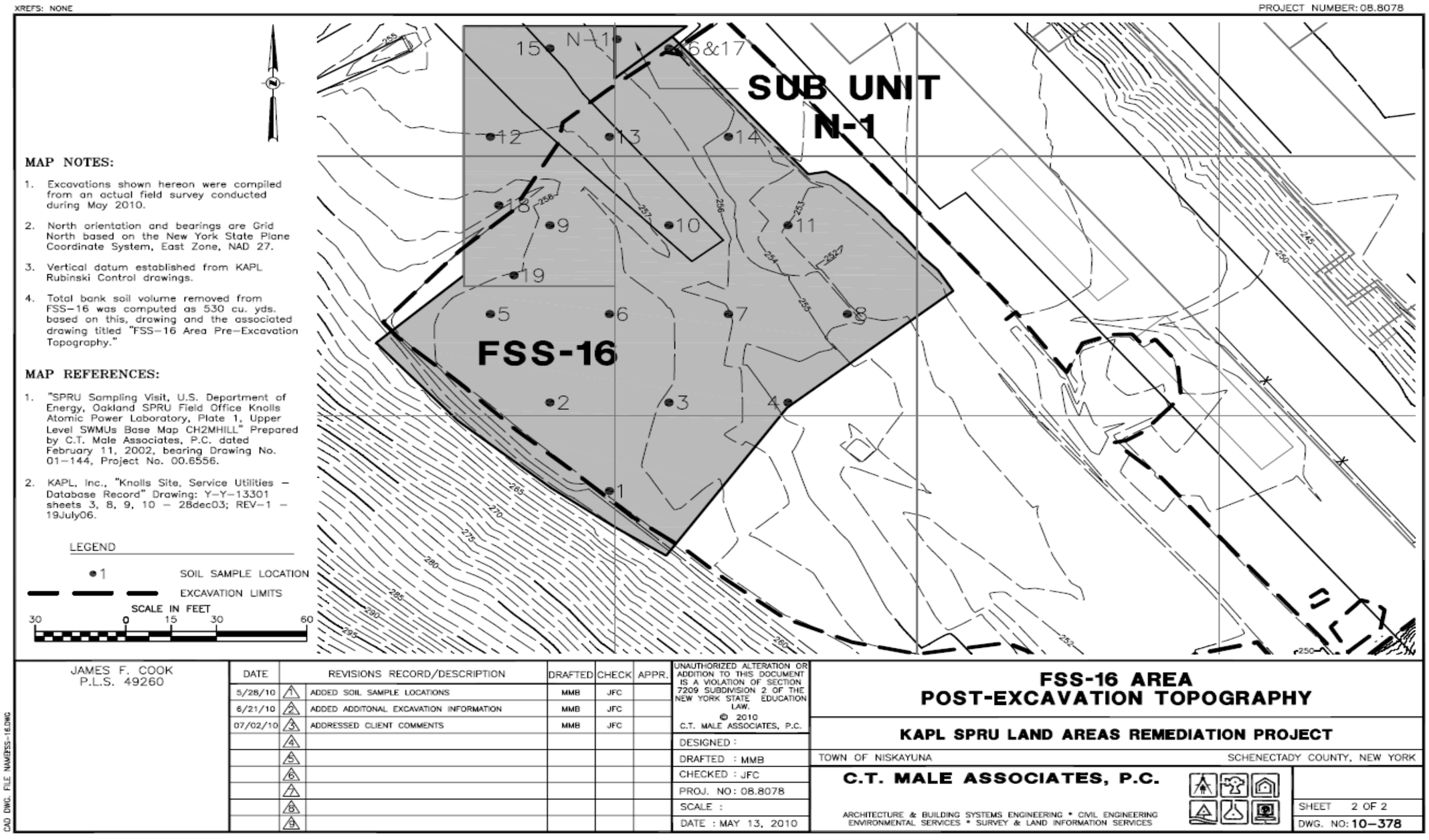

Figure 3 FSS-16 excavation area post-excavation topography

7.0 References

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)," *United States Code*, October 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 1980.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 7, 2008.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Rev. 2, Accelerated Remediation Company, August 2008.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Rev. 1, U.S. Department of Energy, CH2M Hill, February 2002.

EPA, 1999, *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review,* EPA 540/R-99/008, U.S. Environmental Protection Agency, Washington, D.C., October 1999.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-04-004, U.S. Environmental Protection Agency, Washington, D.C., October 2004.

EPA, 2008, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated August 28, 2008.

NYSDEC, 2006a, "Hazardous Management Permit," Title 6, New York Code of Rules and Regulations, Part 373, Subpart 375-6, New York State Department of Environmental Conservation, December 2006.

NYSDEC, 2006b, Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002, New York State Department of Environmental Conservation, March 9, 2006.

O'Hearn, Jack, aRc, to Steven Feinberg, U.S. Department of Energy, September 15, 2009, "Contract No. DE-AM09-05SR22399/Task Order: DE-AT30-07CC60013/SP15 Resubmittal of Confirmation Sampling in SPRU Grid Units 1126, 1129, and 1130," Letter No. LAR-09-112.

O'Toole, Michael J., Jr., NYSDEC Division of Hazardous Waste Remediation, to Regional Hazardous Waste Remediation Engineers, Bureau Directors, and Section Chiefs, January 24, 1994, "Determination of Soil Cleanup Objectives and Cleanup Levels," TAGM 4046.

Portage, 2010a, *SPRU Metals, FSS Unit 16,* SDG F0E130473 Rev 1., June 15, 2010.

Portage, 2010b, *SPRU Metals, FSS Unit 16,* SDG F0F030436, June 18, 2010.

Portage, 2010c, *SPRU FSS16 VOC analyses,* SDG F0E130473 Rev. 1 (SFS-016-009-V), June 18, 2010.

Test America, 2010a, *SPRU Final Status Survey Unit 16 and Subunit N-1 Analytical Report SPRU/LL*, Project No. 179223, Lot # F0E130473 Rev 1., May 28, 2010.

Test America, 2010b, *SPRU Final Status Survey Unit 16 Analytical Report Metals SPRU/LL*, Project No. 179223, Lot # F0F030436, June 14, 2010.

Appendix A
CD-ROM with Electronic Copy of Analytical Report, Project No. 179223, SDG # F0E130473 Rev. 1, and SDG # F0F030436, Final Status Survey Unit 16

Appendix B
CD-ROM with Electronic Copy of
Data Limitations and Validation Reports SDG # F0E130473 Rev. 1, SFS-016-009-V and SDG # F0F030436, Final Status Survey Unit 16

Attachment 18
RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation (ARC-PLN-6106)
(electronic copy)

RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation

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Approval for Use

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Acronyms

AOC	Area of Concern
aRc	Accelerated Remediation Company
CB	Catch Basin
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Constituent of Concern
CY	Cubic Yards
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
ELAP	Environmental Laboratory Approval Program
FY	Fiscal Year
KAPL	Knolls Atomic Power Laboratory
ICM	Interim Corrective Measures
LLPL	Lower Level Parking Lot
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
PAH	Polycyclic Aromatic Hydrocarbon
PPE	Personal Protective Equipment
QAPjP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RSA	Railroad Staging Area
SAP	Sampling and Analysis Plan
SCO	Soil Cleanup Objectives
SPRU	Separations Process Research Unit
SPRU-LL	SPRU Lower Level
SV	Sampling Visit
SWMU	Solid Waste Management Units
SWPPP	Storm Water Pollution Prevention Plan
TAGM	Technical and Administrative Guidance Memorandum
TCE	Trichloroethylene
VOC	Volatile Organic Compound
XRF	X-ray Fluorescence

1.0 Introduction/Objective

The Separations Process Research Unit (SPRU) is located on the Knolls Atomic Power Laboratory (KAPL) at 2425 River Road in Niskayuna, Schenectady County, New York. Chemical contamination in the SPRU lower level land areas known as the railroad staging area (RSA) and the lower level parking lot (LLPL) is being addressed under the Resource Conservation and Recovery Act (RCRA) (42 USC 6901 et seq. 1976) and radiological contamination is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC 9601 et seq. 1980). The New York State Department of Environmental Conservation (NYSDEC) is overseeing cleanup of the chemical contamination at the SPRU Lower Level (SPRU-LL) under the RCRA corrective action program. The U.S. Department of Energy (DOE) is using its authority under the CERCLA non-time critical removal process to pursue cleanup of the SPRU site. A CERCLA Engineering Evaluation and Cost Analysis has been issued, presented to the public, and DOE has selected the preferred alternatives (DOE 2006). This Interim Corrective Measures (ICM) Work Plan is limited to RCRA chemical remediation and any reference to radiological contamination is for informational purposes only. This RCRA ICM Work Plan was developed in accordance with the 6 New York Code of Rules and Regulations (NYCRR) Part 373 Hazardous Management Permit requirements.

DOE has considered potential future uses at the KAPL site and evaluated the residual chemical and radiological contamination to develop remedial action objectives for the SPRU-LL. These objectives include: (1) restoring the SPRU land areas to a state suitable for reuse by KAPL in an area zoned for industrial and research use, (2) reducing surveillance and maintenance costs, and (3) reducing or eliminating the potential for future radiological and chemical releases from SPRU-LL (DOE 2006). The 6 NYCRR Part 375-6.8(b) soil cleanup objectives (SCOs) have been promulgated for residual chemical contamination in soil based on a site's reasonably foreseeable future use. DOE's proposed SCOs are described in Section 2 of this Work Plan. DOE seeks to obtain a "no-further-action" determination from the NYSDEC for chemicals attributed to waste releases from SPRU in the lower level area. Cleanup goals for radiological contamination are based on DOE Order 5400.5, "Radiation Protection of the Public and the Environment."

To meet these objectives in the SPRU-LL land areas, DOE will remove chemical and radiological contamination left in the soils impacted by the former SPRU operations. DOE will follow a three-step excavation process that includes: (1) an initial survey, (2) excavation, and (3) resurvey to compare the excavated surface against cleanup goals. Once the resurvey indicates that the surface is potentially compliant with the cleanup goals, confirmation sampling will be performed.

1.1 Physical Setting and Site Description

KAPL is owned by the U.S. government and operated by KAPL, Inc., a Lockheed Martin company, for the U.S. DOE, Naval Reactors Laboratory Field Office-Schenectady. The KAPL site mission to design and develop nuclear-powered reactors for naval propulsion is expected to continue indefinitely. SPRU research and development activities were not associated with or used for the Naval Nuclear Propulsion Program.

KAPL is located in the Town of Niskayuna, Schenectady County, New York, on the southern bank of the Mohawk River. It consists of 170 acres, located mostly on a bluff approximately 115 to 120 feet (ft) above the Mohawk River surface (Figure 1). Along the northern margin of the KAPL site, the land surface slopes steeply to a natural bench about 15 to 20 ft above the river's surface.

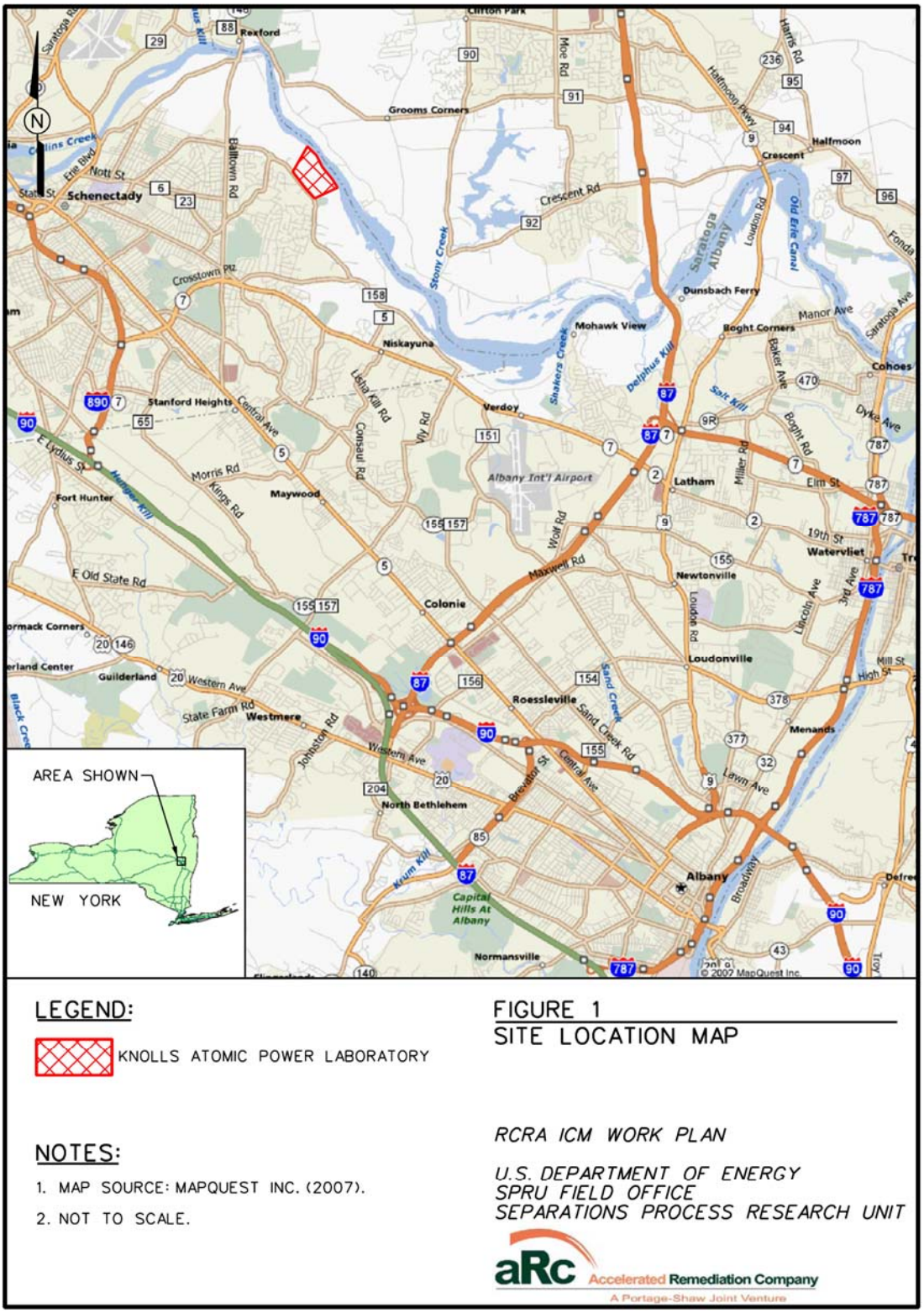

Figure 1 Site location map

The KAPL site, which fronts approximately 4,200 ft of the river, is bounded to the north and east by the Mohawk River; to the south by a mixture of open land, parks, and the town of Niskayuna's closed municipal landfill; to the west and southwest by a low-density suburban residential area; and to the west and northwest by an industrial research center.

The SPRU facilities were constructed in the late 1940s to research the chemical separation of plutonium and uranium. SPRU operated between February 1950 and October 1953, after which research activities ceased following successful development of reduction oxidation and plutonium uranium extraction processes. These processes were subsequently used by Hanford and the Savannah River sites. Research was performed on a laboratory scale; SPRU was never a production plant. Decommissioning of SPRU began in October 1953 and continued through the 1990s. The SPRU facilities and land areas are currently maintained in a safe condition and are subject to a surveillance and maintenance program.

The SPRU-LL associated with this project is located on approximately 24 acres in the northwest corner of the KAPL site referred to as the lower level area (Figure 2). The lower level consists of two distinct areas (i.e., RSA and LLPL). The RSA contains four solid waste management units (SWMUs): the Former K6 Storage Pad (SWMU-036), Former K7 Storage Pad (SWMU-037), RSA (SWMU-038), and the K5 Retention Basin (SWMU-040). The LLPL comprises the area of concern (AOC) (AOC-003). The lower level area extends along the parking lot and old railroad spur within the bench between the lower level facility area and the hill slope rising up to the Knolls Site upper level. The eastern portion of the lower level area is primarily a grassy surface with asphalt roadways bisecting the area along the east-west and north-south axes. The western portion of the lower level area consists of an asphalt parking lot.

The entire KAPL facility is surrounded with a fence with a minimum height of 8 ft (7-ft-high chain link topped with three strands of barbed wire). Access is controlled through continuously guarded gates. Entrance is restricted to authorized personnel, contractors, and visitors. The RSA area is surrounded with a variable height chain link fence with a minimum height of 8 ft. Personnel gates at the top of the hillside and eastern security fence currently allow pedestrian traffic between KAPL buildings.

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1.1.1 Regional Geology

Most of the KAPL site is located on the upper level bluff approximately 115 to 120 ft above the Mohawk River surface. Along the northern margin of the KAPL site, the land surface slopes steeply to a natural bench comprising the lower level that is approximately 15 to 20 ft above the river's surface.

The geology underlying the site consists of unconsolidated overburden materials overlying bedrock. Bedrock at the lower level is at depths of approximately 5 to 20 ft below existing grade elevations. Bedrock underlying KAPL is mapped as the Upper-Middle Ordovician aged Schenectady Formation, which comprises a series of alternating beds of graywacke, sandstone, siltstone, and shale about 2,000 ft thick, dipping gently to the west and southwest. The Schenectady Formation is underlain by the Canajoharie shale, which is a dark gray to black, thinly bedded, fissile shale.

The unconsolidated materials at the KAPL site consist mainly of glacial deposits. The till, which directly overlies the bedrock at most locations, consists of a grayish-blue, dense, compact till. This is known as

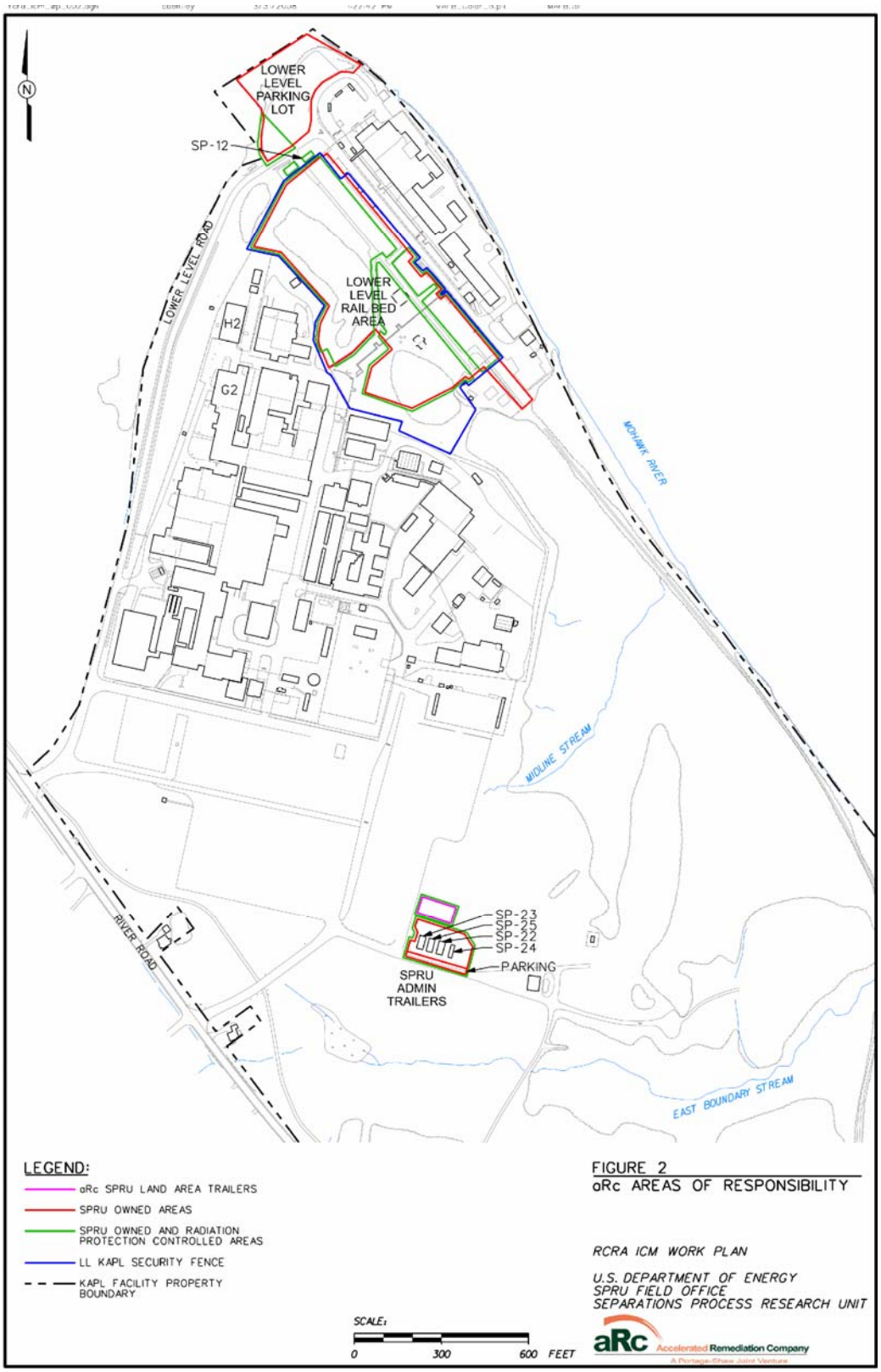

Figure 2 aRc areas of responsibility

the Mohawk Till, which is commonly referred to as gray till. The gray till extends from the bedrock typically to within 10 to 15 ft of the ground surface, where the gray till transitions into a yellowish-brown till, commonly referred to as brown till. The brown till originally was thought to be a separate depositional sequence from the gray till. However, evidence suggests that the brown till is the weathered surface of the gray till. Occasional lenses of graded material, usually fine sand, exist within the till. In areas of the KAPL site where construction and site development has occurred, the uppermost portion of the brown till has been removed and replaced as fill where needed. In some areas, excavations penetrated into the gray till, which was removed and reused as fill where needed. Additional detail is provided in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002), and the *Task IV RCRA Facility Investigation Report for Groundwater Upper and Lower Levels Separations Research and Process Unit* (DOE/CH2M HILL 2006a).

1.1.2 General Hydrogeology

The groundwater resources at the KAPL site are limited because of the low permeability of the bedrock and unconsolidated deposits. The predominant unconsolidated deposits are composed of brown and gray till with occasional lenses of graded material, usually fine sand, within the till. Overlying the till in some areas are thin glacial lake sequences (silts and clays) and discontinuous ice-contact deposits (sand and gravel). Consequently, there are no principal or primary bedrock or overburden aquifers underlying the KAPL site for development as commercial or public water supplies. The gray till is of very low permeability except for the occasional lenses of fine sand, which are capable of transmitting small quantities of water. Based on drilling records, these lenses are small in both vertical and horizontal extent and are isolated from one another. Over most of the KAPL site, the gray till aquaclude serves as the base of the unconfined hydrogeologic unit. Exceptions are portions of the lower level where the gray till is absent or thinned due to scour from the Mohawk River. The brown till is also relatively impermeable; however, water can percolate through the brown till, as indicated by perched water at the brown till/gray till contact. In the horizontal shales and sandstones of the Schenectady Formation, groundwater is found in the bedrock fractures, joints, and bedding planes, and in the upper portions of the bedrock where it interfaces with the unconsolidated deposits. These shales and sandstones are characteristically nonporous and of very low impermeable, and they form poor aquifers.

The overall sitewide direction of groundwater flow at the KAPL site is generally northeast to the Mohawk River. Based on the low permeability of the bedrock and till, groundwater movement is slow. The movement of perched groundwater on the gray till mirrors the topography of the top of the till surface. The topography of the gray till is similar to the natural topography of the landscape where it has not been disturbed. In areas where gray till has been excavated for construction of site buildings, utilities, and other facilities, groundwater flow direction and velocities vary, with groundwater preferentially flowing into and along the less compact and more permeable backfill material. Addition detail is provided in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002), and the *Task IV RCRA Facility Investigation Report for Groundwater Upper and Lower Levels Separations Research and Process Unit* (DOE/CH2M HILL 2006a).

1.1.3 Surface Water

Three streams drain directly into the Mohawk River from the KAPL site. The East Boundary Stream is located on the KAPL site between the closed Knolls and Niskayuna Landfills and receives drainage from the southeastern portion of the land area. The Midline Stream drains the central area of the KAPL site and receives only run-off from the KAPL property. The West Boundary Stream, which is located on property adjacent to the KAPL site, receives some surface water run-off from the KAPL site. Run-off from the

lower level SWMUs/AOC flows to the Mohawk River via storm sewers or, in the case of the northwestern parking lot, directly into the West Boundary Stream and the Mohawk River. Addition detail is provided in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002), and the *Task IV RCRA Facility Investigation Report for Groundwater Upper and Lower Levels Separations Research and Process Unit* (DOE/CH2M HILL 2006a).

1.2 Historical Information Review

Several investigations and radiological contamination surveys of the site have been conducted. These investigations are summarized and site characterization data are included in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002), the *Task IV RCRA Facility Investigation Report for Groundwater Upper and Lower Levels Separations Research and Process Unit* (DOE/CH2M HILL 2006a), the *SPRU Radiological Characterization Report* (DOE/CH2M HILL 2006b), and the *Amendment to K-5 Retention Basins* (DOE/LATA/SHARP 2007).

The SPRU RCRA Facility Assessment (RFA) sampling visit (SV) was conducted from October 2000 through July 2001 to assess whether a release of hazardous waste or constituents was occurring or had occurred from eight SWMUs and one AOC associated with historical SPRU operations. Four of the SWMUs and one AOC are located in the lower area (Figure 3). Chemical data were generally collected from three depth intervals at each boring. The number of soil borings, general depth of the soil borings, and number of soil samples collected during the RFA SV in the lower land area are as follows: 103 borings, 0–6 ft, collecting 250 samples. Figure 4 shows the results from several boreholes where constituents of concern (COCs) were found above SCOs.

The SV Report identified specific gaps in the RCRA corrective action characterization involving groundwater in the Lower Levels. These were evaluated and are addressed in the RCRA Facility Investigation (RFI) (DOE/CH2M HILL 2006a). The RFI focused primarily on groundwater and the transfer of contaminants from soil to groundwater in the upper and lower levels. Based on the results of the RFI, no further action was recommended for groundwater in the Lower Level.

Figure 3 also shows the DOE voluntary cleanup area that includes metals and polycyclic aromatic hydrocarbon (PAH) contamination associated with the former rail line. The boundaries of the voluntary cleanup area were defined based location of railroad construction materials identified in the SV Report (DOE/CH2M HILL 2002). The report noted that the railroad construction materials coincide with the lineation of the railbed. The voluntary cleanup area runs the length of the railbed, approximately 10 ft to the southwest of the railbed centerline and to the SPRU security fence on the northeast. The COCs associated with the railroad construction are antimony, arsenic, copper, lead, and PAHs.

Investigation results, along with conclusions and recommendations, were submitted to NYSDEC in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002), which was approved by NYSDEC in February 2006 (Rogers 2006). Results of the RFA SV for the lower land area are summarized below. Detailed analysis is provided in the *Task IV RCRA Facility Investigation Report for Groundwater Upper and Lower Levels* (DOE/CH2M HILL 2006a). The following sections summarize the findings from these reports.

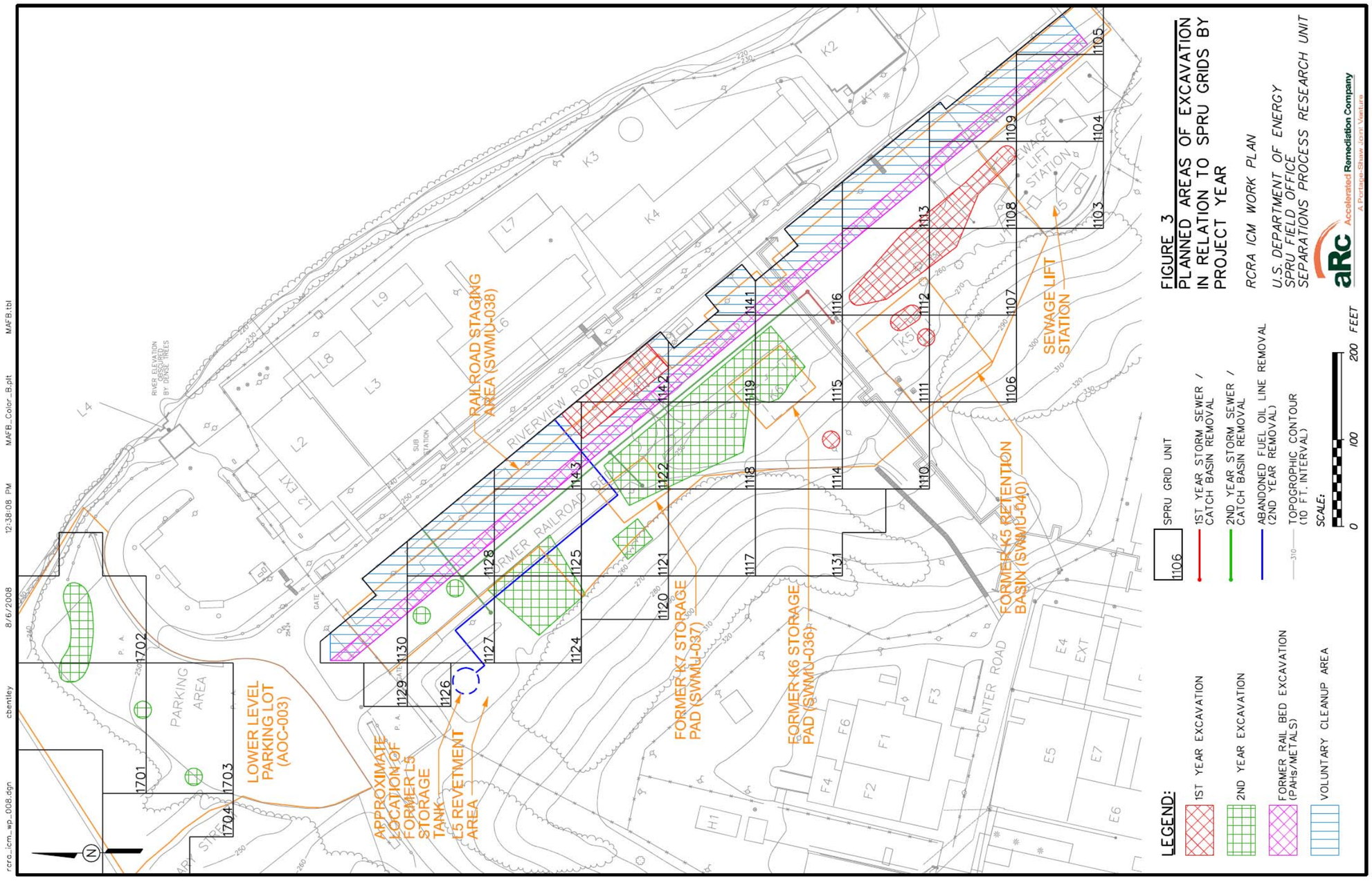

Figure 3 Planned areas of excavation in relation to SPRU grid units by project year

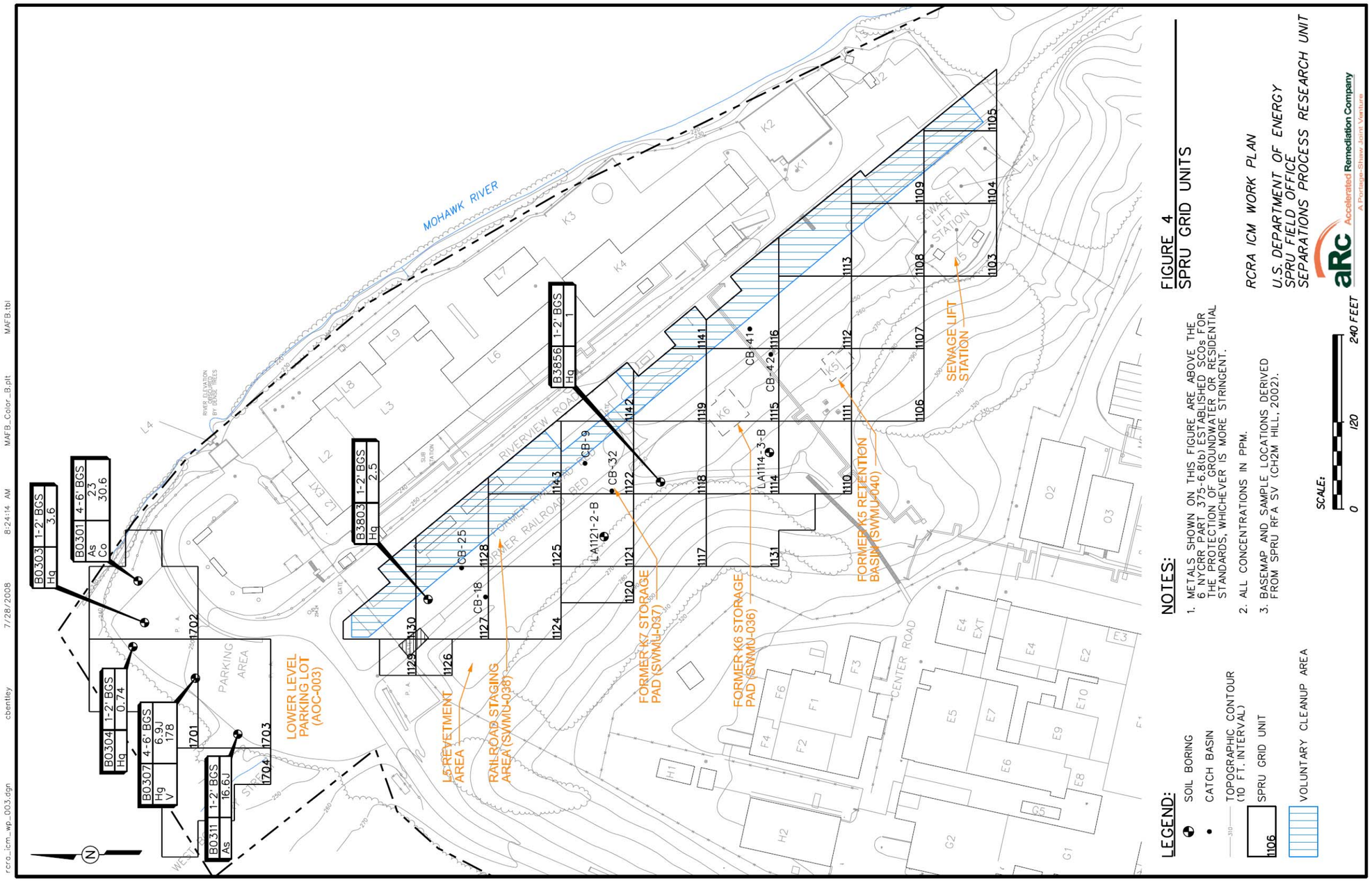

Figure 4 SPRU grid units

1.2.1 Former K6 Storage Pad (SWMU-036)

The Former K6 Storage Pad was a 1,100-ft^2 concrete slab with walls used in the 1950s and 1960s for storing radioactive waste. The walls and slab were demolished in 2004. The soils underlying the Former K6 Storage Pad were chemically characterized and found to meet NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 (1994) SCOs (DOE/CH2M HILL 2002). Radioactivity, primarily cesium-137, is still present in soils and will be removed from this area to meet radiological remediation objectives. NYSDEC concurred that no further action was required for the K6 SWMU-036 (Rogers 2006).

1.2.2 Former K7 Storage Pad (SWMU-037)

The Former K7 Storage Pad consisted of a fenced and roofed concrete pad located west of the Former K6 Storage Pad. It was used to store solid waste in containers awaiting off-site disposal. The K7 Storage Pad was removed in 1988. The soils underlying the Former K7 Storage Pad were chemically characterized and found to meet TAGM 4046 SCOs (DOE/CH2M HILL 2002). NYSDEC has concurred that there is no further action necessary for chemicals at the K7 Storage Pad (Rogers 2006). Radioactivity is still present in soils and will be removed from this area to meet radiological remediation objectives.

1.2.3 Railroad Staging Area (SWMU-038)

Concentrations of silver, mercury, total chromium, and thallium detected in shallow soil above background indicate chemical hazardous constituent releases in the southeastern, central, and northern portions of the RSA. These metals are also above the TAGM 4046 SCOs. Traces of volatile organic compounds (VOCs) were detected below these SCOs in the northwestern part of the RSA near the L5 revetment (L5) area and southeastern portions of the RSA in the vicinity of the former Sewage Treatment Plant near the location of the J4 sand filter bed. Traces of gasoline constituents evident throughout the RSA are likely associated with motor vehicle use, not waste management or product spills from SPRU operations. Elevated metals and VOCs in the southeastern portion of the RSA are not related to SPRU (DOE/CH2M HILL 2002) and are not addressed in this ICM. Antimony, arsenic, copper, lead, and PAH compounds are elevated throughout the extent of the former railbed area. These PAHs and metals are attributed to railroad construction materials and operations, and not SPRU or KAPL waste management (DOE/CH2M HILL 2002). However, DOE intends to address this contamination on a voluntary basis.

1.2.4 K5 Retention Basin (SWMU-040)

The *Task IV RCRA Facility Investigation Report for Groundwater Upper and Lower Levels* (DOE/CH2M HILL 2006a) identified a trace detection of trichloroethylene (TCE) in soil at a concentration well below NYSDEC TAGM 4046 (1994) recommended SCOs at the northeast corner of the K5 Retention Basin, suggesting a potential release of VOCs from the building's foundation. The *RFA SV Amendment to K-5 Retention Basins* (DOE/LATA/SHARP 2007) report concluded that trace amounts of toluene, TCE, and perchloroethylene identified during the 2000–2001 SV were not confirmed in the 2006–2007 sampling. The low-level semivolatile organic compounds reported during the initial SV were associated with the use of asphaltic building materials and not associated with SPRU waste management operations (DOE/CH2M HILL 2002). Slightly elevated concentrations of copper and zinc were identified in the soils surrounding the K5 Retention Basin. Elevated concentrations of copper and zinc occur sporadically above background at isolated locations. These metals are considered likely associated with mineralogy and/or construction activities not associated with SPRU (DOE/CH2M HILL 2002).

Additional sampling was performed in fall and winter 2006–2007 after the building's foundation was removed (DOE/LATA/SHARP 2008). Acetone was detected in 24 of 32 soil samples in ranges from 28 to 230 ppm. These levels of acetone have not been identified as laboratory contaminants. The reported values are also not considered to be of SPRU origin, because acetone was not detected in the 2000–2001 sampling event soil samples or in the pre-demolition samples collected around the perimeter of the K5 foundation (DOE/LATA/SHARP 2008). The acetone found may have resulted from the coating material used to control dust during the demolition of the K5 structure.

1.2.5 Lower Level Parking Lot (AOC-003)

Concentrations of antimony, arsenic, cadmium, lead, mercury, and silver were identified above background and in some cases the NYSDEC TAGM 4046 (1994) recommended SCOs in soil borings primarily in the northern portion of the LLPL (DOE/CH2M HILL 2002). Concentrations of mercury significantly exceed the 375-6.8(b) SCOs. Trace detections of toluene were found at two soil boring locations along the perimeter of the LLPL asphalt. These detections likely resulted from minor drips from vehicles and run-off from the asphalt roadway and parking lot (DOE/CH2M HILL 2002). The PAH compounds were detected at three soil boring locations along the northwestern perimeter of the asphalt covered parking area and are below NYSDEC TAGM 4046 (1994) recommended SCOs. These, along with metal concentrations, may be the result of soils removed from the RSA during construction of the parking lot or from the parking lot asphalt (DOE/CH2M HILL 2002).

1.3 Interim Corrective Measures Objective

The objectives of the SPRU-LL Areas ICM as recommended in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and agreed to by NYSDEC via the February 1, 2006, letter to the DOE SPRU Field Office (Rogers 2006) are to remove soil contaminated with COCs that are above SCOs and to achieve a no further action determination from NYSDEC for chemicals attributed to SPRU waste releases.

In addition, the SPRU-LL metals and PAH contamination associated with the former rail line will be remediated as part of a DOE voluntary cleanup. The COCs associated with the railroad construction are antimony, arsenic, copper, lead, and PAHs. These COCs are generally located between 0 and 2 ft below the surface and 10 ft on either side of the center of the rail line.

2.0 Interim Corrective Measures Plan

The ICM will include the excavation, removal, and off-site disposal of contaminated soil. This ICM Work Plan includes a soil surveying approach to better define the extent of soil contamination prior to excavation. Information from an x-ray fluorescence (XRF) screening survey of each SPRU grid unit will be combined with data from earlier investigations to guide the excavation process. During and following excavation, a confirmatory sampling and analysis approach will be used to demonstrate that the SCOs have been met.

Figure 3 shows the general area to be excavated. An estimated 6.5 acres in the RSA and 2 acres in the LLPL are anticipated to be disturbed by the excavation. The work will focus on the soils in and around the lower level area potentially contaminated with antimony, arsenic, chromium, cobalt, lead, mercury, thallium, and vanadium. Contamination by radionuclides, primarily cesium-137, is the reason for removing the majority of the soils in the SPRU-LL. The location and extent of contaminated soil are based on the results of previous investigations (DOE/CH2M HILL 2006b).

The SPRU-LL COCs for soils were identified based on the results of the RFA SV (DOE/CH2M HILL 2002). These include metals that were found in concentrations above background that could be attributed to SPRU operations and VOCs found at trace levels that could be attributed to a chemical release. Table 1 lists the COCs identified. The COCs cadmium, chromium, cobalt, silver, mercury, thallium, vanadium, and zinc were determined to potentially be associated with SPRU operations. Antimony, arsenic, copper, and lead were identified as primarily being associated with the former rail line construction and operation and are not being attributed to SPRU operations. However, they are being included in the list as part of the SPRU-LL cleanup. The VOC TCE was found at trace levels below TAGM 4046 (1994) recommended SCOs in the L5 area (SPRU Grid Unit 1126). TCE is included as a COC for SPRU Grid Unit 1126 to ensure that the RFA SV sampling did not overlook potential contamination in that area. Acetone is being included as a COC in the K5 Retention Basin area due to contamination that is believed to have occurred during the demolition of the basin.

The proposed SCOs for the COCs are provided in Table 1. The SCO value for each chemical is the more stringent of the promulgated SCOs under 6 NYCRR Part 375-6.8(b) for the protection of groundwater or for residential exposure. Under 375-6, no SCOs were promulgated for antimony, cobalt, thallium, or vanadium. Because the analytical data for antimony and thallium collected during the 2002 RFA SV were estimated values and no other site investigations have established defensible background values, the laboratory contract required quantitation limit was used as the SCO in accordance with TAGM 4046 guidance (NYSDEC 1994). The reporting limits for Test America Labs, which is a New York State Department of Health, Environmental Laboratory Approval Program (ELAP), Analytical Services Protocol approved lab, were used. For cobalt and vanadium, the TAGM 4046 numerical values for recommended SCOs were determined to be appropriate SCOs since they are the most stringent.

If the concentrations of other constituents that are not listed as COCs are found in soil samples analyzed in the course of the ICM that exceed the more stringent NYSDEC Part 375-6 SCO for residential exposure or protection of groundwater, NYSDEC will be notified and consulted regarding any further action.

2.1 Site Preparation/Mobilization

Site mobilization includes the initial mobilization in 2008 and the second field season mobilization in 2009. Generally, construction equipment will be mobilized for field season activities and demobilized from the site during winter shutdown.

Initial mobilization activities will include the delivery and set up of two site trailers in the SPRU Field Office complex area. One existing trailer will be utilized for the on-site radiological field laboratory and radiological instrument support. After the trailers are blocked and leveled, utilities (electric, water, and sanitary) will be hooked up. Portable toilets will be available for the crew located adjacent to the RSA.

A civil topographic and lay-out survey will be performed to accurately locate the survey grid areas to be excavated. The entire RSA will be surveyed and marked in 2008. The parking lot area will be surveyed at the beginning of the second field season (2009).

The soil staging and load-out area will be constructed in the extreme northwest area of the RSA (Figure 5) between the asphalt road and the toe of the hill in the vicinity of the L5 area. The field logistics area will be located next to the load-out area.

Table 1 Soil cleanup objectives

Constituent of Concern (Metals)	SCOs (ppm)
Antimony	1[a]
Arsenic	16
Cadmium	2.5
Trivalent Chromium	36
Cobalt	30[b]
Copper	270
Lead	400
Mercury	0.73
Silver	8.3
Thallium	2[a]
Vanadium	150[b]
Zinc	2,200
Constituent of Concern (VOCs)	SCOs (ppm)
Acetone[c]	0.05
TCE[d]	0.47

a. Reporting limit for Test America Labs.
b. TAGM 4046 recommended cleanup levels (NYSDEC 1994).
c. COC only in SWMU-040.
d. COC in SPRU Grid Unit 1126.

The soil staging area will be leveled, covered with a woven geotextile, and capped with 6 inches (in.) of compacted gravel. The soil staging area will be approximately 100 by 200 ft. Jersey barriers will be used to construct three 250-cubic yard (CY) soil storage cells. Snow fencing will be used to segregate and control traffic in the area. Contaminated media will only be placed on the protected surface in the staging area. The size of the soil stockpiles was determined based on space limitations, stability, to facilitate load-out operations, and to control the amount of soil that may need to be shipped to an alternate disposal facility if it does not meet the waste acceptance criteria at intended disposal facility. During demobilization activities, the stone and geotextile materials will be removed and will be disposed of as waste in same manner as the contaminated soil and debris, in accordance with Section 4.0.

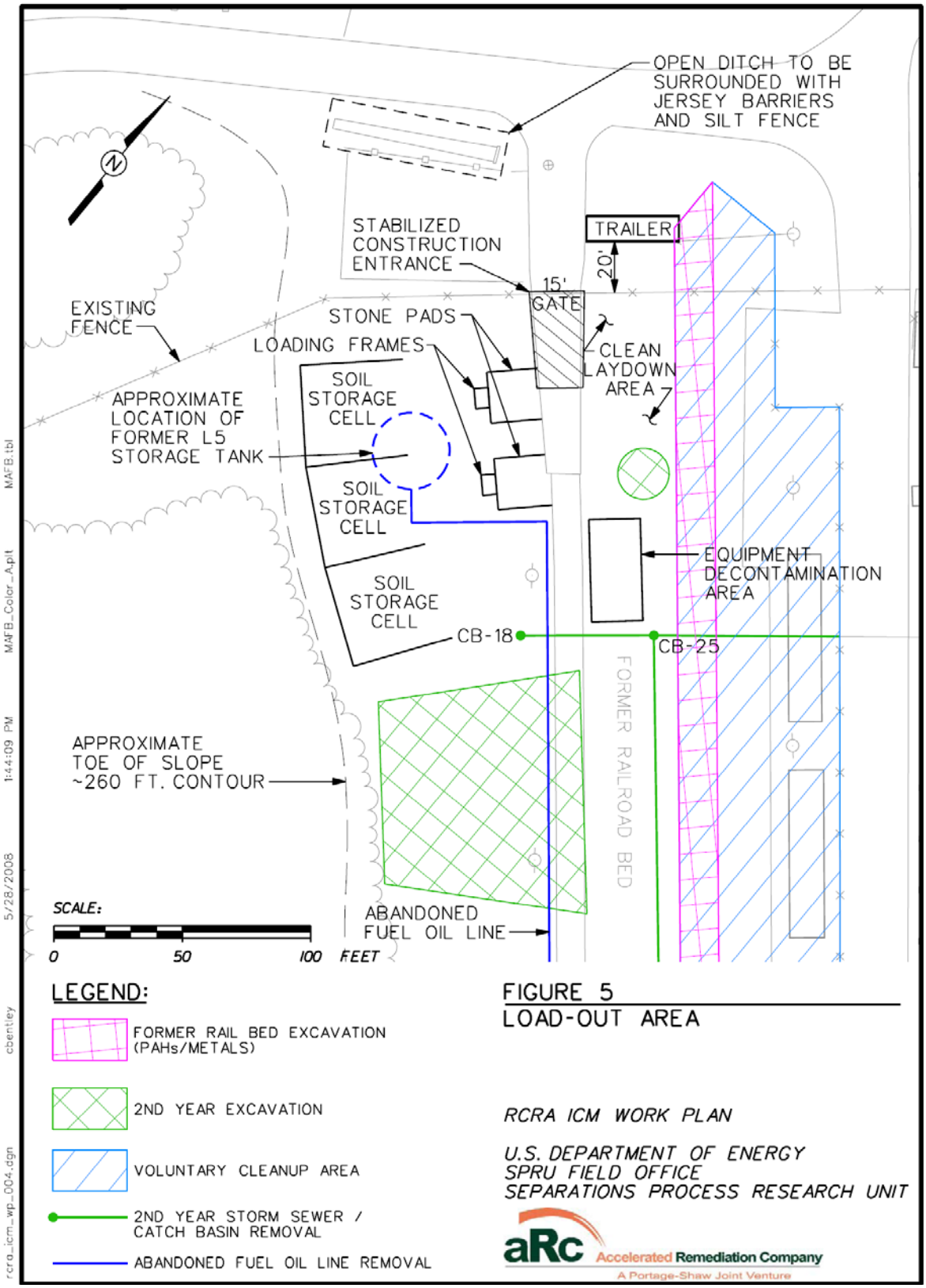

Figure 5 Load-out area

A container loading area will be constructed adjacent to the soil staging area. This area will be radiologically surveyed, leveled, and capped with 6 in. of compacted stone and pads for stability and to minimize the potential for contamination. Containers will be filled, closed, radiologically surveyed, and loaded either directly onto the transport vehicle or temporarily stored in a container staging area in the LLPL prior to transport for disposal. The existing drainage ditch located between the lower level road and the RSA will have Jersey barriers placed on the south and east sides to route truck traffic and silt fence around the perimeter to ensure surface water run-off will not be affected by site operations. After the soil staging area is completed, the equipment decontamination area will be constructed on the northeast side of the existing road once a radiological survey of the area is complete. The area will be graded and berms constructed using native soil and/or imported gravel.

The equipment decontamination area will be constructed with geotextile and heavy mil plastic liner that will be drain to the lined sump. Snow fencing will be used to segregate and control traffic in that area. Plastic sheeting will be placed on the snow fencing to control overspray from the decontamination process. Frac tanks will be located adjacent to the equipment decontamination area to contain the decontamination fluids. The same frac tanks will be used to contain water that enters the excavations during remedial actions via run-on or groundwater infiltration, which will be characterized prior to disposal. During demobilization activities, the stone and geotextile materials will be removed and will be disposed of as waste in same manner as the contaminated soil and debris, in accordance with Section 4.0.

All temporary facilities will be periodically inspected by the quality control manager or designee to determine if maintenance or upgrading is required. Maintenance of temporary facilities will be performed as needed to ensure the facilities remain in good working order.

2.2 Excavation Plan

2.2.1 General Excavation

The excavation process will follow a three-step process that includes: (1) an initial survey, (2) excavation, and (3) resurvey to compare the excavated surface against cleanup goals. Once the resurvey indicates that the surface is potentially compliant with the cleanup goals, confirmation sampling will be performed.

The excavation process will begin with a civil survey to lay-out and mark the SPRU grid unit corners, sub-grids, and any additional key control features. An excavation will be initiated based on the location and the extent of contamination previously identified in the RFA SV report (DOE/CH2M HILL 2002) and known radiological contamination (DOE/CH2M HILL 2006b). A real-time handheld sodium iodide (NaI) detector (for radioactive contamination) and an XRF analyzer (for metals) will be used to help guide (survey) excavation and indicate when an excavation is potentially complete. At this point, confirmation sampling will be conducted to determine if contamination has been removed to below SCOs.

Excavation will be conducted in controlled lifts. When the contaminated soil has been removed in the first sub-grid (grid 1), the excavation crew will move to the adjacent sub-grid (grid 2) and perform excavation as necessary based upon the assessment of the pre-survey data from the sub-grid against the cleanup objectives.

While the excavation crew is active in a given sub-grid, the characterization technician will be executing a pre-excavation survey in the adjacent sub-grid. While the excavation is active in grid 2, the characterization technician will return to grid 1 and execute an in-progress survey of the new surface to

assess its metals contamination levels. If the field data indicate non-compliance with the criteria, another lift (approximately 6 in.) of soil will be removed and the process repeated. If the data indicate preliminary compliance, then the excavation within that grid is deemed complete, pending the results from final confirmation sampling. The survey, excavation, resurvey, and comparison against cleanup goals is the process for determining whether or not a surface is potentially compliant with the SCOs or if the removal of additional materials within designated grids is warranted. Figure 6 illustrates this approach. When two SPRU grid units (approximately 2,390 yd^2) are complete, post-excavation confirmation sampling will be performed for all COCs (metals and organics) in accordance with the Sampling and Analysis Plan (SAP) described in Section 3 and the QAPjP (ARC-PLN-6402). Samples collected during the post-excavation confirmation sampling effort will initially be analyzed in the on-site laboratory using XRF to provide additional confidence that the excavation will meet cleanup goals. In the unlikely event that one of these samples does not meet cleanup criteria, the on-site analysis will reveal that condition immediately avoiding the time lag and expense associated with the off-site lab analysis for a failed sample. The area of the failed sample will be promptly identified and additional excavation will take place in the area of the specific sample.

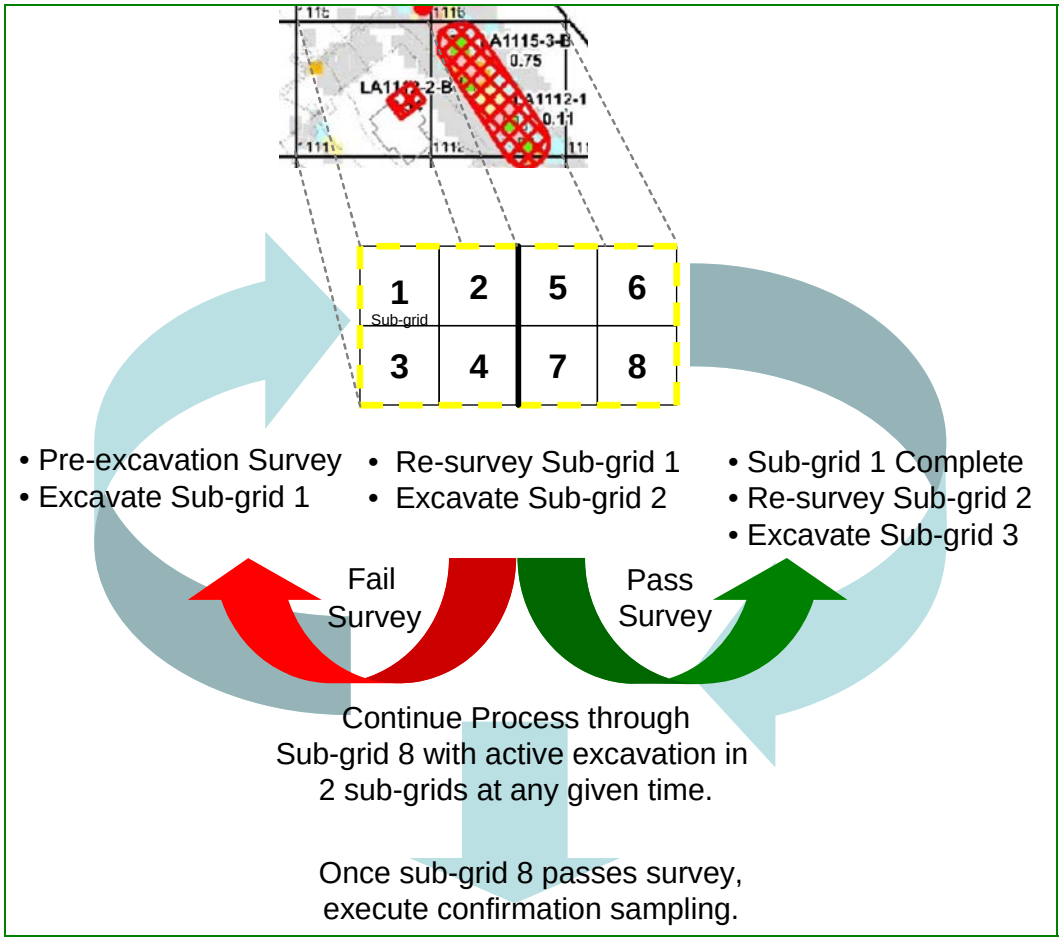

Figure 6 Excavation approach

For locations where confirmation sampling identifies soil above SCOs, additional soil will be excavated. The area of the excavation will be defined by the distance from the sample that exceeded SCOs to 1/2 the

distance to the next closest surrounding samples that were below SCOs. An additional ½ foot of soil will be excavated in this area followed by additional confirmation sampling.

During excavation, dust control measures will be based on the use of a water truck to provide water in a controlled manner to the working excavation area, the staging area, and the active roadways within the control area. When the sub grids are cleared using the process described above, hay bale berms, plastic sheeting, and/or grade changes will be used to maintain separation between units that have achieved cleanup based on field instruments and those that have not. A graded approach will be used to control cross-contamination that includes actions up to lining excavated areas. Total dust monitors downwind of work zones during active soil excavation and soil loading activities will be used. This will include a handheld or tripod mounted monitor capable of measuring 0.1 milligram per cubic meter of air as PM10 or total dust.

2.2.2 Railroad Staging Area

Excavation efforts will proceed in sub-grids (typically a 50-ft by 50-ft area) within a SPRU grid unit that has been previously surveyed on a 10-ft grid basis with the XRF for metals. In-progress surveys will be compared to the targeted areas of excavation to better guide excavations. Copies of the survey work will be downloaded daily and printed out in a scale map of the specific survey area and color coded based on radiological and XRF readings.

Contaminated soils and debris will be removed from the RSA. These materials include the catch basins (CBs) and associated piping from the rail staging area storm sewer system, the L5 area, abandoned fence post anchors, and the radiologically contaminated soils from the K6 and K7 Storage Pads.

The Fiscal Year (FY) 08 excavation is anticipated to begin in the southeast corner of the RSA in SPRU Grid Unit 1108 (Figure 4). The excavation will proceed to SPRU Grid Units 1106, 1107, 1111, 1112, 1114, 1116, and completing the FY08 field season in SPRU Grid Units 1142, 1143, and the northeast corner of 1122. The FY08 field season will include CBs 41, 42, and associated piping. The average depth of excavation in the RSA is estimated at 2 ft to achieve the cleanup objectives. However, some areas such as the K5 Retention Basin may require 4–12 ft depths of excavation to remove chemical COCs, based on analytical data from the RFA SV, to meet cleanup objectives. Figure 3 presents the SPRU grid units and the areas to be excavated each year determined by DOE's best estimates based on both chemical and radiological information.

During the FY09 field season, the first area anticipated to be excavated will be in SPRU Grid Unit 1115, continue through the southwest corner of SPRU Grid Unit 1122, and terminate in the southeast corner of SPRU Grid Unit 1130, thereby encompassing the remaining grid units to be excavated in the RSA. This area is adjacent to the northeast fence. Included in the FY09 field season in the RSA are CBs 9, 18, 25, 32, and associated piping. The depths of excavation of the trenches to remove the CBs and associated piping will range from 6 ft at CBs 41 and 42 to more than 15 ft at CBs 18 and 25. Trenches greater than 4 ft deep will require a trench box if personnel enter the trench. An 8 ft high, by approximately 20-ft-long trench box will be utilized. Excavations will be sloped at a 1:1 slope (approximate) to limit the need for trench boxes. Trenches less than 4 ft will not require shoring.

In addition, though not related to SPRU activities, the abandoned 4–in.-diameter former fuel oil line extending from the L5 berm area towards the lower level rail bed roadway will be excavated and removed in its entirety. It is estimated that the pipe exists at a uniform depth of 3 ft below existing grade.

Approximately 180 bank cubic yards of material will be removed. The line generally exists within the SPRU grid units shown in Figure 3.

The projected annual volumes of soil and debris for RSA FY08 and FY09 project years by SPRU grid units are presented in Tables 2 and 3, respectively. These volumes do not include the DOE voluntary cleanup area for the contamination associated with the former rail line. The volume of soil and debris for each SPRU grid unit was calculated utilizing the soil boring, groundwater, and other analytical data for samples taken at various depths as provided in the *SPRU Radiological Characterization Report* (DOE/CH2M HILL 2006b), the *Amendment to K-5 Retention Basins* (DOE/LATA/SHARP 2007), the *Task IV Resource Conservation and Recovery Act (RCRA) Facility Investigation Report for Groundwater Upper and Lower Levels Separations Research and Process Unit (*DOE/CH2M HILL 2006a), and the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002).

Interim RCRA ICM Data Reports (Section 5.0) will be prepared for each set of two SPRU grid units and submitted to the NYSDEC for interim review and approval. This approach will result in smaller more manageable data packages and help to expedite the review process. Each set of two SPRU grid units (approximately 2,390 yd^2) will be backfilled and restored as described in Section 2.2.5.

2.2.3 K5 Retention Basin

The contaminated soils and debris will be excavated from the K5 basin during the first field season (FY08). The cleanup area is defined includes SPRU Grid Units 1106, 1111, and 1112 as identified in Figure 3. This area will be excavated as an integral part of the overall RSA excavation sequence as the work moves from the southeast corner of the contamination zone, using the excavation approach presented in the previous section. The projected volume of soil and debris for the K5 Retention Basin is shown in Table 4. Each set of two SPRU grid units (approximately 2,390 yd^2) will be backfilled per as described in Section 2.2.5.

Table 2 Anticipated soil volumes for the RSA FY08 Project Year

SPRU Grid Unit	Approximate Area (ft^2)	Depth of Excavation (ft)	Anticipated Volume (CY)
1107	150	2	11
1108	2,300	2	170
1110	0	0	0
1112	4,600	2	341
1113	0	0	0
1114	625	2	46
1115	15 ft of CB piping	4	9
1116	600 plus Catch Basin 41 and 75 linear ft of piping	4	67
1117	0	0	0
1120	0	0	0
1122	3,000	2	222
1142	5,000	2	370
1143	1,250	2	93
		2008 Total:	1,329
		Loose Total:	1,728

Table 3 Anticipated soil volumes for the RSA FY09 Project Year

SPRU Grid Units	Approximate Area (ft^2)	Depth of Excavation (ft)	Anticipated Volume (CY)
1115	3,000 plus 15 ft of CB piping	2	276
1118	6,750	2	500
1119	3,200 plus 120 ft CB piping	2	395
1121	1,500	2	111
1122	1,250 plus CB 9 and 32 120 ft of piping	2	253
1124	4,500, piping included	2	333
1125	1,800 plus 100 linear ft (8ft depth) of piping	2	370
1126	0	0	0
1127	Catch Basins 18 and 25 and 75 linear ft of piping	12	405
1128	50 linear ft of piping	16	415
1129	0	0	0
1130	0	0	0
1131	0	0	0
1141	0	0	0
1143	20 linear ft of piping	6	27
		2009 Total:	3,085
		Loose Total:	4,010

Table 4 Anticipated soil volumes for the K5 Basin FY08 Project Year

SPRU Grid Units	Approximate Area (ft^2)	Depth of Excavation (ft)	Anticipated Volume (CY)
1111	50	12.5	23
1111	300	2	23
1112	100	6	22
1106	300	2	22
1107	50	2	4
		Total :	94
		Loose Total :	122

2.2.4 Lower Level Parking Lot

Contaminated soils and debris from the LLPL, associated with SPRU grid units identified in Figure 3 (SPRU Grid Units 1701, 1702, 1703, and 1704) are anticipated to be removed in FY09. All other areas within the LLPL are not anticipated to require soil or debris removal. The excavation of contaminated soils and debris in the LLPL will begin with the implementation of sediment and erosion controls, which include the placement of temporary sheet pile shoring bordering the wetland area on the northwest side of the parking lot. The piling will form a 30-ft semicircle to support the excavation of the asphalt, soils, and debris in the parking lot. The sheet piles will prevent subsidence of material into the wetlands, preventing the spread of contamination, protecting the wetlands, and providing stability for the safety of personnel.

Clean overburden will be removed in order to excavate the contaminated soil for which qualified analytical data confirm that the concentrations of COCs exceed the SCOs. Excavation will continue to the depth of known contamination at which point the excavation floor and sidewalls will be surveyed with the XRF to indicate when an the excavation is potentially complete. Additional soil will be excavated in 6-in. lifts from the floor and/or sidewalls until the survey indicates that the contaminants in the remaining soil are potentially below SCOs. At this point confirmation sampling, including both the floor and sidewalls, will be conducted. If analysis of the confirmation samples shows contamination above SCOs, additional soil will be excavated from the floor and/or sidewall of the excavation where the contamination is identified. This process will continue until confirmation sampling demonstrates that the soil remaining in floor and sidewalls of the excavation does not contain contaminants above SCOs (see Section 3.2 for more details).

Excavated material will be placed directly into an articulated dump truck and transferred to the soil staging and load-out area in the RSA. The excavation and survey approach defined in Section 2.2.1 will be used.

The average depth of excavation in SPRU Grid Units 1701, 1702, and 1703 is anticipated to be 5 ft to achieve the SCOs. No excavation is anticipated in SPRU Grid Unit 1704. The projected annual volumes of soil and debris for each SPRU grid unit are defined in Table 5. Each set of two SPRU grid units (approximately 2,390 yd^2) will be backfilled as described in Section 2.2.5.

Table 5 Anticipated soil volumes for the LLPL FY09 Project Year

SPRU Grid Units	Approximate Area (ft^2)	Depth of Excavation (ft)	Anticipated Volume (CY)
1701	900	2	67
1701	300	6	67
1702	1,800	2	133
1702	900	5	167
1703	100	4	15
1703	400	0.5	7
1704	0	0	0
		Total:	456
		Loose Total:	593

2.2.5 Backfill and Restoration

Following the completion of post-excavation sampling and analysis to ensure that SCOs have been met, a separate Interim RCRA ICM Data Report (Section 5.0) will be prepared for each excavation area and the area backfilled. With minor exceptions, the final restoration grades will be those in existence at the time of mobilization.

Off-site borrow material (general fill, select fill for below the roadway and topsoil) will be provided from a reputable source. The selected supplier will be one that maintains both a compliant NYSDEC borrow

source permit and is currently an approved NYS Department of Transportation (NYSDOT) materials supplier in full compliance with NYSDEC and NYSDOT requirements. This assures the DOE that only uncontaminated virgin materials will be placed and eliminates the need for additional analytical work associated with use of on-site excess fill and for unlicensed unpermitted sources.

The placement and grading of fill materials will be performed to promote positive drainage and to minimize erosion potential. A vegetative cover will be established over the backfilled areas through hydroseeding or other similar technology to control erosion. At the conclusion of all restoration activities, a final civil survey will be performed to document the final grade.

The fill material will consist of granular, well-graded material free of stones larger than 3 in. and meet the following gradation requirements:

Sieve Designation	Percent Passing
3 in.	100
No. 40	0–70
No. 200	0–15

Backfill will be placed in layers of approximately 12–16 in. in loose depth. If necessary, prior to compaction, the material will be aerated or moistened to facilitate compaction to the required density. Backfill will not be conducted on muddy or frozen ground. Backfill will be compacted to achieve proper compaction using either a smooth drum vibratory roller or other typical earth-moving construction equipment. Nuclear Density/Moisture Gauge readings will be obtained to document density of the backfill materials. The fill will be compacted 95 percent of the maximum density determined per the ASTM D-698 (Standard Proctor) for roadway and parking lot areas and 90 percent elsewhere.

For parking lot areas that may be paved in the future, the final 12 in. of sub-base gravel will be topped with 3 in. of binder coarse gravel and 1.5 in. of coarse gravel. Asphalt placed on these areas will meet the requirements of Section 401 of the NYSDOT specification, “Hot Mix Pavement General.”

The permanent erosion and sediment control measures identified in the Stormwater Pollution Prevention Plan (SWPPP) (ARC-PLN-6310) will be implemented for all areas that will not be repaved. This will include covering these areas with 2 in. of compacted topsoil and reseeding. The topsoil will meet the requirements of NYSDOT Section 613, “Topsoil”. Fertilizer will consist of a 15-15-15 mix and meet the requirements of NYSDOT Section 713-03, “Fertilizer”. The seed mixture will consist of 30 percent perennial rye, 45 percent red fescue, and 25 percent Kentucky blue grass, and meet the requirements of NYSDOT Section 713-04, “Seeds.” Reseeding will be conducted as soon as possible as weather permits.

2.3 Excavation Water Management

Storm water and groundwater will be managed in accordance with the NYSDEC *Stormwater General Permit for Construction Activities* (GP 02-01) and associated SWPPP (ARC-PLN-6310). The SWPPP meets the requirements of the GP-02-01 and includes erosion and sediment controls and post construction storm water controls as required.

The general strategy for managing water is based on limiting storm water from entering the excavation area and minimizing the areas of excavation open at one time. One of the initial mobilization activities will be the installation of storm water mitigations up- and down-gradient of disturbed areas. These mitigations include a grassed water way diversion, straw bale dikes, earth dikes, sediment traps, and silt fences. The grassed waterway is designed to divert storm water flow from the hillside above the excavation area to catch basins in the sewage lift station and ultimately to permitted Outfall 002. Earth dikes and silt fence will be installed around the perimeter of excavations to divert any storm water run-on from the excavation area to an existing permitted outfall and minimize or prevent run-off, erosion, and cross-contamination. A straw bale dike will be placed along the eastern and portions of the southern and northern fence lines to reduce sediment in run-off. Straw bale dikes will also be placed around the catch basin drains in the LLRBA and sewage lift station to reduce sediment reaching the storm sewer system.

Once excavation is initiated, the area of active excavation will be limited at any one time. Once two SPRU grid units are complete and the post-excavation sampling performed, the excavation will be backfilled as soon as feasible in order to minimize unnecessary management of storm water and excavation sidewalls, etc. During the period that the excavation is open, cross contamination controls will be implemented as described in Section 2.2.1.

Based on analytical data in the *SPRU Radiological Characterization Report* (DOE/CH2M HILL 2006b) and the *RFA SV Amendment to K-5 Retention Basins* report (DOE/LATA/SHARP 2007), groundwater is not anticipated to be encountered at the planned depths of excavation except in the northernmost section of the storm water drainage system near CBs 18 and 25. The data reported in 2003 from the monitoring wells in the LLRBA indicated that two wells had gross beta and gross alpha radioactivity slightly higher than the background wells. The concentration of strontium-90 measured in the wells was less than KAPL discharge limits after sediment was removed. Collected water may be discharged once verification samples are obtained.

Storm water and groundwater removed from active excavations will be transferred to one of two 21,000-gal frac tanks after being processed through bag filters (50 and 10 μ units) to remove any sediment. The water will then be analyzed to ensure it does not exceed KAPL discharge limits. Sample analysis will be performed both on-site in the analytical laboratory trailer and at a New York State Department of Health ELAP, Analytical Services Protocol approved off-site laboratory. Collected water that exceeds KAPL discharge limits (if any) will be shipped to a licensed industrial waste water treatment plant for processing. Water below discharge limits will be released to an existing permitted outfall.

3.0 Sampling and Analysis Plan

The SAP describes the post-excavation confirmation sampling for the SPRU-LL lands area. The intent of the post-excavation sampling program is to confirm that soil has been removed to meet the SCOs. This section presents the sample locations and frequency, sample depths, and sample analysis. Detailed quality assurance procedures for implementation of the SAP are presented in the QAPjP (ARC-PLN-6402).

3.1 Pre-Excavation Sampling of the K5 Retention Basin for Acetone

As discussed in Section 1.2.4, trace amounts of acetone were found in samples collected around the perimeter of the K5 foundation during post-demolition sampling (DOE/LATA/SHARP 2008). Additional sampling will be performed to determine the continued presence of residual acetone.

Sampling in the area will be focused on the area of the former retention basin foundation where the trace amounts of acetone were identified. A direct push method will be used to obtain samples from 8 locations; one at each corner of the former basin and one along each side (midsection) of the former basin. The direct push method will be driven to bedrock, estimated at 15 ft, and samples collected at 2-ft intervals, including at the bedrock-soil interface. The samples will be analyzed in accordance with the QAPjP (ARC-PLN-6402).

3.2 Post-Excavation Confirmatory Soil Sampling

The purpose of design optimization in the data quality objectives (DQO) process is to identify the best sampling and analysis design that satisfies all of the previous steps in the process. The SPRU-LL sampling approach follows the NYSDEC *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002). This guidance provides for prescriptive sampling for excavations depending on their perimeter and the nature of the contamination. Specifically for excavations with perimeters of less than 20 ft, one bottom sample and one sidewall sample biased in the direction of the surface runoff is to be collected. For perimeters between 20 and 300 ft, one sample is to be collected for every 900 ft^2 of bottom area and 1 sample every 30 linear ft of sidewall at the top for surface spills and from the bottom for subsurface spills. For excavations with perimeters greater than 300 ft, the DER-10 guidance provides for a reduced sample frequency based on a methodology acceptable to NYSDEC.

Due to the nature of the contamination in the LLPL, the DER-10 criteria for subsurface spills with excavation perimeters less than 300 linear feet will be used for all excavations in the LLPL. For excavation within the RSA, the following approach will be used. The sampling design process begins with development of DQOs. The DQOs use site and contamination conditions to calculate the types, quantities, and locations of measurement to ensure that sampling efforts are able to conclusively demonstrate compliance with the SCOs. The DQOs are defined in the QAPjP (ARC-PLN-6402). The DQOs identify the decision to be made following excavation of a given survey area of the site as follows: "Has the SPRU grid unit been excavated sufficiently to demonstrate compliance with SCOs?"

Sample collection techniques and analytical methodologies are selected to generate appropriate data. Analytical data, received from the laboratory, are validated and then evaluated using statistical techniques relative to the hypothesis described in the QAPjP (ARC-PLN-6402).

3.2.1 Sampling Design for the RSA

For excavations within the RSA, the following sample design will be used. Sampling data included in the *RCRA Facility Assessment Sampling Visit Report, Separations Process Research Unit Project* (DOE/CH2M HILL 2002) provides information regarding the concentrations of COCs in the lower level soils. The sampling areas have been selected based on the previously established SPRU grid unit system. Each sampling area will generally consist of two SPRU grid units as for the CERCLA cleanup. The sampling area will include both excavated and unexcavated areas. The sample size equation when the standard deviation is estimated is used to determine the number of confirmation samples needed for testing compliance of each set of two SPRU grid units (EPA 2000). To establish the number samples needed, the following equation is used.

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2 \sigma^2}{\Delta^2} + 0.5(Z_{1-\alpha})^2$$

where

$Z_{1-\alpha}$ and $Z_{1-\beta}$	=	standard normal random variables (Harnett 1975)
σ	=	standard deviation calculated from existing sample data
Δ	=	minimum detectable difference
α	=	probability of committing a false-positive decision error
β	=	probability of committing a false-negative decision error.

The standard deviation was estimated based on the data collected for the *RCRA Facility Assessment Sampling Visit Report, Separations Process Research Unit Project* (DOE/CH2M HILL 2002). Table 6 provides the standard deviations estimated for each COC.

Based on the decision errors of 0.05 for both α and β and a Δ of 20%, (see Section 3.1.6 of the QAPjP), the number of required samples for each COC from each set of two SPRU grid units (approximately 2,390 yd^2) is calculated using the sample size equation. Table 6 provides the results of this calculation. The following example shows the calculation for arsenic.

$$n = \frac{(1.645 + 1.645)^2\, 3.13^2}{3.2^2} + 0.5(1.645)^2$$

n = 11.7; therefore, 12 samples are needed.

The COC requiring the maximum number of samples (12) is arsenic. Therefore, a sample size of 12 (for each COC) is selected for the confirmation sampling. For SPRU Grid Unit 1126 where TCE is a COC, 12 samples for VOC analysis will also be collected.

Table 6 Required number of samples

Metal	Estimated Standard Deviation	Required Samples
Antimony	0.11	5
Arsenic	3.13	12
Cadmium	0.09	2
Chromium, Total	3.36	4
Cobalt	2.98	4
Copper	8.71	2
Lead	7.59	1
Mercury	0.13	10
Silver	0.07	1
Thallium	0.05	2
Vanadium	4.64	2
Zinc	28.3	1

3.2.2 Post-Excavation Soil Sampling Location and Frequency

For excavations within the RSA, the physical sample locations within each set of two SPRU grid units will be laid out using a random–start triangular grid. The distance between survey locations (L) is calculated based on the following equation.

$$L = \sqrt{A/(0.866*n)}$$

where

A = area.

The two SPRU grid units (Figure 3) will be excavated prior to the confirmation sampling being conducted. The layout of the post-excavation sample locations will be determined utilizing a random starting point and laid out in a triangular pattern with each sample location being "L" distance away from the previous location. Therefore, the exact sample locations will be dependent on the random starting locations. If, due to obstructions or other interferences, the locations of the 12 samples do not all fall within the boundaries of a set of two SPRU grid units, then additional randomly selected locations within the two SPRU grid units will be determined such that 12 samples are collected within each set of two SPRU grid units.

Sloped sidewalls will be included as part of the surface area of the survey unit and will be included in the selected sample locations. In areas where a trench box is required, the trench box will be removed prior to surveying/sampling using the XRF extension arm from a safe location. These physical samples will be collected remotely with extension rods and/or collected from the excavation equipment bucket as a grab sample.

In addition, if any staining or other anomalies that could potentially be contaminated are identified in or around and excavation, biased samples will be collected in that location.

3.3 Soil Sampling Analysis

The post-excavation soil samples will be subjected to a series of analyses. An in-situ field survey will be obtained for select inorganic COCs using the XRF. Procedures for obtaining field XRF data are detailed in the QAPjP (ARC-PLN-6402). The final confirmatory analysis will be completed by shipping the samples to a laboratory certified by New York State Department of Health ELAP. The off-site chemical analyses will provide confirmation of total COCs in the samples. Details on sample analysis are provided in the QAPjP (ARC-PLN-6402). If the concentrations of other constituents found in soil samples analyzed in the course of the ICM that are not identified as a COC and exceed the more stringent Part 375-6.8(b) SCOs for residential exposure or protection of groundwater, NYSDEC will be consulted regarding any further action.

3.4 Laboratory Deliverable and Data Validation

A detailed description of laboratory reporting and data validation is provided in the QAPjP (ARC-PLN-6402). The laboratory will provide ASP Category B analytical packages. The packages will includes all pertinent raw data, extraction notes, standard preparation, and instrument printouts and identifiers for all samples and quality control solutions prepared.

Analytical data validation involves evaluation of all sample-specific information generated from sample collection to receipt of the final data package. The data validation for SPRU-LL excavations will be performed and reported within the data summary reports. The validation report will contain an itemized discussion of the validation process and results. Copies of the data forms, annotated for qualification as discussed in the validation report, will be attached to the report.

4.0 Waste Management Plan

Waste will be generated in the SPRU-LL land areas during pre-excavation sampling, excavation, and post-excavation confirmation sampling activities. These activities will produce the following waste materials:

- ICM waste that consists of contaminated soil and debris
- Liquid derived from excavation dewatering and equipment cleaning
- Personal protective equipment (PPE) and associated materials
- Sanitary waste.

Approaches for safe and protective management of these wastes are described in this section.

4.1 ICM Waste

ICM waste will consist of contaminated soil and debris generated from the lower level excavations. Investigations in the lower level area to date indicate that no RCRA characteristically hazardous soil will be excavated (if any such hazardous soil is generated, it will be managed as a hazardous waste and manifested off-site for final disposal at a Subtitle C facility). Contaminated soil from each SPRU grid unit under excavation will be loaded into an articulating end dump that will transfer excavated material to 250 CY staging stockpiles in the load-out area. A front end loader equipped with a calibrated bucket scale will be used to manage the staged stockpiles and load shipping containers after confirmatory radiological and chemical analytical data for the stockpiles have been obtained from the laboratory. The bucket loader scale provides the information to load the maximum legal and cost-effective weights to keep trucks moving and eliminate the need for stopping at a public scale. The loaded shipping containers will be transported off-site to DOE-approved and state-licensed disposal facilities.

4.2 Excavation Dewatering and Equipment Cleaning

Storm water and groundwater removed from active excavations will be transferred to one of two 21,000-gal frac tanks after being processed through bag filters (50 and 10 μ units) to remove any sediment. The water will be analyzed to ensure it does not exceed KAPL discharge limits. Sample analysis will be performed both on-site in the analytical laboratory trailer and off-site at the local approved laboratory. Based on groundwater monitoring data collected in the RSA and LLPL (DOE/CH2M HILL 2006a), it is not anticipated that any collected water will exceed on-site discharge limits. Water below discharge limits will be released to an existing permitted outfall. Any such discharges will be approved by KAPL prior to discharge.

4.3 PPE and Related Investigation-Derived Waste Materials

PPE and related materials (e.g., gloves, booties, and tyvek suits, towels used to clean equipment and tools) will be appropriately containerized. This waste will be collected and disposed of in the same manner as ICM soils (i.e., as *de minimus* materials in the shipping containers consistent with approved waste profiles at respective disposal sites).

4.4 Sanitary Waste

Sanitary waste from the SPRU Soils project administrative offices will be managed via existing sanitary sewers. Contracted temporary chemical toilets, aka "porta-potties" will be used by personnel working in the lower level, and resultant wastes will be managed by the subcontractor in accordance with permit and license requirements.

5.0 RCRA ICM Data Reports

5.1 Interim RCRA ICM Data Reports

Once confirmation sampling indicates that a set of two SPRU grid units (approximately 2,390 yd^2) has been deemed complete (Section 2.2.1), the results of the excavation process and confirmation sampling will be summarized in an individual Interim RCRA ICM Data Report. These reports will be developed for each set of two SPRU grid units during the excavation process and submitted to NYSDEC for approval. Submitting these small interim reports should help to expedite NYSDEC review and approval. These reports will include the following:

- Discussion of pre-excavation soil sampling activities, excavation activities and post-excavation soil confirmation sampling activities for COCs
- Site map(s) showing excavated area, sample locations, and topography of final excavation depth
- Summary and evaluation of analytical results of COCs
- Data validation results
- Data quality assessment summary and evaluation of laboratory data validated results
- Documentation of waste management activities
- Presentation of laboratory analytical results of COCs (appendices)
- Any additional action(s) completed as a result of the data obtained during implementation of the ICM Work Plan.

Data will be presented in a tabular form and figures and maps showing the confirmation sample locations will be presented. If any non-COC constituents are found at levels that exceed the more stringent of residential or protection of groundwater 375-6 cleanup objectives, NYSDEC will be made specifically aware of that data and consulted regarding any further sampling or excavation that may need to be done.

A final all-inclusive cleanup report will be developed based upon the individual Interim RCRA ICM Data Reports.

5.2 K5 Retention Basin Pre-Excavation Sampling Report

Once the direct push sampling and analysis is complete for acetone in the K5 Retention Basin, as described in Section 3.1, a report will be prepared documenting the results and providing recommendations for future actions. This report will include the following:

- Discussion of the sampling activity
- Site map(s) showing sample locations
- Summary and evaluation of analytical results
- Data validation results
- Recommendations of future actions.

6.0 References

42 USC 6901 et seq., 1976, "Resource Conservation and Recovery Act of 1976," as amended.

42 USC 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980," as amended. (NOTE: The 1986 amendment is cited as "Superfund Amendments and Reauthorization Act of 1986," [SARA])

ARC-PLN-6310, *Storm Water Pollution Prevention Plan*, Accelerated Remediation Company, as amended.

ARC-PLN-6402, *RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, as amended.

DOE, 2006, *Engineering Evaluation Cost Analysis for the Separations Process Research Unit Disposition Project*, U.S. Department of Energy, December 2006.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report, Separations Process Research Unit Project,* TSM-09, Rev. 1, CH2M HILL, February 2002.

DOE/CH2M HILL, 2006a, *Task IV RCRA Facility Investigation Report for Groundwater Upper and Lower Levels,* TSM-27, Rev. 2, CH2M HILL, April 2006.

DOE/CH2M HILL, 2006b, *SPRU Radiological Characterization Report,* TSM-26, CH2M HILL, June 2006.

DOE/LATA/SHARP, 2007, *RFA SV Amendment to K-5 Retention Basins*, RPT-006, Rev. 0, May 2007.

DOE/LATA/SHARP, 2008, *SPRU RFA SV Amendment to K-5 Retention Basins,* RPT-006, Rev. 1, February 2008.

EPA, 2000, *Guidance on Systematic Planning Using the Data Quality Objectives Process,* EPA QA/G-4, EPA/600/R-96/055, U.S. Environmental Protection Agency, Washington, D.C., August 2000.

Harnett, D.L. 1975. *Introduction to Statistical Methods, 2nd ed*. Addison-Wesley, Reading, Massachusetts.

NYSDEC, 1994, *NYSDEC Technical and Administrative Guidance Memorandum 4046,* January 24, 1994.

NYSDEC, 2002, *Draft DER-10 Technical Guidance for Site Investigation and Remediation*, Draft DER-10, December 25, 2002.

Rogers, Margaret, NYSDEC, to Steven Feinberg, DOE SPRU Field Office, February 1, 2006, "Re: Response to NYSDEC, SPRU RCRA Facility Assessment Sampling Visit Report SWMUs/AOC, February 2002; March 9, 2005."

Attachment 19
RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation (ARC-PLN-6402)
(electronic copy)

RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation

ARC-PLN-6402
May 28, 2009
Revision 3

DOE Contract No. DE-AMO9-05SR22399
Task Order No. DE-AT30-07CC60013/SP15

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RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation

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RCRA Quality Assurance Project Plan for the Separations Process Research Unit Lower Level Land Areas Remediation

Approval for Use

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Acronyms

AA	Alternative Action
AL	Action Level
ASTM	American Society of Testing and Materials
aRc	Accelerated Remediation Company, LLC
ASP	Analytical Services Protocol
CL	Characterization Lead
CLP	Contract Laboratory Program
COC	Constituents of Concern
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
DNAPL	Dense Non-Aqueous Phase Liquid
DOE	U.S. Department of Energy
DQA	Data Quality Assessment
DQO	Data Quality Objective
DS	Decision Statement
EPA	U.S. Environmental Protection Agency
ES&H	Environment, Safety, and Health
HDPE	High-Density Polyethylene
HSA	Hollow Stem Auguring
ICM	Interim Corrective Measures
ID	Inner Diameter
KAPL	Knolls Atomic Power Laboratory
LDPE	Low Density Polyethylene
LNAPL	Light Non-Aqueous Phase Liquid
L&V	Limitations & Validation
MDL	Method Detection Limit
MS/MSD	Matrix Spike/ Matrix Spike Duplicate
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
PDB	Passive Diffusion Bag

PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
PQAM	Project Quality Assurance Manager
PSQ	Principal Study Question
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAO	Quality Assurance Objectives
QAP	Laboratory Quality Assurance Plan
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SCO	Soil Cleanup Objectives
SOP	Standard Operating Procedures
SOW	Statement of work
SPRU	Separations Process Research Unit
SPRU-LL	SPRU Lower Level
SVOC	Semi-volatile Organic Compound
TAL	Target Analyte List
UFP	Uniform Federal Policy
VOC	Volatile Organic Compound
XRF	In-situ X-ray fluorescence

Comparison to RFI QAPjP

The following table identifies modifications and/or additions to the following Resource Conservation and Recovery Act (RCRA) Quality Assurance Project Plan (QAPjP) relative to the April 2005 RFI Work Plan (DOE/CH2M HILL 2005) and the RCRA Facility Assessment Sampling Visit (RFA SV) Work Plan (WP) for the Land Areas, dated April 2002.

RCRA ICM QAPjP Topic	Section	Page	Modification Relative to RFI QAPjP and RFA SV WP*
General note	Document wide		Change reference to RFI to ICM
General note	Document wide		Numbering of section reflects additions and deletion to document.
General note	Document wide		Removed all reference to Upper Level.
Approval Page		i	Added to Meet UFP requirements.
Distribution List		ii	Added to Meet UFP requirements.
Project Personnel Sign-off Sheet		iii	Added to Meet UFP requirements.
Table of Contents		iv	Revised to reflect page number changes.
List of Acronyms		vi	Revised to reflect additions and deletions to document.
Purpose	1.1	1	Revised to reflect RCRA ICM Work Plan.
Project Description	1.2	1	Revised to reflect RCRA ICM Work Plan.
Project Organization and Responsibility	1.3	1	Revised to reflect new project organization and responsibilities and to incorporate UFP requirements. UFP requirements include Organizational Chart, Project Personnel Responsibility and Qualifications Matrix, and Communications Pathways matrix.
Well Installation and Development Procedures	2.1	6	Updated to note that monitoring wells/temporary well points will be determined, as needed, during implementation of ICM activities.
Well and Borehole Decommissioning Procedures	2.1.1	6	*Groundwater Monitoring Well Decommissioning Procedures is inserted before the Permanent Monitoring Well Installation section.
Permanent Monitoring Well Installation	2.1.2	6	Changed "fluid rotary drilling" to water rotary drilling." Also modified the approach to hydrate all bentonite seals.
Split-Barrel Sampling Method	2.2.1	9	Modified to incorporate the potential of SVOC sampling
Sample Identification and Labeling	2.4	17	Modified to reflect project specific sampling methodology.
Soil and Sediment Sampling	2.6.1	19	Replaced reference to alconox rinse and

RCRA ICM QAPjP Topic	Section	Page	Modification Relative to RFI QAPjP and RFA SV WP*
Equipment			replaced with non-phosphate detergent. Removed references to isopropanol wash.
Data Quality Objectives	3.0	20	Revised to provide ICM project specific DQO and to meet UFP requirements. Revision provides description of the seven steps of the DQO process as associated with the ICM.
Sample Collection and Preservation	3.3.1	28	Updated Table 4 to reflect latest SW-846 methods.
Inspection/Acceptance Requirements for Supplies and Consumables	3.3.6	29	Added section on Inspection/Acceptance Requirements for Supplies and Consumables to meet UFP requirements.
Field Equipment Calibration	3.5.1	30	Add XRF
Analytical Laboratory Procedures	3.6	34	Updated analytical procedures
Documentation	3.8	39	Added section to address UFP requirements.
Data Validation	3.9.2	42	Revised to reflect UFP requirements, specifically the DQA process.
Data Quality Assessment	3.9.3	42	Revised to address UFP requirements
Corrective Action	3.10	43	Revised to differentiate between laboratory and field corrective actions

1.0 Introduction

1.1 Purpose

This Quality Assurance Project Plan (QAPjP) provides the guidelines and procedures for generating data for the Interim Correctives Measures (ICM) to cleanup chemical contamination at the Separations Process Research Unit (SPRU) Lower Level (SPRU-LL) as defined in the *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation* (ICM Work Plan) (ARC-PLN-6106). This QAPjP was prepared in accordance with the guidelines provided in the *EPA Quality Assurance Project Plan Guidance* (EPA 2002), and the Uniform Federal Policy for Quality Assurance Project Plans (IDQTF 2005). Appendix A provides a crosswalk table indicating where the Uniform Federal Policy (UFP) requirements are addressed within this QAPjP. This QAPjP describes the field and laboratory sampling, analysis, and quality control (QC) procedures to be used for the confirmation sampling for the RCRA interim corrective measures in the SPRU-LL. This plan presents the activities, organization, and quality assurance (QA)/QC protocols to achieve specific data quality objectives (DQOs).

1.2 Project Description

In accordance with the ICM Work Plan (ARC-PLN-6106), as recommended in the *SPRU RCRA Facility Assessment Sampling Visit Report* (DOE/CH2M HILL 2002) and agreed to by New York State Department of Environmental Conservation (NYSDEC) via the *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002* (NYSDEC 2006), the objectives of the ICM Work Plan are to remove soil contaminated with constituents of concern (COCs) associated with SPRU waste releases that are above Soil Cleanup Objectives (SCOs) and to achieve a No Further Action determination from NYSDEC for chemicals in the SPRU land areas.

1.3 Project Organization and Responsibilities

The project must have a clearly defined project organization. Figure 1 depicts the organizational chart for the project. Table 1 provides a listing of project personnel implementing the ICM Work Plan and their responsibilities and qualifications. Table 2 provides the communications pathways including points of contact for resolving sampling and analysis problems, distribution of data, and changes to the QAPjP for the project. The following sections outline the specific duties of key project personnel through the ICM effort. All project and support personnel shall be expected to stop work at the site if an unsafe condition or condition adverse to quality exists.

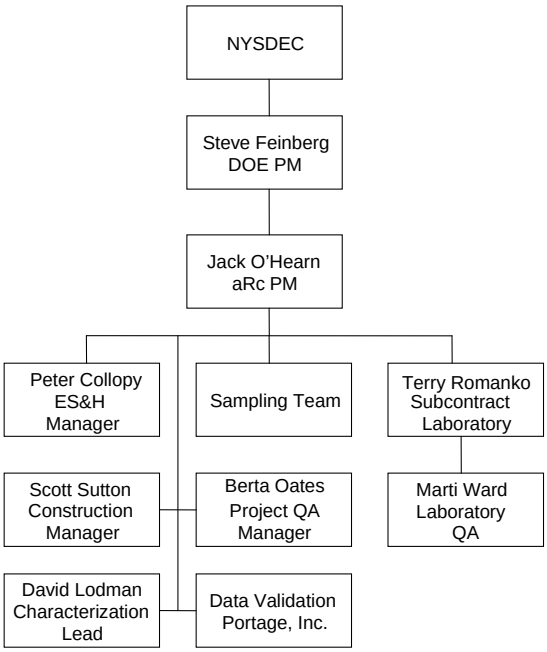

Figure 1 SPRU-LL RCRA ICM organization chart

Table 1 Project personnel responsibilities and qualifications

Name	Title	Organizational Affiliation	Education, Experience and Qualifications
Steve Feinberg	Department of Energy (DOE) Point of Contact with Contractor	DOE	
Jack O'Hearn	Project Manager	aRc	M.S., Civil Engineering, 40 years exp.
Scott Sutton	Construction Manager	aRc	30 years experience in earth moving and environmental remediation
David Lodman	Characterization Lead	aRc	M.S., Animal Science, 19 years experience In characterization and QA
Peter Collopy	Environment, Safety, and Health Manager	aRc	M.E. Environmental Engr., CHP, CIH, CSP, 30 years exp.
Berta Oates	Project Quality Assurance Manager	aRc	B.S., Chemistry, 16 years experience

Table 2 Communications pathways

Communication Drivers	Project Role	Responsible Official	Telephone Number	Procedure
Point of Contact with NYSDEC	DOE Project Manager	Steve Feinberg	518-395-4627	All NYSDEC required materials and information will be forwarded to NYSDEC by Steve Feinberg
Management of all project phases	Project Manager	Jack O'Hearn	518-344-2860	Jack O'Hearn is the aRc liaison to Mr. Feinberg. Notifies Mr. Feinberg of negative field related activities by phone or e-mail by COB the next business day.
QAPjP changes in the field	Characterization Lead	Dave Lodman	518-783-6088	Notifies Jack O'Hearn by phone and e-mail with cc to PQAM of changes to QAPjP made in the field and the reason within 2 business days.
Daily field progress reports	Characterization Lead	Dave Lodman	518-783-6088	Provides Jack O'Hearn daily field progress report by e-mail.
Reporting Lab data issues	Laboratory Quality Assurance Officer	Marty Ward	314-298-8566	All negative/adverse QA/QC activities with project field samples will be reported the Laboratory QA Officer to Berta Oates within 2 business days.
Field and Analytical Corrective Actions, Release of Analytical Data	Project Quality Assurance Manager	Berta Oates	801-782-5179	The initial need for corrective action for field and analytical issues will be determined by Berta Oates. All data will be considered preliminary until validation is completed and Berta Oates has approved the release.
QAPjP Amendments	NYSDEC	Margaret Rogers	518-357-2353	Any major changes to the QAPjP must be approved by NYSDEC before changes can be implemented.

1.3.1 Project Manager

The Project Manager (PM) will ensure that all activities conducted during the project are consistent with the project requirements documents, and all applicable Occupational Safety and Health Administration, Environmental Protection Agency (EPA), DOE, U.S. Department of Transportation, and State of New York requirements. The PM coordinates all document preparation and all field, laboratory, and data quality assessment (DQA). The PM is responsible for the overall work scope, schedule, and budget.

The PM is responsible for field activities and will work closely with the sampling team at the site to ensure that the objectives of the project are accomplished in a safe and efficient manner. The PM will work with all other identified project personnel to accomplish day-to-day operations at the site, identify and obtain additional resources needed at the site, and interact with the DOE environment, safety, and health (ES&H) and QA oversight personnel on matters regarding health and safety. The PM or designee will conduct all pre-job briefings.

1.3.2 Construction Manager

The construction manager is responsible for the safe and successful completion of all excavation and waste load-out tasks as well as for interfacing with the PM to ensure coordination in accomplishing all required construction related field and reporting tasks.

1.3.3 Characterization Lead

The characterization lead (CL) is responsible for the safe and successful completion of confirmation sampling. The CL works with the construction manager, the ES&H personnel, and the field team to manage field sampling related operations and to execute the Sampling and Analysis Plan. The CL enforces site control, documents activities, and may conduct the daily safety briefings at the start of the work shift. Any team member may bring health and safety issues to the attention of the CL. If the CL leaves the site, an alternate will be appointed. The identity of the acting CL will be conveyed to site personnel, recorded in the closure logbook, and communicated to the facility representative, as appropriate.

1.3.4 Environment, Safety, and Health

The ES&H Manager is the primary source for information regarding hazardous agents at the site. The ES&H personnel assess the potential for worker exposures to hazardous agents according to the *Worker Safety and Health Program Plan for SPRU Land Areas Remediation* (ARC-PLN-6302). By participating in pre-job planning, the ES&H manager assesses and recommends appropriate controls for the protection of affected workers, and operates and maintains airborne sampling and other monitoring equipment, as appropriate. The ES&H manager also recommends and assesses the use of personal protective equipment in relevant work control documentation.

1.3.5 Project Quality Assurance Manager

The Project Quality Assurance Manager (PQAM) is responsible for verifying the implementation of this QAPjP. The PQAM responsibilities include the following:

Independent review and approval of quality-related documentation.

Overseeing, evaluating, and verifying adherence to this QAPjP and other quality-related documents through periodic assessments.

Reviewing external directives to determine the QA requirements that must be selected and applied to the SPRU-LL.

Communicating quality system requirements, procedures, and opportunities to the appropriate management and staff.

Recommending corrective actions and quality system improvements to the PM.

Verifying timely resolution of corrective actions identified through assessments or the quality improvement process and tracking of corrective action to closure.

Reviewing sample data for samples collected to verify regulatory or contractual requirements.

1.3.6 Sampling Team Members

The sampling team will be responsible for collecting samples in sufficient numbers and of sufficient quality to meet the requirements presented in this QAPjP. At the end of each sampling effort, the sampling team, under direct supervision of ES&H oversight personnel, will be responsible for removal and transport of any sampling equipment brought into the sampling area to a decontamination facility.

1.3.7 Data Validation

Analytical data validation is the comparison of analytical results versus the requirements established by the analytical method. Data validation will be the responsibility of data validators who are independent from the project and the analytical laboratory. The data validators will review the chain of custody documentation, reported sample results, and laboratory and field quality control data to review laboratory data qualifying flags and assign data qualifying flags as appropriate in accordance with the National Functional Guidelines (EPA 1999, EPA 2004). Validation includes evaluation of all sample-specific information generated from sample collection to receipt of the final data package by the PM. Data validation is used to determine if the analytical data are technically and legally defensible and reliable. A more detailed description of the data validation process is provided in section 3.9.2.

2.0 Field Sampling Plan

The following sections augment the ICM Work Plan in describing the specific procedures and requirements of the ICM activities. Specific information such as the proposed number of samples, sample locations are provided in the ICM Work Plan. One or more of the procedures provided below may be used on the basis of environmental conditions and/or unsuspected circumstances. Alternative procedures must be selected on the basis of obtaining samples and/or data of the best possible quality and integrity.

Whenever possible, minor deviations from this QAPjP that are consistent with standard environmental investigations will receive prior approval from the SPRU Project Manager. Major deviations from this QAPjP will also receive prior approval from NYSDEC.

2.1 Well Installation and Development Procedures

The following procedures will be used to complete well decommissioning, well installation, and/or well development activities. The specific methods selected and the locations for the monitoring wells/temporary well points will be determined, as needed, during implementation of ICM activities.

Supervision of well installation and well development activities will be provided by a qualified geologist or hydrogeologist who will be in attendance during field activities to determine the well depth and screen interval based on field conditions, to prepare well completion logs, and to complete daily drilling records.

2.1.1 Well and Borehole Decommissioning Procedures

2.1.1.1 Groundwater Monitoring Well Decommissioning

Consistent with well decommissioning guidance developed for the NYSDEC (Malcolm Pirnie 1996) and American Society for Testing and Materials (ASTM) D-5299-99 [ASTM 1999], two methods of well decommissioning are proposed: perforating the well casing with grouting in place or overdrilling the well. For monitoring wells to be decommissioned by perforating the well casing and grouting in place, a perforating tool will be lowered into the well and used to perforate the well screen and well casing with a series of small-diameter holes at a minimum of five holes per linear foot (Malcolm Pirnie 1996). After removing the perforating tool from the well, the perforated monitoring well will be grouted from the bottom of the well to approximately 0.5 feet below grade. The grout material will consist of Type I Portland cement mixed with either a powdered or granular bentonite. The grout mixture will be prepared in accordance with ASTM Standard D 5092-04e1 such that approximately 3 to 5 pounds of bentonite is mixed with 6.5 to 7 gallons of water per 94-pound sack of cement. For monitoring wells to be decommissioned by overdrilling, a hollow-stem auger fitted with a plug cutter will be advanced through the existing well. The plug cutter will grind the well construction materials, which will be brought to the surface by the auger. After drilling to a depth of approximately one-half foot below the measured well depth, the borehole will be filled with grout from the bottom of the borehole to approximately one-half foot below grade. The grout material will consist of Type I Portland cement mixed with either a powdered or granular bentonite. The grout mixture will be prepared such that approximately 3 to 5 pounds of bentonite is mixed with 6.5 to 7 gallons of water per 94-pound sack of cement. Depending on the location of the well, the remaining half foot of borehole will be backfilled with an asphalt patch or clean soil. If possible, temporary wells will be decommissioned by pulling the well casing and screen from the ground and filling the resultant borehole with bentonite chips or equivalent. If necessary, temporary well boreholes will be filled with cement/bentonite grout mixed as above.

Well decommissioning activities will be recorded in the field book or on separately prepared forms. Information to be recorded shall include, but not necessarily be limited to, the decommissioning method, date of decommissioning, backfill, and surface restoration method.

2.1.1.2 Overburden Monitoring Well Decommissioning

In general, the preferred method for overburden monitoring wells requiring decommissioning is pulling the well with concurrent grouting. Where this is not feasible, grouting in place via perforation or puncturing of the casing, or overdrilling, may be performed. NYSDEC and ASTM guidance (Malcolm Pirnie 1996, ASTM 1999) should be followed for circumstances involving contaminated wells penetrating a confining layer, bedrock or telescoped wells, or wells demonstrating non-aqueous phase liquid or dense non-aqueous phase liquid (DNAPL) contamination.

2.1.1.3 Borehole Decommissioning

Where possible, shallow hand-sampled borings will be backfilled with surrounding soil. Deeper hand-sampled or direct-push borings may require backfill with bentonite chips or granules. Test borings derived from drilling activities that are not backfilled with soil cuttings or are not completed as monitoring wells will be backfilled with a cement/grout mixture.

Adequate hydration of dry bentonite (e.g., pellets) is required if the borehole is installed above the water table and/or where only perched water has been encountered.

2.1.2 Permanent Monitoring Well Installation

Permanent monitoring wells will be installed into the borehole advanced using either hollow stem auguring (HSA) or water rotary drilling techniques. For wells requiring penetration into the gray till and to minimize the potential for cross-contamination into the till, a nominal 4-inch-diameter steel casing will be grouted approximately 5 feet into the gray till prior to further borehole advancement. The monitoring wells shall be sufficiently plumb and straight such that there is no interference with the use of sampling equipment.

Well sumps may be used to enhance groundwater recovery when low groundwater yield is expected. The sump shall be constructed of the same material as the well casing and shall not penetrate deeper than 3 feet below the base of the well screen. The sump borehole annulus shall be filled with bentonite chips or pellets and hydrated. The bentonite shall be emplaced with a tremie pipe to avoid bridging over the screened interval. Care shall be taken such that the hydrated clay does not extend over the well screen. One foot of filter pack shall be placed above the bentonite fill to the base of the well screen.

Split-barrel samples will be obtained continuously throughout the total depth of the borehole at each location according to ASTM Standard Method D-1586 (ASTM 1984) in advance of the hollow-stem augers. All soil samples will be logged onsite and selected soil samples may be retained for geotechnical analysis, if necessary. Test boring logs describing subsurface materials encountered in each of these borings will be prepared by the onsite geologist or hydrogeologist. Descriptions of soil sample texture, composition, color, consistency, moisture content and recovery will also be recorded. Soil samples from these borings will also be screened with a portable photoionization detector (PID) described in Section 3.5.1.3.

Each monitoring well will be constructed of a 2-inch inside-diameter, flush joint, schedule 40 polyvinyl chloride (PVC) riser pipe with either 5 or 10 feet of 0.010-inch slot well screen. Screen lengths may be modified to monitor more discrete zones. In the event more discrete zones are to be monitored and the well screen is not placed at the bottom of the borehole, the open portion of the borehole below the bottom of the well screen will be backfilled using bentonite hole plug material. The hole plug will extend from the bottom of the borehole to about 1 foot below the proposed bottom of the well screen. Approximately 1 foot of filter pack will be placed above the bentonite seal prior to installation of the well screen and riser pipe. The well screen and riser pipe preferably will be factory-wrapped and sealed by the manufacturer. If the well screen is not factory sealed, the well screen and riser pipe will be high pressure steam cleaned prior to well construction. The base of each well will be equipped with threaded bottom plugs and the top of each well will be equipped with a vented, non-threaded cap.

After setting the well, sand will be introduced gradually inside the augers to fill the annular space between the screen and the borehole adjacent to the screen. The sand pack will extend from the bottom of the

boring to approximately 2 feet above the top of the screen. The sand pack will consist of a clean, graded, silica sand with grain size distribution matched to the slot size of the screen. A Morie Grade 0 or equivalent sand is deemed appropriate.

A bentonite seal will be placed above the sand pack to form a seal at least 2 feet thick. The bentonite seal will be hydrated with potable or distilled water prior to placement of the cement-bentonite grout. A cement-bentonite grout will extend from the top of the bentonite seal to the ground surface. The grout material will consist of Type I Portland cement mixed with either a powdered or granular bentonite. The grout mixture will be prepared in accordance with *Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers* (ASTM 1992), such that approximately 3 to 5 pounds of bentonite is mixed with 6 to 7 gallons of water per 94-pound sack of cement. If practicable, the grout will be introduced via a tremie pipe lowered to just above the top of the bentonite seal. As the grout is pumped into the borehole, the tremie pipe will be removed in sections so that the grout is pumped into the borehole at a level below the top of the grout seal as it is put in place.

The monitoring well will be completed using either a stick up protective well casing or a flush-mounted road box placed over the top of the PVC well casing and cemented in place. A lockable cap will be installed over the top of the well casing and or riser pipe and secured with a lock. A well completion log, which documents the construction materials and techniques, will be generated for each monitoring well installed.

2.1.3 Temporary Well Point Installation Procedures

Temporary well points will be installed into the borehole advanced using either hollow stem auger or direct push drilling techniques. The temporary well points shall be sufficiently plumb and straight such that there is no interference with the utilization of sampling equipment. Temporary well points will consist of a 5-foot or 10-foot length of ¾-inch or 1-inch diameter, 0.010-inch slot, flush joint PVC well screen and PVC riser pipe installed into the borehole (details may vary). If borehole collapse is problematic, wells may consist of pre-packed screens installed within direct push or HSA casing. Screen lengths may be modified to monitor more discrete zones. The well screen and riser pipe preferably will be factory-wrapped and sealed by the manufacturer. If the well screen is not factory sealed, the well screen and riser pipe will be high pressure steam cleaned prior to well construction. The base of each well will be equipped with threaded bottom plugs and the top of each well will be equipped with a vented, non-threaded cap.

If the temporary well is installed within casing, sand will be introduced gradually inside the augers to fill the annular space between the screen and the borehole adjacent to the screen. The sand pack will extend from the bottom of the boring to approximately 2 feet below grade. The sand pack will consist of a clean, graded, silica sand with grain size distribution matched to the slot size of the screen. A Morie Grade 0 or equivalent sand is deemed appropriate. The remaining annular space between the temporary well point and the borehole will be filled with bentonite. For direct push installation, a bentonite seal will be placed around the annulus to prevent surface water infiltration unless protection is provided by equivalent impervious materials (e.g., asphalt or concrete). The bentonite will be hydrated with potable or distilled water. The temporary well points will be protected using an aboveground protective casing or a flush-mounted road box placed over the top of the PVC well casing. A vented cap will be fitted onto the top of the well casing. A well completion log, which documents the construction materials and techniques, will be generated for each temporary well point installed. Completion by formation collapse is not acceptable.

2.1.4 Well Development

Following the completion of the monitoring well/temporary well point installation program, the wells will be developed to remove fine-grained materials from the well, reduce the turbidity of groundwater samples, and potentially increase the yield of the well. The monitoring wells and temporary well points will be developed not less than 48 hours after installation. The wells will be developed using one or a combination of the following procedures:

Bailing

Peristaltic pumping

Inertial pumping (e.g., WaTerra pump) and/or

Mechanical Surge Block

Centrifugal pumping.

The down hole well development equipment (e.g., bailers, tubing and/or foot valves) will be new, pre-cleaned and/or dedicated to each monitoring well. Care will be taken not to introduce contaminants on the equipment during installation.

If organic vapors are detected above background or organic compounds are detected on the water level probe, then a clear bailer or tubing will be lowered into the well to check for both light non-aqueous phase liquids (LNAPLs) and DNAPLs. If LNAPLs and or DNAPLs are discovered, an attempt will be made to collect a sample in an appropriate container and submit the sample to the analytical laboratory for appropriate analysis. Well development will then proceed by repeated removal of groundwater from the well. Development water will be directed to a graduated pail. After each well volume is removed the field parameters pH, temperature, specific conductivity, and turbidity will be measured using the equipment discussed in Section 3.5.1. Alternatively, a flow through cell may be used to provide a continuous measurement of well development parameters during pumping. If used, data will be recorded at least every well volume and final turbidity will be measured using a turbidimeter as discussed in Section 3.5.1.4. If practical, well development will continue until turbidity has stabilized at less than 5 Nephelometric Turbidity Units (NTUs); and/or pH, temperature, and specific conductivity have stabilized. Stabilization is defined here as a ten percent or less variation of temperature, specific conductivity, and turbidity, and less than 0.1 unit variation of pH between three successive readings. If turbidity stabilizes above 5 NTUs and the other parameters also have stabilized, the well will be considered developed. For wells that evacuate to dryness after removal of one well volume, well development will be considered completed after removal of three well volumes, regardless of parameter stabilization.

In addition, the newly installed and existing monitoring wells will be inspected and total depths measured prior to and after well development activities. If silting has occurred in a well where greater than 50% of the well screen is occluded, then the monitoring well will be redeveloped prior to groundwater sampling activities.

At the beginning of the well development process, prior to the removal of the first well volume, the field parameters will be measured and subsequently recorded in the field notes.

Field parameters will continue to be measured after each well volume is removed. Well development information will be recorded in the field notebook and will include, but not necessarily be limited to, head space organic vapor readings, water levels and time measured, well depth, well volume calculation, field parameter measurements, and total water volume removed (nearest 0.1 gallon).

2.2 Soil Collection Procedures

Soil samples may be collected by split barrel, direct push, or hand auguring methods. Samples collected for VOCs shall be collected within 24 hours after completion of excavation. If sampling cannot be completed within this time frame, samples will be collected at a depth of 6–12 inches.

2.2.1 Split-Barrel Sampling Method

Surface and subsurface soil may be sampled using the split barrel sampling method. Split barrel samplers typically consist of a 2 foot long, 2-inch or 3-inch outside diameter carbon-steel sampler (split-barrel). However, depending on the sampling depth, smaller hand driven split barrel and/or core samplers may be used. Depending on field conditions, sample depth requirements or site access, the split barrel samples may be advanced by hand using a slide hammer, sledge hammer, pneumatic hammer, a tripod/monopod rig and/or a drilling rig. Acetate and/or PVC liners may be used to facilitate extraction of the sample from the split-barrel.

After retrieval of the split-barrel sampler, the soil sampler will be opened, and the onsite hydrogeologist or geologist will inspect the soil sample. If laboratory samples are to be collected for volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCs), a representative portion of the soil sample will be placed in the appropriate pre-cleaned containers provided by the laboratory. These samples will not be mechanically stirred or mixed in any way prior to the bottling step.

Following any VOC/SVOC sampling, descriptions of soil sample texture, composition, color, consistency, moisture content, and recovery will be recorded on the boring log. Soil samples collected for target analyte list (TAL) inorganics will then be transferred from the split-barrel sampler to a stainless-steel pan, using a stainless-steel trowel or scoopula, and homogenized. The soil will be rolled to the center of the pan and initially mixed using a clean stainless-steel trowel. The soil will then be quartered and each quarter moved to a corner of the pan. Each quarter will then be mixed individually, moved back to the center of the pan, and thoroughly mixed with the other quarters. Soil for the remaining analyses will be selected from this final mixture. All soil samples will be placed in a cooler containing ice and transferred to the laboratory following chain-of-custody procedures. To minimize the potential of cross-contamination, the split-barrel samplers will be cleaned in accordance with the cleaning protocol provided in Section 2.6.

2.2.2 Direct-Push Method

Soil samples may be collected during the ICM using direct-push methods. Soil samples will be collected in an open hole, provided the soil is suitably stable to prevent or minimize fall-in or sloughing. Where the hole is not adequately stable, discrete direct-push sampling methods may be used, whereby an outer casing or a closed piston-type sampler may be used. Typically, a clear acetate liner will be used in the direct-push sampler. Upon retrieval from the direct push sampler, the liner will be cut lengthwise allowing sample inspection and collection. Soil sample collection via direct push technology will be done similar to that for the split-barrel sampler, described herein. If laboratory samples are to be collected, a representative portion of the soil sample will be placed in appropriate pre-cleaned containers. For samples

to be analyzed for VOCs or SVOCs, the samples will not be mechanically stirred or mixed in any way prior to the bottling step. These soil samples will be placed in a cooler containing ice and transferred to the laboratory following chain-of-custody procedures. To minimize the potential of cross-contamination, the direct-push samplers will be cleaned in accordance with the cleaning protocols provided in Section 2.6, and/or a new plastic sleeve insert will be used for each soil sampling interval.

2.2.3 Hand Auger/Post-Hole Tool/Sediment Corer Method

This sampling method is designed for collecting soil samples from depths down to 4 ft or sediment samples from depths down to 2 ft. A pre-cleaned bucket auger or post-hole tool will be advanced manually from the ground surface to the bottom of the boring at 6-inch intervals. If sediment sloughing or collapse is problematic, a pre-cleaned sediment corer (e.g., piston type) will be advanced manually into the sediment to the target depth defined in the ICM Work Plan. The soil or sediment will be transferred directly to a stainless-steel pan. The onsite hydrogeologist or geologist will inspect the soil and sediment retrieved from the sampler and will describe the soil and sediment similarly to that performed for the split-barrel sampler in Section 2.2.1. If laboratory samples are to be collected, a representative portion of the soil or sediment will be placed in appropriate pre-cleaned containers. These samples will be placed in an ice-filled cooler and transferred to the laboratory following chain-of-custody procedures. To minimize the potential of cross-contamination, the bucket auger, post-hole tool, or sediment sampler will be cleaned between sampling intervals in accordance with the cleaning protocol provided in Section 2.6.

2.3 Groundwater Collection Procedures

Following monitoring well completion and development, a groundwater sample will be obtained from the newly installed monitoring wells and temporary well points. Groundwater samples will be collected using either a bottom-loading bailer, a peristaltic pump, or inertial pump with high-density polyethylene (HDPE) tubing equipped with a foot valve. At monitoring well locations that do not recharge sufficiently within 24 hours following purging or do not contain a sufficient volume of water for the collection of VOC samples, Passive Diffusion Bag (PDB) samplers will be used. Field QC samples associated with the groundwater sampling will be collected in accordance with this QAPjP. At each well to be sampled, a clean sheet of polyethylene will be laid out on which the monitoring and sampling equipment can be placed. The equipment required is listed below:

Sample Containers

- Upon receipt of the sample containers from the laboratory, inventory the containers to confirm that appropriate containers were delivered, check if preservatives have been added, if necessary, and assess the general condition of the containers.

Submersible pump and accessories (e.g., Grundfos®, or bladder squeeze pump):

- Control box and tool kit
- Dedicated tubing (5/8-, 1/8-inch inner diameter (ID) low density polyethylene (LDPE) tubing, 3/8-, 1/4-inch ID silicon tubing)
- Generator, extension cords, gas can
- Air compressor for bladder pump

Peristaltic pump (e.g., Isco® or equivalent) and dedicated tubing for monitoring wells with shallow screens (< 20 feet)

- Graduated cylinder and stopwatch

Inertial Pump (polyethylene or Teflon® tubing with check valve)

Bailers (PVC, stainless steel, or Teflon®; minibailers for direct push wells)

- Clean nylon rope or Teflon® -coated wire.

PDB

- Clean nylon rope or Teflon® -coated wire.

Other Equipment

- Solinst® water level meter (or equivalent)
- Several 5-gallon buckets
- YSI® Model 8260 flow through cell and accessories, or equivalent
- Cleaning Supplies
- PID
- Turbidity meter
- 55-gallon drum for development/purge water accumulation

2.3.1 Water Level Measurements

Prior to conducting groundwater sample collection activities, the depth to groundwater will be measured in the monitoring well or temporary well point to calculate the volume of water to be purged during sampling activities and to assess groundwater flow conditions. A complete round of groundwater level measurements in either the Upper or Lower Levels will be obtained from all accessible monitoring wells and temporary well points subject to the groundwater investigation prior to commencing groundwater sampling activities in the respective investigation area. Care will be taken to disturb only the upper portion of the well water column to avoid re-suspending settled solids in the wells. The depth to groundwater levels will be measured using an electronic water level indicator probe. The probe cable will be graduated in 0.01 foot increments. The water level measurements will be obtained in accordance with the procedures below.

1. Unlock the well cover and carefully remove to avoid having any foreign material enter the well. The riser pipe will be monitored with a PID for the presence of VOCs.

2. Clean the water level probe and lower portion of cable.

3. Lower the probe slowly into the monitoring well until the audible and/or visual alarm indicates the top of the water column.

4. Read the depth, to the nearest 0.01 feet, from the graduated cable using the marked measuring point on the monitoring well casing as a reference. Record the depth to water in the field notebook. If the well is dry or frozen, record that condition in the field notebook.

5. Remove the probe from the monitoring well slowly. Clean the probe and lower portion of cable using clean paper towels saturated with distilled or deionized water.

6. Replace the monitoring well cap and lock the protective casing cover.

Groundwater levels will be recorded in the field notebook and on a field form if desirable. Information to record should include well identification, physical condition of the well, date and time of water level measurement, depth to water, total installed depth of the well, measuring point reference, and elevation.

2.3.2 Purging Procedures

Groundwater monitoring wells and temporary well points will be purged prior to sample collection. In rapidly recharging monitoring wells/well points, purging will be accomplished by removal of a minimum of three well volumes of water. In slowly recharging monitoring wells/well points, the well should be purged to dryness for a minimum of one well volume. Samples should be collected within 3 hours of completing well purging activities or until sufficient water is available for sampling. The procedure to be followed in purging the monitoring wells/well points is as follows:

1. Prior to purging the well, water level and known total depth of each well will be reviewed to calculate the volume of water to be purged from the well. Using the water level and known total depth, the length of the water column in the well is calculated. This is accomplished by subtracting the depth to water from the measured total depth, both measured from the top of the casing, followed by multiplication by a conversion factor of 0.163 for 2-inch diameter wells to calculate the volume of water (in gallons) of water equaling one well volume. That value is multiplied by three to determine the volume of water required to purge the well of three well volumes.

2. The well cover will be unlocked and carefully removed to avoid having any foreign material enter the well.

3. If a dedicated Teflon®, polyethylene, or PVC bailer with new nylon line is used for evacuation, a sampling team member will remove the bailer from the protective bag and lower it down the well until it comes in contact with the water. The sampling team member will continue to lower the bailer allowing it to submerge. When the bailer has filled, it will be removed from the monitoring well and the water discharged into a 5-gallon pail. Care will be taken to prevent the bailer from touching the 5-gallon pail, which could lead to cross-contamination of the bailer. These steps will be repeated until three well volumes have been removed or until the monitoring well is essentially dry. Sufficient time will be allowed for slowly recovering wells to recharge prior to sampling.

4. Monitoring wells may be purged using a peristaltic pump and dedicated tubing. A inertial pump with check valve and tubing may also be used, if practical. The discharge from the peristaltic or inertial pump will be directed into a 5-gallon pail. Operation of the pump will be conducted as follows:

Lower the pump and water level indicator slowly into the well to the sample depth. The sample depth is the midpoint of well screen if fully saturated or midpoint of water column if screen is not fully saturated, but not less than 2 feet from bottom.

Secure a dedicated length of tubing (LDPE) so that the pump (submersible) or pump (peristaltic) remains at the appropriate depth.

Measure the water level with the pump (submersible), bailer, or pump hose (peristaltic) in the well. Record measurements in the field log book.

Set up a graduated bucket to collect all purge water.

Start the pump at the lowest setting and slowly increase as necessary until discharge occurs. Continually check water level and adjust pump speed so that the drawdown is at least stable and ideally there is less than 0.3 feet of drawdown. Achieving a stable drawdown should take less than 15 minutes. Do not allow the water level to fall to the pump intake (submersible) or pump tubing intake (peristaltic) level.

If the well dewaters at the lowest pump setting, then stop purging and collect sample once sufficient ground water has recharged into the well. For wells with insufficient yields to support minimum pumping rates, wells will be considered purged after removal of one well volume, including the sump volume if a sump is constructed into the aquaclude.

Measure flow rate using a graduated cylinder once drawdown is stabilized. Ideally, <0.3 feet drawdown occurs, but this is not critical if the field parameter stabilization and water level stabilization is achieved.

Carefully record all depths, pumping rates (and particular pump and type), etc. for subsequent rounds of sampling.

For pumped groundwater, it is anticipated all field parameters, except turbidity, shall be measured using a flow-through cell (preferably transparent). Turbidity measurements shall be recorded from groundwater prior to entering the flow-through cell. Field parameters may be taken from a clean sample container in the event sustained flow from the well cannot be maintained.

Remove at least three well volumes from the well prior to collection of the groundwater sample. For wells that exhibit insufficient yield to support minimum pumps, refer to section 2.3.3.

5. Measure the turbidity, temperature, pH, and specific conductivity of the purge water after each well volume is purged. Record field parameter measurements (including flow rate and drawdown) initially and at a minimum of every three minutes. Stabilization occurs when three consecutive readings, taken at 3 minute intervals, are within the following limits:

   Turbidity =10% if greater than 5 NTU
   Conductivity =10%
   Temperature =10%
   PH =plus or minus 0.1 unit

Purging information will be recorded in the field notebook and on a field form if desirable. Information to record should include well identification, date and time of purging, recharge time, type of purging equipment, depth to water, well diameter, volume of water in well volume, appearance of purge water, and volume of water purged.

2.3.3 Groundwater Sample Collection

Subsequent to purging activities, groundwater samples will be collected and submitted for laboratory analysis. Groundwater samples may be collected using bailers or peristaltic or dedicated inertial pumps with dedicated tubing or PDB samplers. VOC samples will be collected using bailers as described below. Persons involved with the sampling program will be technically competent and familiar with the sampling procedures described herein.

Groundwater samples will, if at all possible, be collected within three hours after purging is completed. If recharge is sufficient, then samples will be collected immediately following well purging. For slowly recharging wells, groundwater samples will be collected after a sufficient volume of water for sampling is available in the well. Samples will be collected using peristaltic or inertial pumps with dedicated tubing (including the silicon peristaltic tubing) or dedicated, pre-cleaned, bottom-filling bailers composed of Teflon®, polyethylene, stainless steel, or PVC lowered into the well using dedicated nylon line. VOC samples will only be collected with bailers. Sample containers will be filled directly from the bailer or tubing according to a prioritized order and using the specific sampling procedures listed below.

1. Groundwater samples should be collected on the same date as the purging activities, at a time immediately after the well has recovered sufficiently to sample, or within three hours after purging. After well purging is completed and the well has sufficiently recharged, prepare the appropriate sample containers for sample collection. If the sample is not collected within three hours of purging; turbidity, conductivity, temperature, and pH will be measured and recorded only if there is sufficient sample volume.

2. If a bailer is utilized, lower the bailer slowly down the well taking care to minimize agitation of the water column that could result in the loss of VOCs. After the bailer is submersed to within the screened section of the well, slowly remove the bailer from the well and fill individual sample containers directly from the bailer. During sampling, take care to prevent the bailer and line from coming in contact with any objects other than the riser of the well. Special attention should be taken when filling vials for volatile organic analysis. These vials will be filled in a controlled manner focused at reducing groundwater contact with the air and confirming that no headspace remains after capping.

3. For wells purged using the peristaltic pump and dedicated tubing, the tubing will be removed from the well and placed in a clean plastic bag and labeled with the monitoring well identification. Samples will then be collected using a dedicated bailer or dedicated inertial pump, as appropriate.

4. Fill the individual sample containers directly from the bailer or tubing in the prioritized order set forth below:

Priority	Parameter
1.	Volatile Organic Compounds
2.	Semi-Volatile Organic Compounds
3.	Total Metals
4.	Filtered Metals (if turbidity > 5 NTUs)

5. After collecting the sample, record the date and time of sampling onto the sampling containers and in the field notebook. It is anticipated sampling equipment will be removed from the well between sampling activities. The tubing or bailers will be placed in a labeled plastic bag or plastic wrap and sealed to minimize outside contamination prior to use during subsequent sampling activities.

6. Place sample containers in a cooler containing ice for transportation to the laboratory.

7. Close and lock, if available, the monitoring well. Remove all waste materials from the area before moving to the next sampling location.

If a monitoring well does not recharge to adequate pre-purging static levels after 24 hours or there is an insufficient volume of water available for VOC sampling, laboratory filled and supplied PDB samplers will be deployed for collection of a groundwater sample for VOC analysis. The following procedure will be followed for the deployment and recovery of the PDBs.

1. Determine the depth at which the PDB will be placed. Using the water level meter, determine the depth to groundwater and the depth to the bottom of the well. Calculate the length of water column within the well and divide number by 2. Add the quotient to the water level depth. This will be the depth at which the mid-point of the PDB will be placed within the well.

2. Attach and secure a Teflon coated wire to the eyelet of the PDB. Attach and secure a stainless steel weight to the bottom eyelet of the PDB. Measure out the wire from the mid-point of the PDB so that it equals the distance determined in item 1 above and tie a knot at this location. Slowly lower the PDB assembly into the well. Once the desired depth is achieved (knot at top of well casing) secure the wire at the top of the well casin using nylon ties, stainless steel clamps or hook tied to the wire. Trim any excess wire.

3. Secure the well head. PDB will be left within the monitoring well for 14 days.

4. Following a period of 14 days, remove the PDB using the attached wire. Examine the surface of the PDB for evidence of damage and coatings and record observations in the field notebook. If there are any tears noted in the PDB it will be rejected and properly disposed with other investigation-derived waste.

5. Detach the PDB sampler from the wire and properly dispose wire. Wipe down exterior of PDB with new towels.

6. Using laboratory provided discharge accessory tubing, transfer the water from the PDB into the laboratory provided VOC sample containers. Collect appropriate quality control samples at this time.

7. After collecting the sample, record the date and time of sampling onto the sampling containers and in the field notebook.

8. Place sample containers in a cooler containing ice for transportation to the laboratory.

9. Close and lock, if available, the monitoring well. Remove all waste materials from the area before moving to the next sampling location.

Groundwater sampling information will be recorded in the field notebook and field form, if desirable. Information to record should include date and time of sampling, well identification, sample identification, method of sample collection, appearance of sample, type of sample container, analytical method requested, identification of QC samples, and potential interferences present in the sample.

2.4 Sample Identification and Labeling

Preprinted labels will be affixed to the sample containers before use and will contain the name of the project, location, requested analysis, and unique identification number. The specific location and sample number will be added at the time the sample is taken. Following collection, the date and time of collection and the sample team member's initials will be recorded with a waterproof black marker on the sample label. The samples will be placed in coolers with blue ice, if required, while awaiting preparation and shipment to the appropriate laboratory. The time and date of sample collection also will be recorded in the field logbook and/or on the chain of custody form.

Each sample will be assigned a unique identification number. Sample numbers will be comprised of the project designator followed by a three-digit number that will indicate the survey unit and a sequence number that will indicate the sample number. A three-digit number will be used to indicate duplicate analysis of a particular sample, and the analysis code will be appended to the end of each sample label, as appropriate. Samples submitted as blind to the laboratory will not be distinguishable as such from the sample number or custody for submitted to the laboratory.

The sample numbering system assigns a unique number to each sample that identifies the type and location of each sample. This number also serves as a tracking method for retrieval of information. Sample numbers are generated in the SXX-UUU-NNN format as follows:

S = SPRU Site

XX = sample origin/type as follows:
- FS = Final Status Soil Sample
- SL = Soil sample-Excavation Guidance
- SW = Soil Sample – Waste Acceptance
- DP = Direct Push Sampling

UUU=Location. For field duplicates, the Survey Unit Number will be replaced with a sequential DU1, DU2, etc. For rinse blanks, the Survey Unit Number will be replaced with a sequential RB1, RB2, etc.

NNN = Sequential sample number for each sample type, as appropriate. The final status survey sample numbers are sequential within each survey unit. Replicate and blank samples are given a "900" series number by sample type, in sequence.

- A = Analysis Codes are added for redundancy and as a check
- M = metals
- S = SVOCs
- V = VOCs

Example:
SFS-001-003-M = Final Status soil sample taken from Survey Unit 001, Location 003 for metals.

2.5 Hydraulic Conductivity Testing Procedures

In situ hydraulic conductivity tests will be performed, as needed, on the newly installed and selected existing permanent monitoring wells to assess the hydraulic conductivity of the screened interval. The hydraulic conductivity tests involve observing the recovery of water levels toward an equilibrium level after an initial perturbation. The perturbation may be either a sudden rise or fall in water level (rising head test and falling head test, respectively). For a falling head test, either a 5-foot inert rod or a volume of deionized water will be quickly introduced into the well to cause a water level rise. For a rising head test, a 5-foot inert rod or a clean sampling bailer will be rapidly removed from the well to cause a water-level drop. Procedures and equipment requirements may vary depending on the rate of the water-level recovery. Each well will be tested in accordance with the following procedures:

Determine the type of test to be performed based on the following:

- If the screened interval of the well straddles the water table, only use a rising head test;
- If the screened interval of the well is submerged within water, either method may be used, preferably both.

Record appropriate initial data in field notebook, including date of test, well identification, well construction details (i.e., screen length, screen diameter, riser diameter, depth to top of screen, sand pack length, sand pack diameter, and depth to top of sand pack), type of test and names of field personnel;

Clean the downhole equipment (e.g., pressure transducer, associated cable and, if used, the bailer or slug and associated line) following cleaning procedures provided in Section 2.8 before initiating test(s) at each well;

Measure and record the static water level in the well (only wells that have fully recovered to static level conditions after drilling and development should be tested);

Connect the pressure transducer to the data logger and lower the transducer into the well 5 to 10 feet below the water surface. Secure the position of the transducer by clamping the transducer cable to the well casing using a rubber-covered clamp. If the edges of the well casing are sharp, cover them with cloth or duct tape to protect the transducer cable;

Quickly create the water level perturbation. While there is no fixed requirement for the magnitude of the change in water level, it is suggested that a minimum of 20% instantaneous hydraulic head differential be created to allow collection of a suitable data base; and

If another test is to be performed, replace the bailer or solid object and allow the well to re-equilibrate prior to performing the next test. Repeat the procedures, changing settings as appropriate.

Interpretation of water level versus time data from the hydraulic conductivity tests will be performed using the Bouwer and Rice method. Corrections for variations in the Bouwer and Rice method assumptions will be incorporated as appropriate; for example, corrections for sand pack porosity and aquifer anisotropy. Other appropriate methods may also be utilized, if deemed appropriate.

2.6 Equipment Cleaning Procedures

2.6.1 Soil and Sediment Sampling Equipment

The soil and sediment sampling program will follow cleaning procedures to minimize potential cross-contamination between sampling intervals. Cleaning of non-disposable sampling equipment will be performed at a temporary cleaning pad or in plastic containers. The non-disposable sampling equipment will be cleaned prior to sampling the first location, between sampling intervals, between locations, and prior to leaving each area at the conclusion of sampling activities. The cleaning process will involve hand washing the equipment using a non-phosphate detergent wash and tap water wash followed by a tap water rinse and a distilled water rinse.

2.6.2 Groundwater Sampling Equipment

Dedicated groundwater sampling equipment will be stored and used again in each well; therefore, cleaning is not required. Non-dedicated sampling pumps that cannot be disassembled or otherwise adequately cleaned will be flushed with the cleaning liquids outlined in Section 2.6.1.

2.7 Surveying

Each soil boring, newly installed monitoring well, and temporary well point location will be surveyed for horizontal and vertical control. Ground surface at each location will be surveyed to the nearest 0.1 foot. Monitoring wells and temporary well points will be surveyed to the nearest 0.01 foot at the top of the well's riser pipe (measuring point) and top of the protective steel casing.

2.8 Investigation-Derived Waste Management

Investigation-derived wastes may include, but not necessarily be limited to, personal protective equipment (PPE), disposable sampling materials (e.g., aluminum foil), cleaning fluids, soil cuttings, and purged groundwater. Any wastes that are suspected to be hazardous will be managed in accordance with applicable laws and regulations.

All PPE and sampling materials will be appropriately containerized and disposed of in accordance with SPRU waste management procedures. At this time, it is envisioned that PPE will be non-hazardous.

All soil will be returned to the originating borehole or onto the ground in the immediate vicinity of the boring location if deemed non-hazardous. Soil will be determined potentially hazardous based on field evaluation including observed waste materials, visual staining and discoloration, presence of organic vapors over 2 ppm, or other odors. In the event the soil is not returned to the borehole or ground, the soil will be containerized and appropriately managed. Equipment cleaning liquids and accompanying soil will be dispositioned to the ground within the individual investigation area.

Development/purge water will be returned to the ground in the vicinity of the well from which it was generated.

3.0 Quality Assurance Objectives and Criteria for Measurement Data

The overall objective of the confirmation sampling is to obtain data that demonstrate that the SCOs have been met. Data quality objectives (DQOs) are qualitative and quantitative statements, derived from the first six steps of the seven-step DQO process, that:

Clarify the study objective

Define the most appropriate type of data to collect

Determine the most appropriate conditions from which to collect the data

Specify tolerable limits on decision errors that will be used as a basis for establishing the quantity and quality of data needed to support the decision(s) to be made using the data.

The criteria for measurement data are expressed as quality assurance objectives (QAOs). The measurement QAOs are specifications that data must meet to comply with the project needs specified by the DQOs. The specific QA parameters of interest are defined as quantitative QA parameters (precision, accuracy, method detection limit [MDL], and completeness), and qualitative QA parameters (representativeness and comparability). As discussed in the ICM Work Plan (ARC-PLN-6106), the SPRU-LL sampling approach follows the NYSDEC *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002). This guidance provides prescriptive sampling for excavations depending on the perimeter and nature of contamination. For perimeters greater than 300ft, the guidance allows for use of an alternative methodology that is acceptable to NYSDEC. Based on the anticipated excavations in the Lower Level Parking Lot, the prescriptive sampling approach in the DER-10 will be used in that area. The statistical approach to sample design as defined in the ICM Work Plan (ARC-PLN-6106) will be used for excavations in the Railroad Staging Area.

3.1 Data Quality Objectives

The sampling objectives are discussed in the context of the DQOs process as defined by *EPA Guidance for the Data Quality Objectives Process* (EPA 2000b). This process was developed by the EPA to ensure that the type, quantity, and quality of data used in decision-making are appropriate for the intended application. The DQO process includes seven steps, each of which has specific outputs. In this document, the DQO process has been applied to the sampling activities that will be conducted during the confirmation sampling of the SPRU-LL. Each of the following sections corresponds to a step in the DQO process, and the outputs for each step are provided, as appropriate.

3.1.1 Problem Statement

The first step in the DQO process is to clearly state the problem to be addressed. The intent of this step is to clearly define the problem so that the focus of the sampling and analysis will be unambiguous. The appropriate outputs for this step are a concise description of the problem, a list of the planning team members, identification of the decision-maker(s), a summary of available resources, and relevant deadlines for the study. The planning team members are identified in Table 1 of this QAPjP. The schedule is presented in the ICM Work Plan (ARC-PLN-6106). The problem statement is as follows:

Following the excavation of contaminated soil and debris from the SPRU-LL, the remaining soils must meet SCOs.

Data are required to demonstrate that the SCOs have been met.

3.1.2 Decision Statement

This step in the DQO process is used to identify the decisions and the potential actions that will be affected by the data collected. This is done by specifying principal study questions (PSQs), alternative actions (AAs) that could result from resolution of the PSQs, and combining the PSQs and AAs into decision statements (DSs). The objective of sampling the soil is to answer the following PSQs:

PSQ: Has the SPRU grid unit been excavated sufficiently to demonstrate compliance with the SCOs?

The AAs to be taken depending on the resolution to the PSQ are as follows:

AA1-1: If the concentrations of COCs in soils samples are less than the SCOs then the SPRU grid unit has been sufficiently excavated.

AA1-2: If the concentrations of COCs are greater than the SCOs, then the SPRU grid unit has not been sufficiently excavated and additional excavation and further sampling will be necessary.

AA1-3: If the concentrations of potential non-COC constituents in soil samples analyzed in the course of the interim corrective measure exceed the more stringent NYSDEC Part 375-6 soil cleanup objective for residential exposure or protection of groundwater, NYSDEC will be consulted regarding any further action.

Combining the PSQ and the AAs results in the following DS:

Determine whether or not the excavation activities have resulted in the grid units meeting the SCOs or if additional excavation is necessary.

3.1.3 Decision Inputs

The purpose of this step is to identify informational inputs that will be required to resolve the DS and to determine which inputs require measurements. The information needed to resolve the DS listed previously is the identification and quantification of COCs in the soil samples following excavation of the SPRU grid units. A detailed discussion of the COCs is provided in the ICM Work Plan (ARC-PLN-6106). The COCs for this effort are specified in Table 3.

During the decision step of the DQO process, the basis for an action level (AL) is established. The AL is the threshold value that provides the criterion for choosing among AAs. The ALs for soils are based on the SCOs and are defined in Table 3. If samples result in concentrations for all constituents that are below the ALs, further excavation of the SPRU grid unit will not be required.

3.1.4 Study Boundaries

This step in the DQO process defines the spatial and temporal boundaries of the study covered by the DS. The spatial boundaries simply define the physical extent of the study area and may be subdivided into specific areas of interest. The temporal boundaries define the duration of the study, or specific parts of the

study. The appropriate outputs of this step are a detailed description of the spatial and temporal boundaries of the problem and a discussion of any practical constraints that may interfere with the study.

Table 3 Constituents of concern

Constituents of Concern			
Metals	Site Cleanup Objectives (mg/Kg)	Metals	Site Cleanup Objectives (mg/Kg)
Antimony	1[a]	Lead	400
Arsenic	16	Mercury	0.73
Cadmium	2.5	Silver	8.3
Trivalent Chromium	36	Thallium	2[a]
Cobalt	30[b]	Vanadium	150[b]
Copper	270	Zinc	2,200
VOCs	Site Cleanup Objectives (mg/Kg)		Site Cleanup Objectives (mg/Kg)
Acetone[c]	0.05	Trichloroethylene[d]	0.47

a. Reporting limits for Test America Labs

b. Technical and Administrative Guidance Memorandum 4046 recommended cleanup levels (NYSDEC 1994)

c. COC only in SWMU-040

d. COC in L5 area.

The confirmation sampling approach for the LLRBA will be applied to two SPRU grid units at a time and will ultimately include all SPRU grids in the LLRBA. The confirmation sampling approach in the LLPL will be applied to the areas within the perimeter of each excavation. The SPRU grid unit boundaries addressed in this QAPjP are defined in Figure 3 of the ICM Work Plan (ARC-PLN-6106). Defining the temporal boundaries of the study involves specifying the timeframe in which the decision applies and determining when to collect data. The time period within which to collect the data is determined by excavation operations and the approved project schedule. Upon determination that excavation activities are likely to have resulted in the SCOs being met, excavation will cease and sample collection will commence.

3.1.5 Decision Rule

The objective of this step is to define the parameter(s) of interest in the population being characterized, specify the AL, and integrate previous DQO outputs into a single statement defining conditions that direct decision-makers to choose among AAs. The decision rule, like the AA, typically takes the form of an "*If…then*" statement describing the action to take if one or more conditions are met.

The decision rule is specified in relation to the population parameter of interest. The parameter of interest for these soils will be the true mean concentration of the COCs within a set of two SPRU grid units. The decision rules are based on the requirements that specify that COCs in the soils of the SPRU grid units cannot exceed the ALs specified in Table 3. The decision rules are:

If the true mean concentration of any COC in the soils exceeds the ALs, then additional excavation of the SPRU grid units will be required.

If the concentration of any COC in the soils at any location is greater than the contaminant-specific AL specified in Table 3, *then* that location will be considered a hotspot and additional excavation for that location will be required.

If the true mean concentrations of all COCs in the soils do not exceed the ALs and the concentration at all locations is less than the AL, then the site as a whole will be considered in compliance and no further excavation will be necessary.

3.1.6 Decision Error Limits

The purpose of this step is to minimize data uncertainty by specifying tolerable limits on decision errors that are used to establish performance goals for the data collection design. It is necessary to determine the possible range for the parameter of interest and to define both the types of decision errors and the potential consequences of the errors. A set of hypotheses must be defined to dictate the way the statistical test will be performed. Note that the discussion of hypotheses and error limits only applies to the comparison of the mean concentration to the ALs (UCL analysis) because comparison of a single data point to an AL for hotspot identification is not a statistical test. In addition, the statistical test does not apply to the LLPL area where the DER-10 prescriptive approach requires single data point comparisons. A discussion of the comparison of individual observations to the AL for hotspot identification is included at the end of this subsection.

The null hypothesis (H_0) for the DS is "the true mean concentration of at least one COC in the soil sample is greater than, or equal to, the AL." Conversely, the alternative hypothesis is, "the true mean concentration of all COCs in the soils sample are less than the AL." The statistical hypothesis test assumes that the null hypothesis is true unless there is strong evidence to the contrary.

A decision error occurs when the decision-maker rejects the null hypothesis when it is true, or fails to reject the null hypothesis when it is false. These two types of decision errors are classified as *false-positive* and *false-negative* decision errors, respectively. The false-positive decision error in this case would be to assume that decontamination activities have been successful when, in fact, they have not been successful. The false-negative decision error would occur when it is decided that further excavation is necessary when, in fact, excavation has been successful. The chance of committing each type of error must be quantified if possible. The chance of committing a false–positive decision error is denoted by α. The chance of committing a false-negative decision error is denoted by β. A value of 0.05 has been selected for both α and β.

A range of possible parameter values must be specified where the consequences of false negative decision error are relatively minor. This range of parameter values is referred to as the "gray region." The gray region is bounded on one side by the AL and on the other side by a predetermined parameter value (e.g., 80% of the AL). It is necessary to specify the gray region because the variability in the population and unavoidable imprecision in the measurement system combine to produce variability in the data such that a decision may be "too close to call" when the true parameter value is very close to the AL. In statistics, this interval is called the "minimum detectable difference" and is expressed with the Greek letter delta (Δ). A narrow gray region implies a desire to be able to differentiate between the AL and a parameter value that is very close to the AL. From a practical standpoint, the gray region is an area where it is

determined that the cost of higher accuracy is more detrimental than committing a false-negative error. A value of 20% of the AL has been selected for Δ.

If it is determined that the mean concentrations of COCs in the soils of the site as a whole are less than the ALs it is still possible that one or more hotspots are present at the site. Therefore, each of the observed samples will be individually compared to the AL to determine if a location may be a hotspot. As stated above, this comparison is not a statistical test so there is not a null or alternative hypothesis or error rates associated with this comparison.

3.1.7 Sampling Design

The purpose of design optimization in the DQO process is to identify the best sampling and analysis design that satisfies all of the previous steps in the process. Formulas were used to compute the number of samples needed to perform a sufficiently accurate comparison of the mean concentration of each COC to the AL based on the error rated defined in Section 3.1.6. The comparison of each observation to the AL is not a statistical test so there are no formulas to determine the number of samples needed for such a comparison. However, the samples collected to compare the mean concentrations to the AL should be sufficient to perform the hotpot analysis. The methodology used to determine the number of confirmatory samples needed in each set of two grid units is detailed in the ICM Work Plan (ARC-PLN-6106). As previously discussed, the number of confirmatory samples for the LLPL is defined by the DER-10.

3.2 Measurement Performance Criteria

The DQOs provide the basis for setting criteria for the performance of the measurements to be made in the field and analytical laboratory. These criteria are specified as data QAOs. Quantitative QAOs are developed by data users to specify the quality of data from field and laboratory data collection activities. The QAOs are established to ensure that all project DQOs are met and that resulting data support the decision-making activities that will ultimately occur at the site. The following sections outline the specific parameters that will be used to evaluate the quality of data obtained during the confirmation sampling of the SPRU grid units.

3.2.1 Precision

Precision is a measure of agreement or reproducibility among individual measurements for the same property under the same conditions. Precision is expressed as relative percent difference (RPD), which is defined, and shown in Equation (1), as the absolute value of the difference divided by the mean, expressed as a percentage.

$$(1)\quad RPD = \left| \frac{(C1 - C2)}{(C1 + C2)/2} \right| \times 100$$

where

RPD = Relative percent difference

C1 = measured concentration of sample 1

C2 = measured concentration of sample 2.

The analytical laboratory will report the precision of their measurements in the sample matrix based on the results obtained from the matrix spike and matrix spike duplicate analyses.

Acceptable laboratory precision will be determined by method-specific criteria outlined in SW-846, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* (EPA 2003), for total metals and each requested organic analysis. During DQA activities, precision of the environmental measurements will be assessed to determine if any impacts on data use are due to the precision of the data.

3.2.2 Accuracy

Accuracy is the relative agreement or non-agreement between a measured value and an accepted reference value. Accuracy reflects the measurement error associated with a measurement and is determined by assessing actual measurements in the sample matrix during the analysis of matrix spike samples. Accuracy is assessed by means of determining analyte recovery from matrix spikes, samples, or laboratory reference samples and is expressed as percent recovery (%R), defined as the measured value divided by the true value expressed as a percent, as shown in Equation (2).

$$(2)\quad \%R = \frac{C_{ss} - C_{us}}{C_{as}} \times 100$$

where

C_{ss} = measured analyte concentration in spiked sample

C_{us} = measured analyte concentration in nonspiked sample

C_{as} = calculated analyte concentration added to sample.

Acceptable laboratory accuracy will be determined by assessing the results against the method-specific criteria outlined in SW-846 (EPA 2003). During the DQA process, accuracy of the environmental measurements (in the form of bias that may be indicated by the measure discussed above) will be assessed to determine if any impacts of hypothesis testing are due to the accuracy of the data.

3.2.3 Detection Limits

The laboratory will use guidance found in SW-846 (EPA 2003) or 40 CFR 136, Appendix B, "Definition and Procedure for the Determination of the Method Detection Limit – Revision 1.11," to aid in determining MDLs for analytical methods. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte. The quantitation limit (QL) [sometimes also referred to as practical quantitation level (PQL), estimated quantitation level (EQL), or limit of quantitation (LOQ)] is defined as the minimum amount of a substance that can be quantitatively measured with a specified degree of confidence and within the accuracy and precision guidelines of a specific measurement system.

Matrix effects, sample size, or other analytical interferences may increase QLs. The effects of these conditions on the laboratory's quantitation limits, if determined, will be documented.

The laboratory analysts will follow the SW-846 (EPA 2003) protocols as closely as possible to ensure the data are compliant with the requirements of the project.

3.2.4 Completeness

Completeness is the measure of the amount of valid analytical data obtained compared to the total number of data points planned. Valid analytical data are those generated when analytical systems and the resulting analytical data meet all of the quantitative measurement quality objectives outlined for the project (i.e., all calibration verification, interference, and other checks not affected by the sample matrix meet acceptance criteria). It is important to understand that data that are flagged during the data validation process are not necessarily invalid data. Part of the DQA process is the review of flagged data to determine the negative impact, if any; the validation flags have on the intended use of the data. Therefore, the definition of "valid data" in the context of calculating completeness is: "data that are acceptable for their intended purpose." Completeness of the reported data (expressed as a percentage) is calculated as shown in Equation (3).

(3) $C(\%) = M_v / Mt \times 100$

where

M_v = number of valid sampling or analytical results obtained per analyte

Mt = total number of samples (data points planned) submitted for analysis per analyte.

A completeness of 95% is a common goal. All data obtained from this project should meet the quality requirements and reporting protocols unless irregularities in the matrix (a.k.a., matrix effects) impede contaminant recovery or a broken, spilled container results in a loss of sample materials. The completeness goal for the project is to obtain enough valid data to satisfy the DQO specifications for the number of measurements required to statistically test the null hypothesis.

3.2.5 Comparability

Comparability is the degree to which one data set can be compared to another obtained from the same population using similar techniques for data gathering. Comparability will be achieved through the use of consistent sampling procedures, experienced sampling personnel, the same analytical method for like parameters, standard field and laboratory documentation, and traceable laboratory standards.

3.2.6 Representativeness

Representativeness is a measure of the degree to which data accurately and precisely represent a characteristic of a population parameter at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative term that should be evaluated to determine whether in situ and other measurements are made, and physical samples are collected, in such a manner that the resulting data appropriately reflect the population parameter of interest in the media and phenomenon measured or studied.

The sampling design discussed in Section 3.1.7 of this plan is the basis for obtaining data that will be representative of the soil samples. A final determination of the representativeness for the initial data set will be made by the PM and other project personnel following the return of the chemical analysis data from the analytical laboratory and completion of DQA activities.

3.2.7 Data Quality

The data generated from the soil sampling effort will be used to evaluate if the site meets the SCOs. Each parameter to be evaluated requires data of specific quality. To demonstrate compliance with the SCOs,

the data obtained must be of high quality. Laboratory analytical procedures and laboratory data reporting will follow the QA/QC protocols described in SW-846 (EPA 2003), and the task-specific laboratory SOW prepared by the project for these analyses.

3.3 Field Quality Control Procedures

A detailed description of the sampling procedures that will be used during the ICM is presented in Section 2.0.

3.3.1 Sample Collection and Preservation

Samples collected for VOCs shall be collected within 24 hours after completion of excavation. If sampling cannot be completed within this time frame, samples will be collected at a depth of 6–12 inches. Immediately after collection, samples will be transferred to properly preserved sample containers and labeled. Table 4 lists the appropriate sample containers, volume requirements, and preservation techniques. However, with concurrence from the laboratory, alternative sample containers may be utilized if sample volume is limited. The sample container should meet the same structure and preservation requirements; however, the container size can be reduced to preserve their integrity of the sample. Samples requiring refrigeration for preservation will be promptly transferred to coolers packed with ice. Samples will be properly stored until shipped or transported to the analytical laboratory. The laboratory will be contacted to ensure safe arrival and that proper sample integrity was maintained. Proper chain-of-custody documentation will be maintained as discussed in Section 3.4 of this QAPjP. Samples will be extracted and/or analyzed within the holding times specified in Table 4. Holding times begin from the date of sample collection.

3.3.2 Field Duplicate Samples

Collection of field duplicate samples provides for the evaluation of sampling precision and matrix homogeneity by comparing analytical results of two samples from the same location. Field duplicate samples are duplicate samples collected from one location and sent to the laboratory blind (with two different sample identifications). Field duplicate samples will be collected at a minimum rate of one per 20 environmental samples or one per sample delivery group, per matrix, per parameter.

3.3.3 Matrix Spikes and Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) samples are duplicate samples that have a known concentration of spiking solution added to evaluate potential matrix interferences, and thus matrix accuracy and precision. One set of MS/MSD samples will be collected at a minimum rate of one per 20 environmental samples, or one per sample delivery group per matrix, per parameter.

3.3.4 Field and Equipment Blanks

Field blanks will consist of analyte-free and organic-free deionized water that will be used for equipment decontamination. One field blank will be collected per source lot of water. Equipment blanks consist of field blank source water that has been passed through and/or over cleaned sampling equipment. One equipment blank will be collected per 20 samples for each type of sampling equipment used (exception being single use, pre-cleaned pump tubing). Field and equipment blanks will be subject to the same analyses as the associated environmental samples.

3.3.5 Trip Blanks

Trip blanks will consist of samples of analyte-free, organic-free water that have undergone shipment from the laboratory to the SPRU Project and back to the laboratory in coolers containing aqueous samples to be analyzed for VOCs. Trip blanks will be analyzed for VOCs to determine if contamination has taken place during sample shipment and/or laboratory storage. A trip blank will accompany each shipment that contains samples for VOC analyses.

Table 4 Sample container, preservation, and holding times

Parameter	Matrix	Sample Containers	Preservation	Holding Times
TCL VOCs	Water	3 × 40 mL glass vial with PTFE-lined septum cap	≤6°C, HCl	14 days
TCL SVOCs	Water	1 × one liter amber glass container with PTFE-lined cap	≤6°C	7/40 days
TAL Total and Dissolved Metals	Water	1 × 500 mL plastic bottle	≤6°C, HNO_3	6 months
TAL Total Mercury	Water	1 × 500 mL plastic bottle	≤6°C, HNO_3	28 days
TAL Total Cyanide	Water	1 × 500 mL plastic bottle	≤6°C, NaOH	14 days
VOCs	Soil	1 × 4 oz glass jar with PTFE-lined lid VOA vial with PTFE-lined silicone septum for 5035 analysis	≤6°C	14 days
SVOCs	Soil	1 × 250-mL widemouth glass container with PTFE-lined cap	≤6°C	14/40 days
TAL Total and Dissolved Metals	Soil	1 × 4 oz widemouth glass container with PTFE-lined cap	≤6°C	6 months
TAL Total Mercury	Soil	1 × 4 oz widemouth glass container with PTFE-lined cap	≤6°C	28 days
TAL Total Cyanide	Soil	1 × 4 oz widemouth glass container with PTFE-lined cap	≤6°C	14 days

Notes:
mL - milliliters
HCl - hydrochloric acid
HNO_3 - nitric acid
NaOH - sodium hydroxide
C - degrees Celsius
oz - ounces
7/40 - 7 days to extraction/ 40 days to analysis
14/40 - 14 days to extraction/40 days to analysis
Holding times begin from the date of sample collection.

3.3.6 Inspection/Acceptance Requirements for Supplies and Consumables

Disposable sampling equipment will be checked before use to ensure it is made of material appropriate for the media being sampled. Sample containers will be obtained from vendors that certify the cleaning protocol used is appropriate for the analyses to be performed on the sample. Reagents used for sample preservation will be checked to ensure they are appropriate grade before use. Inspection and acceptance of these items will be documented in closure log books or, when certifications are provided by the manufacturer, maintained in project files to ensure availability of these records.

3.4 Sample Custody

Chain-of-custody records for all samples shall be maintained. A sample shall be considered to be "in custody" of an individual if said sample is either in direct view of or otherwise directly controlled by that individual. Storage of samples during custody shall be accomplished according to established preservation techniques, in appropriately sealed storage containers. Chain-of-custody shall be accomplished when the samples or sealed sample containers are directly transferred from one individual to the next, with the first individual witnessing the signature of the recipient upon the chain-of-custody record.

Signed chain-of-custody forms will be included with each cooler documenting sample content. A copy will be kept with the sampling personnel.

The chain-of-custody records will contain the following information:

Site name

Field sample numbers

Signature of collector

Date and time of collection

Sample type (e.g., groundwater, soil)

Identification of monitoring well or sampling point

Number of containers per sampling location

Parameters requested for analysis for each container

Signature of person(s) involved in the chain-of-possession

Problems associated with sample collection (i.e., breakage, no preservatives), if any noted by field personnel.

The sample cooler temperature and the integrity of the sample containers will be checked and documented by the analytical laboratory upon receipt. Samples received by the laboratory will be compared to those samples identified on the chain-of-custody and laboratory identification numbers assigned. Any problems noted during sample receipt will be documented in the laboratory's sample

receiving/storage log, and the project manager will be notified. Samples will be protected from sunlight and stored at ≤6°C until extraction or analysis in accordance with the holding times identified in Table 4.

3.5 Equipment Operation and Calibration Procedures

The following sections describe the operation and calibration procedures for the field and laboratory analytical instruments that are anticipated to be used during the ICM.

3.5.1 Field Equipment Calibration

Calibration and maintenance of the field equipment will be conducted in accordance with manufacturer's recommendations to assure accurate field data is collected. The calibrations will be documented for each measuring instrument and include at least the following information, where applicable.

Name of instrument calibrated

Instrument serial and/or identification number

Expiration or frequency of calibration

Results of calibration

Name of person performing the calibration

Identification of the calibration gas (if applicable)

Buffer solutions (if applicable).

The calibration procedures and frequency for the field equipment is presented in the following sections.

3.5.1.1 pH Meters

Because of the great variety of pH meters available, operators should refer to the manufacturer's instruction manual for specific calibration, operation, and troubleshooting procedures for their instrument. The following general procedure is used for measuring pH in the field with a pH meter:

The pH meter will be calibrated at the start of each day of activities with a minimum of 2 different buffer solutions bracketing the expected pH range of the samples.

The instrument will be checked and calibrated prior to the initiation of the field effort. The pH electrodes will be kept moist at all times.

Buffer solutions used for calibration should be checked. Buffer solutions will degrade upon exposure to the atmosphere.

Select 4.0, 7.0 and 10.0 buffers for calibration.

Make sure all electrolyte solutions within the electrode(s) are at their proper levels and that no air bubbles are present within the electrode(s).

Immerse the electrode(s) in a pH-7.0 buffer solution.

Adjust the temperature compensator to the proper temperature (on models with automatic temperature adjustments, immerse the temperature probe into the buffer solution). It is best to maintain buffer solution at or near expected sample temperature before calibration.

Adjust the pH meter to read 7.0.

Remove the electrode(s) from the buffer and rinse well with distilled water. Immerse the electrode(s) in pH 4.0 or 10.0 buffer solution and adjust the slope control to read the appropriate pH. At least three successive readings during calibration, one minute apart, should be within ±0.1 pH unit.

Rinse the electrode(s) with distilled water.

3.5.1.2 Specific Conductance Meters

Because many conductivity meters are available, operators should refer to the manufacturer's instruction manual for specific calibration, operation, and troubleshooting procedures. The following general procedure is used for obtaining specific conductance measurements:

The conductivity meter will be calibrated at the start of each sampling day or more frequently if deemed necessary.

Check batteries before going into the field.

Check the µmhos/cm value of the potassium chloride standard solution normalized to 25ºC.

Calibrate the instrument using a potassium chloride standard solution.

3.5.1.3 HNu PID

For ambient air monitoring for health and safety considerations during work activities and field screening of soil samples, an HNu or equivalent PID with a lamp energy of at least 10.2 electron volts will be used. The PID will be used to measure the total concentration of volatile compounds with ionization potentials less than the PID lamp energy. Because many PIDs are available, operators should refer to the manufacturer's instruction manual for specific calibration, operation, and troubleshooting procedures. The general operating and calibration procedure for the HNu is provided below. Operation of PIDs under wet conditions can cause erratic and potentially unreliable readings. The use of PIDs under wet conditions may not be practical.

An HNu can be used to detect a variety of trace gases, particularly VOCs. The HNu uses the principle of photoionization to detect and measure the VOC concentrations in the atmosphere or from a sample.

The following procedure is used for operating and calibrating the HNu.

Turn the function switch to BAT. The needle should be in the green; if not, the battery should be recharged.

Turn function switch to STANDBY and adjust the meter needle to read zero using the ZERO set control.

Turn the function switch to the 0-200 range with the probe connected to the calibration gas (isobutylene) and note the meter reading. Adjust the SPAN control as needed to obtain the proper concentration reading.

Recheck the zero setting; if readjustment is needed, repeat, third step.

At this point, a two-point calibration has been made (against zero and the gas standard) and the instrument is ready to use.

The meter will be calibrated once per day, or more frequently, if necessary.

Turn the function switch to the 0-20 range. The instrument will measure the concentration of any gases with ionization potentials less than the lamp.

Use the HNu to monitor the breathing zone for health and safety precautions or use it to screen samples by placing the probe near suspected sources of contaminants.

Adjust the function switch as needed depending on concentrations detected.

3.5.1.4 Turbidity Meters

Because many turbidity meters are available, operators should calibrate the meter in accordance with the manufacturer's instruction manual. The turbidity meter will be calibrated prior to its use each day and more frequently, if necessary. Turbidity may be measured in a flow cell using an integrated water quality probe (e.g., Horiba Model U-10); however, the final assessment of turbidity use for establishing well development or determining whether metals are to be filtered will be based on measurements from a desktop turbidity meter with planchet (e.g., Kernco Model 800-P). The following is a general procedure for calibrating and operating the turbidity meter.

Place a mark on the reference standards and sample cuvettes and the top of the optical well to ensure that any incidental marks on the cuvettes are consistently positioned in the optical well.

Place the supplied reference standard in the optical well of the turbidimeter. Be careful to ensure the glass vial is clean and dry.

Adjust the reference until the turbidimeter reads the reference standard value.

To measure a sample, fill a clean, dry cuvette. Dry the cuvette and place in the optical well. Select the appropriate range until reading has stabilized. Be consistent with the methodology for each sample analyzed.

3.5.1.5 In-Situ X-Ray Fluorescence

The in-situ X-ray fluorescence (XRF) measurement typically requires little or no sample preparation. Although the instrument can measure undisturbed soil directly, preparation protocol is usually followed. First, the field operator removes any debris (e.g., leaves, twigs, grass, and stones) from the measurement surface. Second, the operator loosens the soil to a depth of approximately 1.5 to 2.5 centimeters (cm) over an area of at least 10 cm in diameter, and stirs the loosened soil to achieve some homogenization. The loosened soil may be allowed to dry in the sun for a few hours or oven dried before the measurement, as needed, to improve accuracy. Just before the measurement, the operator mixes and levels the loose soil

and packs it down gently. For improved accuracy, the operator may screen or comb the loose soil to remove stones, roots, broken glass, metal fragments, paint chips and other such objects.

The following is the general procedure for using the XRF.

Allow the instrument to warm-up for 15 to 30 minutes before use.

Perform any manufacturer-specified blank and internal calibration checks using the supplied materials. If the system fails the blank check, clean the window and repeat. If the internal calibration check fails, consult the manual to determine how to perform an Energy Calibration. Do not use an instrument that fails either the blank check or internal calibration criteria.

Prior to analyzing any samples, analyze all of the required QC samples and compare to the project criteria. Do not proceed to project samples until QC meets criteria. QC samples in sample cups should be tilted to remix the contents before analysis.

Analyze a calibration check after every twenty sample analyses, following any extended down period, and at the end of the analysis day/shift.

Download data if required, turn off the analyzer, clean the window, and properly store the instrument when finished. Systems that use batteries should be left on their chargers overnight.

Sensitivity is a function of the count time. Consult the manual to establish a count time that provides the needed sensitivity while allowing for sample throughput efficiency. Typical count times are 60 to 180 seconds.

3.5.2 Laboratory Equipment

The analytical laboratory's Operations Director (or equivalent) and Project Manager will be responsible for the operation and calibration of laboratory analytical instruments in accordance with the schedules and procedures specified by the most current edition of EPA SW-846 (EPA 2003) or the NYSDEC Analytical Services Protocol (ASP) manual, whichever applies to the analyses requested.

3.6 Analytical Laboratory Procedures

The analytical laboratory will carry certification by the New York State Department of Health Environmental Laboratory Approval Program. All laboratory analytical methods, including QA/QC procedures, will conform to the most current EPA SW-846 (EPA 2003) or NYSDEC ASP requirements, whichever reference applies to the analyses being requested. The laboratory analytical results will be reported and documented in a manner conforming with EPA SW-846 protocols and ASP (NYSDEC 1995) requirements, where applicable. The analytical data will be reported in ASP Category B deliverable packages.

To obtain data of a quality sufficient to meet the project DQOs, analytical laboratory techniques provided in Table 5 will be used.

Table 5 Analytical methods

Sampling Program	Matrix	Parameter	EPA SW-846 Preparation/Cleanup Method	EPA SW-846 Analytical Method
Groundwater Investigation	Water	TCL VOCs	5030B	8260B
		TCL SVOCs	3500/3600 methods, as appropriate	8270C
		TAL total and dissolved metals	3000 methods, as appropriate	6010B & 7470(1)A
		Antimony		6020
Soil Investigation	Soil and Sediment	VOCs	5021, 5035	8260B
		SVOCs	3500/3600 methods, as appropriate	8270C
		TAL total metals	3000 methods, as appropriate	6010B & 7471A
		Total Cyanide		9010B
		Antimony		6020

Tables 6, 7, and 8 list the quantitation limits for the VOCs, SVOCs, and TAL metal and cyanide analyses. The quantitation limits provided are the CRQLs and contract required detection limits (CRDLs) for organic and inorganic methods, respectively, as taken from the ASP (NYSDEC 1995) requirements. The CRQLs and CRDLs are based on the EPA Contract Laboratory Program (CLP) SOW for the analyses of organics and inorganics. Soil and sediment quantitation limits will be calculated and reported on a dry weight basis and, therefore, will be variably higher as dry weight concentrations are dependent on the sample moisture content.

3.7 Tentatively Identified Compounds

A library search shall be executed for non-target sample components for the purpose of tentative identification. For this purpose, the most recent available release of the NIST/EPA/MSDC mass spectral library shall be used. Computer generated library search routines must not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

1. Up to 10 organic compounds of greatest apparent concentration not listed in the client specific compound list, excluding the system monitoring compounds, shall be tentatively identified via a forward search of the NIST/EPA/MSDC Library (substances with responses less than 10% of the nearest internal standard are not required to be searched in this fashion). Only after visual comparison of sample spectra with the nearest library searches will the mass spectral analyst assign a tentative identification. Computer generated library search routines must not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

2. Guidelines for making tentative identification:

   a. Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.

   b. The relative intensities of the major ions should agree within ± 20% (Example: For an ion with an abundance of 50 percent of the standard spectra, the corresponding sample ion abundance must be between 30 and 70 percent.)

   c. Molecular ions present in reference spectrum should be present in sample spectrum.

   d. Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting compounds.

   e. Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting compounds. Data system library reduction programs can sometimes create these discrepancies.

3. If, in the technical judgment of the mass spectral analyst, no valid tentative identification can be made, the compound should be reported as unknown. The mass spectral analyst should give additional classifications of the unknown compound, if possible (i.e., unknown aromatic, unknown hydrocarbon, unknown acid type, unknown chlorinated compound). If probable molecular weights can be distinguished, include them.

Table 6 Laboratory contract required quantitation limits for target compound list volatile organics (Method 8260B)

Parameter	Water CRQL (µg/L)	Soil CRQL (µg/kg), wet weight[a]
Chloromethane	1	10
Vinyl chloride	1	10
Bromomethane	1	10
Chloroethane	1	10
Acetone	5	10
1,1-Dichloroethene	1	10
Methylene chloride	2	10
Carbon disulfide	1	10
trans-1,2-Dichloroethene	1	10
1,1-Dichloroethane	1	10
2-Butanone	5	10
cis-1,2-Dichloroethene	1	10
Chloroform	1	10
1,1,1-Trichloroethane	1	10
Carbon tetrachloride	1	10
1,2-Dichloroethane	1	10
Benzene	1	10
Trichloroethene	1	10
1,2-Dichloropropane	1	10
Bromodichloromethane	1	10
4-Methyl-2-Pentanone	5	10
cis-1,3-Dichloropropene	1	10
Toluene	1	10
trans-1,3-Dichloropropene	1	10
1,1,2-Trichloroethane	1	10
Dibromochloromethane	1	10
2-Hexanone	5	10
Tetrachloroethene	1	10
Chlorobenzene	1	10
Ethylbenzene	1	10
Xylene (total)	1	10
Styrene	1	10
Bromoform	1	10
1,1,2,2-Tetrachloroethane	1	10

[a] Soil results should be reported with the CRQL adjusted for the dry weight.

Notes:
CRQL indicates contract required quantitation limit.
µg/L indicates micrograms per liter or parts per billion.
µg/kg indicates micrograms per kilogram or parts per billion.

Table 7 Laboratory contract required quantitation limits for target compound list semivolatile organics (Method 8270C)

Parameter	Water CRQL (µg/L)	Soil CRQL (µg/kg) wet weight[a]
Phenol	10	330
Bis(2-chloroethyl)ether	10	330
2-Chlorophenol	10	330
1,3-Dichlorobenzene[b]	10	330
1,4-Dichlorobenzene[b]	10	330
1,2-Dichlorobenzene[b]	10	330
2-Methylphenol	10	330
1-Chloropropane	10	330
4-Methylphenol	10	330
N-Nitroso-di-n-propylamine	10	330
Hexachloroethane	10	330
Nitrobenzene	10	330
Isophorone	10	330
2-Nitrophenol	10	330
2,4-Dimethyl phenol	10	330
Carbazole	10	330
Bis(2-chloroethoxy)methane	10	330
2,4-Dichlorophenol	10	330
1,2,4-Trichlorobenzene	10	330
Naphthalene	10	330
4-Chloroaniline	10	330
Hexachlorobutadiene	10	330
4-Chloro-3-methylphenol	10	330
2-Methylnaphthalene	10	330
Hexachlorocyclopentadiene	10	330
2,4,6-Trichlorophenol	10	330
2,4,5-Trichlorophenol	10	330
2-Chloronaphthalene	10	330
2-Nitroaniline	25	800
Dimethyl phthalate	10	330
Acenaphthylene	10	330
2,6-Dinitrotoluene	10	330
3-Nitroaniline	25	800
Acenaphthene	10	330
2,4-Dinitrophenol	25	800
4-Nitrophenol	25	800
Dibenzofuran	10	330
2,4-Dinitrotoluene	10	330
Diethylphthalate	10	330
4-Chlorophenyl-phenyl ether	10	330
Fluorene	10	330
4-Nitroaniline	25	800
4,6-Dinitro-2-methylphenol	25	800
N-Nitrosodiphenylamine	10	330
4-Bromophenyl-phenyl ether	10	330

Table 7 (continued)

Parameter	Water CRQL (µg/L)	Soil CRQL (µg/kg) wet weight[a]
Hexachlorobenzene	10	330
Pentachlorophenol	25	800
Phenanthrene	10	330
Anthracene	10	330
Di-n-butyl phthalate	10	330
Fluoranthene	10	330
Pyrene	10	330
Butylbenzylphthalate	10	330
3,3-Dichlorobenzidine	20	660
Benzo(a)anthracene	10	330
Chrysene	10	330
Bis(2-ethylhexyl)phthalate	10	330
Di-n-octylphthalate	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(a)pyrene	10	330
Indeno(1,2,3-cd)pyrene	10	330
Dibenzo(a,h)anthracene	10	330
Benzo(g,h,i)perylene	10	330

[a] Soil results should be reported with the CRQL adjusted for the dry weight.
[b] These parameters may be analyzed by Method 8260C instead of 8270C.

Notes:
CRQL indicates contract required quantitation limit.
µg/L indicates micrograms per liter or parts per billion.
µg/kg indicates micrograms per kilogram or parts per billion.

Table 8 Laboratory contract required detection limits for target analyte list metals (Method 6010B), antimony (Method 6020), mercury (Methods 7470A/7471A), and cyanide (Method 9010B)

Parameter	Water CRDL (µg/L)	Soil CRDL (mg/kg), wet weight[a]
Aluminum	200	20
Antimony	60	6
Arsenic	10	5
Barium	200	20
Beryllium	5	0.5
Cadmium	5	0.5
Calcium	5000	500
Chromium	10	1
Cobalt	50	5
Copper	25	2.5
Iron	100	10
Lead	3	5
Magnesium	5000	500
Manganese	15	1.5
Mercury	0.2	0.02
Nickel	40	4
Potassium	5000	500
Selenium	5	5
Silver	10	1
Sodium	5000	500
Thallium	10	5
Vanadium	50	5
Zinc	20	2
Cyanide	10	1

[a] Soil results should be reported with the CRQL adjusted for the dry weight.

Notes:
CRDL indicates contract required detection limit.
µg/L indicates micrograms per liter or parts per billion.
mg/kg indicates milligrams per kilogram.
The assumption made in the soil calculation is that 1 gram of sample aliquot is prepared in a final volume of 100 milliliters.

3.8 Documentation

Documentation involves the recording of all events relating to field and laboratory activities. Typical field documentation will include field logbooks and chain-of-custody forms. Sample handling procedures include chain of custody, sample- and investigation-derived waste packaging, and sample transport.

To ensure that all sampling, analysis, and data reporting activities are conducted in accordance with project DQOs and all appropriate safety procedures, adequate documentation of each event must be completed. Therefore, all field activities related to sample collection, site safety, and sample custody must be recorded by the CL and/or the field team members in the closure logbook. In addition, all laboratory activities relating to sample custody, sample preparation, sample analysis, and data reporting must also be completely recorded to ensure that laboratory data can be confidently assigned to field sample points. The laboratory will perform all lab functions relating to the SPRU-LL samples in accordance with the Test America Quality Assurance Manual, provided in Appendix B.

3.8.1 Field Operations Records

The following sections provide a summary of requirements for adequate field documentation. All field documentation, document control, and daily updating of closure logbooks and field materials will be the responsibility of the CL or designee.

3.8.1.1 Closure Logbooks

Closure logbooks are legal documents that are the written record for all field data gathered, field observations, field equipment calibrations, samples collected for laboratory analysis, and sample custody. Logbooks are also maintained to ensure that field activities related to site safety meetings are properly documented and that site work is conducted in accordance with the health and safety procedures. Closure logbooks will be bound and will contain consecutively numbered pages. All entries to closure logbooks will be made using permanent ink pens or markers. All mistakes made as entries will be amended by drawing a single line through the entry, initialed, and dated by the person making the correction. At a minimum, the following entries will be made to the closure logbook:

Identification of all sampling team members

References to field methods used to obtain samples, field data, etc.

Location and description of each sampling point

Types, numbers, and volumes of samples (when observable)

Date of sample collection, time of sample collection, and sample identification

Date and time of sample shipping or transfer of sample custody

Observed weather conditions

All field measurements

Any deviations from the standard or expected procedure

Chain-of-custody form numbers

Date of entry in logbook and initials of person entering it.

Deviations to the exact location based on conditions in the field will be documented in the closure log book and considered non-quality affecting. Deviations in the number of samples collected is considered quality affecting and shall be considered a major change to the QAPjP (See table 2).

3.8.1.2 Chain-of-Custody Record.

The chain-of-custody procedures will begin immediately after collection of the first sample. Details are provided in Section 3.4

3.8.2 Laboratory Records

Laboratory records are required to document all activities involved in sample receipt, processing, analysis, and data reporting. The following sections describe the laboratory records that will be generated for this project.

3.8.2.1 Sample Data

Sample data are records that contain the times that samples were analyzed to verify that holding times prescribed by the analytical methods are met. Sample data records should include information on the overall number of samples analyzed in a given day, location of sample analysis (i.e., instrument identification number), any deviations from analysis SOPs and/or methods, and time and date of analysis. Corrective action steps taken to rectify situations that did not conform to laboratory SOPs and/or analytical methods (including steps taken to seek additional sample material if required) should also be noted in these records.

3.8.2.2 Sample Management Records

Sample management records document sample receipt, handling and storage, and scheduling of analyses. The records verify that the chain of custody and proper preservation were maintained, reflect any anomalies in the samples (such as receipt of damaged samples), note proper log-in of samples into the laboratory, and address procedures used to prioritize samples received to ensure that holding time requirements were met.

3.8.2.3 Test Methods

Unless analyses are performed exactly as prescribed in the analytical methods or laboratory SOPs, test methods describe how the analyses were carried out by the laboratory. Items to be documented include sample preparation and analysis, instrument standardization, detection and reporting limits, and test-specific QC criteria. Documentation demonstrating laboratory proficiency with each method used could also be included in this category.

3.8.2.4 QA/QC Reports

The QA/QC reports will include general QC records, such as initial demonstration of capability of individual analysts to conduct specific analyses, instrument calibration, routine monitoring of analytical performance (e.g., control charts), and calibration verification. Project-specific information from the QA/QC checks such as blanks (e.g., field, reagent, and method), spikes (e.g., matrix, matrix spike duplicate, and surrogate), calibration check samples (e.g., zero check, span check, and mid-range check), replicates, and splits should be included in these reports to facilitate data quality analysis. Specific requirements for the reporting format and quantity and types of QA/QC monitoring will be specified in the analytical SOW to the laboratory.

3.9 Data Reduction, Validation, and Reporting

The laboratory will be conducting analyses on samples in accordance with referenced EPA SW-846 method protocols (EPA 2003), NYSDEC ASP (NYSDEC 1995) and the laboratory's QA Manual. Laboratory validation and data reduction will be incorporated into their in-house effort for the appropriate parameters.

3.9.1 Data Reduction, Handling, and Reporting

Specific laboratory procedures and instrumentation may be found in the QA Manual and/or SOPs from the laboratory. The data production and reporting procedures described below will be employed at the laboratory.

ASP Category B analytical data packages and document sample preparation, extraction, and analysis will be provided for the analyses. If needed, ASP Category B data packages will be provided to NYSDEC either in a sequentially numbered hard copy report or, if available, in a digital format such as PDF, or other conventional format.

The analyst has the primary responsibility and accountability for the correctness and completeness of the analytical data. Each laboratory analyst has responsibility for QA/QC functions at their level and within their assigned tasks. Initial review by the analyst and supervisor is completed in relation to compliance with methodology and acceptability of precision and accuracy results. Review at the QA Officer level includes these elements as well as a review of data acceptability based upon internal and project-specific QC criteria. Tertiary review occurs with the laboratory management where pertinent information pertaining to each specific analysis is compiled. The data generated from the various laboratory sections is transferred to the laboratory's QA Officer. Analytical data forms are then processed and data validation is accomplished.

3.9.2 Data Validation

Analytical data validation is the comparison of analytical results versus the requirements established by the analytical method. Data validation is performed by data validators who are independent from the project and the analytical laboratory. Validation includes evaluation of all sample-specific information generated from sample collection to receipt of the final data package by the PM. Data validation is used to determine if the analytical data are technically and legally defensible and reliable. Validation will be performed in accordance with the National Functional Guidelines (EPA 1999, EPA 2004).

The final product of the validation process is the limitations & validation (L&V) report. The L&V report communicates the quality and usability of the data to the decision-makers. The L&V report will contain an itemized discussion of the validation process and results. Copies of the data forms, annotated for qualification as discussed in the validation report, will be attached to the report.

3.9.3 Data Quality Assessment

The DQA process is used to determine whether the data meet the project DQOs. Following data validation, the DQA process involves data plotting, testing for outlying data points, and statistical hypothesis testing relative to the null and alternative hypotheses stated in the DQOs. The outcome of the DQA process is a DQA report documenting that the statistical hypothesis testing suggests that the null hypothesis is accurate, that the null hypothesis has been rejected, or that not enough data exist to make a determinative conclusion based upon the hypothesis test used. In this latter case, either additional data must be collected to support the statistical hypothesis testing or the data user must make a decision with higher uncertainty than the levels expressed in the DQOs.

As stated in the discussion of completeness, data that are not necessarily invalid may be flagged during the data validation process. Flagged data are reviewed during the DQA process to determine whether the

validation flags affect the intended use of the data. The determination of whether or not flagged data are used in statistical hypothesis testing is documented in the DQA report.

Data generated in accordance with this QAPjP will be subject to DQA in accordance with the Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S (EPA 2006a) and Data Quality Assessment: A Reviewer's Guide, EPA QA/G-9R (EPA 2006b). Assumptions made in preparing this QAPjP and DQOs will be checked, including normality and sample size.

The statistics of interest will be determined based on appropriate statistical methodology. In addition, the assignment of values for non-detects will be determined during the DQA process using guidance found in EPA guidance (EPA 2006b). Other methods, as appropriate, may be used for non-detects, including Kaplan-Meier and Cohen's adjustment on non-detect data (Helsel 2004).

3.10 Corrective Action

Corrective action procedures are implemented whenever sampling, field monitoring, or laboratory analysis results do not meet the required QA/QC standards. The types of corrective action applicable to environmental analysis are laboratory corrective action(s) and field corrective action(s).

3.10.1 Laboratory Corrective Action

The laboratory manager, laboratory QA officer, laboratory analysts, PM, and sampling and data quality personnel will be responsible for ensuring that all laboratory QA/QC procedures are followed. Situations requiring corrective action, and the type of correction required, will be as stated in the analytical method or the laboratory SOW. The laboratory will utilize internal QAPs and procedures to complete all corrective actions identified both internally and externally. Completion of corrective actions will require notification to the PM or the sampling and data quality personnel of any laboratory situation that may impact the usability of the data. If notified of a laboratory nonconformance for which the laboratory seeks the project's required corrective action, sampling and data quality personnel will:

Notify the PM and PQAM of the situation

Devise a reasonable corrective action in conjunction with the laboratory staff and the PM

Request, formally, that the laboratory implement the corrective action.

All sampling and data quality personnel and the laboratory QA officer will be responsible for monitoring the effectiveness of all corrective actions. The sampling and data quality personnel will report directly to the PM regarding problems or deviations observed, corrective actions proposed, and the effectiveness of ongoing corrective actions.

3.10.2 Field Corrective Action

The CL and PM are responsible for ensuring all field sampling procedures are completely followed and that field sampling personnel are adequately trained. The CL and the PM must document situations that may impair the usability of the samples and/or data in the closure logbook. The CL will note any deviations from the standard procedures for sample collection, chain of custody, sample transport, or any other monitoring that occurs. The CL will also be responsible for coordinating all activities relating to the use of field monitoring equipment, such as dosimeters and industrial hygiene equipment. The ES&H

oversight personnel will provide any notations to the logbook, which document noncompliant measurements taken during field sampling. Ultimately, the PM or the CL (at the discretion of the PM) will be responsible for the communicating field corrective action procedures, for documenting all deviations from procedure, and for ensuring that immediate corrective actions are applied to field activities.

4.0 References

40 CFR 136, Appendix B, 2003, *Definition and Procedure for the Determination of the Method Detection Limit*, Code of Federal Regulations, Office of the Federal Register, September 19, 2003.

ARC-PLN-6106, *RCRA Interim Corrective Measures Work Plan for the Separations Process Research Unit Lower Level Land Areas Remediation*, Accelerated Remediation Company, as amended.

ARC-PLN-6302, *Worker Safety and Health Program Plan for SPRU Land Areas Remediation*, Accelerated Remediation Company, as amended.

ASTM, 1984, *Standard Method for Penetration Test and Split-Barrel Sampling of Soils*, American Society of Testing and Materials, D 1586-84.

ASTM, 1992, *Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers*, American Society of Testing and Materials, D 5299-92.

ASTM, 1999, *Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities,* American Society of Testing and Materials, D-5299-99.

ASTM, 2004, *Standard Practice for Design and Installation of Ground Water Monitoring Wells*, American Society of Testing and Materials, D 5092-04e1.

DOE/CH2M HILL, 2002, *RCRA Facility Assessment Sampling Visit Report*, Separations Process Research Unit Project, TSM-09, Revision 1, February 2002.

DOE/CH2M HILL, 2005, *Task IV RCRA Facility Investigation Work Plan for Groundwater*, Upper and Lower Level Areas, TSM-20, April 2005.

DOE, 2006, *Engineering Evaluation Cost Analysis for the Separations Process Research Unit Disposition Project*, December 2006.

EPA, 1999, *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA 540/R-99/008, October 1999.

EPA, 2000b, *EPA Guidance for the Data Quality Objectives Process*, EPA QA/G-4, EPA/600/R-96/055, August 2000.

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

EPA, 2003, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, Office of Solid Waste and Emergency Response, SW-846, 3rd Edition,

http://www.epa.gov/epaoswer/hazwaste/test/main.htm, Web page updated January 7, 2008, Web page visited February, 12, 2008.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540-R-04-004, October 2004.

EPA, 2006a, *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, EPA/240/B-06/003, Environmental Protection Agency, Office of Environmental Information, Washington D.C., February 2006.

EPA, 2006b, *Data Quality Assessment: A Reviewer's Guide*, EPA QA/G-9R, EPA/240/B-06-002, Environmental Protection Agency, Office of Environmental Information, Washington D.C., February 2006.

Helsel, D., 2004, *Non-detects and Data Analysis: Statistic for Censored Environmental Data*, Wiley Interscience, October 2004.

IDQTF, 2005, *Uniform Federal Policy for Quality Assurance Project Plans*, Intergovernmental Data Quality Task Force, EPA-5-5-B-04-900A, Version 1, March 2005.

Malcolm Pirnie, 1996, *Groundwater Monitoring Well Decommissioning Procedures,* Prepared for New York State Department of Environmental Conservation.

NYSDEC, 1994, *NYSDEC Technical and Administrative Guidance Memorandum 4046*, January 24, 1994.

NYSDEC, 1995, *Analytical Services Protocol*, New York State Department of Environmental Conservation.

NYSDEC, 2002, *Draft DER-10 Technical Guidance for Site Investigation and Remediation*, Draft DER-10, December 25, 2002.

NYSDEC, 2006, *Response to NYSDEC SPRU RCRA Facility Assessment Sampling Visit SWMUs/AOC, February 2002*, March 9.

Appendix A

Uniform Federal Policy for Quality Assurance Project Plans

Requirements Crosswalk

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Test America Quality Assurance Manual

Quality Assurance Manual

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Title Page:

Quality Assurance Manual
Approval Signatures

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Laboratory Director – Elaine Wild	Date
Marti Ward	12/13/07
Quality Manager - Marti Ward	Date
Michael J. Ridenhower	12/13/07
ES & H Manager – Michael Ridenhower	Date

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SOPs AND POLICIES REFERRED TO IN THE QA MANUAL

SOP/Policy Reference	Title
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-003	Management of Change Procedure
CA-Q-S-004	Method Compliance & Data Authenticity Audits
CA-Q-S-005	Calibration Curves (General)
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CA-L-S-001	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CA-L-S-002	Subcontracting Procedures
CA-L-P-001	Ethics Policy
CA-L-P-002	Contract Compliance Policy
CW-L-P-001	Record Retention
CW-F-P-002	Authorization Matrix
CA-C-S-001	Work Sharing Process
CA-T-P-001	Qualified Products List
CW-F-S-004	Controlled Purchases Policy
	For a list of Laboratory SOPs See Appendix 9

SECTION 3

INTRODUCTION
(NELAC 5.1 - 5.3)

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica St. Louis's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. Each TestAmerica laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with the U.S. Department of Energy, Quality Systems for Analytical Services (QSAS, current revision), U.S. Department of Defense Quality Systems Manual for Environmental Laboratories (Version 3) ,2003 National Environmental Laboratory Accreditation Conference (NELAC) standards and ISO/IEC Guide 17025 (2005). In addition, the policies and procedures outlined in this manual are compliant with the various accreditation and certification programs listed in Appendix 6. The relevant QSAS and NELAC sections are included in the heading of each QAM section.

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- EPA SW-846, *Test Methods for the Evaluation of Solid Waste, 3rd Edition,* September 1986; Update I, July 1992; Update II, September 1994; and Update III, December 1996.
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th and 21st Edition.
- *U.S. Department of Energy* Order 414.1c, *Quality Assurance*
- Nuclear Regulatory Commission (NRC) quality assurance requirements.
- Toxic Substances Control Act (TSCA).

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by TestAmerica St. Louis conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 5 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

TestAmerica St. Louis analyzes thousands of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical and physical parameters. The Program also contains guidelines on maintaining documentation of analytical process, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all requests to provide analyses are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested water, air, industrial waste, and soil methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Appendix 4. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet requirements. All methods performed by TestAmerica St. Louis shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director, Technical Directors and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

The manual is reviewed annually by the QA Manager and laboratory personnel to assure that it reflects current practices and meets the requirements of TestAmerica St. Louis's clients and regulators. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. The updates will be reviewed by the QA Manager, Laboratory Director, Technical Director(s), relevant operational staff and Corporate Quality Assurance (if a change is made to the Corporate template) and then formally incorporated into the document in periodic updates. The QAM is based on a Corporate QAM Template that is prepared and approved by the Chief Operating Officers (COOs) and Corporate Quality Assurance. This template is reviewed annually by the COOs, Corporate Quality, and each laboratory. Necessary changes are coordinated by the Vice President of Quality and Environmental Health & Safety (EHS) and distributed to each laboratory for inclusion in the laboratory specific QA Manuals.

Policies in the QAM that require immediate attention may be addressed through the use of Corporate QA/QC Policy Memoranda. QA/QC Policy Memoranda are published from time to time to facilitate immediate changes to QA/QC Policy. QA/QC Policy Memoranda supersede the QAM and all other SOPs (refer to Section 5.3). All policy memoranda are dated, archived and distributed by their placement into the front of the QAM between the signature page and Section 2. At a minimum, each policy memorandum is approved by the same authorized signatories as shown on the cover page of the QA Manual. In addition, Corporate QA/QC Policy

Memoranda are signed by the COOs and VP of Quality and EHS. The QA/QC Policy Memoranda are incorporated into the QAM during the periodic updates. Policy memorandum may also include an expiration date if appropriate. An example format can be found in Figure 3-1. A similar procedure is followed for local laboratory changes.

Laboratory-specific QAM changes are approved and documented through the procedure outlined in SOP ST-QA-0035, "Preparation and Management of Standard Operating Procedures". Updates and changes to the laboratory QAM follow the same procedure as changes and updates to laboratory SOPs.

3.4.2 Control

This manual is considered confidential within TestAmerica and may not be altered in any manner by other than a duly appointed representative from TestAmerica. If the document has been provided to external users or regulators, it is for the exclusive purpose of reviewing TestAmerica St. Louis's quality systems and shall not be used in any other way without the written permission of an appointed representative of TestAmerica. The procedure for control of distribution is incorporated by reference to SOP ST-QA-0035, "Preparation and Management of Standard Operating Procedures".

The order of precedence in the event of a conflict between policies is outlined in Section 5.3.1 of this Quality Assurance Manual.

Figure 3-1.

Example - Format for a QA/QC Policy Memorandum

Corporate (or Laboratory) QA/QC Policy Memorandum # _____

Effective Date: _____ Expiration Date: When Appropriate QAM Section is Revised

Corporate: *(Only needed for Corporate Memorandum – Delete if Laboratory)*

_____	_____
COO - West Date	Vice-President, QA and EHS Date
_____	
COO - East Date	

Local:

_____	_____
Laboratory Director Approval Date	Quality Assurance Approval Date
_____	_____
ES&H Manager Approval Date	Date

1. **Purpose**

2. **Procedure**

3. **Attachments**

4. **References/Cross References**

SECTION 4

ORGANIZATION AND MANAGEMENT
(NELAC 5.4.1)

4.1 OVERVIEW

TestAmerica St. Louis is part of a national network of laboratories known as TestAmerica. This Quality Assurance Manual (QAM) is applicable to the TestAmerica St. Louis laboratory only.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, Missouri 63045
23-2637347
MO00054

The Corporate organization chart can be found in Figure 4-1 and the laboratory's organization chart can be found in Appendix 2. The locations of other TestAmerica labs are as follows:

TestAmerica Anchorage
TestAmerica Austin
TestAmerica Buffalo
TestAmerica Burlington
TestAmerica Cedar Falls
TestAmerica Chicago
TestAmerica Connecticut
TestAmerica Corpus Christi
TestAmerica Dayton
TestAmerica Denver
TestAmerica Edison
TestAmerica Honolulu
TestAmerica Houston
TestAmerica Irvine
TestAmerica King of Prussia
TestAmerica Knoxville
TestAmerica Los Angeles
TestAmerica Mobile
TestAmerica Morgan Hill
TestAmerica Nashville
TestAmerica North Canton
TestAmerica Ontario
TestAmerica Orlando
TestAmerica Pensacola
TestAmerica Phoenix
TestAmerica Pittsburgh
TestAmerica Portland
TestAmerica Richland

TestAmerica San Francisco
TestAmerica Savannah
TestAmerica Seattle
TestAmerica Spokane
TestAmerica Tacoma
TestAmerica Tallahassee
TestAmerica Tampa
TestAmerica Valparaiso
TestAmerica Watertown
TestAmerica West Sacramento
TestAmerica Westfield

4.2 ROLES AND RESPONSIBILITIES

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions define each role in its relationship to the Quality Assurance Program. More extensive job descriptions are maintained by laboratory management.

4.2.1 Quality Assurance Program

The responsibility for quality lies with every employee of TestAmerica St. Louis. All employees have access to the QAM and are responsible for knowing the content of this manual and upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs.

4.2.2 Chairman/Chief Executive Officer (CEO)

The Chairman/CEO is the Chairman of the Board of Directors and is ultimately responsible for the quality and performance of all TestAmerica facilities. Together with the President/CEO of the Analytical Division, the Chairman/CEO establishes the overall quality standard and data integrity program for the company, providing the necessary leadership and resources to assure that the standard and integrity program are met.

4.2.3 President/Chief Executive Officer (CEO)

The President/CEO is a member of the Board of Directors and is ultimately responsible for the quality and performance of all TestAmerica facilities. Together with the Chairman/CEO, the President/CEO establishes the overall quality standard and data integrity program for the Analytical Division, providing the necessary leadership and resources to assure that the standard and integrity program are met.

4.2.4 Chief Operating Officer (COO) – East and West

The COOs serve as the ranking executives for all respective analytical laboratory operational functions and report to the President/CEO of the Analytical Division. They are responsible for the daily management of all analytical laboratories, long-term planning and development of technical policies and management plans. They ensure the attainment of corporate objectives

through the selection, development, motivation, and evaluation of top management personnel. The COOs approve all operating budgets and capital expenditures. The COOs sign-off on the final QAM template that contains company policies for implementing the Quality Program.

4.2.5 General Manager (GM)

Each GM reports directly to a COO. Each GM has full responsibility for the overall administrative and operational management of their respective laboratories. The GM's responsibilities include allocation of personnel and resources, long-term planning, setting goals, and achieving the financial, business, and quality objectives of TestAmerica. The GM ensures timely compliance with corporate management directives, policies, and management systems reviews. The GM is also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.6 Vice President of Quality and Environmental Health and Safety (VP-QA/EHS)

The Vice President of QA/EHS reports directly to the Chairman/CEO. With the aid of the Analytical Division and Non-Analytical Division Senior Management Teams, Laboratory Director/ Managers, Quality Directors, EHS Directors, QA Managers and EHS Coordinators, the VP-QA/EHS has the responsibility for the establishment, general overview and Corporate maintenance of the Quality Assurance and Environmental, Health and Safety Program within TestAmerica. Additional responsibilities include:

- Review of QA/QC aspects of Corporate SOPs, national projects and expansions or changes in services.
- Coordination/preparation of the Corporate QAM Template that is used by each laboratory to prepare its own laboratory-specific QAM.
- Maintenance of Corporate Policies, Quality Memorandums and SOPs. Maintenance of data investigation records that are reported to Corporate Management.
- Work with various organizations outside of TestAmerica to further the development of quality standards and represent TestAmerica at various trade meetings.
- Preparation of a monthly report that includes quality metrics across the Analytical Division and a summary of any quality related initiatives and issues.
- With the assistance of the Corporate Senior Management Teams and the EHS Directors, development and implementation of the TestAmerica Environmental, Health and Safety Program.

4.2.7 Quality Directors (Corporate)

The Quality Directors report to the VP-QA/EHS. Together with the VP-QA/EHS, the Quality Directors have the responsibility for the establishment, general overview and maintenance of the Analytical Division's Quality Assurance Program within TestAmerica. The Quality Directors are responsible for:

- Oversight of the QA/QC programs within each laboratory. This includes a final review of each laboratory-specific QAM and receipt of each laboratory's QA monthly report.
- Review of QA/QC aspects of national projects.

- Assistance with certification activities.

4.2.8 Ethics and Compliance Officers (ECOs)

TestAmerica has designated two senior members of the Corporate staff to fulfill the role of Ethics and Compliance Officer (ECO) – VP-QA/EHS and VP-Client and Technical Services. Each ECO acts as a back-up to the other ECO and both are involved when data investigations occur. Each ECO has a direct line of communication to the entire senior Corporate and lab management staff.

The ECOs ensure that the organization distributes the data integrity and ethical practices policies to all employees and ensures annual trainings and orientation of new hires to the ethics program and its policies. The ECO is responsible for establishing a mechanism to foster employee reporting of incidents of illegal, unethical, or improper practices in a safe and confidential environment.

The ECOs monitor and audit procedures to determine compliance with policies and to make recommendations for policy enhancements to the CEOs, COOs, Laboratory Director or other appropriate individuals within the laboratory. The ECO will assist the laboratory QA Manager in the coordination of internal auditing of ethical policy related activities and processes within the laboratory, in conjunction with the laboratories regular internal auditing function.

The ECOs will also participate in investigations of alleged violations of policies and work with the appropriate internal departments to investigate misconduct, remedy the situation, and prevent recurrence of any such activity.

4.2.9 Vice President of Client and Technical Services

The Vice President (VP) of Client and Technical Services is responsible for offerings to clients including risk management, technical assistance, legal compliance and contract administration. The VP of Client and Technical Services provides support and direction to the Managers of these areas, and supports the COOs in decisions regarding long term planning, resource allocation and capital expenditures.

4.2.10 Director of Technical Services

The Director of Technical Services is responsible for establishing, implementing and communicating TestAmerica's Analytical Division's Technical Policies, SOPs, and Manuals. Other responsibilities include conducting technical assessments as required, acting as a technical resource in national contracts review, coordinating new technologies, establishing best practices, advising staff on technology advances, innovations, and applications.

4.2.11 Chief Information Officer (CIO)

The CIO is responsible for establishing, implementing and communicating TestAmerica's Information Technology (IT) Policies, SOPs and Manuals. Other responsibilities include coordinating new technologies, development of electronic communication tools such as TestAmerica's intranet and internet sites, ensuring data security and documentation of software, ensuring compliance with the NELAC standard, and assistance in establishing, updating, and maintaining Laboratory Information Management Systems (LIMS) at the various TestAmerica facilities.

4.2.12 Environmental Health and Safety Directors (EHSDs) (Corporate)

The EHSDs report directly to the VP-QA/EHS. The EHSDs are responsible for the development and implementation of the TestAmerica Environmental, Health and Safety program. Responsibilities include:

- Consolidation and tracking all safety and health-related information and reports for the company, and managing compliance activities for TestAmerica locations.
- Coordination/preparation of the corporate Environmental, Health and Safety Manual Template that is used by each laboratory to prepare its own laboratory-specific Safety Manual/ CHP.
- Preparation of information and training materials for laboratory EHS Coordinators.
- Assistance in the internal and external coordination of employee exposure and medical monitoring programs to insure compliance with applicable safety and health regulations.
- Serving as Department of Transportation (D.O.T.) focal point and providing technical assistance to location management.
- Serving as Hazardous Waste Management main contact and providing technical assistance to location management.

TestAmerica St. Louis is a local operating unit of TestAmerica Laboratories, Inc. The TestAmerica organizational chart can be found in Figure 4-1.

4.2.13 Laboratory Director

The St. Louis Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to his/her respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- The Laboratory Director is responsible for maintaining positive operating margin to the company at the laboratory level and for meeting and exceeding the annual budget.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Supervises all laboratory personnel and provides guidance and direction as needed.

- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Responsible for ensuring compliance and integration of facility operation with corporate and regulatory policies and procedures.
- Ensures that appropriate corrective actions are taken to address issues identified by external and internal audits.
- The Laboratory Director has signatory authority for the QAM, policies, SOPs and contracts (as defined by TestAmerica policy).

4.2.14 QA Manager

The Quality Assurance Manager is responsible for developing and implementing the laboratory quality system. The QA manager reports to the laboratory director and has access to corporate QA for advice and resources. This position is able to evaluate data objectively and perform assessments without outside (managerial) influence.

Responsibilities include but are not limited to:

- Providing Quality Systems training to all new personnel, maintaining a Quality Assurance Manual (QAM), arranging and managing PT samples, and performing systems, data, special, and external audits with both clients and regulatory officials.
- Oversees the maintenance of QC records, maintains certifications, approves, develops, and maintains Standard Operating Procedures (SOPs), submits monthly QA Reports, evaluates corrective actions and assists in reviewing new work as needed.
- Has the final authority to accept or reject data, and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data.
- Be available to any employee to resolve data quality or ethical issues.
- Be independent of laboratory operations.
- Has signatory authority for the QAM, SOPs and policies pertaining to QA/QC.
- QA Manager or designee reviews control charts.

4.2.15 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory. The Operations Manager reports directly to the Laboratory Director. He/She assists the Technical Director in determining the most efficient instrument utilization.

Responsibilities include:

- Evaluates production capacity and improves capacity utilization.
- Evaluates turnaround time and addresses issues that may hinder meeting the required and committed turnaround time.
- Evaluates the level of internal/external non-conformances for all departments
- Responsible for timely compliance with audits and corrective actions as applicable
- Develops and improves the training of all analysts in cooperation with the Technical Director and the QA Manager
- Ensures that scheduled instrument maintenance is completed

- Responsible for efficient utilization of supplies.
- Monitors and modifies the processing of samples through departments.
- Supports the Quality System

4.2.16 Technical Director

The Technical Director(s) report(s) directly to the Laboratory Director. The scope of responsibility ranges from the new hire process and existing technology through the on going training and development programs for existing analysts and second and third generation instrumentation.

Specific responsibilities include:

- Assists in coordinating, writing and reviewing SOPs.
- May assist in the review of proposals
- Solves day to day technical issues, provides technical training and guidance to staff, project managers, and clients.
- Investigates technical issues identified by QA, and directs evaluation of new methods.

4.2.17 Manager of Project Management/Customer Service Manager

In addition to filling the requirements of Project Manager for key accounts, he/she fulfills supervisory duties and responsibilities. As Manager, he supervises the Project Management staff, sets standards for and monitors productivity, manages the assignment of accounts and the daily workload and tracks and maintains information for various revenue reports. With the QC Manager, he determines acceptable corrective actions for the nonconformance occurring within his group, develops and reviews standard operating procedures for the group.

Additional responsibilities include:

- Has signatory authority for final reports.
- Training of the Project Management staff
- Notify supervisors of incoming projects and sample delivery schedules
- Coordinate requests for sample containers and sample pick-up/deliveries

4.2.18 Project Manager

- Coordinates and manages customers' projects through all phases of laboratory operations, ensuring fulfillment of TestAmerica's commitment to client requirements, error-free work, and on-time delivery.
- Responsible to ensure that clients get timely responses to status inquiries, resolutions to problems and the agreed upon deliverables
- Discusses with clients any project related problems, resolves service issues and coordinates technical details with the lab staff
- Responsible for staff familiarization with specific quotes, sample log-in review and final report accuracy and completeness
- Maintains communications with clients and Account Executives and serves as a

liaison between clients and laboratory operations to meet client's needs.

- Works closely with business unit personnel to manage quotations and change orders for existing scopes of work.
- Generates narratives outlining project observations, QC excursions, and laboratory comments.
- Has signatory authority for final reports.

4.2.19 Department Manager/Supervisor

The Department Manager/Supervisor is responsible for the overall operations of a specific laboratory area.

These responsibilities include but are not limited to:

- Meeting client satisfaction goals, managing the human resources within the department, and ensuring health and safety and quality assurance plan compliance.
- Serves as a technical resource to department employees, as well as Project Managers, sales personnel, and clients.
- Make recommendations to laboratory management in regard to process improvements.
- Ensure analysts in their department adhere to applicable SOPs and the QAM.

4.2.20 Chemist/Analyst

- Laboratory analysts are responsible for the generation of data by preparing and analyzing samples according to written SOPs and client requirements.
- They are responsible for understanding the requirements in the LQM and the SOPs associated with their specific function.
- Perform the initial technical review of sample preparation information, calculations, qualitative identifications and raw data with the authority to stop, accept, or reject data based on compliance with sell-defined QC criteria.
- The laboratory analyst also provides prompt documentation and notification to the Group Leader of problems or anomalies detected.
- Monitor, calibrate, and maintain standard laboratory equipment such as refrigerators, ovens, water systems, and pipettes, and instrumentation, as necessary.

4.2.21 Environmental Health and Safety Coordinator

- The Environmental Health and Safety Coordinator is responsible for administering the EH&S program that provides a safe, healthy working environment for all employees and the environment.
- Monitors all areas for unsafe conditions, acts, and potential hazards. Enforces environmental, health, and safety policies and procedures. Maintains regulatory compliance with local, state, and federal laws.
- Makes safety and health recommendations to laboratory management in conjunction with the facility safety committee.
- Develops and maintains the facility's health and safety and waste disposal procedures.
- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.

- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is "reasonable" and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica's medical consultants.

4.2.22 Radiation Safety Officer (RSO)

- Under the direction of the Laboratory Director, implements the radiation protection program that, as a minimum, provides compliance with pertinent regulatory requirements, license provisions, and the Radiation Protection Program.
- Maintains direct access to the Laboratory Director on matters relating to radiological protection.
- Maintains sufficient organizational independence to review and evaluate activities involving the use of radioactive materials.
- Provides Authorized Users and radiation workers with the instruments, protective devices, dosimetry, training, and other items needed to perform their work in accordance with the radiological protection program elements.
- Maintains original copies of all St. Louis licenses/permits, including attachments and amendments, for radioactive materials.
- Directs program to monitor and control radioactive materials throughout the laboratory
- Conducts radiation safety training
- Maintains inventory of standards, tracers, and radiological samples
- Manages segregated area for storing radioactive and mixed wastes

4.3 DEPUTIES

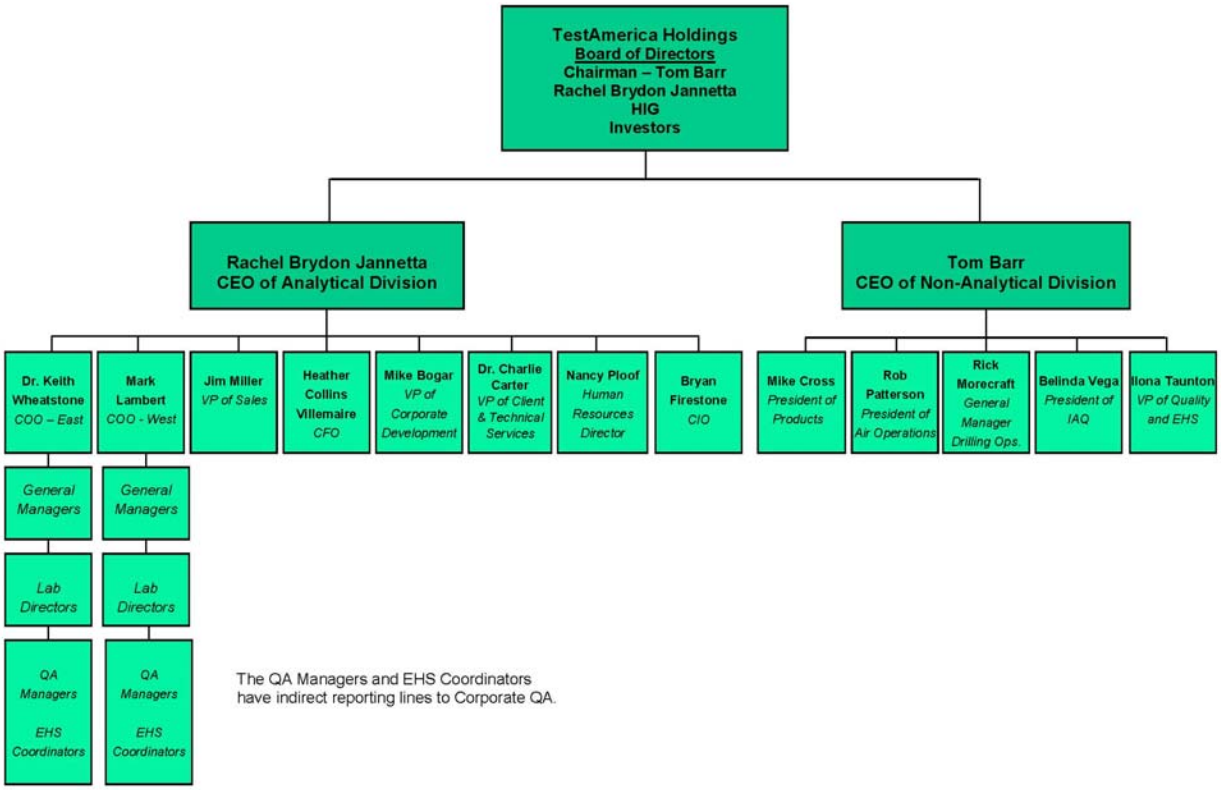
The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy	Comment
Laboratory Director: Elaine Wild	Ben Hicks Rhonda Ridenhower	
QA Manager Marti Ward	Terry Romanko	

Key Personnel	Deputy	Comment
Technical Director Terry Romanko	Ben Hicks	
Organic Manager Ben Hicks	Wenjun Han	
Radiochemistry Manager Rhonda Ridenhower	Jody Watson	
Metals Supervisor Fernando Cruz	Elaine Wild	
Wet Chemistry Supervisor Chris Hough	Elaine Wild	
EHS Coordinator Mike Ridenhower	Jim Kleszczewski	
Radiation Safety Officer Mike Ridenhower	Terry Romanko	
Project Management Department Manager Mike Franks	Marty Cahill	

Figure 4-1.

Corporate Organization Chart



SECTION 5

QUALITY SYSTEM
(NELAC 5.4.2)

5.1 QUALITY POLICY STATEMENT

The management of TestAmerica and TestAmerica St. Louis are committed to providing data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols described in this manual.

In all aspects of the laboratory and business operations, management is dedicated to maintaining the highest ethical standards. An Ethics Policy sign-off can be viewed in Appendix 1. Training on ethical and legal responsibilities is provided annually and each employee signs off annually on the policy as a condition of employment.

It is TestAmerica's Policy to continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. The company recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.

TestAmerica St. Louis strives to provide clients with the highest level of professionalism and the best service practices in the industry.

Every staff member at TestAmerica St. Louis plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 ETHICS AND DATA INTEGRITY

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The 7 elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Policy No. CA-L-P-001) and employee ethics statements (Appendix 1).
- An Ethics and Compliance Officer (ECO).
- A training program.
- Self-governance through disciplinary action for violations.
- A confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (SOP No. CA-L-S-001)
- Procedures and guidance for recalling data if necessary (SOP No. CA-L-S-001).
- An effective external and internal monitoring system that includes procedures for internal audits (Section 16).

As an American Council of Independent Laboratories (ACIL) member, all TestAmerica laboratories adhere to the following ACIL Code of Ethics:

- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the ethical and quality standards of our industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 QUALITY SYSTEM SUPPORTING DOCUMENTATION

The laboratory's Quality System is communicated through a variety of documents prepared by the laboratory and company management:

- Quality Assurance Manual (QAM) Template
- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Corporate TestAmerica QA/QC Policy Memorandums (Refer to Section 3.4).
- Laboratory QA/QC Policy Memorandums (Refer to Section 3.4).
- Laboratory Waste Management Plan (composed of several SOPs)
- Laboratory Radiation Safety Program (composed of several SOPs)

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- TestAmerica QA/QC Policy Memorandum - Corporate
- Laboratory QA/QC Policy Memorandum
- Quality Assurance Manual

- Corporate SOPs and Policies
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

5.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples. The calculation of precision is described in Section 25.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery. The calculation of accuracy is described in Section 25.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories, and by the degree to which approval from the US EPA or other pertinent regulatory agencies is obtained for any procedure for which significant modifications have been made.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), inter-element corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit/Minimum Detectable Activity) or quantified (Reporting Limit).

5.5 CRITERIA FOR QUALITY INDICATORS

The laboratory prepares a ***Reference Data Summary***, through QC Browser, that summarizes the precision and accuracy acceptability limits for analyses performed at TestAmerica St. Louis. This summary includes an effective date, is updated each time new limits are generated and is located with the QC Browser program. Copies of method specific QC limits are included in the analytical SOPs for the various methods. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, TestAmerica St. Louis has developed limits from evaluation of data from similar matrices. Criteria for development of control limits are contained in Section 25.

5.6 STATISTICAL QUALITY CONTROL

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs. TestAmerica St. Louis routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 25. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Surrogate recoveries are determined for a specific time period as defined above. The resulting ranges are entered in LIMS.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

As the QC limits are calculated, QC charts are generated showing warning and control limits for the purpose of evaluating trends. The QA Manager evaluates these to determine if adjustments need to be made or for corrective actions to methods. All findings are documented and kept on

file. See SOP STL-QA-0014, “Evaluation of Analytical Accuracy and Precision Through the Use of Control Charts”.

5.7 QUALITY SYSTEM METRICS

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 17). These metrics are used to drive continuous improvement in the laboratory’s Quality System.

SECTION 6

DOCUMENT CONTROL
(NELAC 5.4.3)

6.1 OVERVIEW

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled at each laboratory Facility:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions, Operator Aids and Forms
- Corporate Policies and Procedures distributed outside the intranet

The Corporate staff posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These are collectively termed "Official Documents" and encompass the Policies and Procedures that all facilities are required to employ. These official documents are only considered controlled when they are read on the company intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving official documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving and in the TestAmerica St. Louis SOP STL-QA-0023 "Document Control".

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, non-conformance memos and validation requests. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports. Discussion on records control is described in Section 15.

The maintenance of purchasing data is discussed in Section 9.

The maintenance of sales and marketing contracts is discussed in Section 7.

6.2 DOCUMENT APPROVAL AND ISSUE

The pertinent elements of a control system for each document include a unique name and number, the number of pages of the item, the effective date, revision number and the

laboratory's name. The QA Manager is responsible for the maintenance of the system and maintains the items electronically.

Controlled documents are authorized by the QA Department and other management. In order to develop a new document, a manager submits a draft to the QA Department and/or Technical Director for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retain the official document on file. The official document is provided as needed to those using it. Controlled documents shall be available at all locations where the operational activity described in the document is performed (may include electronic access). Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years. When related to DoD (Department of Defense) work the review will be done every year. Revisions are made as appropriate. Changes to documents occur when a procedural change warrants a revision of the document.

6.3 PROCEDURES FOR DOCUMENT CONTROL POLICY

For changes to the QA Manual and SOPs refer to SOP ST-QA-0035, "Preparation and Management of Standard Operating Procedures". Uncontrolled copies must not be used within the laboratory. Electronic copies are stored on the Public server in the QA folder for the applicable revision. Previous revisions and back-up data are stored by the QA department.

Forms, worksheets, work instructions and information are organized by department in the QA folder. There is an index. Electronic versions are kept on the network server in the QA folder.

6.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are destroyed. At least one copy of the obsolete document is archived as described in Section 15.

SECTION 7

REVIEW OF WORK REQUEST

7.1 OVERVIEW

TestAmerica St. Louis has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is TestAmerica's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and TestAmerica's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these regulatory and client requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the lab's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and TestAmerica's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the

contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.
All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The review process is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 REVIEW SEQUENCE AND KEY PERSONNEL

Appropriate personnel will review the work request at each stage of evaluation. SOP STL-PM-0001, "Project Setup and Quote" outlines the procedure used at TestAmerica St. Louis.

The contract review process is outlined in SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on the scope of contract, to evaluate all of the requirements (not necessarily in the order below).

- Legal & Contracts Director
- General Manager
- The Laboratory Customer Service Manager
- The Laboratory Operations Manager
- Laboratory and/or Corporate Technical Directors
- Laboratory and/or Corporate Information Technology Managers/Directors
- Regional and/or National Account representatives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The National Account Director, Legal Contracts Director, or the local Customer Service Manager or Project Manager then submits the final proposal to the client. In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Legal & Contracts Director maintains copies of all signed contracts**.** A copy is kept in the Project Management Directory on the network server.

7.3 DOCUMENTATION

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. See Figure 7-1 for an example of the proposal review form. This is kept in the hardcopy contract file maintained by the Business Development Manager.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, TestAmerica St. Louis assigns a PM to each client. The PM is the first point of contact for the client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the direct client contact and they coordinate opportunities and work with laboratory management and supervisory staff to ensure that available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, a Client Requirement Memo may be associated with each sample lot as a reminder of special sample receipt instructions and analytical requirements.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation may be by letter, e-mail, variance and/or contract addendum.

Such changes are also communicated to the laboratory during production meetings. Such changes are updated on the Client Requirement Memo and are introduced to the department supervisors at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Department Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

TestAmerica strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

Figure 7-1

TestAmerica St. Louis

Quality Assurance Project Plan/Statement of Work Review Form

QAPP/SOW Title:
_____

QAPP/SOW Revision No.: _____

Client Name: _____

Project Name: _____

QAPP/SOW Location: _____

Date QAPP/SOW Received at STL: _____

Requested Tests: _____

Distribution:

Department/Individual	**Review Req'd? Y/N**
Operations _____	_____
QA Manager _____	_____
Other _____	_____

Date Comments/Response Due to Client: ____/_____/_____

Review Completed (PM Initials/Date): _____/_____

Reviewer's Comments (or attached):

SECTION 8

SUBCONTRACTING OF TESTS
(NELAC 5.4.5)

8.1 OVERVIEW

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the corporate network. The phrase "work sharing" refers to internal transfers of samples between company laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When we must outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to the SOP on Subcontracting Procedures (CA-L-S-002) and the Work Sharing Process SOP (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements / specified in NELAC/ISO 17025 and or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-NELAC accredited work where required.

For Department of Defense/Department of Energy projects the subcontractor and/or Work Share laboratories used must have an established and documented laboratory quality system that complies with DoD QSM/DOE QSAS requirements. The subcontractor and/or Work Share laboratories are evaluated following the procedures outlined below and as seen in Figure 8-1. The subcontractor and/or Work Share laboratory must receive project-specific approval from the DoD/DOE client before any samples are analyzed.

The DoD QSM has 5 specific requirements for subcontracting:

1. Subcontractor laboratories must have an established laboratory quality system that complies with the QSM.
2. Subcontractor laboratories must be approved by the specific DoD Component laboratory approval process.
3. Subcontractor laboratories must demonstrate the ability to generate acceptable results from the analysis of PT samples, subject to availability, using each applicable method, in the specified matrix, and provide appropriate documentation to the DoD client.
4. Subcontractor laboratories must receive project-specific approval from the DoD client before any samples are analyzed.
5. Subcontractor laboratories are subject to project-specific, on-site assessments by the DoD client or their designated representatives.

The DOE QSAS has the following requirements for subcontracting:

> "The laboratory shall not use any sub-tier laboratories or subclients (including those possessing the same or similar corporate name) for performance of work under this specification without written approval from the Procurement Representative. The laboratory using the sub-tier laboratory or subclient shall document and is responsible for ensuring that such subclient meets all of the requirements of this specification, including being available for client inspections and audits.
> Some clients may not allow any subcontracting to third party (sub-tier) laboratories. If this is the case, then this will be specifically noted in the site-specific contracts vis Contracts, Task Orders, Laboratory Delivery Orders, etc."

Project Managers (PMs), Customer Service Managers (CSM), or Regional Account Executives (RAE) for the Export Lab are responsible for obtaining client approval prior to outsourcing any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder.

Note: In addition to the client, some regulating agencies, such as the US Army Corps of Engineers and the USDA, require notification prior to placing such work.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

Whenever a PM [or Regional Account Executive (RAE) or Customer Service Manager (CSM)] becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified network laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with the company.
- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- NELAC accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

With the exception of DOD and DOE programs noted in 8.1, all intra-company laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. Refer to SOPs CA-C-S-001, Work Sharing Process and STL-PM-0001, Project Set Up.

When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the QA Manager begin the process of approving the subcontract laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented).

8.2.1 The QA Manager must ensure that the Subcontracting Approval Form (Figure 8-1) has been completed and have supporting documentation on file prior to initiation of any work. In some cases a network laboratory or Corporate QA may have previously completed an approval of a subcontracting laboratory. A listing of all approved subcontract laboratories and supporting documentation is available on the TestAmerica intranet site. If this option is used, the laboratory must ensure that the subcontract lab is capable of meeting the needs of the current project. A letter or e-mail is sent to the lab requesting the following information:

8.2.1.1 A copy of their Quality Assurance Manual (controlled if possible). Determine that data quality limits for relevant methods are acceptable and that training procedures are adequate (optional if a lab is NELAC accredited)

8.2.1.2 Evidence of a current SOP per method. A copy of the first page and signature page from the SOP is sufficient. A Table of Contents that includes effective dates is also acceptable. (optional if a lab is NELAC accredited)

8.2.1.3 The most recent 2 sets of full proficiency testing (PT) results relevant to the analyses of interest and any associated corrective action. (optional if a lab is NELAC accredited)

8.2.1.4 Copy of necessary certifications verifying that the required approvals are current. Ensure that all needed analytes are included; some may not be accredit-able (if so, document). Certificate and scope of International Standard accreditation are required, when applicable.

8.2.1.5 Example final report to confirm format is compliant and provides the necessary information. (minimally it must be determined that Batch QC results are included in the laboratory reports and data is appropriately qualified.

8.2.1.6 Statement of Qualification (SOQ) or summary list of Technical Staff and Qualifications – position, education and years of experience

8.2.1.7 USDA soil permit if available and/or required. USDA permit is required if soils less than three feet deep from New York, North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Texas, Oklahoma, New Mexico, Arizona, California, Hawaii, or outside the continental U. S. are to be analyzed. These samples require special shipping measures; check with the EHS Department. It may be necessary to heat-treat the samples before shipping if the subcontract laboratory does not have a USDA permit; however, some analytes/tests may be irrelevant after heat treatment.

8.2.1.8 Insurance Certificate. This is required by TestAmerica's Chief Financial Officer

8.2.1.9 State Audit with Corrective Action Response

8.2.1.10 Description of Ethics and Data Integrity Plan.

8.2.1.11 DoD work includes additional requirements as described in Section 8.1 above.

8.2.1.12 A copy of raw data associated with the first project is requested for internal review. The raw data is reviewed by the QA Manager and the PM to ensure that the results meet the client's needs. If the QA manager is unfamiliar with the analysis being performed, notify Corporate QA for guidance on the review (it may need to be sent elsewhere for evaluation). This requirement can be skipped if an on-site visit of the laboratory is planned. (This requirement is effective as of the effective date of this section. Laboratories worked with previously [minimum of 6 months] are grandfathered in.)

Note: The lab does not need to complete the approval form (figure 8-1) if the information on the intranet site is sufficient to meet the needs of the project.

8.2.2 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. The company does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contract Department. Any problems identified will be brought to Corporate QA attention.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints must be posted using the Vendor Performance Report (Form No. CW-F-WI-009)**.**
- Information must be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all network laboratories and Corporate QA and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Lab Directors/Managers, QA Managers and Sales Directors.

8.3 OVERSIGHT AND REPORTING

The PM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Legal & Contracts Director can tailor the document or assist with negotiations, if needed. The PM (or RAE or CSM) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the

proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. For network laboratories, certifications can be viewed on the company website.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a Chain of Custody (COC). A copy of the original COC sent by the client must be included with all samples subbed within the network.

The PM will communicate with the subcontracted laboratory to monitor the status of the analyses, facilitate successful execution of the work and ensure the timeliness and completeness of the analytical report.

Non-NELAC accredited work must be identified in the subcontractor's report as appropriate. If NELAC accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a network work sharing laboratory may be transferred electronically and the results reported by the network work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 CONTINGENCY PLANNING

With the exception of DOD and DOE programs noted in 8.1, the Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs. In the event this provision is utilized, Corporate QA must be informed, and the QA Manager will be required to verify adequacy of proficiency scores and certifications. The laboratory must also request a copy of the raw data to support the analytical results for the first project submitted to the subcontract laboratory unless the laboratory has NELAC accreditation. The raw data is reviewed by the QA Manager and the PM to ensure that the results meet the client's needs. The QA Manager will request full documentation and qualify the subcontractor under the provisions above. The approval process should be completed within 30 calendar days of subcontracting.

Figure 8-1.
Example - Subcontracting Laboratory Approval Form (Initial / Renewal)

SUBCONTRACTING LABORATORY APPROVAL

Reference: Section 8 – Quality Assurance Manual

Date: _____
Laboratory: _____
Address: _____
_____
Contact and e-mail address: _____
Phone: Direct _____ Fax _____

Requested Item[3]	Date Received	Reviewed/ Accepted	Date
1. Copy of State Certification[1]			
2. Insurance Certificate			
3. USDA Soil Permit			
4. Description of Ethics Program[3]			
5. QA Manual[3]			
6. Most Recent (and relevant) 2 Sets of WP/WS Reports with Corrective Action Response[1,3]			
7. State Audit with Corrective Action Response (or NELAC or A2LA Audit)[3]			
8. Sample Report[3]			
9. SOQ or Summary list of Technical Staff and Qualifications [3]			
10. SOPs for Methods to Be Loadshifted[2,3]			
11. For DoD Work: Statement that Lab quality system complies with QSM and lab is approved by DoD.			
12. For DoE Work: Lab compliant with QSAS and approved by specific DoE Component laboratory approval process.			

1 - Required when emergency procedures are implemented.
2 - Some labs may not submit copies due to internal policies. In these cases, a copy of the first page and signature page of the SOP is acceptable. This requirement may also be fulfilled by supplying a table of SOPs with effective dates.
3 – If the laboratory has NELAC accreditation, Item #s 4 through 10 are not required.

On Site Audit Planned: YES NO If yes, Date Completed: _____ By Whom: _____
Comments:

Lab Acceptable for Subcontracting Work: YES NO Limitations: _____

QA Manager (Signature): _____ Date: _____
(Printed Name)

☐ Forwarded to Contract Coordinator, by: _____ Date: _____

SECTION 9

PURCHASING SERVICES AND SUPPLIES
(NELAC 5.4.6)

9.1 OVERVIEW

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff.

Capital expenditures are made in accordance with the Controlled Purchases Procedure, CW-F-S-004. Only one quote is required where the item being purchased is a sole source product, Examples of sole source capital expenditures are laboratory test equipment, client specified purchases and building leases. A minimum of two quotes is required where the opportunity exists to source from more than one vendor. All documentation related to the purchase of capital items will be maintained in the individual CapEx files located in Corporate Purchasing. Data will be held in accordance with the record retention policy.

TestAmerica will enter into formal contracts with vendors when it is advantageous to do so. Contracts will be signed in accordance with the Authorization Matrix Policy, CW-F-P-002. Examples of items that are purchased through vendor contracts are laboratory instruments, consumables, copiers and office supplies. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

Non-capital expenditure items are purchased through the requisition and approval process in JD Edwards or through other TestAmerica authorized methods (approved web-sites, purchasing cards). Labs have the ability to select from the approved vendors in JD Edwards.

9.2 GLASSWARE

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 REAGENTS, STANDARDS & SUPPLIES

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Purchasing guidelines for equipment and reagents must meet with the requirements of the specific method and testing procedures for which they are

being purchased. Solvents and acids are pre-tested in accordance with Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001, STL-QA-0037, "Procurement of quality Related Items" and STL-QA-0002, "Standards and Reagent Preparation".

9.3.1 Purchasing

The nature of the analytical laboratory demands that all material used in any of the procedures is of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP.

The procedure for purchasing/ordering quality related items can be found in the TestAmerica St. Louis SOP STL-QA-0037, "Procurement of Quality Related Items".

9.3.2 Receiving

It is the responsibility of the purchasing manager to receive the shipment. It is the responsibility of the analyst who ordered the materials to date the material when received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. Material Safety Data Sheets (MSDSs) are kept in binders in the laboratory's Tech Library and online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

There are many different grades of analytical reagents available to the analyst. All methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, it may be assumed that it is not significant in that procedure and, therefore, any grade reagent may be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals unless noted otherwise by the manufacturer or by the reference source method.

- An expiration date can not be extended if the dry chemical is discolored or appears otherwise physically degraded; the dry chemical must be discarded.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user. When a traceable standard is not available to use for calibration or verification activities, a nontraceable standard may be used if written client approval is obtained (when required).

Compressed gases in use are checked for pressure and secure positioning daily. The minimum total pressure must be 500 psig or the tank must be replaced. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a conductivity of less than 1mmho/cm (or resistivity of greater than 1.0 megaohm-cm) at 25°C. The conductivity is checked and recorded daily. If the water's conductivity is outside the specified limit, the QA Manager must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade water (or other similar quality) for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased VOA vials must be certified clean and the certificates must be maintained. If uncertified VOA vials are purchased, all lots must be verified clean prior to use. This verification must be maintained.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Standards and Refernce Materials are stored separately from samples. Radiochemical standards are stored in a controlled access cabinet. The Laboratory SOPs detail specific storage instructions for reagents and chemicals.

9.4 PURCHASE OF EQUIPMENT/INSTRUMENTS/SOFTWARE

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Laboratory Director. If they agree with the request the procedures outlined in Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, it is given a short name, such as HP-20, added to the equipment list described in Section 21 that is maintained by the QA Department and IT must be notified so that can be linked for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application.

For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department as specified in the laboratory's procedure for software verification. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is readily accessible to the laboratory.

9.5 SERVICES

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 21. The need for service is determined by analysts and/or Department Managers. The service providers that perform the services are approved by the Department Managers/Technical Director.

9.6 SUPPLIERS

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). The level of control used in the selection process is dependent on the anticipated spend and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers /vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report (CW-F-WI-009).

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc. As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

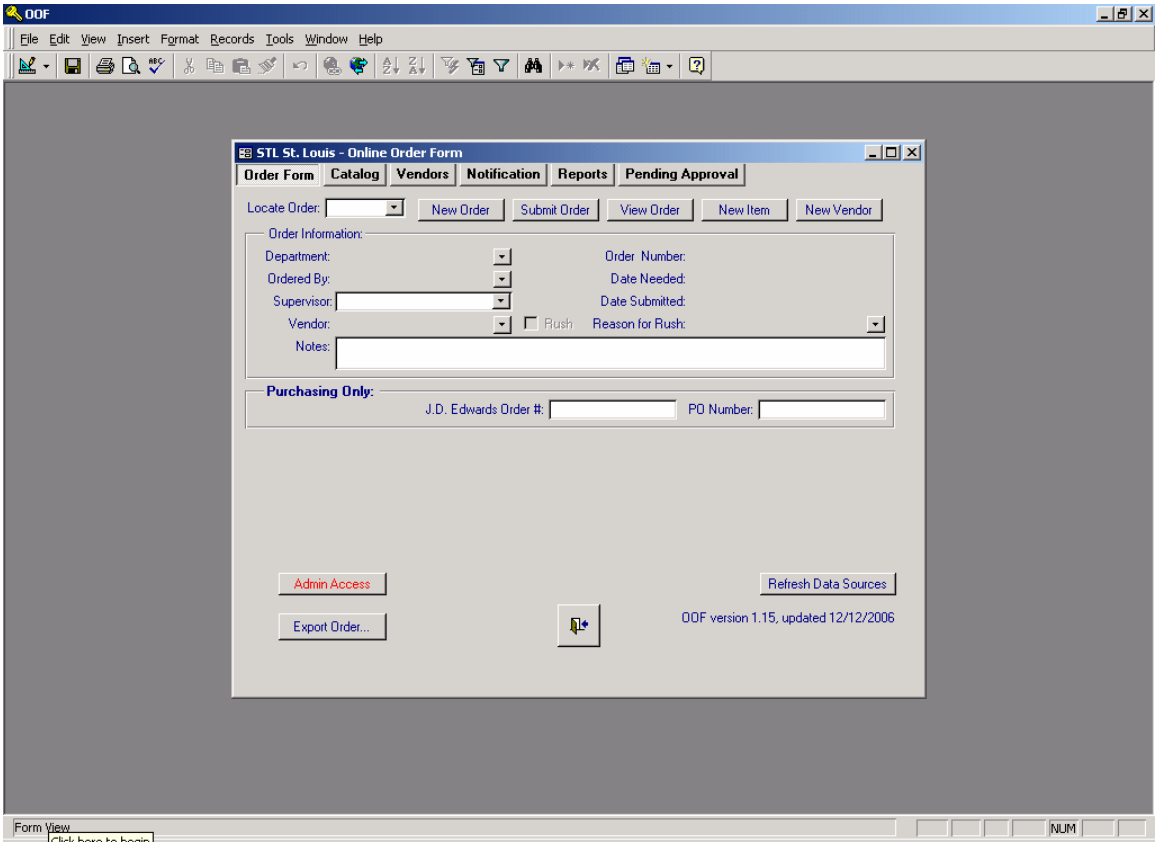
9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form (CW-F-WI-007 – refer to Figure 9-2).

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technology Director are consulted with vendor and product selection that have an impact on quality.

Figure 9-1.

Electronic Order Form



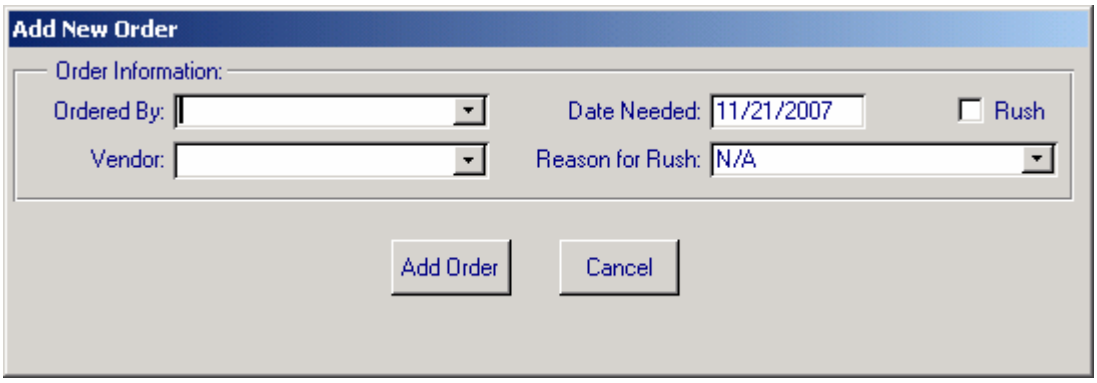


Figure 9-2
Example – JD Edwards Vendor Add Request Form

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

JD Edwards Vendor Add Request Form

Vendor name:	Lab location and individual making request:
Vendor address (remit to):	Vendor phone:
Vendor address (remit to):	Vendor fax:
Contact name:	Product / service provided:

Reason for Vendor Addition: Check all reasons that apply

☐ Cost Reduction	Estimated Annual Savings $
☐ Replace Current Vendor	Reason?
	Vendor being Replaced?
☐ New Product / Service	Describe:
☐ ISO Approved (Required for Aerotech / P&K only)	

Small Business:

Does this vendor help us to meet our small business objectives: _____

If yes, which category: _____

Personal and Ethical Considerations:

Is there any personal conflict of interest with a TestAmerica employee and the vendor listed above? _____
_____

Have ethical considerations been taken into account in your evaluation of this vendor?_____
_____

Can this product be sourced from another TestAmerica facility?_____

Please complete form and email to NCPurchasing@testamericainc.com or fax to (330) 966-9275.

I approve the addition of this vendor:

_____ _____

Purchasing Manager - Patrick Eckman Corporate Controller - Leslie Bowers

Form No. CW-F-WI-007

SECTION 10

SERVICE TO THE CLIENT
(NELAC 5.4.7)

10.1 OVERVIEW

TestAmerica St. Louis cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements discussed in Section 5. The laboratory has procedures to ensure confidentiality to clients (Section 16 and 26). The laboratory will afford clients or their representative cooperation to clarify the client's request.

10.2 SPECIAL SERVICES

The laboratory's standard procedures for reporting data are described in Section 26. When requested the following special services are provided:

- The laboratory will provide the client or the client's representative reasonable access to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- The laboratory will work with client-specified third party data validators as specified in the client's contract.
- The laboratory will provide the client with all requested information pertaining to the analysis of their samples. An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

10.3 CLIENT COMMUNICATION

Project managers are an important communication link to the clients. The lab shall inform its clients of any delays in project completion as well as any non-conformances in either sample receipt (refer to Section 24) or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Directors are available to discuss any technical questions or concerns that the client may have.

10.4 REPORTING

The laboratory will work with the client to produce any special communication reports required by the contract.

10.5 CLIENT SURVEYS

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service.

TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 11

COMPLAINTS
(NELAC 5.4.8)

11.1 OVERVIEW

TestAmerica St. Louis believes that effective client complaint handling processes have important business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that helps to continually improve processes and improve client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services, communications, responsiveness, data, reports, invoicing and other functions expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for dealing with both external and internal complaints.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 13 (Corrective Actions) and is documented in the laboratory's Validation Database. It is the laboratory's goal to provide a satisfactory resolution to complaints in a timely and professional manner.

11.2 EXTERNAL COMPLAINTS

An employee that receives a complaint initiates the complaint resolution process and the documentation of the complaint.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likely hood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

11.3 INTERNAL COMPLAINTS

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 13. In addition, Corporate Management, Sales and Marketing and Information Technology (IT) may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 13.

11.4 MANAGEMENT REVIEW

The number and nature of client complaints is reported by the QA Manager to the Laboratory Director and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 17)

SECTION 12

CONTROL OF NON-CONFORMING WORK
(NELAC 5.4.9)

12.1 OVERVIEW

In the context of environmental testing, a non-conformance is any situation in which some aspect of the work does not conform to the laboratory's own procedures or agreed upon client requirements. A non-conformance does not necessarily invalidate reported data, but it does initiate the requirements of this section.

When a non-conformance or deviation from standard laboratory practice is detected, correction and/or corrective action (as defined in Section 13) is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then a plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 13).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for advice. The supervisor may elect to discuss it with the QA Manager and/or Technical Director or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 13. This information can then be supplied to the client in the form of a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 20. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Department Supervisor and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with NELAC (or the analytical method) requirements and the reason. Data being reported to a non-NELAC state would need to note the change made to how the method is normally run.

12.2 RESPONSIBILITIES AND AUTHORITIES

SOP No. CA-L-S-001, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall, outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of the company's data integrity

policies as well as the policies and procedures related to the determination of the potential need to recall data.

Under certain circumstances the Laboratory Director, a Lab Supervisor, QA Manager may exceptionally authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. For DOE and other programs where required, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures and entered into the Clouseau non-conformance database. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any nonconforming work discovered by any laboratory staff member must be reported to facility senior laboratory management within 24-hours. The laboratory's Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Department Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO) and Quality Director within 24 hours.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

All lab employees have the authority to stop work for reasons of unresolved safety or quality issues. Employees are encouraged to work through their chain of command to resolve such problems, but TestAmerica also presents other lines of communication in ethics and safety training that are available to all employees.

12.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

SOP No. CA-L-S-001 distinguishes between situations when it would be appropriate for the laboratory QA Manager and Laboratory Director (or his/her designee) to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECO's and Corporate Management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting (Section 13) in lieu of the data recall determination form contained in SOP No. CA-L-S-001.

When applicable (i.e.DOE and DOD projects) the laboratory notifies affected clients of potential data quality issues. Corrective actions taken to resolve the issues are submitted to the client in a timely and responsive manner.

12.4 PREVENTION OF NONCONFORMING WORK

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system (Section 13).

On a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

12.5 METHOD SUSPENSION/RESTRICTION (STOP WORK PROCEDURES)

In some cases it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any person in the laboratory.

Prior to suspension/restriction, confidentiality will be respected, and the problem and the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem. The meeting will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases a meeting may not be necessary if all appropriate personnel are in agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 13 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (i.e., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Director, QA Manager, Supervisor can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management, the Director of Client Services and Sales and Marketing should be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report as described in Section 13.

SECTION 13

CORRECTIVE ACTION
(NELAC 5.4.10)

13.1 OVERVIEW

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memos (NCM) and the Validation Request Database.

For DOE and other programs where required, the client will be informed of the proposed corrective action.

13.2 DEFINITIONS

- **Correction***:* Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions are contained in analytical SOPs. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

- **Corrective Action***:* The action taken is not only a correction made to the immediate event, but a change in process, procedure or behavior that is required to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

13.3 GENERAL

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility for investigation.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify Systematic Problems before they become serious.
- Identify and track Client complaints and provide resolution (see more on client complaints in Section 11).

13.3.1 Non-Conformance Memo (NCM) - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non matrix related)
- Isolated Reporting / Calculation Errors
- Sample volume issues

13.3.2 Validation Request - used to document the following types of corrective actions:

- Questionable trends that are found in the monthly review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Failed or Unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic Reporting / Calculation Errors
- Client complaints

Health and Safety Violations are documented in the EH&S Quarterly Inspection Reports.

Internal and External Audit Findings are documented in the Audit Database.

13.4 CLOSED LOOP CORRECTIVE ACTION PROCESS

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

13.4.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or Validation Request must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Supervisor, Lab Director, or QA Manager is consulted.

13.4.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.

- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or Validation Request is used for this documentation.

13.4.3 Monitoring of the Corrective Actions

- The Department Manager/Supervisor and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions will be documented and re-evaluated until acceptable resolution is achieved. Department Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM and Validation Request is entered into a database for tracking purposes and a monthly summary of all corrective actions is printed out for review to aid in ensuring that the corrective actions have taken effect.
- The QA Manager reviews monthly NCMs and Validation Requests for trends. Highlights are included in the QA monthly report (refer to Section 17). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

13.4.4 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements. (Section 16 includes additional information regarding internal audit procedures.)
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

13.5 TECHNICAL CORRECTIVE ACTIONS

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 12 for information regarding the control of non-conforming work). The documentation of these procedures is through the use of an NCM or Validation Request Database.

For specific criteria and corrective actions refer to the analytical methods or specific method SOPs.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with

an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by a written NCM and appropriate corrective action (e.g., reanalysis) is taken and documented.

13.6 BASIC CORRECTIONS

When mistakes occur in records, each mistake shall be crossed-out, and not erased, deleted, made illegible, or otherwise obliterated (e.g. no white-out), and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 13-1.
Example - Corrective Action Report

CLOUSEAU CORRECTIVE ACTION MEMO

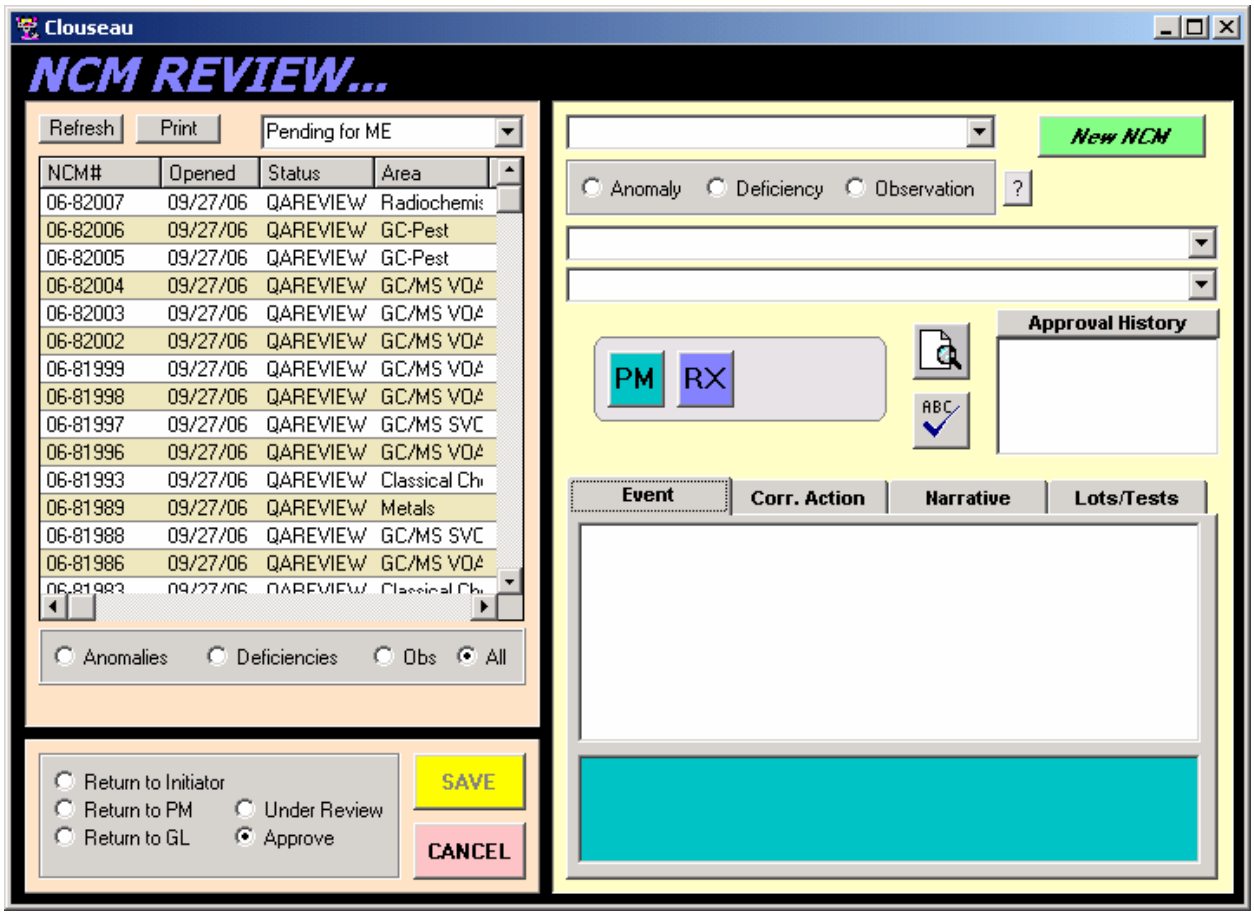
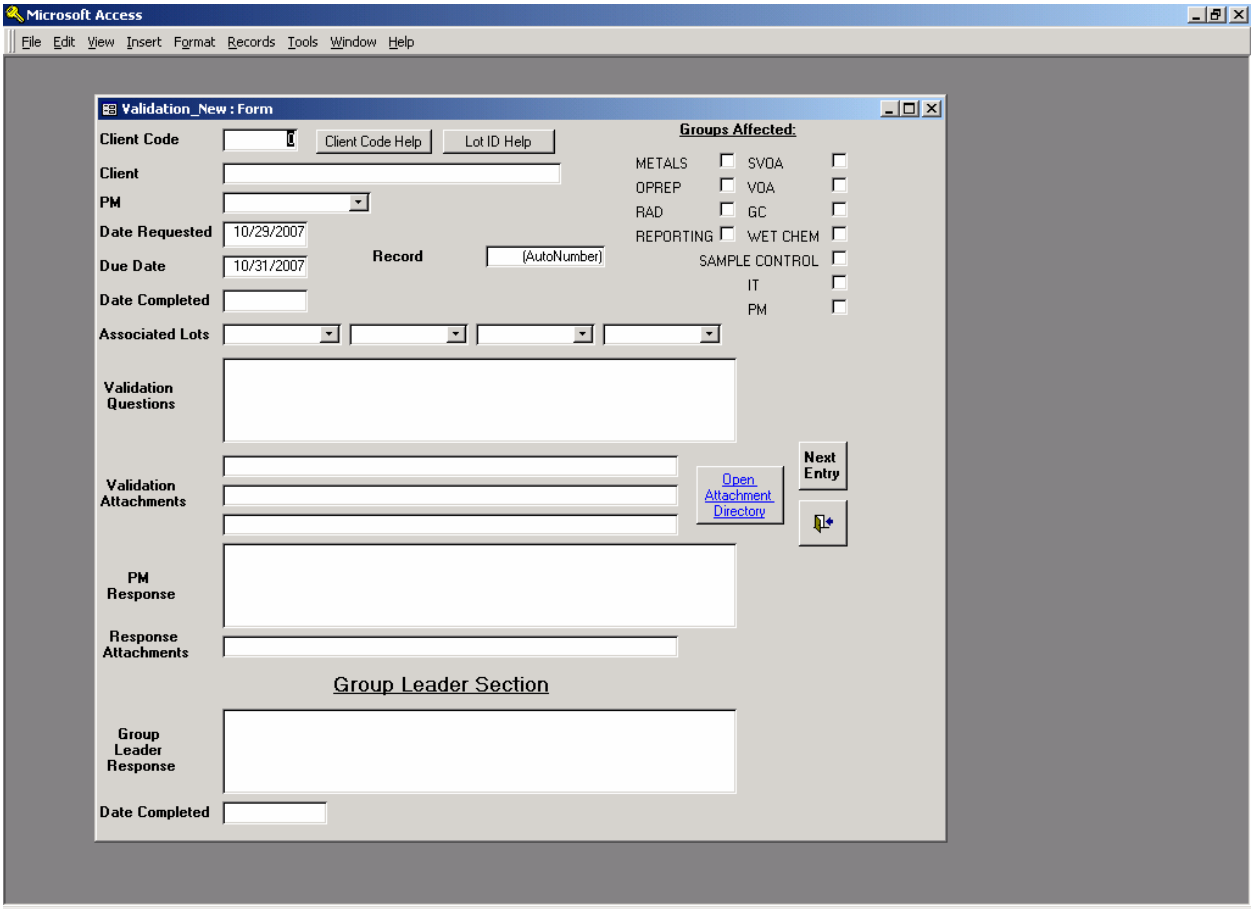


Figure 13-2.
Example – Validation Request

VALIDATION REQUEST DATA BASE



SECTION 14.0

PREVENTIVE ACTION
(NELAC 5.4.11)

14.1 OVERVIEW

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive continuous process improvement activity that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes TestAmerica St. Louis's commitment to its Quality Assurance (QA) program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management reviews, the QA Metrics Report, internal or external audits, proficiency testing performance, client complaints, staff observation, etc..

The monthly Quality Assurance Metrics Report shows performance indicators in all areas of the quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. These metrics are used to help evaluate quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

The laboratory's Corrective Action process (Section 13) is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

14.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process, management review.

Note: There may be varying levels of formality and documentation during the preventive action process due to the simplicity/complexity of the action taken.

14.1.2 Any Preventive Actions undertaken or attempted shall be taken into account during the Annual Management Review (Section 17). A highly detailed recap is not required; a simple recount of success and failure within the preventive action program will provide management a measure for evaluation.

14.1.3 Documentation of preventive actions shall be maintained for review.

14.2 MANAGEMENT OF CHANGE

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. This process is discussed in further detail in SOP CA-Q-S-003, Management of Change.

SECTION 15.0

CONTROL OF RECORDS
(NELAC 5.4.12)

TestAmerica St. Louis maintains a record system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. See SOP STL-QA-0023, "Document Control", for TestAmerica St. Louis specific details.

15.1 OVERVIEW

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 15-1. Quality records are maintained by the Quality Assurance (QA) Manager electronically and backed up as part of the regular network backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by the Data Reporting Group (raw data, analytical records, lab reports) and the QA department (logbooks, standards, certificates).

Table 15-1. Record Index[1]

Technical Records	Official Documents	QA Records	Project Records	Administrative Records
Retention: 5 Years from analytical report issue*	5 Years from document retirement date*	5 Years from archival* **Data Investigation:** 5years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)	5 Years from analytical report issue*	**Personnel:** 7 Years (HR Records must be maintained as per Policy CW-L-P-001) **Finance:** See Accounting and Control Procedures Manual
Raw Data Logbooks[2] Standards Certificates Analytical Records Lab Reports	Quality Assurance Manual (QAM)	Internal and External Audits/ Responses	Sample receipt and COC Documentation	Finance and Accounting
	Work Instructions	Certifications	Contracts and Amendments	EH&S Manual, Permits, Disposal Records
	SOPs Manuals	Corrective/Preventive Action	Correspondence	Employee Handbook
		Management Reviews	QAPP	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)
		Method & Software Validation, Verification data	SAP	
		Data Investigation	Telephone Logbooks	Administrative Policies

Technical Records	Official Documents	QA Records	Project Records	Administrative Records
Retention: 5 Years from analytical report issue*	5 Years from document retirement date*	5 Years from archival* **Data Investigation:** 5years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)	5 Years from analytical report issue*	**Personnel:** 7 Years (HR Records must be maintained as per Policy CW-L-P-001) **Finance:** See Accounting and Control Procedures Manual
	Policies		Lab Reports	Technical Training Records

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 15-2.

All records are legible and stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss. Retention of hardcopy records are maintained on-site at the laboratory for at least 60 days after their generation and moved offsite for the remainder of the required storage time. Electronic records are stored on site for a minimum of 5 years. Records are maintained for a minimum of five years unless other wise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 15-2 have lengthier retention requirements and are subject to the requirements in Section 15.1.3. Policy CW-L-P-001 (Record Retention) provides additional information on record retention requirements.

15.1.1 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 15-3 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data. For projects/programs that require a retention time longer than five years, the Project Manager informs the Document Control group of the extended storage requirement. The Document Control department tracks these requirements in a database.

Table 15-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	10 years (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
NY Potable Water NYCRR Part 55-2	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

15.1.2 All records are held secure and in confidence. Records maintained at the laboratory are located in the Data Reporting Department. Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Logs are maintained in the Reporting Department to note removal and return of records.

15.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, see section 20.14.1 'Computer and Electronic Data Related Requirements' for more information.

15.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data. The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the chain of custody is stored with Client Analysis Summary sheet generated by the LIMS. The chain of custody would indicate the name of

the sampler. Per DOE requirements, a log of names, initials and signatures for all individuals responsible for signing or initialing any laboratory records is maintained in the Human Resources Department.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set. Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run long or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in the Standards Log Program and relevant printouts are included in the data packages.

- Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "Analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned.
- Also refer to Section 20.14.1 'Computer and Electronic Data Related Requirements'.

15.2 TECHNICAL AND ANALYTICAL RECORDS

15.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement (refer to Section 15.1). The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the performance of each analysis and checking of results.

15.2.2 Observations, data and calculations are recorded at the time they are made and are identifiable to the specific task.

15.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include (previous discussions relate where most of this information is maintained – specifics may be added below):

- laboratory sample ID code;
- Date of analysis and time of analysis is required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in a non-instrument analysis, the time is recorded on the bench sheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs or posted on the instruments.
- analysis type;
- all manual calculations and manual integrations;
- analyst's or operator's initials/signature;
- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;
- test results;
- standard and reagent origin, receipt, preparation, and use;
- calibration criteria, frequency and acceptance criteria;
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- quality control protocols and assessment;
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats.

15.3 LABORATORY SUPPORT ACTIVITIES

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;

- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

15.3.1 Sample Handling Records

Sample handling and tracking is discussed in Section 24. Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.
- Legal Chain of Custody protocols required by DOE and DOD.

15.4 ADMINISTRATIVE RECORDS

The laboratory also maintains the administrative records in either electronic or hard copy form. See Table 15-1.

15.5 RECORDS MANAGEMENT, STORAGE AND DISPOSAL

15.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available to the accrediting body upon request.

15.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

15.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access.

15.5.4 TestAmerica St. Louis has a record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are numbered sequentially. Within each logbook, pages are sequentially numbered. Bench sheets are filed sequentially electronically. Standards are maintained in the Standards Log program.

15.5.5 Records are considered archived when moved off-site. Access to archived information is documented in an access logbook that notes when data is removed and returned. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to the data is limited to laboratory and company employees. Dual storage of these records is maintained by the IT department during its daily and weekly back-ups of the laboratory network. These back-ups are stored off site.

15.5.6 In the event that the laboratory transfers ownership or goes out of business, TestAmerica St. Louis shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

15.5.7 **Records Disposal**

15.5.7.1 Records are removed from the archive and disposed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration.

15.5.7.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

15.5.7.3 If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required. [Refer to Policy No. CW-L-P-001 (Records Retention).]

SECTION 16

AUDITS
(NELAC 5.4.13)

16.1 OVERVIEW

Audits measure laboratory performance and insure compliance with accreditation/certification and project requirements. Audits specifically provide management with an on-going assessment of the quality of results produced by the laboratory, including how well the policies and procedures of the QA system and the Ethics and Data Integrity Program are being executed. They are also instrumental in identifying areas where improvement in the QA system will increase the reliability of data. There are two principle types of audits: Internal and External. Internal audits are performed by laboratory (see SOP STL-QA-0021, "Internal Surveillance".) or corporate personnel. External audits are conducted by regulators, clients or third-party auditing firms. In either case, the assessment to program requirements is the focus.

Table 16-1. Audit Types and Frequency

Internal Audits	Description	Performed by	Frequency
	Analyst & Method Compliance	QA Department or Designee	- 100% of all methods over a two year period. - 100% of all analysts annually.
	Instrument	QA Department or Designee	100% of all organic instruments and any inorganic chromatography instruments over a two year period.
	Work Order/ Final Report	QA Department or Designee	- 1 complete report each month.
	Support Systems	QA Department or Designee	- Annual for entire labs support departments & equipment (e.g., thermometers, balances), can be divided into sub-sections over the course of the year.
	Performance Audits (Double-Blind PTs)	Corporate QA, Laboratory QA Department or Designee	- As needed.
	Special	QA Department or Designee	- As Needed
External Audits	**Description**	**Performed by**	**Frequency**
	Program / Method Compliance	Regulatory Agencies, Clients, accreditation organizations	- As required by program and/or clients needs
	Performance Audits	Provided by a third party.	- As required by a client or regulatory agency. Generally provided semi-annually through the analysis of PT samples.

16.2 INTERNAL AUDITS

Annually, the laboratory prepares a schedule of internal audits to be performed throughout the year. As previously stated, these audits verify and monitor that operations continue to comply with the requirements of the laboratory's QA Manual, the Corporate Ethics Program and

accreditation authorities. A schedule of the internal audits is maintained by the QA Manager in the *Internal Audit Workbook*. An example can be found in Attachment 1.

It is the responsibility of the QA Manager to plan and organize audits in consideration of the laboratory work load and the department personnel schedules so that all pertinent personnel and operations are thoroughly reviewed. When designees (other than QA department personnel & approved by the QA Manager), perform audits, the QA Manager shall insure that these persons do not audit their own activities except when it can be demonstrated that an effective audit will be carried out. In general, the auditor:

- is neither the person responsible for the process being audited nor the immediate supervisor of the person responsible for the project/process.
- Is free of any conflicts of interest.
- Is free from bias and influences that could affect objectivity.

Laboratory personnel (e.g., supervisors and analysts) may assist with both method and support system audits as long as the items listed in the above paragraph are observed. These audits are conducted according to defined criteria listed in the checklists of the *Internal Audit Workbook.* These personnel must be approved by the QA Manager; and must complete the audit checklists in their entirety. This process introduces analyst experience and insight into the laboratory's auditing program.

The auditor must review the previous audit report and identify all items for verification of corrective actions. A primary focus will be dedicated to the ability of the laboratory to correct root-cause deficiencies and that the corrective action has been implemented and sustained as documented.

16.2.1 Systems

An annual systems audit is required to ensure compliance to analytical methods and SOPs, the laboratory's Data Integrity and Ethics Policies, NELAC quality systems, client and State requirements. This audit is performed in portions throughout the year through method, analyst, instrument, work order/final report and support system audits. Audits are documented and reported to management within 1 week of their performance. Systems audits cover all departments of the facility, both operational and support. The multiple audits are compiled into one systems audit package at the end of the year (*Internal Audit Workbook*).

16.2.1.1 Method, Analyst, Instrument and Work Order/Final Report Audits

Procedures for the method compliance, analyst, instrument and work order/final report audits are incorporated by reference to SOP No. CA-Q-S-004, Method Compliance and Data Authenticity Audits. These audits are not mutually exclusive. For example, the performance of a method audit will also cover multiple analysts and instruments. The laboratory's goal is to annually review all analysts and instruments (i.e., each instrument with multiple detectors is audited separately, not each detector) as described in SOP No. CA-Q-S-004. The laboratory will also audit all methods within a two year time period and audit a minimum of one Work Order/Final Report from receiving through reporting on a monthly basis.

16.2.1.2 Support Systems

Support system audits are performed to ensure that all departments & ancillary equipment are operating according to prescribed criteria. Support system audits include the review of both non-analytical and operational departments. Support equipment audits (e.g., metrology items) include the review of balance calibrations, weight calibrations; water quality testing, etc. Non-analytical may include sample receiving and bottle preparation. These types of support audits ensure that the operations are being performed to support ethical data as well as ensuring the accuracy & precision of the utilized equipment.

These audits can be performed in portions throughout the year or in one scheduled session. However, the audit schedule must document that these aspects are reviewed annually. Many of the metrology systems are considered to be surveillance activities that can be monitored by QA personnel or delegated to specified department personnel. These surveillance activities are performed on a semi-annual basis unless issues warrant a greater frequency or previous audits continually showing no deficiencies allow the frequency to be reduced to once a year.

An example audit checklist can be found in Attachment 2. Instructions for reporting findings are included in the *Internal Audit Workbook*. In general, findings are reported to management within 1 week of the audit and a response is due from management within 30 days.

16.2.2 Performance Audits

Corporate QA may arrange for double blind PT studies to be performed in the laboratories. Results are given to Management and Corrective actions of any findings are coordinated at each facility by the QA Manager and Laboratory Director. These studies are performed on an as needed basis. They may be performed when concerns are raised regarding the performance of a particular method in specific laboratories, periodically to evaluate methods that may not normally be covered in the external PT program or may be used in the process of developing best practices. The local QA Manager may also arrange for PT studies on an as needed basis. (Refer to Section 16.3.2 for additional information on Performance Audits.)

16.2.3 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

16.2.4 Safety Inspections

Safety inspections are conducted by the EH&S department. The inspections include thorough examinations of each laboratory and work area to note any safety concerns.

Radiological contamination swipes are periodically taken. Should contamination be detected, actions are taken as described in the Radiation Protection plan. Impact to samples is also evaluated.

16.3 EXTERNAL AUDITS

TestAmerica facilities are routinely audited by clients and external regulatory authorities. External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. The laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. This time frame is generally 30 days.

TestAmerica St. Louis cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

16.3.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2003 NELAC standards.

16.3.2 Performance Audits

The laboratory is involved in performance audits conducted semi-annually through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: ERA Water Pollution, ERA Water Supply, ERA Soil, ERA RadChem and the Department of Energy MAPEP PT studies.

- It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Further, where PT samples present special or unique problems in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

- PTs generally do not have holding times associated with them. In the absence of any holding time requirement, it is recommended that the holding time begin when the PT sample is prepared according to the manufacturers instructions. Holding times should apply to full volume PT samples only if the provider gives a meaningful "sampling date". If this is not provided, it is recommended that the date/time of opening of the full volume sample be considered the beginning of holding time.

- Login will obtain the COC information from the documentation provided with the PT study with review by QA or other designated staff.

- Vials will be prepared as required in the instruction set provided with the samples. After preparation to full volume the sample may be spiked, digested, concentrated, etc., as would be done for any normal sample requiring similar analysis.

- PT samples will not undergo multiple preps, multiple runs, multiple methods (unless being used to evaluate multiple methods), multiple dilutions, UNLESS this is what would be done to a normal client sample (e.g. if a client requests, as PT clients do, that we split VOA coeluters, then dual analysis IS normal practice).

- The type, composition, concentration and frequency of quality control samples analyzed with the PT samples shall be the same as with routine environmental samples.

- No special reviews shall be performed by operation and QA, UNLESS this is what would be done to a normal client sample. To the degree that special report forms or login procedures are required by the PT supplier, it is reasonable that the laboratory WOULD apply special review procedures, as would be done for any client requesting unusual reporting or login processes.

- Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

16.4 AUDIT FINDINGS

Internal or External Audit findings are documented in the laboratory's Audit Database. The laboratory is expected to prepare a response to audit findings within 30 days of receipt of an audit report unless the report specifies a different time frame. The response may include action plans that could not be completed within the 30 day timeframe. In these instances, a completion date must set and agreed to by operations management and the QA Manager.

Responsibility for developing and implementing corrective actions to findings is the responsibility of the Department Supervisor where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

The procedures must be in accordance to SOP No. CA-L-S-001, Internal Investigations of Data Discrepancies and Determination of Data Recall.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or

amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

For DOE and other programs where required, the client will be informed of the proposed corrective action.

Figure 16-1.

Internal Audit Workbook

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica St. Louis
Last Updated: 9/10/2007

Workbook Instruction No. CA-Q-WI-011

Internal Audit Workbook
Summary Page

Note: Click on the (Summary Page) to located on each audit sheet to return to this page.
*** The lab may choose to audit these areas with each method/analyst/instrument audit. The auditor must document on the checklist that this item is audited as part of the <defined> audit.**

Area Audited	Audit Type	Audit Cycle	Scheduled	Date Audited	Date Closed	Comments
(Click on the Area to get to that Spreadsheet)						
Balances	System	6 mo				
Temperature Logs/Thermometers	System	6 mo				
Sample Storage and Disposal	System	1 yr				
Maintenance Logs *	System	6 mo				
Volatile Storage Blanks	System	6 mo				
Lab Water Quality Testing	System	6 mo				
Sample Log In	System	1 yr				
Shipping Procedures	System	1 yr				
Computer Operations (LIMS)	System	1 yr				
SOP & Document Distribution System	System	1 yr				
Archiving Electronic & Paper Records	System	1 yr				
Statistical Process Control	System	1 yr				
Data Review System	System	1 yr				
Final Report Generation	System	1 yr				
Standards/Reagents *	System	6 mo				
Manual Integration *	System	1 yr				
Corrective Action System	System	1 yr				
Training Records	System	6 mo				
MDLs	System	1 yr				
SOPs - Prep/Review/Update Process	System	1 yr				
Purchasing/Procurement	System	1 yr				
Eppendorf/Diluter/Dispenser Calibration Check	System	6 mo				
Subcontract Lab Approval	System	1 yr				
Customer Complaint System	System	1 yr				
Methods	Method	2 yr				
....	....	....				
.....	....	....				
.....	....	....				

Figure 16-2.

Internal Audit System Checklist: Corrective Actions

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica <Location>

INTERNAL AUDIT - Corrective Actions

[Printed Name(s) or Date(s)]

(Summary Page)

Area Audited:
Auditor:
Date:
Persons Contacted During Audit:

Date Reported to Department Manager:
Reported To:

Date Reported to Lab Director/Manager:
Reported To:

Date Response Due:

Response Received and Accepted by QA Manager:

Associated Corrective Action Report Number(s):

Scheduled Follow-up:

Item	Requirement	Ref.	Y	N	NA	Evidence/Comments	Follow Up
1	Does the laboratory have a corrective action program in place?	5.4.10.1					
2	Does the laboratory have a current corrective action SOP or is this information in the QA Manual?	5.4.10.1					
3	Do all laboratory personnel have documented training and access to initiate corrective actions?	5.4.10.1					
4	Are causes clearly identified by department, staff name, scope of issue (how many reports affected)?	5.4.10.6					
5	Is a root cause for the issue identified?	5.4.10.2					
6	Is a corrective action (plan) clearly described?						
7	Was the corrective action fully implemented?						
8	Is documentation (if applicable) completed as specifed by the corrective action (training, revised SOP, etc)						
9	Has a follow-up assessment been conducted to verify the corrective action was successful?						
10	Are corrective actions reviewed on a regular basis by management?	5.4.10.6a 5					
11	Is there a defined distribution flow for corrective action notification, review, closure, and follow-up?	5.4.10.6a					
12	Are non-conformances reviewed on a regular basis and used, if necessary, to initiate root cause corrective actions?						
13	Does the lab have a documented procedure for QC corrective action (i.e., documented within each method / parameter SOP or in the QA Manual)?	4.10.1					
14	***Verify Corrective Actions from previous systems audits. List Items:***						
15							
16							
17							

Auditor Signature:_____

Primary Reference(s): Corporate SOP CA-Q-S-002, Acceptable Manual Integration Practices
NELAC Standard, June 2003
DoD Quality Systems Manual, Version 3, January 2006
EPA Manual for the Certification of Laboratories Analyzing Drinking Water

SECTION 17

MANAGEMENT REVIEWS
(NELAC 5.4.14)

17.1 QUALITY ASSURANCE REPORT

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director for review and comments. The final report shall be submitted to the Technical Directors and Operation Managers as well as the appropriate Quality Director and General Manager. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. At a minimum, the report content will contain the items listed below. During the course of the year, the Laboratory Director, General Manager or Corporate QA may request that additional information be added to the report.

The TestAmerica QA Report template is comprised of a discussion of three key QA issues facing the laboratory and ten specific sections (Figure 17-1):

- **Metrics:** Describe actions or improvement activities underway to address any outlying quality metrics that have been reported in the monthly Quality system Metrics Table.
- **SOPs:** Report SOPs that have been finalized and report status of any outstanding SOP reviews.
- **Corrective Actions:** Describe highlights and the most frequent cause for report revisions and corrective/preventive action measures underway. Include a discussion of any recalls handled at the lab level as per Section 6.2.2 in the Investigation/Recall SOP (SOP: CA-L-S-001). Include a section for client feedback and complaints. Include both positive and negative feedback. Describe the most serious client complaints and resolutions in progress.
- **MDLs and Control Limits:** Report which MDLs/ MDL verifications are due. Report the same for Control Limits.
- **Audits:** Report Internal and External Audits that were conducted. Include all relevant information such as which methods, by whom, corrective actions needed by when and discuss unresolved audit findings.
- **Performance Testing (PT) Samples:** Report the PT tests that are currently being tested with their due dates, report recent PT results by study, acceptable, total reported and the month and year.
- **Certifications:** Report on any certification programs being worked on by due date, packages completed. Describe any issues, lapses, or potential revocations.
- **Regulatory Updates:** Include information on new state or federal regulations that may impact the laboratory. Report new methods that require new instrumentation, deletion of methods, changes in sampling requirements and frequencies etc…
- **Miscellaneous:** Include any issues that may impact quality within the laboratory.
- **Next Month:** Report on plans for the upcoming month.
- **Lab Director Comments Section:** This section gives the Laboratory Director the opportunity to comment on issues discussed in the report and to document plans to resolve

these issues. Unresolved issues that reappear in subsequent monthly reports must be commented on by the Laboratory Director.

- **Quality System Metrics Table:** The report also includes statistical results that are used to assess the effectiveness of the quality system. Effective quality systems are the responsibility of the entire laboratory staff. Each laboratory provides their results in a template provided by Corporate QA (Figure 17-2).

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The VP-QA/EHS prepares a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Analytical Division Senior Management Team and General Managers.

17.2 ANNUAL MANAGEMENT REVIEW

The senior lab management team (Laboratory Director, Technical Directors, QA Manager, Department Supervisors) conducts an annual review of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. Corporate Operations and Corporate QA personnel may be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that can not be solved by the lab and report them to Corporate IT.

This review uses information generated during the preceding year to assess the “big picture” by ensuring that routine quality actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review (refer to Section 17.1) should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior Senior Management team meetings. Issues that may be raised from these meetings include:
    - Adequacy of staff, equipment and facility resources.
    - Adequacy of policies and procedures.
    - Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed) and external PT program results.
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.
- Laboratory Health and Safety issues
- Radioactive materials management issues

The annual review includes the previous 12 months. Based on the annual review, a report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

The QA Manual is also reviewed at this time and revised to reflect any significant changes made to the quality systems.

17.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. The Corporate Data Investigation/ Recall SOP shall be followed (SOP No. CA-L-S-001). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

The Chairman/CEO, President/CEO, COOs and Quality Directors receive a monthly report from the VP of Quality and EHS summarizing any current data integrity or data recall investigations as described in SOP No. CA-L-S-001. The General Manager's are also made aware of progress on these issues for their specific labs.

Figure 17-1.

Example - QA Monthly Report to Management

LABORATORY: x
PERIOD COVERED: Month/Year
PREPARED BY: x DATE: Month Day, Year
DISTRIBUTED TO: xx (Include LD, GM, QA Director, etc…)

THREE KEY ISSUES FOR MONTH:
Include a discussion of three key issues that were focused in on this month.
1. x
2. x
3. x

---

1. METRICS
Describe actions or improvement activities underway to address any outlying quality metrics.

2. SOPs

See Tab for SOP specifics.

The following SOPs were finalized (or reviewed for accuracy): (See Tab)

The following SOPs are due to QA: xx

In QA to complete: xx

3. CORRECTIVE ACTION

Highlights: xx

Revised Reports:
Describe the most frequent cause for report revisions and corrective/preventive action measures underway.

Data Investigations/Recalls (Corporate Data Investigation/Recall SOP) :
Include a discussion of any recalls handled at the lab level as Corp SOP.

Client Feedback and Complaints:
Include both positive and negative feedback.

Describe the most serious client complaints) and resolutions in progress.

4. MDLs AND CONTROL LIMITS

MDLs Due:

Control Limits Due:

5. AUDITS

INTERNAL AUDITS

Discuss Any Outstanding Issues (or Attach Summary):

EXTERNAL AUDITS
Discuss Any Outstanding Issues (or Attach Summary):

6. PT SAMPLES

The following PT samples are now in house (Due Dates):
xx

7. CERTIFICATIONS

Certification Packages Being Worked On (Include Due Date):
x

Describe any issues, lapses, or potential revocations.

8. REGULATORY UPDATE
Include information on new state or federal regulations that may impact the laboratory – new methods that require new instrumentation, deletion of methods, changes in sampling requirements or frequencies, …

9. MISCELLANEOUS
Include any issues that may impact quality within the laboratory.

10. NEXT MONTH
Items planned for next month.

LAB DIRECTOR COMMENTS AND PLANNED CORRECTIVE ACTIONS:	
LAB DIRECTOR REVIEW:	DATE:

Figure 17-2.

Example - Laboratory Metrics Categories

Reports for month
Reports revised due to lab error
% Revised Reports
# of Data Recall Investigations
# of Reports Actually Recalled
Corrective Action Reports
Corrective Action Reports still open
Total Number of Unresolved Open Corrective Action Reports
% of Unresolved Open Corrective Action Reports
# Reports independent QA reviewed
% QA Data Review: Reports
# Technical staff (Analysts/technicians, including Temps)
# of Analyst work product reviewed year-to-date
# of Analytical instruments w/electronic data file storage capability
# of Analytical instruments reviewed for data authenticity year-to-date
% Analyst/Instrument Data Authenticity Audits
 # Client Complaints
 # Client Compliments
# of planned internal audits
# of planned internal method audits performed year-to-date
% Annual Internal Audits Complete
# of Open Internal Audit Findings Past Due
Total Number of External Audit Findings
# of Open External Audit Findings Past Due
% External Audit Findings Past Due
# of PT analytes participated and received scores
# of PT analytes not acceptable
% PT Cumulative Score
 # PT Repeat Analyte Failures Cumulative (analyte failed more than once in 4 consecutive studies by PT Type) (only applies to failed analytes)
SOPs

SOPs Reviewed/revised within 24 months
Methods **or Administrative procedures** without approved SOPs
SOP Status
Method certification Losses due to performance/audit issues
Hold Time Violations due to lab error
Date of Last Comprehensive Ethics Training Session
 # Staff that haven't Received Comprehensive Ethics Training (>30 Days From Employment Date)
MDL Status (Good, Fair, or Poor) >90%, >70%, <70%
Training Documentation Records (Good, Fair, or Poor)
LQM Revision/review Date
QAM Updated to New Integrated Template
Last Annual Internal Audit Date (Opened, Closed)
Last Management QS Review Date
#SOPs required for 12 month review cycle (DOD *or drinking water)*
#SOPs for 12 month cycle/revised within 12 months *(Includes QS and Methods Listed in QSM)*
12 month % SOP Status *(Includes QS and Methods Listed in QSM)*

SECTION 18

PERSONNEL
(NELAC 5.5.2)

18.1 OVERVIEW

TestAmerica's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Appendix 2.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

The laboratory ensures that all personnel, including part time, temporary, contracted and administrative personnel, are trained in basic laboratory QA and health and safety programs.

Personnel dealing with sample receipt, radioactive waste management and materials shipping are trained in waste management, shipping and handling, and hazardous and/or radioactive material control as appropriate.

18.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL

Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training guidelines for TestAmerica employees are outlined in job descriptions.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance or quantitation techniques, etc. are also considered).

18.3 TRAINING

TestAmerica is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame*	Employee Type
Environmental Health & Safety	Refer to EH&S Manual	All
Ethics – New Hires	1 week of hire	All
Ethics - Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given.

The following evidence must be on file at the laboratory for each employee:

- Ethics Training documentation
- Ethics agreement (signed)
- Confidentiality agreement (signed)
- NELAC statement of qualification
- Copy of college degree, if applicable
- New Employee Orientation checklist
- Safety Orientation checklist

The following evidence must be on file at the laboratory for each technical employee:

- Department checklist
- Demonstration of Capability (DOC)
- Manual integration training, if applicable.

- Annual evidence of continued DOC that may include successful analysis of a blind sample on the specific test method, or a similar test method, or an annual DOC, or four successive, successful LCS.
- Specialty training, if applicable

Also refer to "Demonstration of Capability" in Section 20.

The training of technical staff is kept up to date by:

- Each employee must have documentation filed with the QA Department that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics is maintained in their training file.
- Documentation of proficiency (refer to Section 20).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

18.4 DATA INTEGRITY AND ETHICS TRAINING PROGRAM

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established an Ethics Policy No. CA-L-P-001 and an Ethics Statement/Agreement (Appendix 1). All initial and annual training is documented by signature on the signed Ethics Policy and Ethics Agreement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy (Appendix 1)
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 19

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS
(NELAC 5.5.3)

19.1 OVERVIEW

TestAmerica St. Louis is a 31,000 ft^2 secure laboratory facility with controlled access and is designed to accommodate an efficient workflow and provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc. OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

19.2 ENVIRONMENT

Laboratory accommodation, test areas, energy sources and lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels (refer to Section 12).

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

19.3 WORK AREAS

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.
- Separate high and low level radiochemical preparation areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

19.4 FLOOR PLAN

A floor plan can be found in Appendix 3.

19.5 BUILDING SECURITY

Building keys are distributed to management as necessary. The Human Resources Manager maintains a list of employees who have been issued keys. Electronic access "swipe" cards are issued to all laboratory employees.

All visitors to the laboratory enter through the main entrance and sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of TestAmerica St. Louis. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.

Visitors (with the exception of company employees) are given a visitor's badge and are escorted by laboratory personnel while in the laboratory facility.

SECTION 20.0

TEST METHODS AND METHOD VALIDATION
(NELAC 5.5.4)

20.1 OVERVIEW

TestAmerica St. Louis uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

20.2 STANDARD OPERATING PROCEDURES (SOPs)

TestAmerica St. Louis maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory (refer to Section 6 on Document Control):

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for preparation, review, revision and control are incorporated by reference to SOPs: **CW-Q-S-002** (Writing a Standard Operating Procedure (SOP) and ST-QA-0035, "Preparation and Management of Standard Operating Procedures**".** SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.
- A listing of the TestAmerica St. Louis SOPs is included in Appendix 9.

20.3 LABORATORY METHODS MANUAL

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP. Refer to the corporate SOP CW-Q-S-002 "Writing a Standard Operating Procedure" for content and requirements of technical and non-technical SOPs and ST-QA-0035, "Preparation and Management of Standard Operating Procedures**".**

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from

the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

20.4 SELECTION OF METHODS

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists, etc.), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

20.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

In general, TestAmerica St. Louis follows procedures from the referenced methods shown below.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

20.4.1.1 The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM); Non-polar Material) by Extraction and Gravimetry, EPA-821-R-98-002, February 1999*
- *Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032, August 1980.*
- *Eastern Environmental Radiation Facility Radiochemistry Procedures Manual, EPA, PB84-215581, June 1984.*
- *HASL-300 28th Edition, Environmental Measurements Laboratory (EML), 1997..*
- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*

- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

Where required by specific programs (eg. DOE) the selected or modified methods shall be approved by the client prior to use.

20.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

20.4.2.1 A demonstration of capability is performed whenever there is a change in instrument type, method or personnel.

20.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the QA Manager prior to independently analyzing client samples. All associated

documentation must be retained in accordance with the laboratories archiving procedures (refer to Section 15, Control of Records).

20.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct a method detection limit study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes and the criteria below are acceptable to the client, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method).
- The reporting limit is set at or above the first standard of the curve for the analyte.
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted or narrated.
- Refer to Section 12 (Control of Non-Conforming Work).

20.4.3 **<u>Initial Demonstration of Capability (IDOC) Procedures</u>**

20.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

20.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

20.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

20.4.3.4 Calculate the recovery for each aliquot in the appropriate reporting units

20.4.3.5 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

20.4.3.6 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 20.4.3.3 above.
- Beginning with 20.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 20.4.3.1 above.

A certification statement (see Figure 20-1) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

20.5 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS

Any new method developed by the laboratory must be fully defined in an SOP/Methods Manual (Section 20.2) and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method. The information included in the New Method checklist (Figure 20-2) is needed before samples are accepted for analysis by a new method.

20.6 VALIDATION OF METHODS

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled. (From 2003 NELAC Standard)

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

20.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

20.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

20.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular

measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed. The laboratory determinations of MDLs are described in Section 20.7.

20.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum level at which both the presence of an analyte and its concentration can be reliably determined. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

20.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix may be performed.

20.6.1.5 Determination of Range

Where appropriate, a determination of the applicable range of the method may be performed. In most cases, range is determined and demonstrated by comparison of the response of an analyte in a curve to established or targeted criteria. The curve is used to establish the range of quantitation and the lower and upper values of the curve represent upper and lower quantitation limits. Curves are not limited to linear relationships.

20.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

20.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

20.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

20.7 METHOD DETECTION LIMITS (MDL)/ LIMITS OF DETECTION (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements (refer to 20.7.10). The analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL.

20.7.1 MDL's are initially performed for each individual instrument and non-microbiological method analysis. Unless there are requirements to the contrary, the laboratory will use the highest calculated MDL for all instruments used for a given method as the MDL for reporting purposes. This MDL is not required for methods that are not readily spiked (e.g. pH, turbidity, etc.) For titration and gravimetric methods, where there is no additional preparation involved, the MDL is based on the lowest discernable unit of measure that can be observed.

20.7.2 MDL's must be run against acceptable instrument QC, including ICV's and Tunes. This is to insure that the instrument is in proper working condition and falsely high or low MDL's are not calculated.

20.7.3 Use only clean matrix which is free of target analytes (e.g.: Laboratory reagent water, Ottawa Sand) unless a project specific MDL is required in a field sample matrix.

20.7.4 The Reporting Limit should generally be between 2 and 5 times the MDL. If the MDL is being performed during method development, use this guideline to determine the Reporting Limit for the analysis. For DoD work the RL must be $\geq$ 3x MDL. If a sample is diluted, the reported MDL is adjusted according to the dilution factor.

20.7.5 If the MDL is < 1/10 of the spike concentration for more than 10% of the analytes in the method (< 1/5 of spike recovered for DoD for water samples) the MDL must be repeated (including extraction or digestion) using a lower spike level unless the % recovery is < 50% or > 150% of the "true value". Note: The concentration of the spike will be at a level below the calibration range.

20.7.6 The calculated MDL cannot be not greater than the spike amount.

20.7.7 If the most recent calculated MDL does not permit qualitative identification of the analyte then the laboratory may use technical judgment for establishing the MDL (e.g., calculate what level would give a qualitative ID, compare with IDL (20.7), spike at a level where qualitative ID is determined and assign that value as MDL, minimum sensitivity requirements, Standard deviation of method blanks over time, etc.) See SOP STL-QA-0016, "MDL/IDL Determination".

20.7.8 Each of the 7 spikes must be qualitatively identifiable (e.g., appear in both columns for dual column methods, characteristic ions for GCMS mass spectra, etc). Manual integrations to force the baseline for detection are not allowed.

20.7.9 The initial MDL is calculated as follows:

$$MDL = t_{(n-1,\ 1-a\ =\ 0.99)} \times (\text{Standard Deviation of replicates})$$

where $t_{(n-1,\ 1-a\ =\ 0.99)}$ = 3.143 for seven replicates.

20.7.10 Subsequent to the initial MDL determination, periodic MDL verification, confirmation or determinations may be performed by the procedure in 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices (e.g., method blanks over time, single standard spikes that have been subjected to applicable sample prep processes, etc.). See SOP STL-QA-0016, "MDL/IDL Determination".

20.7.11 Because of the inherent variability in results outside of the calibration range, TestAmerica does not recommend the reporting of results below the lowest calibration point in a curve; however, it is recognized that some projects and agencies require the reporting of results below the RL. Any result that falls between the MDL and the Reporting limit, when reported, will be qualified as an estimated value.

20.7.12 Detections reported down to the MDL must be qualitatively identified.

20.7.13 MDLs and Reporting limits are adjusted in LIMs based on moisture content and sample aliquot size.

20.8 Minimum Detectable Activity (MDA)/Minimum Detectable Concentration (MDC)

For radiochemical analyses, the MDA/MDCs are determined based on normal factors and conditions which influence measurement. The MDA/MDC is used to evaluate the capability of a method relative to the required RDLs. Sample size, count duration, tracer recovery, detector background and detector efficiency all contribute to determining the sample's MDA/MDC.

The Minimum Detectable Concentration (MDC) for a radionuclide by radiochemical measurement is determined from the blank/background variability associated with the appropriate detector, the detector efficiency, sample aliquot size and chemical yield. The background variability is proportional to the sample count time.

NOTE: The background variability is based on the analytical test and derived by: 1) using sample specific parameters, or 2) process blank specific parameters, or 3) by averaging the multiple MDCs derived in 1 or 2.

Matrix material is used whenever possible and is of a similar composition as the client samples.

The MDC is calculated for individual samples (depending on counting technique) using the formulas provided in Appendix 8. The MDC is expected to be less than the client required detection limit. Cesium-137 is the MDC analyte of interest for gamma evaluation.

If the sample MDC is greater than the client required detection limit (CRDL) or reporting limit (RL), the Data Reviewer shall examine the sample volume/weight, counting time, tracer yield and/or other relevant factors. The Data Reviewer shall decide the corrective action which may include reanalysis, recounting or data acceptance and document per laboratory procedure.

20.9 INSTRUMENT DETECTION LIMITS (IDL)

20.9.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

20.9.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

20.9.3 If IDL is > than the MDL, it may be used as the reported MDL.

20.10 VERIFICATION OF DETECTION AND REPORTING LIMITS

20.10.1 Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at approximately 2-3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and 1-4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified or see section 20.7.7 for other options. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, and will redevelop their MDL or use the level where qualitative identification is established (See 20.6.7). MDLs must be verified at least annually.

20.10.2 When a Reporting limit is established, it must be initially verified by the analysis of a low level standard or QC sample (LCS at 1-2 the reporting limit) and annually thereafter. Unless there are requirements to the contrary the acceptance criteria is ± 50%. The annual requirement is waved for methods that have an annually verified MDL.

20.11 RETENTION TIME WINDOWS

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specified in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte

used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes.

For GC, HPLC and IC methods, there must be sufficient separation between analyte peaks so as to not misidentify analytes. In the mid-level standard, the distance between the valley and peak height cannot be any less than 25% of the sum of the peak heights of the analytes. This also applies to GCMS in the case where the two compounds share the same quantitation ion.

Note: Some analytes do not separate sufficiently to be able to identify or quantitate them as separate analytes (e.g. m-xylene and p-xylene) and are quantitated and reported as a single analyte (e.g. m,p-xylenes).

Once the analyst has determined that the instrument is in optimum working condition through calibration and calibration verification procedures, he or she uses a mid-range calibration or calibration verification standard to establish the retention times for each of the individual analytes in a method. The analyst makes three injections of the same standard over a 72-hour (24 hr period for 300.0) period, tabulating the retention times for each analyte for each of the three injections. The width of retention time window is normally the average absolute retention time ± 3 Standard Deviations. A peak outside the retention time window will not be identified by the computer as a positive match of the analyte of interest. (Work for DOD clients may require the 3x SD even though the methods have more flexibility.)

It is possible for the statistically calculated RT window to be too tight and need to be adjusted based on analyst experience. In these instances method default retention time windows may be used (e.g., for 8000 series methods a default of 0.03 minutes may be used, and EPA CLP 0.05 minutes is used). The same concept is applied when any peak outside of that window will not be identified by the computer as a positive match.

The calibration verification standard at the beginning of a run may be used to adjust the RT for an analyte. This is essentially re-centering the window but the size of the window remains the same. The RTs are verified when all analytes are within their RT windows and are properly identified.

20.12 EVALUATION OF SELECTIVITY

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, fluorescence profiles, co-precipitation evaluations and specific electrode response factors.

20.13 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

20.13.1 Uncertainty is “a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand” (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result’s validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of

an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

20.13.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. For environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systemic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

20.13.3 The uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

20.13.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent a 99%-certain range for the reported result. As an example, suppose that the result reported is 1.0 mg/l, and the LCS percent recovery range is 50 to 150%. The uncertainty range would be 0.5 to 1.5 mg/l, which could also be written as 1.0 +/- 0.5 mg/l. This approach may be used for chemical analyses. For radiochemical uncertainty determination see the calculations in Appendix 8.

20.13.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g. 524.2, 525, etc) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

20.14 CONTROL OF DATA

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

20.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOPs STL-IS-0001, STL-IS-0002 and STL-IS-0003. The laboratory is currently running Quantims which is a custom in-house developed LIMS system. It is referred to as LIMS for the remainder of this section. The LIMS utilizes an industry standard relational database platform. It is referred to as Database for the remainder of this section.

20.14.1.1 **Maintain the Database Integrity:** Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use.

  Note: "Commercial off-the-shelf software in use within the designed application range is considered to be sufficiently validated." *From NELAC 2003 Standard.* However, laboratory specific configurations or modifications are validated prior to use.

- In order to assure accuracy, all data entered or transferred into the LIMS data system goes through a minimum of two levels of review.
- The QA department performs random data audits to ensure the correct information has been reported.
- Changes to reports are documented in the Validation Request database.
- Analytical data file security is provided through three policies.
  - The first policy forbids unauthorized personnel from using laboratory data acquisition computers.
  - The second policy is the implementation of network passwords and login names that restrict directory access.
  - The third layer is maintained through the LIMS and includes the use of username/password combinations to gain access to the LIMS system, the fact that all data in the LIMS is associated with the user to added/reviewed the data, and the restriction of review authority of data.
- All software installations will be in accordance with any relevant copyright licensing regulations.
- All software installed on any computer within the laboratory must be approved by the Information Technology Department regional support technician assigned to the laboratory Shrink-wrapped or otherwise sealed OEM software that is directly related to instrument usage does not need approval but the Information Technology department must be notified of the installation.
- Anti-virus software shall be installed on all servers and workstations. The anti-virus software shall be configured to check for virus signature file and program updates on a daily basis and these updates will be pushed to all servers and workstations. The anti-virus software will be configured to clean any virus-infected file if possible, otherwise the file will be deleted. Disks and CDs brought from any outside source that are not OEM software must be scanned for viruses before being accessed.

- **Interlab LIMS Permissions Policy**
  - <u>PURPOSE</u> - The purpose of this policy is to provide a mechanism for maintaining the integrity of information contained in each laboratory's LIMS while providing the necessary access for information sharing to staff at other laboratory facilities.
  - <u>DEFINITIONS</u> - Host Laboratory: The laboratory facility that 'owns' the LIMS system or 'hosts' a project/job.
  - <u>POLICIES</u>
    (a) All permissions for the laboratory's LIMS system must only be granted by a representative of that laboratory.

- If someone outside of the host lab needs permissions for Project Management or other uses, they must go through the Lab Director or his/her designated representative.
- Permissions must never be granted without the knowledge of the host laboratory.

(b) Only laboratory analytical staff from the home laboratory may have edit permissions for laboratory analysis data.

(c) Any changes made in laboratory's LIMS system:

- Must be documented and traceable.
- If made by staff of an affiliate lab, written permission from the home lab to make the changes (email approval is sufficient) is required.
- No corrections may be made in another laboratories system without their knowledge.

(d) Data qualifiers in laboratory reports must only be corrected, edited, etc. by the staff at the host laboratory.

(e) Full analytical data "View" only permissions may be granted to outside Project Management and Sales staff. Search permissions may also be granted so status may be checked.

(f) All qualifiers must be approved by QA staff before adding to standard reference tables.

(g) Please contact Corporate QA or IT staff if you have any questions regarding implementation or interpretation of this policy.

20.14.1.2 **<u>Ensure Information Availability:</u>** Protection against loss of information or service through scheduled back-ups, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

- Insured by timely backup procedures on reliable backup media, stable file server network architecture, and UPS protection
- UPS Protection:
- Each fileserver is protected by an appropriate power protection/backup unit. In the event of a power outage, there is approximately 15-30 minutes of up-time for the servers prior to shutdown. This allows for proper shutdown procedures to be followed with the fileservers.
- File Server Architecture
  - All files are maintained on multiple Windows 2000 or newer servers which are secured physically in the Information Technology office. Access to these servers is limited to members of the Information Technology staff.
  - All supporting software is maintained for at least 5 years from the last raw data generated using that software. [Length of time is dependent on local regulations or client requirements (e.g., OVAP requires 10 years).]
- System Back-up Overview and Procedures
  - Data from both servers and instrument attached PC's are backed up and purged in compliance with the corporate back-up policy.
  - A Maintenance Plan has been defined to create a daily archive of all data within the LIMS database to a backup location. This backup is initiated automatically by either the database or back-up system.

- Backup tapes will be stored in compliance with the corporate Data Backup Policy. Backup verifications are carried out in accordance with the corporate Data Backup Policy.
- Instrument data back-ups are verified on a periodic basis by the IT and/or QA department.

20.14.1.3 Maintain Confidentiality: Ensure data confidentiality through physical access controls, and encryption of when electronically transmitting data.

- All servers are located in a secure area of the IT department offices. Access to the servers is limited to IT staff members, lab directors, the President and Vice President of Operations.
- The company website contains SSL (Secure Socket Layer) encryption for secure website sessions and data transfers.
- Electronic documents such as PDF files and electronic data deliverables will be made available to clients via the secure web site. The logon page for this web site contains an agreement that the customer must accept before they will be logged on which states that the customer agrees not to alter any electronic data made available to them.
- If electronic documents are made available outside of the web site, the customer must sign an agreement in advance that states they will not alter the data in any way.

20.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by the analyst and the review cover page is signed by both the analyst and second reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP CA-Q-S-002, *Acceptable Manual Integration Practices* and STL-QA-0040, “Manual Integration Procedure”.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer’s indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

20.14.2.1 All raw data must be retained in the reporting department archive files. All criteria pertinent to the method must be recorded.

20.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) or pico-curies per liter (pCi/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) or pico-curies per gram (pCi/g) for solids. The units "mg/l" and "mg/kg" are the same as "parts per million (ppm)". The units "µg/l" and "µg/kg" are the same as "parts per billion (ppb)."

- Several environmental methods, such as color, turbidity, conductivity, use very specific, non-concentration units to report results (e.g., NTU, umhos/cm etc).

20.14.2.3 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

20.14.2.4 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. Where possible, the data file is stored in a monthly folder on the instrument computer; periodically, this file is transferred to the server and, eventually, to a tape file. For instruments without the capability of file storage, the data is scanned to a pdf file and archived by the data reporting group.

20.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 13.
- Logbooks have sequentially numbered pages.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Persons responsible for the activity recorded in the logbook sign or initial the entry.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

20.14.4 Review / Verification Procedures

Review procedures are out lined in SOP STL-PM-0004 "Data Review, Verification and Reporting" to ensure that reported data are free from calculation and transcription errors, that

QC parameters have been reviewed and evaluated before data is reported. The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data STL-QA-0040, "Manual Integration Procedure. The general review concepts are discussed below, more specific information can be found in the SOPs.

20.14.4.1 The data review process at TestAmerica St. Louis starts at the Sample Control level. Sample Control personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Sample Control Supervisor reviews the transaction of the chain-of-custody forms and the inputted information. The Project Managers perform final review of the chain-of-custody forms and inputted information.

20.14.4.2 The first level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS. To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. Issues that need further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

20.14.4.3 Unacceptable analytical results may require reanalysis of the samples.

20.14.4.4 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

20.14.4.5 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met. The following are some examples of chemical relationships that are reviewed (if data is available):

- Total Results are ≥ Dissolved results (e.g. metals)
- Total Solids (TS) ≥ TDS or TSS
- TKN ≥ Ammonia
- Total Phosphorus ≥ Orthophosphate
- COD ≥ TOC
- Total cyanide ≥ Amenable Cyanide
- TDS ≥ individual anions
- Compare gross alpha results to results for alpha emitters
- Compare gross beta results to results for beta emitters

20.14.4.6 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. (*Also see section 26 on Reporting Results*). When complete, the report is sent out to the client.

20.14.5 <u>Manual Integrations</u>

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using SOP CA-Q-S-002 and STL-QA-0040 as the guidelines**.**

20.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

20.14.5.2 Analysts shall not increase or decrease peak areas to for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

20.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

20.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 20-1.
Demonstration of Capability Documentation

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Analyst Demonstration of Capability
Certification Statement

Analyst Name
Date: 1/9/2008

Method
SOP
Matrix

TestAmerica St. Louis
13715 Rider Trail North
Earth city, MO 63045
(314) 298-8566

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method with the specifications in the cited SOP, which is in use at this facility for the analysis of samples under the TestAmerica Quality Assurance Plan, has met the Initial or Ongoing Demonstration of Capability.
2. The test method was performed by the analyst identified on this certification following the TestAmerica SOP.
3. A copy of the laboratory-specific SOP is available for all personnel on-site.
4. The data associated with the initial/ongoing demonstration of capability are true, accurate, complete and self-explanatory (*). These data are attached to this certification statement.
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized inspectors.

Comments/Observations:

Analyst's Name	Signature	Date
Supervisor's Name	Signature	Date
QA Manager's Name	Signature	Date

(*) *True: Consistent with supporting data.*
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices
Complete: Includes the results of all supporting performance testing.
Self-explanatory: Data properly labeled and stored so that the results are traceable and requires no additional explanation.

Figure 20-2.

Example - New Method / Additional Analyte Checklist

New Method / Additional Analyte Checklist

The following items are completed, as applicable, prior to the acceptance of client samples. Fill in any blanks that do not apply with "NA". Provide associated instrument QC when samples or QC samples are analyzed (includes run log).

New Method _____ Added Analytes _____

1_____ Standard Operating Procedure (for new method)

_____ Analysis SOP
_____ Preparation SOP
_____ SOP for any other relevant process
_____ Pages from any applicable logbooks (instrument, standards, etc)

2_____Evaluation of Selectivity. As applicable: e.g. Retention Time Window Study, second column confirmation, Interelement correction checks, spectral or fluorescence profiles, etc.

3_____ Initial Calibration Curve (Include Tune verification or similar (e.g. degradation checks) if applicable)

4_____ Method Detection Limit (MDL) Study (summary and raw data)

_____ Water
_____ Soil
_____ Other

5_____ Reporting Limit Verification standard

- Spike a blank matrix at the RL and process through the entire method. MDL study should be able to be used if recovery is good. Note the spike level(s) and recovery(~~y~~ies)

6_____ Demonstration of Capability (DOC) per analyst (Precision and Accuracy (P&A) verification)

- 4 LCS for each matrix – most acceptance criteria are in the methods. The MDL study may be used if DOC criteria are met.
- Non-Standard methods – 3 x (1 LCS at LOQ-25%, 50%, 75% of the calibration range + Blank) prepared each day. (see NELAC Chpt 5, appendix C.3.3 (b))

7_____ Acceptable PT sample(s) if available/applicable

Notes: PT sample required for all new methods
PT sample required for all new analytes under NELAP

Submitted by _____ Date _____

8_____ Certification/Approval from Regulatory Agency where applicable

QA Review / Acceptance _____ Date _____

SECTION 21

EQUIPMENT (AND CALIBRATIONS)
(NELAC 5.5.5)

21.1 OVERVIEW

TestAmerica purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory method SOPs. A list of laboratory equipment and instrumentation is presented in Table 21-1.

Equipment is only operated by authorized and trained personnel. Manufacturer's instructions for equipment use are readily accessible to all appropriate laboratory personnel.

21.2 PREVENTIVE MAINTENANCE

21.2.1 TestAmerica St. Louis follows a well-defined program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

21.2.2 Routine preventive maintenance procedures and frequency, such as lubrication, cleaning, and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

21.2.2.1 Calibrations, routine maintenance, and adjustments are part of the analysts' and Department Managers' responsibilities. However, service contracts may be in place for some instruments to cover any major repairs.

21.2.2.2 High purity gases, reagents, and spare parts are kept on hand to minimize repair time and optimize instrument performance.

21.2.3 Table 21-2 summarizes the schedule for routine maintenance. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may also be outlined in analytical SOPs or instrument manuals.

21.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment.

21.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

21.2.4.2 Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.).

21.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed.

21.2.5 The laboratory equipment list contains:

- The identification of the instrument/equipment (instrument's Serial Number and Model Number)
- The date the instrument/equipment was put into use.
- If available, the condition when the instrument was received (e.g. new, used, reconditioned).

21.2.6 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out of service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses (refer to Sections 12 and 13).

21.2.7 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted using the procedures outlined in Section 8.

If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

21.3 SUPPORT EQUIPMENT

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. Support equipment is uniquely identified and raw data

records associated with the support equipment are retained to document instrument performance.

21.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory.

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

The recalibration/recertification certificates are kept on file.

See SOP STL-QA-0005, “Calibration and Verification Procedure for Thermometers, Balances, Weights and Pipettes”.

21.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

21.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. Electronic thermometers calibrated quarterly.

The NIST thermometer is recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer has increments of 0.2 ºC, and has a range applicable to all method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks or filed in QA records. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in thermometer-specific logbooks. More information on this subject can be found in the SOP STL-QA-0005, "Calibration and Verification Procedure for Thermometers, Balances, Weights and Pipettes".

21.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day (7 days a week for DOD labs).

Ovens, water baths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept at 4 ^{o}C $\pm$ 2°C

Specific temperature settings/ranges for other refrigerators, ovens water baths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks.

21.3.5 Autopipettors, Dilutors, and Syringes

For those dispensers that are not used for analytical measurements, calibration is not performed. Any device not regularly verified can not be used for any quantitative measurements.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an "Accuracy and Precision Statement of Conformance" from Hamilton attesting established accuracy.

See SOP STL-QA-0005, "Calibration and Verification Procedure for Thermometers, Balances, Weights and Pipettes".

21.4 INSTRUMENT CALIBRATIONS

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.
If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 13).

Note: Instruments are calibrated initially and as needed after that and at least annually.

21.4.1 CALIBRATION STANDARDS

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. However, the general procedures are described below.

21.4.1.1 For each analyte and surrogate (if applicable) of interest, prepare calibration standards at the minimum number of concentrations as stated in the analytical methods. If a reference or mandated method does not specify the number of calibration standards, the minimum number is three, not including blanks or a zero standard. All of the standard solutions are prepared using Class A volumetric glassware, calibrated pipettes, and/or microsyringes and appropriate laboratory quality solvents and stock standards.

21.4.1.2 Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to NIST whenever possible. Dilution standards are prepared from stock standards purchased from commercial suppliers. An electronic Standards Log is maintained for each department, containing concentration, date of receipt, date of standard preparation, any dilutions made, lot number, supplier, type of solvent and a unique code number to identify the standard.

21.4.1.3 The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample). This does not apply to radiochemical methods.

21.4.1.4 The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to 3 significant figures) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The lowest calibration standard must be at or below the reporting limit. The exception to these rules is ICP methods or other methods where the referenced method does not specify two or more standards.

21.4.1.5 Given the number of target compounds addressed by some of the organic methods, it may be necessary to prepare several sets of calibration standards, each set consisting of the appropriate number of solutions at different concentrations. The

initial calibration will then involve the analysis of each of these sets of the appropriate number of standards.

21.4.1.6 All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, where no other source or lot is available, a standard made by a different analyst would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

21.4.2 CALIBRATION FOR ORGANIC METHODS (GC, HPLC, GC/MS)

21.4.2.1 Many of the organic analytical methods utilize an internal standard calibration (GCMS and some GC). Because of the complex nature of the multipeak chromatograms produced by the method, some instruments necessitate the use of external standard calibration (most GC and HPLC). Surrogate compounds are included in the calibration processes for all appropriate organic analyses. For more details on the calibration types listed below, refer to SOP No. CA-Q-S-005, Calibration Curves and/or the calibration section of the laboratory method SOPs.

21.4.2.2 Once the operating parameters have been established according to the method, each instrument is calibrated for the appropriate method. The analyst prepares five or more standard solutions at various concentrations containing all of the analytes of interest, internal standards, and surrogates that are appropriate for the method. Note: There are a several EPA methods that have different requirements and are exceptions (e.g. EPA 547) where a minimum of 3 calibration standards are prepared and analyzed. See Section 10 in the laboratory analytical SOPs for specific calibration procedures for a particular method.

21.4.2.3 The standard solutions are introduced into the instrument in the same manner as samples are; whether it be by direct injection, by headspace analysis, or by purge and trap. The calibration factor (CF) for methods that use external standards, and the response factor (RF) for methods that use internal standards are calculated for the five standards.

- External standard calibration involves comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards. Sample peak areas (or peak heights) are compared to peak areas (or heights) of the standards. The ratio of the response to the amount of analyte in the calibration standard is defined as the Calibration factor (CF).

- Internal standard calibration involves the comparison of instrument responses from the target compounds in the sample to the responses of specific standards added to the sample or sample extract prior to injection. The ratio of the peak area (or height) of the target compound in the sample or sample extract to the peak area (or height) of the internal standard in the sample or sample extract is compared to a similar ratio derived for each calibration standard. The ratio is termed the response factor (RF), and may also be known as a relative response factor in other methods.

In many cases, internal standards are recommended. These recommended internal standards are often brominated, fluorinated, or stable isotopically labeled analogs of specific target compounds, or are closely related compounds whose presence in environmental samples is highly unlikely. The use of specific internal standards is available in the method SOP.

Whichever internal standards are employed, the analyst needs to demonstrate that the measurement of the internal standard is not affected by method analytes and surrogates or by matrix interferences. In general, internal standard calibration is not as useful for GC and HPLC methods with non-MS detectors because of the inability to chromatographically resolve many internal standards from the target compounds. The use of MS detectors makes internal standard calibration practical because the masses of the internal standards can be resolved from those of the target compounds even when chromatographic resolution cannot be achieved.

When preparing calibration standards for use with internal standard calibration, add the same amount of the internal standard solution to each calibration standard, such that the concentration of each internal standard is constant across all of the calibration standards, whereas the concentrations of the target analytes will vary. The internal standard solution will contain one or more internal standards and the concentration of the individual internal standards may differ within the spiking solution (e.g., not all internal standards need to be at the same concentration in this solution). The mass of each internal standard added to each sample extract immediately prior to injection into the instrument or to each sample prior to purging must be the same as the mass of the internal standard in each calibration standard. The volume of the solution spiked into sample extracts should be such that minimal dilution of the extract occurs (e.g., 10 uL of solution added to a 1 mL final extract results in only a negligible 1% change in the final extract volume which can be ignored in the calculations).

An ideal internal standard concentration would yield a response factor of 1 for each analyte. However, this is not practical when dealing with more than a few target analytes. Therefore, as a general rule, the amount of internal standard should produce an instrument response (e.g., area counts) that is no more than 100 times that produced by the lowest concentration of the least responsive target analyte associated with the internal standard. This should result in a minimum response factor of approximately 0.01 for the least responsive target compound. Refer to SOP No. CA-Q-S-005, Calibration Curves, for specific calculations.

21.4.2.4 Policies regarding the use of calibration standard results for creating the calibration curve are as follows:

- A low calibration standard may be excluded from the calibration if the signal-to-noise ratio or spectral criteria are not suitable. The reporting level must be elevated to be the lowest calibration standard used for calibration.

- The upper calibration standard may be excluded if it saturates the detector or is obviously becoming non-linear. Any sample exceeding the upper standard used in the calibration must be diluted and re-analyzed.
- Mid-calibration standards may not be excluded unless an obvious reason is found, i.e., cracked vial, incorrectly made, etc. The failed standard should be re-run immediately and inserted into the initial calibration. If not useful, recalibration is required.

21.4.2.5 Percent RSD Corrective Action

Given the potentially large numbers of analytes that may be analyzed in some methods, it is likely that some analytes may exceed the acceptance limit for the RSD for a given calibration. In those instances, the following steps are recommended, but not required.

21.4.2.5.1 The first step is generally to check the instrument operating conditions. This option will apply in those instances where a linear instrument response is expected. It may involve some trade-offs to optimize performance across all target analytes. For instance, changes to the operating conditions necessary to achieve linearity for problem compounds may cause the RSD for other compounds to increase, but as long as all analytes meet the RSD limits for linearity, the calibration is acceptable.

21.4.2.5.2 If the RSD for any analyte is greater than the applicable acceptance criteria in the applicable analytical method, the analyst may wish to review the results (area counts, calibration or response factors, and RSD) for those analytes to ensure that the problem is not associated with just one of the initial calibration standards. If the problem appears to be associated with a single standard, that one standard may be reanalyzed and the RSD recalculated. Replacing the standard may be necessary in some cases.

21.4.2.5.3 A third alternative is to narrow the calibration range by replacing one or more of the calibration standards with standards that cover a narrower range. If linearity can be achieved using a narrower calibration range, document the calibration linearity, and proceed with analyses. The changes to the upper end of the calibration range will affect the need to dilute samples above the range, while changes to the lower end will affect the overall sensitivity of the method. Consider the regulatory limits or action levels associated with the target analytes when adjusting the lower end of the range.

Note: When the purpose of the analysis is to demonstrate compliance with a specific regulatory limit or action level, the laboratory must ensure that the method quantitation limit is at least as low as the regulatory limit or action level.

21.4.2.6 Alternatively, the least squares regression may be used to determine linearity. A five point line must result in a correlation coefficient (r) of 0.990 or better using the least squares method to be considered acceptable. In many cases it may be preferred that the curves be forced through zero (not to be confused with including the origin as an additional data point, which is not allowed). **Note:** EPA method 8000B does not allow forcing through zero however the agency has revaluated this position and has since changed this stance to allow forcing through zero. In addition, from EPA Method 8000C: "However, the use of a linear regression or forcing the regression through zero may NOT be used as a rationale for reporting results below the calibration range demonstrated by the analysis of the standards.").

21.4.2.7 Instead of a linear curve model (either Average RF or least squares regression), a second order curve (Quadratic) may be used (and preferred) as long as it contains at least six data points. As a rule of thumb, if there is a consistent trend in RFs (or CFs) in the calibration curve, either up or down, then quadratic curve

fit may be indicated as the preferred calibration routine for that analyte. The coefficient of determination (COD or r^2) for the quadratic curve must be at least 0.99 for it to be considered acceptable. For more details on the calculations see Calibration Curve SOP CA-Q-S-005. Some limitations on the use of Quadratic Curve fits:

21.4.2.7.1 Care MUST be exercised to assure that the results from this equation are real, positive, and fit the range of the initial calibration.

21.4.2.7.2 They **may not** be used to mask instrument problems that can be corrected by maintenance. (Not to be used where the analyte is normally found to be linear in a properly maintained instrument).

21.4.2.7.3 They **may not** be used to compensate for detector saturation. If it is suspected that the detector is being saturated at the high end of the curve, remove the higher concentration standards from the curve and try a 1st order fit or average RF.

21.4.3 Calibration for Inorganic Analyses

EPA Method 7000 from EPA SW-846 is a general introduction to the quality control requirements for metals analysis. For inorganic methods, quality control measures set out in the individual methods and in the *Standard Methods for the Examination of Water and Wastewater* (20th Edition) may also be included. Standard Operating Procedures for the analysis and the quality control documentation measures are available on the laboratory's public network drive.

In general, inorganic instrumentation is calibrated with external standards. Some exceptions would be Inductively Coupled Plasma (ICP) and Inductively Coupled Plasma Mass Spec (ICPMS). These analyses may use an internal standard to compensate for viscosity or other matrix effects. While the calibration procedures are much the same for inorganics as they are for organics, CF's or RF's are not used. The calibration model in 21.4.2.6 is generally used for most methods, however in some instances the model from section 21.4.2.7 may be used. A correlation coefficient (r) of 0.995 or greater must be used to accept a calibration curve generated for an inorganic procedure. Correlation coefficients are determined by hand-held scientific calculators or by computer programs and documented as part of the calibration raw data. Coefficients of calibration curves used for quantitation must be documented as part of the raw data. Curves are not allowed to be stored in calculator memories and must be written on the raw data for the purposes of data validation.

21.4.3.1 "Calibrations" for titrimetric analyses are performed by standardizing the titrants against a primary standard solution. See specific methods in *Standard Methods for the Examination of Water and Wastewater* (20th Edition) for more information.

21.4.3.2 Spreadsheets that are used for general chemistry calculations must have all cells containing calculations locked to prevent accidental changes to the calculations.

21.4.3.3 Instrument technologies (e.g. ICP) with validated techniques from the instrument manufacturer or other methods using a zero point and single point calibration require the following:

21.4.3.3.1 The instrument is calibrated using a zero point and a single point calibration standard.

21.4.3.3.2 The linear range is established by analyzing a series of standards, one at the reporting limit (RL).

21.4.3.3.3 Sample results within the established linear range do not need to be qualified.

21.4.3.3.4 The zero point and single standard is run daily with each analytical batch.

21.4.3.3.5 A standard at the RL is analyzed daily with each analytical batch and must meet established acceptance criteria.

21.4.3.3.6 The linearity is verified at a frequency established by the manufacturer or method.

21.4.3.3.7 See Section 10 in the laboratory analytical SOPs for specific calibration procedures for a particular method.

21.4.4 Calibration Verification (Organic and Inorganic)

The calibration relationship established during the initial calibration must be verified at periodic intervals as specified in the laboratory method SOPs in accordance with the referenced analytical methods and NELAC (2003) standard, Section 5.5.5.10. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration, and is not appropriate nor permitted in SW-846 chromatographic procedures for trace environmental analyses.

21.4.4.1 Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods or programs may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12 hours of the beginning of the shift.

21.4.4.2 A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models and inorganic methods, at the end of each analytical batch. Some methods have more frequent CCV requirements; see specific SOPs. Most Inorganic methods require the CCV to be analyzed after ever 10 samples.

21.4.4.3 The acceptance limits for calibration verifications can be found in each method SOP. As a rule of thumb: GCMS ± 20%, GC and HPLC ± 15%, Inorganics: ± 10 or 15%. Actual methods may have wider or tighter limits; see the method SOP for specifics.

21.4.4.4 If the response (or calculated concentration) for an analyte is within the acceptance limits of the response obtained during the initial calibration, then the initial calibration is considered still valid, and the analyst may continue to use the CF, RF or % drift values from the initial calibration to quantitate sample results.

21.4.4.5 If the response (or calculated concentration) for any analyte varies from the mean response obtained during the initial calibration by more than the acceptance criteria, then the initial calibration relationship may no longer be valid. If routine corrective action procedures fail to produce a second consecutive (immediate) calibration verification within acceptance criteria, then either the laboratory has to demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new initial instrument calibration must be performed. However, sample data associated with an unacceptable calibration verification may be reported as qualified data under the following special conditions:

21.4.4.5.1 When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

21.4.4.5.2 When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

21.4.5 <u>Verification of Linear Calibrations</u>

Calibration verification for linear calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. Use the equations below to calculate % Drift or % Difference, depending on the procedure specified in the method SOP. Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

The Percent Difference is calculated as follows:

$$\% \text{ Difference} = \frac{(CF(v) \text{ or } RF(v)) - (\text{Avg. CF or RF})}{(\text{Avg. CF or RF})} \times 100$$

Where: CF(v) or RF(v) = CF or RF from verification standard
Avg. CF or RF = Average CF or RF from Initial Calibration.

The Percent Drift is calculated as follows:

$$\% \text{ Drift} = \frac{\text{Result} - \text{True Value}}{\text{True Value}} \times 100$$

The Percent Recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{\text{Result}}{\text{True Value}} \times 100$$

21.4.6 Verification of a Non-Linear Calibration

Calibration verification of a non-linear calibration is performed using the percent drift or percent recovery calculations described in 21.4.4.6 above.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

21.5 Radiochemical Calibrations

21.5.1 CALIBRATION STANDARDS

- Shelf life for stock radioactive standards shall not exceed 5 half lives. Shelf life for stock solutions prepared in the laboratory from salts, metals or dilution from a mother solution shall be no greater than one year, unless stated otherwise on the calibration certificate from the manufacturer. Standards in the form of a soil, sealed sources, filter, plated sources and sealed epoxy Marinelli beakers do not always have an expiration date. After the1 year shelf life of the stock solution has expired, it must be re-certified.

- If the standard is not re-verified, the standard shall be removed or clearly designated as acceptable for qualitative purposes only.

- The expiration date of the secondary standard shall not exceed the expiration date of the primary standard.

The accuracy of calibration standards is checked by comparison with a calibration verification standard from a second source. In cases where a second standard source is not available, a source from a different vendor is acceptable. All cases where this requirement cannot be met shall be documented with a nonconformance memo.

When a traceable standard is not available to use for calibration or verification activities, a nontraceable standard may be used if written client approval is obtained (when required).

Calibration standards are prepared using the appropriate procedures. However, the general procedures are described below.

21.5.1.1 For each analyte of interest, prepare calibration standards at the minimum number of concentrations as stated in the analytical methods.

21.5.1.2 Standards for instrument calibration are obtained from a variety of sources. All radioactive standards are traceable to NIST whenever possible. Dilution standards are prepared from stock standards purchased from commercial suppliers. A standard log is maintained, containing concentration/activity, date of receipt, date of standard preparation, any dilutions made, lot number, supplier, type of solvent and a unique code number to identify the standard.

The frequency of calibration can be found in the laboratory's radiochemical methods and Table 21-4.

21.5.2 RADIOCHEMICAL CONTINUING INSTRUMENT CALIBRATION VERIFICATION and RADIOCHEMICAL BACKGROUND MEASUREMENT

Performance checks shall be performed using appropriate check sources and monitored to ensure that the instruments are running properly and that detector response has not significantly changed. Background measurements are made according to the schedule on Table 21-4 and monitored to ensure that the laboratory maintains its capability to meet required data quality objectives.

21.5.3 RADIOCHEMICAL INSTRUMENT CONTAMINATION MONITORING

The laboratory radiochemical instrumentation SOPs specify the requirements for monitoring radiochemical instrumentation. The SOP specifies the monitoring frequencies and criteria for initiating corrective action.

21.6 Policy on Tentatively Identified Compounds (TICs) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it will not be reported as a TIC. If the compound is reported on the same form as true TICs, it must be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification. See SOPs STL-MS-0001 and STL-MS-0002 for guidelines for making tentative identifications and reporting TICs.

21.7 Policy on GC/MS Tuning

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

21.7.1 The concentration of the BFB or DFTPP must be at or below the concentrations that are referenced in the analytical methods. Part of the purpose of the tune is to demonstrate sensitivity and analyzing solutions at higher concentrations does not support this purpose. Tune failures may be due to saturation and a lower BFB/DFTPP concentration may be warranted.

21.7.2 Tune evaluations usually utilize the "Autofind" function and are set up to look at the apex +/- 1 scan and average the three scans. Background correction is required prior to the start of the peak but no more than 20 scans before. Background correction cannot include any part of the target peak.

21.7.3 Other Options or if Auto Tune Fails:

21.7.3.1 Sometimes the instrument does not always correctly identify the apex on some peaks when the peak is not perfectly shaped. In this case, manually identify and average the apex peak +/- 1 scan and background correct as in 21.6.4 above. This is consistent with EPA 8260 and 8270.

21.7.3.2 Or the scan across the peak at one half peak height may be averaged and background corrected. This is consistent with Standard Methods 6200, EPA 624 and EPA 625.

21.7.3.3 Adjustments such as adjustments to the repeller and ion focus lenses, adjusting the EM Voltage, etc. may be made prior to tune verification as long as all of the subsequent injections in the 12 hour tune cycle are analyzed under the same MS tune settings and it is documented in the run sequence log and/or maintenance log that an adjustment was made. Excessive adjusting (more than 2 tries) without clear

documentation is not allowed. Necessary maintenance is performed and documented in instrument log.

21.7.3.4 A single scan at the Apex (only) may also be used for the evaluation of the tune. For SW 846 and EPA 600 series methods, background correction is still required.

21.7.3.5 Cleaning the source or other maintenance may be performed and then follow steps for tune evaluation above. Note: If significant maintenance was performed, see methods 8000B or 8000C then the instrument may require recalibration prior to proceeding.

21.7.4 Tune evaluation printouts must include the chromatogram and spectra as well as the Tune evaluation information. In addition, the verifications must be sent directly to the printer or pdf file (no screen prints for DFTPP or BFB tunes). This ability should be built into the instrument software.

21.7.5 All MS tune settings must remain constant between running the tune check and all other samples. It is recommended that a separate tune method not be used, however a separate method may be used as long as the MS conditions between the methods are the same as the sample analysis method and tracked so any changes that are made to the analysis method are also made to the tune method.

Table 21-1.

Laboratory Equipment and Instrumentation – TestAmerica St. Louis

Instrument Type	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
GC/MS – "B"	Hewlett Packard	5970	2623A00600	1989	NEW
GC/MS – "B" GC System	Hewlett Packard	5890	2623A01341	1989	NEW
GC/MS – "B" Concentrator	Tekmar	LSC3000	94187003	1992	NEW
GC/MS – "B" Autosampler	Varian	LSC2016	25101	1989	NEW
GC/MS – "G"	Hewlett Packard	5970	7807A11075	1987	NEW
GC/MS – "G" GC System	Hewlett Packard	5890	2807A11075	1987	NEW
GC/MS – "G" Concentrator	Tekmar	LSC3000	98175006	1992	NEW
GC/MS – "G" Autosampler	Varian	Archon	13540	2001	NEW
GC/MS – "F"	Hewlett Packard	5973	DE00020247	1998	NEW
GC/MS – "F" GC System	Hewlett Packard	6890	US80221392	1998	NEW
GC/MS – "F" Concentrator	IO	Eclipse 4660	D530466888P	2002	NEW
GC/MS – "F" Autosampler	Varian	Archon	14613	2001	NEW
GC/MS – "L"	Hewlett Packard	5973	CN10339019	2004	NEW
GC/MS – "L" Concentrator	Teledyne Tekmar	Velocity XPT	US03346007	2004	NEW
GC/MS – "L" Autosampler	Teledyne Tekmar	SOLATek 72	US03349002	2004	NEW
GC/MS – "M"	Hewlett Packard	5973	CN10412013	2004	NEW
GC/MS – "M" Concentrator	Teledyne Tekmar	Velocity XPT	US0412001	2004	NEW
GC/MS – "M" Autosampler	Teledyne Tekmar	SOLATek 72	US04119003	2004	NEW
GC/MS – "N"	Hewlett Packard	5973	CN10512032	2005	NEW
GC/MS – "N" GC System	Hewlett Packard	6890	US44621325	2005	NEW
GC/MS – "N" Concentrator	IO	Eclipse 4660	C452466563P	2005	NEW
GC/MS – "N" Autosampler	Varian	Archon	14376	2005	NEW
GC/MS – "K	Hewlett Packard	5973	US81221525	1998	NEW
GC/MS – "K" GC System	Hewlett Packard	6890	US00022347	1998	NEW
GC/MS – "K" Series Injector	Hewlett Packard	7683	CN31530345	1998	NEW
GC/MS – "K" Autosampler	Hewlett Packard	G2614A	US83501656	1998	NEW
GC/MS – "J"	Hewlett Packard	5973	US80321385	1998	NEW
GC/MS – "J" GC System	Hewlett Packard	6890	US00021127	1998	NEW

Instrument Type	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
GC/MS – "J" Series Injector	Hewlett Packard	7683	US81801195	1998	NEW
GC/MS – "J" Autosampler	Hewlett Packard	G2614A	US80600251	1998	NEW
GC/MS – "I"	Hewlett Packard	5973	CN10514049	2005	NEW
GC/MS – "I" GC System	Hewlett Packard	G2579A	US44621455	2005	NEW
GC/MS – "I" Series Injector	Hewlett Packard	7683	CN51224243	2005	NEW
GC/MS – "I" Autosampler	Hewlett Packard	G2614A	CN42229061	2005	NEW
GC/MS – "X"	Agilent	6890/5973	US10461280	2007	Used
LC/MS/MS – "R" Mass Spectrometer	Waters	Quattro Premier XE	VAB461	2006	NEW
LC/MS?MS – "S"	Waters	Acuity Ultima	VB 380	2007	Used
LC/MS/MS – "R" Liquid Chromatograph	Waters	Acquity PDA Detector	L05UPD807N	2006	NEW
LC/MS/MS – "R" Liquid Chromatograph	Waters	Acquity Sample Manager	60UPS056M	2006	NEW
LC/MS/MS – "R" Liquid Chromatograph	Waters	Acquity Binary Solvent Man.	C06UPB008M	2006	NEW
GC – "L"	Hewlett Packard	5890	2413A04451	1987	NEW
GC – "L" Autosampler	Varian	Archon	160098	2000	NEW
GC – "L" Concentrator	Tekmar	LSC3000	93300001	1997	NEW
GC – "A"	Hewlett Packard	5890	2843A19513	1987	NEW
GC – "A" Autosampler	Hewlett Packard	7673A	2718A09724	1987	NEW
GC – "F"	Hewlett Packard	5890	2623A08611	1998	NEW
GC – "F" Autosampler	Hewlett Packard	7673A	2718A07794	1998	NEW
GC – "K"	Agilent	6890	US00039258	2000	NEW
GC – "K" Autosampler	Agilent	7683	US04709936	2000	NEW
GC – "E"	Hewlett Packard	6890	US00011425	2000	NEW
GC – "E" Autosampler	Hewlett Packard	6890	US71701354	2000	NEW
GC – "M"	Agilent	6890	US10328036	2003	NEW
GC – "M" Autosampler	Agilent	7683	CN32624339	2003	NEW
GC – "O"	Agilent	6890	CN10422045	2004	NEW
GC – "O" Autosampler	Agilent	7683	CN51132513	2004	NEW
GC – "P"	Agilent	6890N	CN10510018	2005	NEW
GC – "P" Autosampler	Agilent	7683	CN51532846	2005	NEW
HPLC – "N"	Hewlett Packard	G1329A	DE91603153	1999	NEW
HPLC – "N" ALS Therm	Hewlett Packard	G1330A	DE82203165	1999	NEW

Instrument Type	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
HPLC – "N" COLCOM	Hewlett Packard	G1316A	DE91609858	1999	NEW
HPLC – "N" DAD	Hewlett Packard	G1315A	DE91605478	1999	NEW
HPLC – "N" Degasser	Hewlett Packard	G1322A	JP73016399	1999	NEW
HPLC – "N" Quat Pump	Hewlett Packard	G1311A	DE91605960	1999	NEW
HPLC – "N" FLD	Hewlett Packard	G1321A	DE92001122	1999	NEW
HPLC – "Q"	Hewlett Packard	G1329A	DE14907901	1999	NEW
HPLC – "Q" ALS Therm	Hewlett Packard	G1330A	DE13201124	1999	NEW
HPLC – "Q" COLCOM	Hewlett Packard	G1316A	DE14924682	1999	NEW
HPLC – "Q" DAD	Hewlett Packard	G1315A	DE11113468	1999	NEW
HPLC – "Q" Degasser	Hewlett Packard	G1322A	JP05031929	1999	NEW
HPLC – "Q" Quat Pump	Hewlett Packard	G1311A	DE14916965	1999	NEW
HPLC – "Q" FLD	Hewlett Packard	G1321A	DE92001122	1999	NEW
ICP-MS – "6100"	Perkin Elmer	ELAN 6100	0859907	1999	NEW
ICP-MS – "6100" Autosampler	Perkin Elmer	AS-91	4123	1999	NEW
ICP – "61E"	Thermo Jarrell Ash	61E	30083	1987	NEW
ICP – "61T"	Thermo Jarrell Ash	61E trace	247390	1994	NEW
CVAA	Leeman Labs	Hydra AA	204112000641	2002	NEW
IC	Dionex	DX-500	99060648	2000	NEW
IC	Dionex	ICS 2500	03120540	2004	NEW
TOC	Shimadzu	TOC-5050A	36501107	1999	NEW
TOX	Mitsubishi	100 TOX	A7M00017	1999	NEW
UV Spec	Thermospectronic	Genysis	3SGF211001	2003	NEW
TRAACS – "1"	Technicon	Traacs 800	0103011	1988	NEW
TRAACS – "2"	Technicon	Traacs 800	054186	1988	NEW
BOD	Man-Tech Associates	04-227	270D3XB245	2003	NEW
Ignitability Apparatus – Open Cup	Fisher	D-92	906N0014	1998	NEW
Ignitability Apparatus – Closed Cup	Fisher	162	1149	1992	NEW
Alpha Spectrometer – "AV1 - AV72"	EG& G / Ortec	Multi-Component	Multiple*	1987-2004	NEW
Gamma Spectrometer Intrinsic Germanium Detector "GE1-GE8"	Tennelec / Ortec	Multi-Component	Multiple*	1991-2003	NEW
GFPC – "Blue"	Tennelec	LB4100	19852	1994	NEW
GFPC – "Red"	Tennelec	LB4100	24645	1993	NEW

Instrument Type	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
GFPC – "Protean"	Protean	MPC-9604	233126-BO 236534-BO 236532-BO 236533-BO	2003	NEW
GFPC	Tennelec	LB5100	31360	2000	NEW
LSC – "2200"	Packard	Tricarb 2200	86596	1985	NEW
LSC – "2550"	Packard	Tricarb 2550	400749	2000	NEW
LSC – "3170"	Packard	Tricarb 3170	429670	2002	NEW
KPA	Chemchek	Multi-Component	93-45050051	2000	NEW

Table 21-2.

Schedule of Routine Maintenance

Inductively Coupled Plasma

DAILY OR AS NEEDED - CHECK
- Sample pump tubing/windings
- Gas supply
- Waste and rinse solution levels
- Sample capillary tubing
- Droplet size (nebulizer)
- Check nebulizer pressure
- Vacuum system pressure
- Replace orange/orange tubing

WEEKLY
- Check water level in coolflow
- HF nebulizer rinse
- Replace red/red tubing
- Clean injector tip

MONTHLY
- Clean air filter of power unit
- Clean plasma torch assembly

YEARLY
- Check vacuum system oil
- Replace coolant water filter

Inductively Coupled Plasma/Mass Spectrometer

DAILY OR AS NEEDED
- Waste and rinse water container levels
- Roughing pump oil level and color
- Torch and injector
- Replace sample, internal and waste lines

WEEKLY
- Clean interface cones

MONTHLY
- Change pump oil
- Clean autolens

Cold Vapor Automatic Analysis

DAILY OR AS NEEDED
- Pump and drain tubing
- Gas pressure

- Instrument parameter check

MONTHLY
- Change sample, reductant and draining tubings

QUARTERLY
- Change drying tube

TOX

DAILY OR AS NEEDED
- Cell Performance Test
- Electrodes
- Cell Fluid, Dehydrating Fluid and Electrolyte
- Absorption module (cleaned at end of use)

Autoanalyzer Traacs- 1 & 2

DAILY OR AS NEEDED
- Air Pressure gauge
- Washout procedure (at end)

MONTHLY
- Change tubing

TOC

DAILY OR AS NEEDED
- Air Supply and Gas Flow Rate (150mm)
- Humidifier
- A/LS Rinse Tank
- H3PO4 in GLS

MONTHLY
- Rinse all lines and glassware

QUARTERLY
- Change halogen scrubber
- Change CO2 absorber

Ion Chromatography

DAILY OR AS NEEDED
- Plumbing for leaks
- Gases and Pump Pressure
- Conductivity meter
- Fill regenerant
- Record eluant and lifetime (in %)

QUARTERLY
- Change Column, Column guard and suppressor

KPA

DAILY OR AS NEEDED
- Rinse out Sample Cuvettes (after each use)

YEARLY
- Drain, rinse and refill Stilbene-90/Methanol Dye Cell
- Replace tubing line
- Oil Actuator arm sliding bars

UV Spec

DAILY OR AS NEEDED
- Rinse out Sample Cuvettes (after each use)

BOD

DAILY OR AS NEEDED
- Rinse and Dilution Water and Seed is full
- Daily Air Calibration
- Rinse and empty lines (when finished)
- Store probe in fresh water (¾ full)

WEEKLY
- Calibrate probe (Winkler test)
- Change membrane every Monday

MONTHLY
- Change probe membrane

Alpha Spectrometer

MONTHLY
- Backgrounds
- Calibrations
- Clean detectors

Gamma Spectrometer

DAILY OR AS NEEDED
- Delete log and list files (DLLF)
- Full Image Backup (FIB)

MONTHLY
- Clean Backgrounds
- Clean Cave

YEARLY
- Energy calibrations
- Efficiency calibrations

Gas Flow Proportional Counting

DAILY OR AS NEEDED
- Gas Flow

MONTHLY
- Long Backgrounds

YEARLY
- Calibrations

Liquid Scintillation Counter

WEEKLY
- Clean Fan

YEARLY
- Serviced by Packard

Semi-volatile Gas Chomatography / Mass Spectrometer

DAILY OR AS NEEDED
- Gas supply, column flow and inlet pressure
- Fill solvent rinse vials

WEEKLY
- Injection Port Cleaning
- Change Septum, injection port liner, and seals

MONTHLY
- Trim Column

SEMI-ANNUALLY
- Replace Column
- Clean Source

YEARLY
- Replace pump oil

Volatile Gas Chomatography / Mass Spectrometer

DAILY OR AS NEEDED
- Gas supply, column flow and inlet pressure

QUARTERLY
- Trim Column
- Change Trap

SEMI-ANNUALLY
- Replace Column

- Clean Source
- Injection port maintenance

YEARLY
- Replace pump oil

High Pressure Liquid Chromatograph (HPLC)

DAILY OR AS NEEDED
- Ensure column flow and pressure are correct
- Ensure HPLC solvents are sufficient to run
- Ensure proper DAD signals are on
- Visibly check for leaks

MONTHLY
- Change Purge Valve Frit

SEMIANNUALLY
- Change Guard Cartridge and Frit Cap

BIANNUALLY
- Replace Column
- Replace UV Source
- Replace Visible Source
- Replace Pump Seals

Semi-Volatile Gas Chromatograph (Dual ECD)

DAILY OR AS NEEDED
- Ensure column flow and inlet pressure are correct
- Ensure temperature for oven, inlet(s), and detector(s) are correct
- Ensure solvent rinse vials are full
- Ensure injection syringe is secure in tower and plunger is engaged

MONTHLY
- Replace injection port septum
- Visibly inspect injection port liner; replace if contaminated
- Remove injection syringe and ensure plunger is free moving
- Check system for leaks (injection port, detector(s) and any column connectors)

SEMIANNUALLY
- Perform Radioactive leak test

Semi-Volatile Gas Chromatograph (FID)

DAILY OR AS NEEDED
- Ensure column flow and inlet pressure are correct
- Ensure solvent rinse vials are full

MONTHLY
- Replace injection port septum

- Trim Guard Column

SEMIANNUALLY
- Replace Column

Volatile Gas Chromatograph

DAILY OR AS NEEDED
- Ensure column flow and inlet pressure are correct

MONTHLY
- Change trap
- Trim Guard Column

SEMIANNUALLY
- Replace Column
- Injection port maintenance

ANNUALLY
- Clean PID

Liquid Chromatograph Mass Spectrometer Mass Spectrometer (LCMSMS)

DAILY OR AS NEEDED
- Check level of solution in reservoirs
- Check gas supply, column flow and system pressure
- Bubble removal with solvent flush
- Sonicate inlet filters
- Sonicate inlet check values
- Replace PDA lamp
- Clean ionization probes / corona pin
- Ballast Rough Pump

SEMIANNUALLY
- Replace Column
- Clean source
- Injector maintenance

ANNUALLY
- Replace pump oil
- UPLC Pump Preventative Maintenance

Table 21-3.

Example: Periodic Calibration

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using A2LA-accredited NIST weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually. A second annual inspection and calibration by same firm.	Daily	± 0.1%	Clean, check level, insure lack of drafts, and that unit is warmed up, recheck. If fails, call service.
Top Loading Balance	Accuracy determined using A2LA-accredited NIST weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually. A second annual inspection and calibration by same firm.	Daily	± 1.0%	Clean. Replace.
A2LA-accredited NIST Weights	Accuracy determined by accredited weights and measurement laboratory.	1 year	As per certificate.	Replace.
NIST-Traceable Thermometer	Accuracy determined by A2LA-accredited weights and measurement laboratory.	5 years	As per certificate.	Replace.
Thermometer	Against NIST-traceable thermometer	Yearly at appropriate temperature range for intended use	± 1.0°C	Replace

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Minimum-Maximum Thermometers	Against NIST-traceable thermometer	Yearly	± 1.0°C	Replace
Refrigerator	Temperature checked using NIST-traceable thermometer.	Daily. If out of range, check again in two hours.	4 ± 2°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Freezer	Temperature checked using NIST-traceable thermometer	Daily. If out of range, check again in two hours.	(-10)-(-20)°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Oven	Temperature checked using NIST-traceable thermometer.	When in use.	104 ± 1°C (drying) 180 ± 2°C (TDS)	Adjust. Replace.
Incubator	Temperature checked using NIST-traceable thermometer.	When in use. For microbi-ology, twice daily when in use.	BOD: 20 ± 1.0°C	Adjust. Replace.
Water Bath	Temperature checked using NIST-traceable thermometer.	When in use.	± 2°C	Adjust. Replace.
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic dilutor or dispensing devices)	One delivery by weight. Using DI water, dispense into tared vessel. Record weight with device ID number.	Monthly	± 1% Calculate accuracy by dividing weight by stated volume times 100 for percent.	Adjust. Replace.
Glass Microliter Syringes	None	Accuracy must be initially de-monstrated if syringe was not received with a certificate attesting to established accuracy.	± 1%	Not applicable.

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Conductivity Meter	Cell impedance calibrated with three KCl standards.	Each use.	$r \geq 0.99$	Recalibrate.
Deionized Water	Check in-line conductivity meter on system with conductivity meter in Inorganics Department.	Daily	<10 µmhos/cm^2	Record on log. Report discrepancies to QA Director.

Table 21-4 Radiochemistry Calibration, Verification & Background Criteria

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria
Gamma Spectroscopy	Initial Calibration	Energy calibrations shall be established for the germanium spectroscopy systems **annually**, or when the calibration quality control check indicates an unacceptable change in the energy calibration parameters.	The curve should have eight calibration points used to determine the energy relationship of the calibration. The calibration source must have radionuclides that "blanket" the intended range of calibration. The energy difference should be less than 0.1 for all points. Computed efficiency test for all points should have a percent difference less than 5%. The FWHM must be less than 3.0 keV at 1332 keV. FWHM difference should be less than 0.500 for all points.
Gamma Spectroscopy	Initial Background	Background subtraction spectrum shall be established for the germanium spectroscopy systems **monthly**, or when the background quality control check indicates an unacceptable change in the daily background parameters, or as needed per client requirements.	Background count time is 12 hours.
Gamma Spectroscopy	Continuing	Daily Checks The energy, resolution and efficiency calibrations for a detector shall be checked with its respective source each day that the germanium spectroscopy system is used. The detector background shall be checked each day that the germanium spectroscopy system is used.	Calibration (efficiency, resolution, energy alignment, and background) quality control parameters will be found **not acceptable** if the result is outside the established limits (2 to range) and marked as "action". The Daily QC check may only be recounted once without corrective action.
Alpha Spectroscopy	Initial Calibration	Energy calibrations shall be established for the alpha spectroscopy systems **monthly**, or when the calibration quality control check indicates an unacceptable change in the energy calibration parameters. Efficiency calibrations shall be established for the alpha spectroscopy systems **monthly**, or when the calibration quality control check indicates an unacceptable change in the efficiency calibration parameters.	Energy Calibrations shall be performed using at least three isotopes within the energy range of 3-6 meV. Final peak energy positions of all observed isotopes shall be within +/- 40 leV of expected energy.

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria
Alpha Spectroscopy	Initial Background	Background subtraction spectrum shall be established for the alpha spectroscopy systems **monthly**, or when the background quality control check indicates an unacceptable change in the daily background parameters.	Background count time is 960 minutes.
Alpha Spectroscopy	Continuing	Daily Checks Routine pulser quality control verifications are to performed each day of use. The pulser energy, peak centroid, peak resolution, peak area quality control for a detector shall be checked each day that the alpha spectroscopy system is used.	Routine calibration, background and pulser quality control parameters using the "Boundary" out-of-range test will be found unacceptable if the value is outside reasonable parameter tolerance. The routine quality control check should be rerun to determine the statistical significance of the errant parameter.
Gas Flow Proportional Counter	Initial Calibration	Mass attenuation alpha/beta curves should be performed on an **annual** basis, or when the calibration quality control check indicates an unacceptable change in the efficiency calibration parameters.	The efficiency calibration shall consist of at least seven single or dual sets of mass attenuated calibration standards. The standards shall have enough activity to generate at least 10000 counts in 90 minutes of count time for the most highly attenuated source. The count rate shall not exceed 5000 counts per second. The coefficient of determination (r^2) shall be greater than or equal to 0.9.
Gas Flow Proportional Counter	Initial Background	Background established for the GFPC **monthly**, or when the background quality control check indicates an unacceptable change in the daily background parameters.	Backgrounds are counted for 1000 minutes Alpha < 0.2 counts per minute Beta < 2.0 counts per minute
Gas Flow Proportional Counter	Continuing	Daily Checks Efficiency check and background check	

SECTION 22

MEASUREMENT TRACEABILITY
(NELAC 5.5.6)

22.1 OVERVIEW

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. With the exception of Class A Glassware (including glass microliter syringes that have a certificate of accuracy), quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. The following definitions are provided by the American Association for Laboratory Accreditation (A2LA):

"Traceability is the property of a measurement result whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons, each step in the chain having stated uncertainties." There are six essential elements:

- An unbroken chain of comparison
- A calculated measurement uncertainty for each step in the chain to allow for an overall uncertainty calculation
- Documentation of each step in each calibration report
- All steps in the chain are performed by individuals with evidence of technical competence and accredited by a recognized accreditation body
- Reference to International Standard (SI) units
- Recalibration at appropriate intervals to preserve traceability

Calibration is defined as "determining and documenting the deviation of the indication of a measuring instrument (or the stated value of a material measure) from the conventional 'true' value of the measurand."

Uncertainty is defined as "a parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measurand." Measurement of Uncertainty is discussed is Section 20 of this QA Manual.

22.2 NIST-TRACEABLE WEIGHTS AND THERMOMETERS

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), APLAC (Asia-Pacific Laboratory Accreditation Cooperation), or EA (European Cooperation for Accreditation). A certificate and scope of accreditation is kept on file at the laboratory. Refer to Section 21 for calibration of weights and thermometers.

The calibration report or certificate submitted to TestAmerica St. Louis contains, in a well designed format, a traceability statement, the conditions under which the calibrations were made in the context of any potential influence, a compliance statement with an identified metrological specification and the pertinent clauses, a clearly identified record of the quantities and functional test results before and after re-calibration, and no recommendation on the calibration interval. All calibration reports are filed in the QA Office.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

22.3 REFERENCE STANDARDS / MATERIALS

Reference standards/materials, where commercially available, are traceable to certified reference materials and have a Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. (Refer to Section 9 for additional information on purchasing). The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard's Log generated Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number. Reference standards that are used in a radiochemical laboratory shall be obtained from NIST, or suppliers who participate in supplying NIST standards or NIST traceable radionuclides. When a traceable standard is not available written approval for its use must be obtained from DOE clients.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. Radiochemical Standards must be verified prior to initial use. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the

second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to analytical method SOPs "Standards and Reagents" section for additional details. Radiochemical Standards and reference material are stored separately from samples and are protected in a controlled cabinet or refrigerator. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

22.4 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. Purchased stock mixtures and reagents are labeled to indicate the date they are opened. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. Refer to SOP No. CA-Q-S-001, Solvent and Acid Lot Testing and Approval.

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained in a directory on the laboratory's network drive. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to method specific SOPs and STL-QA-0002, "Standards and Reagent Preparation".

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial.

22.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's Standards Log Program database, and are assigned a unique identification number. The following information is typically recorded in the electronic database

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date

- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

22.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date
- Standard ID assigned by the Standards Log Program
- Special Health/Safety warnings if applicable

22.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable) required by DOE
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include a preparation date, expiration date and an ID number to trace back to preparation. The expiration date of a secondary standard can not exceed the expiration date of the primary standard.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and raw data.

All reagents and standards must be stored in accordance to the following priority: 1)with the manufacturer's recommendations; 2) with requirements in the specific analytical methods; and 3) according to the Standards and reagents section of the analytical SOPs.

SECTION 23.0

SAMPLING
(NELAC 5.5.7)

23.1 OVERVIEW

TestAmerica St. Louis does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory

23.2 SAMPLING CONTAINERS

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Any certificates of cleanliness that are provided by the supplier are maintained at the laboratory.

23.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

23.2.2 Preparing Container Orders

When new containers arrive at the laboratory, the date of receipt is recorded on the packing list received with them for retained documentation. Upon request, the containers are then sent to clients for use in collecting samples. The shipping date, type and number of containers are maintained on file by the lab. Shipping personnel insure that container stock is rotated so that "first in" is "first out." When a client requests containers, a Project Manager creates a "Bottle Order" request. Copies of this request are printed or e-mailed to the Sample Control department. One copy goes to the client with the containers; one copy is filed in the Sample Control. See SOP STL-PM-0003, "Bottle Kit Preparation".

The laboratory also provides EnCore, TerraCore or other soil sampling devices when requested.

If containers are provided directly to the client from the manufacturer or from other sources, the laboratory will not be responsible for any of the above records.

23.3 FIELD QUALITY CONTROL (QC)

Common field quality control samples are defined in the following paragraphs. The frequency of field quality control samples should be specified in the site specific Quality Assurance Project Plan (QAPP) or by the client. TestAmerica provides trip blanks for VOC analysis with the sample containers for all volatile organic analyses. Blanks generated in the field will be analyzed along with the field samples (exception soil samples where the blank is aqueous).

23.3.1 Equipment Blank / Rinsate Blank - The equipment blank, sometimes referred to as a rinsate blank, is a sample of the water used to decontaminate sampling equipment. The source water should be as free of target analytes as possible. An aliquot of this water is poured over or through the sample collection device after decontamination, collected in a sample container, preserved with appropriate reagents, and returned to the laboratory. This serves as a check on sampling device cleanliness, and will also be affected by the site and sample handling conditions evaluated by the other types of blanks. The sampling time for the equipment blank should begin when the equipment is rinsed and the water is collected.

23.3.2 Field Blank - The field blank is water that is as free of target analytes as possible and from the same source as the equipment blank. The water is poured into a sampling container at the sampling site, preserved with the appropriate reagents, and returned to the laboratory. This serves as a check on reagent and environmental contamination. The sampling time for the field blank should be when the blank is prepared in the field.

23.3.3 Trip Blank - The trip blank pertains to volatile analysis only. This serves as a check on sample contamination originating from sample transport, sample container contamination, shipping and storage, or from certain site conditions. Trip blanks are often referred to as travel blanks. They are prepared using pre-cleaned sample containers. They are filled with organic-free water (the source of the organic free water is the same source of water used to prepare volatile standards, method blanks, LCS and sample dilutions), sealed and taken into the field with the empty containers which will be used for sampling. The recommended frequency is one trip blank per cooler (in duplicate or triplicate), per volatiles method. Unless otherwise specified, the sampling time for the trip blank is the time of receipt at the laboratory (When the “Trip” ends).

23.3.4 Field Duplicates - Field duplicates are replicate samples collected from the same sampling point or location during a field collection event. This control sample is used to demonstrate the ability of both the sampling and analytical process to generate data of acceptable precision.

23.4 DEFINITION OF HOLDING TIME

The date and time of sampling documented on the chain-of-custody (COC) form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in “days” (e.g 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in “hours” (e.g. 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis

include any necessary reanalysis. However there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

23.4.1 Semi-Volatile - Holding times for sample preparation for semi-volatile organics are measured from the sampling date until the day solvent contacts the sample. Holding times for analysis are measured from the date of initiation of extraction to the time of injection into the gas chromatograph.

23.4.2 Volatiles - Holding times for volatile organics are measured from the date (and time where applicable) of sampling to the date and time of injection into the gas chromatograph.

23.4.3 Inorganics - For inorganic and metals analysis, the preparation/digestion/distillation must be started within the maximum holding time as measured from the sampling date (and time where applicable).

23.4.4 Radiochemistry - For radiochemical analysis, the preparation/digestion/distillation/ separation must be started within the maximum holding time as measured from the sampling date (and time where applicable).

23.5 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria specified in the following tables are derived from the source documents for the methods. If method required holding times (refer to Table 23-1) or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

23.6 SAMPLE ALIQUOTS / SUBSAMPLING

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis. In that regard the following guidelines apply to analysts:

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

See SOP STL-QA- 0038, "Procedure for Compositing and Subsampling".

Table 23-1 details holding times, preservation and container requirements, and sample volumes for the methods run at the TestAmerica St. Louis laboratory. The sample volumes are intended to be a minimal amount to perform the method, the containers that are used may be of larger size. ***Please note****: the holding times are program specific and different programs may have different holding times for equivalent methods (e.g., there are difference in Holding times for many Organic analytes between SDWA and NPDES. RCRA methods may also be different.)*

Table 23-1.

Hold Times, Preservation & Container Requirements

Analysis	Method	Matrix	Volume	Preservative	Hold Time	QC (Default)
Wet Chemistry						
Alkalinity: Total, Carbonate, Bicarbonate	310.1	Water	100 mL P,G	Cool, 4 deg. C	28 days	MS/Dup
		Soil	20 g P,G	Cool, 4 deg. C	14 days	MS/Dup
Ammonia	350.1	Water	20 mL P,G	H2SO4 (pH <2), Cool	28 days	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	28 days	MS/Dup
BOD	405.1	Water	1 L P,G	Cool, 4 deg. C	48 hrs	MS/Dup
Bromide	300.0, 9056A	Water	50 mL P,G	Cool, 4 deg. C	28 days	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	28 days	MS/Dup
CBOD	5210B	Water	1 L P,G	Cool, 4 deg. C	48 hrs	Duplicate
Chloride	300.0, 9056A	Water	50 mL P,G	Cool, 4 deg. C	28 days	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	28 days	MS/Dup
Cyanide	9010A, 9012, 335.2	Water	50 mL P,G	NaOH (pH >12), Cool	14 days	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	14 days	MS/Dup
COD	410.4	Water	50 mL P,G	H2SO4 (pH, 2), Cool	28 days	MS/Dup
Conductivity	120.1, 9050	Water	50 mL P,G	Cool, 4 deg. C	28 days	MS/Dup
		Soil	20 g P,G	Cool, 4 deg. C	28 days	MS/Dup

Ferrous Iron	SM 3500D	Water	100 mL P,G	Cool, 4 deg. C	24 hrs	MS/Dup
		Soil	10 g P,G	Cool, 4 deg. C	24 hrs	MS/Dup
Fluoride	300.0, 9056A (IC)	Water	50 mL P,G	Cool, 4 deg. C	28 days	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	28 days	MS/Dup
	340.2 (probe)	Water	50 mL	Cool, 4 deg. C	28 days	MS/Dup
Flashpoint (Ignitablity)	1010	Water	100 mL P,G	Cool, 4 deg. C	180 days	Duplicate
		Soil	100 g P,G	Cool, 4 deg. C	180 days	Duplicate
Hardness	130.2	Water	100mL	HNO3 (pH <2)	180 days	MS/Dup
Hexavalent Chromium	7196A	Water	50 mL P,G	Cool, 4 deg. C	24 hrs	MS/Dup
		Soil	20 g P,G	Cool, 4 deg. C	30 days	MS/Dup
Iodide	300.0	Water	50 mL	Cool, 4 deg. C	7 days	MS/Dup
Nitrate	300.0, 353.1, 9056A	Water	50 mL P,G	Cool, 4 deg. C	48 hrs	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	48 hrs	MS/Dup
Nitrate/Nitrite	353.1	Water	50 mL P,G	H2SO4 (pH <2), Cool	28 days	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	28 days	MS/Dup
Nitrite	300.0, 353.1, 9056A	Water	50 mL P,G	Cool, 4 deg. C	48 hrs	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	48 hrs	MS/Dup
Oil & Grease	9070, 413.1, 1664	Water	1000 mL G	HCl (pH <2), Cool	28 days	MS/Dup

	9071	Soil	50 g G	Cool, 4 deg. C	28 days	MS/Dup
Orthophosphate	300.0, 365.1, 9056A	Water	50 mL P,G	Cool, 4 deg. C	48 hrs	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	48 hrs	MS/Dup
Paint Filter	9095	Soil	100 g P,G	Cool, 4 deg. C	28 days	Duplicate
Perchlorate	314	Water	50 mL P,G	Cool, 4 deg. C	28 days	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	28 days	MS/Dup
pH	9040, 150.1	Water	50 mL P,G	Cool, 4 deg. C	48 hrs	Duplicate
	9045	Soil	20 g P,G	Cool, 4 deg. C	None	Duplicate
Phenols	9066, 420.2	Water	50 mL P,G	H2SO4 (pH <2), Cool	28 days	MS/Dup
		Soil	5 g G	Cool, 4 deg. C	28 days	MS/Dup
Phosphorus	365.1	Water	50 mL P,G	H2SO4 (pH <2), Cool	28 days	MS/Dup
		Soil	10 g P,G	Cool, 4 deg. C	28 days	MS/Dup
Reactive Cyanide	SW846 Chapter 7	Water	50 mL P,G	NaOH (pH >12), Cool	14 days	MS/Dup
		Soil	10 g P,G	Cool, 4 deg. C	None	MS/Dup
Reactive Sulfide	SW846 Chapter 7	Water	50 mL P,G	NaOH,Zn Ac. (pH >9), Cool	7 days	MS/Dup
		Soil	10 g P,G	Cool, 4 deg. C	None	MS/Dup
Residual Chlorine	330.3	Water	200 mL P,G	Light Resistant Container	24 hrs	MS/Dup

Settleable Solids	160.4	Water	1000 mL P,G	Cool, 4 deg. C	48 hrs	Duplicate
Sulfate	300.0, 9056A	Water	50 mL P,G	Cool, 4 deg. C	28 days	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	28 days	MS/Dup
Sulfide	9030, 376.1	Water	200 mL P,G	NaOH,Zn Ac. (pH >9), Cool	7 days	MS/Dup
	9030, 376.1	Soil	25 g P,G	Cool, 4 deg. C	7 days	MS/Dup
Sulfite	377.1	Water	50 mL P,G	Cool, 4 deg. C	24 hrs	MS/Dup
		Soil	25 g P,G	Cool, 4 deg. C	24 hrs	MS/Dup
Surfactants	425.1	Water	1000 mL P,G	Cool, 4 deg. C	48 hrs	MS/Dup
TDS	160.1	Water	100 mL P,G	Cool, 4 deg. C	7 days	Duplicate
TOC	415.1, 9060	Water	100 mL P,G	H2SO4 (pH <2), Cool	28 days	MS/Dup
		Soil	5 g P,G	Cool, 4 deg. C	28 days	MS/Dup
TKN	351.1	Water	20 mL P,G	H2SO4 (pH <2), Cool	28 days	MS/Dup
		Soil	0.1 g P,G	Cool, 4 deg. C	28 days	MS/Dup
Total Solids	160.3	Water	100 mL P,G	Cool, 4 deg. C	7 days	MS/Dup
TOX (EOX)	450.1, 9020	Water	500 mL AG	H2SO4 (pH <2), Cool	28 days	MS/Dup
		Soil	1 g G	Cool, 4 deg. C	28 days	MS/Dup
TSS	160.2	Water	100 mL P,G	Cool, 4 deg. C	7 days	Duplicate
Turbidity	180.1	Water		Cool, 4 deg. C	48 hrs	MS/Dup

			100 mL P,G			

Microbial

Fecal Coliform		Water	200 mL G	Sterile container Sodium thiosulfate tablet Cool, 4 deg. C	24 hrs	Duplicate
E-Coli		Water	200 mL G	Sterile container, Sodium thiosulfate tablet Cool, 4 deg. C	24 hrs	Duplicate
Chlorophyll A		Water	500 mL G	Light resistant container (e.g. amber glass) Cool, 4 deg. C	24 hrs	Duplicate

VOA Organics

BTEX	8020/8021, 8260, OA-1	Water	2 X 40mL G	HCl (pH<2), Cool, 4 deg. C	14 days	MS/MSD
		Soil	5g AG	Cool, 4 deg. C	14 days	MS/MSD
TCLP ZHE Volatiles	1311/ 8260	Solid	2 X 120mL AG	Cool, 4 deg. C	14 days	MS/MSD
TPH, Gasoline	8015, OA-1	Water	2 X 40 mL G	HCl (pH <2), Cool, 4 deg. C	14 days	MS/MSD
		Soil	5g AG	Cool, 4 deg. C	14 days	MS/MSD
Volatiles	624, 8260 (5mL purge)	Water	2 X 40 mL G	HCl (pH <2), Cool, 4 deg.C	14 days/ 7 days, if not preserved w/ HCl	MS/MSD
	524.2, 624, 8260 (25mL purge)	Water	2 X 40 mL G	HCl (pH <2), Cool, 4 deg.C	14 days/ 7 days, if not preserved w/ HCl	MS/MSD
	8260 (5030)	Soil	5g AG	Cool, 4 deg. C	14 days	MS/MSD
	8260 (5035)	Soil	Encore Sampler x 2	Cool, 4 deg. C	14 days/ 48 hrs (if not rec'd in	MS/MSD

					Sodium Bisulfate preservative)	
Extractable Organics						
Dioxin	8280, 8290, 613	Water	1 L AG	Cool, 4 deg. C	30 days	MS/MSD
		Soil	30 g G	Cool, 4 deg. C	30 days	MS/MSD
Explosives	8330	Water	1 L AG	Cool, 4 deg. C	7 days	MS/MSD
		Soil	30 g G	Cool, 4 deg. C	14 days	MS/MSD
PAHs	8310	Water	1 L AG	Cool, 4 deg. C	7 days	MS/MSD
		Soil	30 g G	Cool, 4 deg. C	14 days	MS/MSD
Herbicides	8151	Water	1 L AG	Cool, 4 deg. C	7 days	MS/MSD
		Soil	50 g G	Cool, 4 deg. C	14 days	MS/MSD
Pesticides	608, 8081	Water	1 L AG	Cool, 4 deg. C	7 days	MS/MSD
	8081	Soil	30 g G	Cool, 4 deg. C	14 days	MS/MSD
PCBs	608, 8082	Water	1 L AG	Cool, 4 deg. C	7 days	MS/MSD
	8082	Soil	30 g G	Cool, 4 deg. C	14 days	MS/MSD
Phenol	8040	Water	1 L AG	Cool, 4 deg. C	7 days	MS/MSD
		Soil	30 g G	Cool, 4 deg. C	14 days	MS/MSD
Semivolatiles	625, 8270	Water	1 L AG	Cool, 4 deg. C	7 days	MS/MSD
	8270	Soil	30 g	Cool, 4 deg. C	14 days	MS/MSD

			G			
TCLP Herbicide	1311/ 8151	Solid	100 g G	Cool, 4 deg. C	14 days	MS/MSD
TCLP Pesticide	1311/ 8081	Solid	100 g G	Cool, 4 deg. C	14 days	MS/MSD
TCLP Semivolatile	1311/ 8270	Solid	100 g G	Cool, 4 deg. C	14 days	MS/MSD
TPH, Diesel	8015, OA-2	Water	1 L AG	HCl (pH <2), Cool, 4 deg. C	7 days	MS/MSD
		Soil	30 g G	Cool, 4 deg. C	14 days	MS/MSD

Metals

Mercury	7470	Water	30ml P,G	HNO3 (pH <2)	28 days	MS/MSD
	7471	Soil	0.6 g G	Cool, 4 deg. C	28 days	MS/MSD
Metals	200.7, 200.8, 6010, 6020	Water	50mL P,G	HNO3 (pH <2)	180 days	MS/MSD
		Soil	0.5g G	Cool, 4 deg. C	180 days	MS/MSD
TCLP Metals	1311/ 6010, 7470	Solid	100 g G	Cool, 4 deg. C	28 days (mercury), 180 days	MS/MSD

TCLP

CWET, TTLC, and SPLP are the same containers and preservatives as TCLP.

TCLP ZHE Volatiles	1311/ 8260	Solid	2 X 120mL G	Cool, 4 deg. C	14 days
Full Extraction	1311	Solid	100 g G	Cool, 4 deg. C	14 days
TCLP ZHE Volatiles	1311/ 8260	Liquid	3 X 40 mL G	Cool, 4 deg. C	14 days
Full Extraction	1311	Liquid	2 L G	Cool, 4 deg. C	14 days

* Notes:

1. Clients are required to do the phase separation when a liquid sample is in multiple phases.

2. When a liquid sample has a % solid content of less than 25 % of the volume, more sample volume will be required to provide an adequate amount of solids for extraction.

3. For samples requiring Matrix QC, 3 times the volume is required.

Radiochemistry

Carbon-14 (C-14)	EERF C-01	Water	500 mL P,G	None	180 days	MS/Dup
		Soil	5 g P,G	None	180 days	MS/Dup
Chlorine-36 (Cl-36)		Soil	2g P	None	180 days	Duplicate
Gross Alpha/Beta	900.0, 9310	Water	200 mL P,G	HNO3 (pH <2)	180 days	MS/Dup
		Soil	1 g P,G	None	180 days	MS/Dup
Iodine-129	GA-01-R MOD	Water	1 L P,G	None	180 days	Duplicate
		Soil	650 g P,G	None	180 days	Duplicate
(Carrier anaylsis)	Liquid Scint	Water	2 L P,G	None	180 days	Duplicate
Iron-55		Water	500 ml	None	180 days	Duplicate
(Carrier anaylsis)		Soil	5 g	None	180 days	Duplicate
Gamma Scan	901, HASL 300	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
		Soil	650 g P,G	None	180 days	Duplicate
Americium 241/Curium 243 244	HASL 300 A-R-01	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Tracer analysis)		Soil	5 g P,G	None	180 days	Duplicate
Americium 243/Curium 245,246,247,248	HASL 300 A-R-01	Water	1 L	HNO3 (pH <2)	180 days	Duplicate

			P,G			
(Tracer analysis)		Soil	5 g P,G	None	180 days	Duplicate
Isotopic Plutonium	HASL 300 A-R-01	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Tracer analysis)		Soil	5 g P,G	None	180 days	Duplicate
Isotopic Thorium	HASL 300 A-R-01	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Tracer analysis)		Soil	5 g P,G	None	180 days	Duplicate
Isotopic Uranium	HASL 300 A-R-01, DOE U-02	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Tracer analysis)		Soil	5 g P,G	None	180 days	Duplicate
Lead 210	EERF PB-01	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Carrier anaylsis)		Soil	5 g P,G	None	180 days	Duplicate
Nickel-59/63		Soil	5 g P,G	None	180 days	Duplicate
(Carrier anaylsis)		Water	500 mL P,G	None	180 days	Duplicate
Polonium 210	HASL 300 PO-01	Water	500mL P,G	HNO3 (pH <2)	180 days	Duplicate
(Tracer analysis)		Soil	5 g P,G	None	180 days	Duplicate
Radium 226 and 228	903.0 / 904.0	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Carrier anaylsis)	HASL 300	Soil	5 g P,G	None	180 days	Duplicate
Radium 226	903.0	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Carrier anaylsis)	HASL 300	Soil	5 g	None	180 days	Duplicate

			P,G			
Radium 228	904.0	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Carrier anaylsis)	HASL 300	Soil	5 g P,G	None	180 days	Duplicate
Total Alpha Radium	903.0	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Carrier anaylsis)	HASL 300	Soil	5 g P,G	None	180 days	Duplicate
Strontium 89 / 90	DOE Sr-02	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Carrier anaylsis)		Soil	5 g P,G	None	180 days	Duplicate
Strontium 90	DOE Sr-02	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Carrier anaylsis)		Soil	5 g P,G	None	180 days	Duplicate
Strontium 89	DOE Sr-02	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Carrier anaylsis)		Soil	5 g P,G	None	180 days	Duplicate
Technetium 99	HASL 300 TC-02	Water	1 L P,G	HNO3 (pH <2)	180 days	Duplicate
(Tracer analysis)		Soil	10 g P,G	None	180 days	Duplicate
Total Uranium	ASTM 5174-91	Water	5 mL P,G	HNO3 (pH <2)	180 days	MS/Dup
		Soil	1 g P,G	None	180 days	MS/Dup
Tritium	906.0 (distilled)	Water	120 mL G	None	180 days	MS/Dup
		Soil	100 g G	None	180 days	MS/Dup

* Sample volumes are based on dry weights, volumes need to be increased if soil is wet/moist.

For samples requiring Matrix QC, 3 times the volume is required.
For normal samples, 2 or more times the volume may be required for re-extracts/digestions.
** Gross Alpha MDA is achievable only when solids are less than 500 ppm.
P – Plastic
G – Glass
AG – Amber Glass

SECTION 24

HANDLING OF SAMPLES
(NELAC 5.5.8)

Sample management procedures at TestAmerica St. Louis ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

24.1 CHAIN OF CUSTODY (COC)

The COC form is the written documented history of any sample and can be initiated at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 24-1.

24.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 24-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

The samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. Samples are only considered to be received by lab when personnel at the laboratory have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form.

24.1.2 Legal / Evidentiary Chain-of-Custody

The use of legal COC procedures may be required by some State or federal programs. The legal COC records shall establish an intact, continuous record of the physical possession, storage and disposal of sample containers, collected samples, sample aliquots and sample extracts or digestates. The COC records shall account for all time periods associated with the samples. Legal COC shall begin at the point established by the State or federal oversight program.

24.2 SAMPLE RECEIPT

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures is described in SOP STL-PM-0002, "Sample Receipt and Chain of Custody".

24.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. Coolers received from a known or potential radiologically contaminated site are frisked prior to opening. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on a "Condition Upon Receipt Form" (Figure 24-5) and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

24.2.1.1 Inspection of samples include a check for:

- Complete documentation to include sample identification, location, date and time of collection, collector's name, preservation type, sample type and any additional comments concerning the samples.
- Complete sample labels to include unique identification in indelible ink.
- Use of appropriate sample containers (see Section 23)
- Adherence to holding times as specified in the test method

- Adequate sample volume for required analyses (see Section 23).
- Damage or signs of contamination to sample container. Volatile vials are also inspected for headspace
- Samples received from a potentially radiologically contaminated site are frisked in the open cooler to determine if special handling is required.

24.2.1.2 Check and record the temperature of the samples, temperature blanks that require thermal preservation.

- Samples shall be deemed acceptable if arrival temperature is just above freezing and less than or equal to 6.0° C Samples that are hand-delivered immediately after collection may not be at the required temperatures; however, if there is evidence that the chilling process has begun, such as the arrival on ice, the samples shall be considered acceptable. This will be documented on the CUR.

24.2.1.3 Verify sample preservation as specified in the test method for all non-volatile tests. Check for correct pH as specified in the test method. The results are documented on the CUR. In the case of volatiles it is recorded after analysis on the run log or on the bench sheets.

24.2.1.4 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

24.2.1.5 For samples from a potentially radiocactive site, an aliquot is removed from the container to perform a “rad screen”.

24.2.1.6 If samples are received without a COC, TestAmerica will provide a generic COC form to be completed by the client when the samples are brought to the laboratory. The client is always provided with a copy of the completed COC form for their records.

24.2.1.7 If analyses with short holding times are requested, the dates and times are inspected to ensure that holding times have not already expired.

24.2.1.8 Samples received after normal working hours are left in their coolers and placed in one of the walk in coolers. The person receiving the samples must record the date and time received.

24.2.1.9 Any deviations from the checks described in Section 24.2.1 that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance criteria (Section 24.3) are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

24.2.2 Sample Log-in

All samples that are received by the laboratory are logged into the LIMS to allow the laboratory to track and evaluate sample progress. Each group of samples that are logged in together (typically one project from a given client/sampling event) is assigned a unique job number. Within each job, each sampling point (or sample) receives a unique number. Sample numbers are generated sequentially over time, and are not re-assigned. A sample may be composed of more than one bottle since different preservatives may be required to perform all analyses requested. Even if multiple containers are received for a single sample, each container is uniquely identified with an alphabetic letter added to the sample number. The LIMS generates sample labels that are attached to each bottle for a given sample.

Each job/set of samples is logged into LIMS with a minimum of the following information:

- Client Name, Project Name, Address, Phone, Fax, Report to information, invoice to information (most of this information is “default information” that is stored in the LIMS).
- Date and time sampled;
- Date and time received;
- Job and/or project description, sample description;
- Sample matrix, special sample remarks;
- Reporting requirements (i.e., QC level, report format, invoicing format);
- Turn-around-time requirements;
- Parameters (methods and reporting limits or MDLs are default information for a given parameter)

24.3 SAMPLE ACCEPTANCE POLICY

- The laboratory has a written sample acceptance policy (Figure 24-4) that clearly outlines the circumstances under which samples shall be accepted or rejected.
- Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is documented on the Condition Upon Receipt form.

24.4 SAMPLE STORAGE

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators suitable for the sample matrix. Metals samples are stored unrefrigerated. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples having high levels of radiochemical contamination are labeled as such. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples, including empty sample containers, are returned to the secure sample control area. All samples are kept in the refrigerators for two to four weeks after analysis, which meets or exceeds most sample holding times. After two to four weeks the samples are moved to dry room temperature sample archive area where they are stored for an additional four weeks before they are disposed of. This eight week holding period allows samples to be checked if a discrepancy or question arises. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

24.5 HAZARDOUS SAMPLES AND FOREIGN SOILS

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples known to be hazardous at the time of receipt or, if after completion of analysis the result exceeds the acceptable regulatory levels, are labeled as such. Potentially radioactive samples are “screened” prior to release to the lab. The RAD Category is entered into the LIMs system and alerts the analyst to the radiation level associated wit the sample. The sample itself is clearly marked “FOREIGN SOIL” if applicable. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility. See SOPs STL-HS-0006, “Quarantine Soils Procedure” and the Radiation Protection SOPs for more details.

Radioactive and hazardous materials management practices as well as laboratory environmental health and safety requirements for the laboratory are described in laboratory SOPs. See Appendix 9 for listing of the laboratory’s SOPs.

24.6 SAMPLE SHIPPING

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

24.7 SAMPLE DISPOSAL

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP STL-HS-0004, "Hazardous Waste Management Plan". All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record (Figure 24-3) should be completed.

Figure 24-1.

Example: Chain of Custody (COC)

TestAmerica St. Louis Chain-of-Custody Record

13715 Rider Trial North
Earth City, MO 63045
Phone: 314-298-8566 Fax: 314-298-8757

Customer Information		Project Information		Analyses / Method Requested
Project Name		Purchase Order		A.
PM/ Quote#		Work Order		B.
Company		Bill To		C.
Send Report To:		Invoice Attn		D.
Address:		Address:		E.
				F.
City/State/Zip		City/State/Zip		G.
Phone		Phone		H.
Fax		Fax		I.

Sx No.	Sample Description	Sample Date	Sample Time	Sample Matrix	Container Type	Preservative	No. of Bottles	A	B	C	D	E	F	G	H	I	Comments
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

	Shipment Method:	Airbill No.:	Required Turnaround:

Relinquished by:	Date	Relinquished by:	Date	Relinquished by:	Date
Company Name:	Time	Company Name:	Time	Company Name:	Time
Received by:	Date	Received by:	Date	Received by:	Date
Company Name:	Time	Company Name:	Time	Company Name:	Time

Figure 24-2.

Example: Internal Chain of Custody (COC)

TestAmerica St. Louis Internal Chain-of-Custody

The "✓" (checked) samples on the attached copy of the original chain-of-custody were transferred internally as indicated below:

		Date	Test(s)
Relinquished by:	**Sample Control**		**Anions**
Received by:			

		Date	Test(s)
Relinquished by:			
Received by:			

Client ID	Test(s)	Client ID	Test(s)

Note: Samples not returned to Sample Control Custody within 24 hours, were placed into a sample cooler for interim storage.

Figure 24-3.

Example: Sample Disposal Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Audit Report

TestAmerica St. Louis
13715 rider Trail North
Earth City, MO 63045

Sample ID	Lot#	Work Order	ClientID	ClientCode	QuoteNo	EventID	TransferTime	UserID	Disposal Drum ID	ContainerID	Type	UserName	ContainerType	StorageLocation	ClientName

Figure 24-4.

Example: Sample Acceptance Policy

TestAmerica St. Louis
Sample Acceptance Policy

NELAC specifies requirements under which any NELAC accredited laboratory will accept samples. TestAmerica St. Louis will review your sample shipment against those requirements listed below, and will communicate any discrepancies to you. Your project manager will assist you in the appropriate resolution of any issues related to sample receipt. Please contact your project manager with any questions.

When completing the chain of custody form, sign your name in the "relinquished by" box.

NELAC requirements are as follows:

- Proper, full and complete documentation, which includes sample identification, the location, date and time of collection, the collector's name, the preservation type, the sample matrix type, the requested testing method, and any special remarks concerning the samples shall be provided.
- Each sample shall be labeled with unique, durable and indelible identification.
- The samples shall be collected in the appropriate sample containers.
- The samples shall arrive at the laboratory within the specified holding time for the analyses requested.
- Sufficient sample volume must be available to perform the requested analyses.
- The laboratory will notify the client upon sample receipt if the samples exhibit obvious signs of damage, contamination or inadequate preservation.

Figure 24-5a.

DoD QSM SAMPLE ACCETANCE POLICY:

NELAC specifies requirements under which any NELAC accredited laboratory will accept samples. TestAmerica St. Louis will review your sample shipment against those requirements listed below, and will communicate any discrepancies to you. Your project manager will assist you in the appropriate resolution of any issues related to sample receipt. Please contact your project manager with any questions.

When completing the chain of custody form, sign your name in the "relinquished by" box.

NELAC requirements are as follows:

-Proper, full and complete documentation, which includes sample identification, the location, date and time of collection, the collector's name, the preservation type, the sample matrix type, the requested testing method, and any special remarks concerning the samples shall be provided.
-Each sample shall be labeled with unique, durable and indelible identification.
-The samples shall be collected in the appropriate sample containers.
-The samples shall arrive at the laboratory within the specified holding time for the analyses requested.
-Sufficient sample volume must be available to perform the requested analyses.

The laboratory will notify the client upon sample receipt if the samples exhibit obvious signs of damage, contamination or inadequate preservation. Samples shall be considered “compromised” if the following conditions are observed upon sample receipt:

- Cooler and/or samples are received outside of temperature specification.
- Samples are received broken or leaking.
- Samples are received beyond holding time.
- Samples are received without appropriate preservative.
- Samples are received in inappropriate containers.
- COC does not match samples received.
- COC is not properly completed or not received.
- Breakage of any Custody Seal.
- Apparent tampering with cooler and/or samples.
- Headspace in volatiles samples.
- Seepage of extraneous water or materials into samples.
- Inadequate sample volume.
- Illegible, impermanent, or non-unique sample labeling.

When “compromised” samples are received, it must be documented on a Condition Upon Receipt Form (CUR) for the project records and the client must be contacted for instructions. If the client decides to proceed with analysis, the project report shall clearly indicate any of the above conditions and the resolution.

For DoD QSM project work, sample containers must be certified to meet the “less than” ½ the RL criteria for the analytes of concern. Analytes for which this certification can not be obtained will be noted in the Case Narrative. Upon DoD project approval, the laboratory will analyze method blanks prepared in the containers of concern, qualify and narrate the sample analytes which do not meet the criteria, or take other appropriate action as determined by the DoD project site.

Figure 24-5.

Example: Cooler Receipt Form: TestAmerica St. Louis

Client: _____ COC/RFA No: _____ Date: _____

Quote No: _____ Initiated By: _____ Time: _____

Shipping Information

Shipper Name: _____ Multiple Packages Y N

Shipping # (s):*

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

Sample Temperature (s):**

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

*Numbered shipping lines correspond to Numbered Sample Temp lines

**Sample must be received at 4°C ± 2°C- If not, note contents below. Temperature variance does NOT affect the following: Metals-Liquid or Rad tests- Liquid or Solids

Condition (Circle "Y" for yes, "N" for no and "N/A" for not applicable):

1.	Y N	Are there custody seals present on the cooler?	8.	Y N	Are there custody seals present on bottles?
2.	Y N N/A	Do custody seals on cooler appear to be tampered with?	9.	Y N N/A	Do custody seals on bottles appear to be tampered with?
3.	Y N	Were contents of cooler frisked after opening, but before unpacking?	10.	Y N N/A	Was sample received with proper pH[1]? (If not, make note below)
4.	Y N	Sample received with Chain of Custody?	11.	Y N	If N/A- Was pH taken by original TestAmerica lab?
5.	Y N N/A	Does the Chain of Custody match sample ID's on the container(s)?	12.	Y N	Sample received in proper containers?
6.	Y N	Was sample received broken?	13.	Y N N/A	Headspace in VOA or TOX liquid samples? (If Yes, note sample ID's below)
7.	Y N	Is sample volume sufficient for analysis?	14.	Y N	Was Internal COC/Workshare received?

[1] For DOE-AL (Pantex, LANL, Sandia) sites, pH of ALL containers received must be verified, EXCEPT VOA, TOX and soils.

Notes:

Corrective Action:

- Client Contact Name: _____ Informed by: _____
- Sample(s) processed "as is"
- Sample(s) on hold until: _____ If released, notify: _____

Project Management Review: _____ Date: _____

THIS FORM MUST BE COMPLETED AT THE TIME THE ITEMS ARE BEING CHECKED IN. IF ANY ITEM IS COMPLETED BY SOMEONE OTHER THAN THE INITIATOR, THEN THAT PERSON IS REQUIRED TO APPLY THEIR INITIAL AND THE DATE NEXT TO THAT ITEM.

SECTION 25.0

ASSURING THE QUALITY OF TEST RESULTS
(NELAC 5.5.9)

25.1 OVERVIEW

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 21, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

25.2 CONTROLS

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

25.3 NEGATIVE CONTROLS

25.3.1 **Method Blanks** are used to assess preparation and analysis for possible contamination during the preparation and processing steps.

25.3.1.1 The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples.

25.3.1.2 The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).

25.3.1.3 The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.

25.3.1.4 Evaluation criteria and corrective action for method blanks is defined in the specific standard operating procedure for each analysis. Generally, corrective action is taken if the concentration of a target analyte in the blank is at or above the reporting limit as established by the method or regulation

- The source of contamination is investigated
- Measures are taken to minimize or eliminate the source of the contamination

- Affected samples are reprocessed or the results are qualified on the final report.

25.3.2 **Calibration Blanks** are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.

25.3.3 **Instrument Blanks** are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

25.3.4 **Trip Blanks** are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples. Trip Blanks are also sometimes referred to as Travel Blanks.

25.3.5 **Field Blanks** are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)

25.3.6 **Equipment Blanks** are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

25.3.7 **Holding Blanks**, also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory (refer to section 24.4*).*

25.3.8 **Field blanks**, equipment blank and trip blanks, when received, are analyzed in the same manner as other field samples. When known, blanks should not be selected for matrix QC, as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB".

25.4 POSITIVE CONTROLS

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP

25.4.1 Method Performance Control - Laboratory Control Sample (LCS)

25.4.1.1 The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

25.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

25.4.1.3 Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

25.4.1.4 As stated in the opening of this section, the LCS goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).

25.4.1.5 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

25.4.1.6 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

25.4.1.6.1 For methods that have 1-10 target analytes, spike all components.

25.4.1.6.2 For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

25.4.1.6.3 For methods with more than 20 target analytes, spike at least 16 components.

25.4.1.6.4 Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

25.4.1.6.5 Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

25.4.1.7 **Accuracy Calculation**: Percent Recovery (%R) Calculation (applies to LCS, CCV, Surrogates, and Matrix Spikes.

$$\%R = \frac{AV}{TV} \times 100$$

Where: AV = Analyzed Value
TV = True Value

25.5 SAMPLE MATRIX CONTROLS

25.5.1 Matrix Spikes (MS)

25.5.1.1 The Matrix spike is used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used.

25.5.1.2 An MS is essentially a sample fortified with a known amount of the test analyte(s). At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects.

25.5.1.3 If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number of the listed components (see LCS analytes 25.4.1.6 above) may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit-specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

25.5.1.4 The percent recovery calculation for matrix spikes is essentially the same as the calculation shown in 25.4.1.7 except that:

AV = Sp – Sa

Where: Sp = Spike result
Sa = Sample result

25.5.2 Surrogate Spikes

25.5.2.1 Surrogate Spikes are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.

25.5.2.2 Surrogate compounds are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method (also refer to Section 25.5). Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.

25.5.3 Duplicates

25.5.3.1 For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure. Duplicate samples are usually analyzed with methods that do not require matrix spike analysis. LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

25.5.3.2 Precision Calculation (Relative Percent Difference - RPD)

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100$$

Where: S=Sample Concentration
D=Duplicate Concentration

25.5.4 Internal Standards

25.5.4.1 In most organic analyses, internal standards are spiked into all environmental and quality control samples (including the initial calibration standards). An internal standard is also used with some metals analyses. It is added to sample extracts after the extraction (post-prep). The acceptance criteria in most methods are 50% to 200% of the responses in the mid-point of the corresponding calibration curve.

Consult the method-specific SOPs for details on the internal standard compounds, calculations and acceptance criteria.

25.5.4.2 When the internal standard recoveries fall outside these limits, if there are not obvious chromatographic interferences, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets internal standard recovery criteria, the second run is reported (or both are reported if requested by the client).

25.5.5 Tracers and Carriers for Radiocehmistry

Tracers and Carriers chemically mimic and do not interfere with the target analytes through radiochemical separations. Isotopic tracers are typically radioactive materials while carriers are typically non-radioactive. They are added to samples to determine the overall chemical yield of the analytical preparation steps. Each sample is spiked separately with the same material and individual sample yields are determined. The tracer/carrier is added to the sample at the very beginning of the preparation steps. For solids, the tracer/carrier is added after grinding, but before muffling or dissolution. Acceptance criteria for tracer and carrier yields can be found in the individual laboratory method SOPs.

25.6 ACCEPTANCE CRITERIA (CONTROL LIMITS)

25.6.1 Each individual analyte in the LCS, MS, or Surrogate Spike are evaluated against the control limits as published in the test method. Where there are no established acceptance criteria, the laboratory calculates control limits with the use of control charts or, in some cases, utilizes client project specific or regulatory mandated control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

25.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on a semi-annual basis unless the method requires more frequent updating (e.g. EPA SW846 8000 series methods). Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

25.6.2.1 The lab should consider the effects of the spiking concentration control limits, and to avoid censoring of data. The acceptance criteria for recovery and precision are often a function of the spike concentration used. Therefore, caution must be used when pooling data to generate control limits.

25.6.2.2 Not only should the results all be from a similar matrix, but the spiking levels should also be approximately the same (within a factor of 2). Similarly, the matrix spike and surrogate results should all be generated using the same set of extraction, cleanup and analysis techniques. For example, results from solid samples extracted by ultrasonic extraction are not mixed with those extracted by Soxhlet.

25.6.2.3 The laboratory should try and avoid discarding data that do not meet a preconceived notion of acceptable performance. This results in a censored data set, which, when used to develop acceptance criteria, will lead to unrealistically narrow criteria. For a 99% confidence interval, 1 out of every 100 observations likely will still fall outside the limits. For methods with long analyte lists this may mean occasional failures every batch or two. While professional judgment is important in evaluating data to be used to develop acceptance criteria, specific results are not discarded simply because they do not meet one's expectations. However, data points shall be discarded if they were the result of human or mechanical error or sample concentration exceeded spike level by > 4x.

25.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking ± 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

25.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

25.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method.

25.6.3.3 The lowest acceptable recovery limit will be 10% (the analyte must be detectable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable.

25.6.3.4 The maximum acceptable recovery limit will be 150%.

25.6.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

25.6.3.6 If either the high or low end of the control limit changes by ≤ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

25.6.4 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits.

25.6.4.1 The QA department generates a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for analyses performed at TestAmerica St. Louis. This summary includes an effective date, is updated each time new limits are generated and is located within the QC Browser program on the network. Copies are also included in the method SOPs and are updated when the SOP is updated. Unless otherwise noted, limits within these tables are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Director and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality

Assurance department maintains an archive of all limits used within the laboratory. Limits can also be found in archived SOPs.

25.6.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 13) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

25.6.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

25.6.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

25.6.5.3 Or, for NELAC and Departement Of Defense (DOD) work, there are an allowable number of Marginal Exceedances (ME):

- <11 analytes – 0 marginal exceedances are allowed.
- 11 – 30 Analytes – 1 marginal exceedance is allowed
- 31-50 Analytes – 2 marginal exceedances are allowed
- 51-70 Analytes – 3 marginal exceedances are allowed
- 71-90 Analytes – 4 marginal exceedances are allowed
- > 90 Analytes – 5 marginal exceedances are allowed

25.6.5.3.1 Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (NELAC).

25.6.5.3.2 Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random.

25.6.5.3.3 Though marginal excedences may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

25.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the method SOPs.

25.6.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client).

Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

If radiochemical tracer or carrier recovery is outside limits the sample is re-analyzed to confirm matrix interference. If the recoveries confirm or there was obvious interference, results are reported from the original analysis and a note is included in the case narrative. If the reanalysis meets recovery criteria, the second run is reported (or both are reported if requested by the client). When samples are non-detect for the target analytes and the carrier/tracer recovery indicates a high bias in the analysis, the samples are not rerun unless required by a client.

25.7 METHOD DETECTION LIMITS (MDLs)

MDLs, calculated as described in Section 20.7, are updated or verified annually, or more often if required by the method.

25.8 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

25.8.1 The laboratory has written procedures to assure the accuracy of the test method including calibration (see Section 21), use of certified reference materials (see Section 22) and use of PT samples (see Section 16).

25.8.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 20.

25.8.3 Use of formulae to reduce data is discussed in the method standard operating procedures and in Section 21.

25.8.4 Selection of appropriate reagents and standards is included in Section 9 and 22.

25.8.5 A discussion on selectivity of the test is included in Section 5.

25.8.6 Constant and consistent test conditions are discussed in Section 19.

25.8.7 The laboratories sample acceptance policy is included in Section 24.

25.8.8 A listing of the type of test result correlations that are looked at during report review (e.g. Total Chromium should be greater or equal to Hexavalent Chromium) is included in Section 20.13.4.5.

SECTION 26.0

REPORTING RESULTS
(NELAC 5.5.10)

26.1 OVERVIEW

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is a conflict between the client requested formats and accreditation requirements or data usability information, accreditation requirements and data usability information will take precedence over client requests. A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 20.

26.2 TEST REPORTS

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

26.2.1 A report title (e.g. Analytical Report For Samples) with a “sample results” column header.

26.2.2 The report cover page is printed on company letter head which includes the laboratory name, address and telephone number.

26.2.3 A unique identification of the report (e.g. lot number or SDG number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

26.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.
- Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (eg. Sampling information).

26.2.5 The name and address of client and a project name/number, if applicable.

26.2.6 Client project manager or other contact

26.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

26.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

26.2.9 Date reported or date of revision, if applicable.

26.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

26.2.11 Practical quantitation limits or reporting limit.

26.2.12 Method detection limits (if requested)

26.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

26.2.14 Sample results.

26.2.15 QC data consisting of method blank, surrogate, tracer/carrier, LCS, and MS/MSD recoveries and control limits.

26.2.16 Condition of samples at receipt including temperature. This is accomplished by attaching sample login sheets (Refer to Sec. 26.2.4 – Item 3 regarding additional addenda).

26.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

26.2.18 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

26.2.19 When NELAC accreditation is required, the lab shall certify that the test results meet all requirements of NELAC or provide reasons and/or justification if they do not. The following statement is included with the Case Narrative: The test results in this report meet all NELAP requirements for parameters in which accreditations are held by STL St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

26.2.20 A narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

26.2.21 When Soil samples are analyzed, a specific identification as to whether soils are reported on a "wet weight" or "dry weight" basis.

26.2.22 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

26.2.23 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., preliminary data), and that a complete report will follow once all of the work has been completed.

26.2.24 Any out of network subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All in-network subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

26.3 REPORTING LEVEL OR REPORT TYPE

TestAmerica St. Louis offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 26.2 above.
- Level II is a Level I report plus summary information, including results for the method blank, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms where available, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 26.7.

26.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services. TestAmerica St. Louis offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), New Agency Standard (NAS), Format A, Excel, Dbase, GISKEY, and Text Files.
EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

26.4 SUPPLEMENTAL INFORMATION FOR TEST

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report. Refer to Appendix 7 for a list of the laboratory's standard qualifiers.

26.4.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

26.4.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications, including identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature.

26.4.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

26.4.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

26.5 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS

If TestAmerica St. Louis is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in Section 8.

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of the TestAmerica network are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

26.6 CLIENT CONFIDENTIALITY

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

26.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

Confidentiality Notice: The information contained in this message is intended only for the use of the addressee, and may be confidential and/or privileged. If the reader of this message is not the intended recipient, or the employee or agent responsible to deliver it to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify the sender immediately.

26.7 FORMAT OF REPORTS

The format of reports are designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

26.8 AMENDMENTS TO TEST REPORTS

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 13).

The revised report is retained on the Archive data server, as is the original report. The revised report is stored in the Archive data server under the sample number followed by "Rev".

When the report is re-issued, a notation of "revised " is placed on the cover/signature page of the report and a brief explanation of reason for the re-issue is included in the beginning of the Case Narrative..

26.9 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS

26.9.1 Sample Reanalysis Policy

Because there is a certain level of uncertainty with any analytical measurement a sample reanalysis may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g. sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. Client specific arrangements for reanalysis protocols can be established.

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Department Supervisor or Laboratory Director if unsure.

26.9.2 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

26.9.3 Multiple Reports

TestAmerica does not issue multiple reports for the same workorder where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1.

TESTAMERICA
ETHICS POLICY No. CA-L-P-001

Refer to CA-L-P-001 for complete policy.

TestAmerica
EMPLOYEE ETHICS STATEMENT

I understand that TestAmerica is committed to ensuring the highest standard of quality and integrity of the data and services provided to our clients. I have read the Ethics Policy of the Company.

- *With regard to the duties I perform and the data I report in connection with my employment at the Company, I agree that:*
- *I will not intentionally report data values that are inconsistent with the actual values observed or measured.*
- *I will not intentionally report the dates, times, sample or QC identifications, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations.*
- *I will not intentionally misrepresent another individual's work as my own or represent my own work as someone else's.*
- *I will not intentionally misrepresent any data where data does not meet Method or QC requirements. If it is to be reported, I will report it with all appropriate notes and/or qualifiers; I shall not modify data (either sample or QC data) unless the modification can be technically justified through a measurable analytical process, such as one deemed acceptable to the laboratory's Standard Operating Procedures, Quality Assurance Manual or Technical Director. All such modifications must be clearly and thoroughly documented in the appropriate laboratory notebooks/worksheets and/or raw data and include my initials or signature and date.*
- *I shall not make false statements to, or seek to otherwise deceive, members of Management or their representatives, agents, or clients/customers. I will not, through acts of commission, omission, erasure, or destruction, improperly report measurement standards, quality control data, test results or conclusions.*
- *I shall not compare or disclose results for any Performance Testing (PT) sample, or other similar QA or QC requirements, with any employee of any other laboratory, including any other TestAmerica laboratory, prior to the required submission date of the results to the person, organization, or entity supplying the PT sample.*
- *I shall immediately inform my supervisor or other member of management regarding any intentional or unintentional reporting of my own inauthentic data. Such report shall be given both orally and in writing to the supervisor or other member of management contacted and to the local Quality Assurance Manager. The Quality Assurance Manager will initial and date the information and return a copy to me. I shall not condone any accidental or intentional reporting of inauthentic data by other employees and will immediately report its occurrence. If I have actual knowledge of such acts committed by any other employees, and I do not report such information to designated members of Management, it shall be considered as serious as if I personally committed the offense. Accordingly, in that event, I understand that I may be subject to immediate termination of employment.*

- *I understand that if any supervisor, manager, or representative of TestAmerica management instructs, requests, or directs me to perform any of the aforementioned improper laboratory practices, or if I am in doubt or uncertain as to whether or not such laboratory practices are proper, I will not comply. In fact, I must report such event to all appropriate members of Management including, but not limited to, the Lab Director, all supervisors and managers with direct line reporting relationship between me and the Lab Director, and the local Quality Assurance representative, excluding such individuals who participated in such perceived improper instruction, request, or directive. In addition, I may contact Corporate Quality Assurance / Ethics Compliance Officer(s) for assistance.*
- *I understand the critical importance of accurately reporting data, measurements, and results, whether initially requested by a client, or retained by TestAmerica and submitted to a client at a later date, or retained by TestAmerica for subsequent internal use;*
- *I will not share the pricing or cost data of Vendors or Suppliers with anyone outside of the TestAmerica family of companies.*
- *I shall not accept gifts of a value that would adversely influence judgment.*
- *I shall avoid conflicts of interest and report any potential conflicts to the management (e.g. employment or consulting with competitors, clients, or vendors).*
- *I shall not participate in unfair competition practices (e.g. slandering competitors, collusion with other labs to restrict others from bidding on projects).*
- *I shall not misrepresent certifications and status of certifications to clients or regulators.*
- *I shall not intentionally discharge wastes illegally down the drain or onto the ground.*
- *I understand that any attempt by management or an employee to circumvent these policies will be subject to disciplinary action.*

As a TestAmerica employee, I understand that I have the responsibility to conduct myself with integrity in accordance with the ethical standards described in the Ethics Policy. I will also report any information relating to possible kickbacks or violations of the Procurement Integrity Act, or other questionable conduct in the course of sales or purchasing activities. I will not knowingly participate in any such activity and will report any actual or suspected violation of this policy to management.

I understand that if my job includes supervisory responsibilities, I shall not instruct, request, or direct any subordinate to perform any laboratory practice which is unethical or improper. Also, I shall not discourage, intimidate, or inhibit an employee who may choose to appropriately appeal my supervisory instruction, request, or directive which the employee perceives to be improper, nor retaliate against those who do.

The Ethics Policy has been explained to me by my supervisor or at a training session, and I have had the opportunity to ask questions if I did not understand any part of it. I understand that any violation of this policy subjects me to disciplinary action, which can include termination of my employment. In addition, I understand that any violation of this policy which relates to work under a government contract or subcontract could also subject me to the potential for prosecution under federal law.

EMPLOYEE SIGNATURE _____ Date _____

Supervisor/Trainer: _____ Date _____

Work Instruction No. CA-WI-005

TestAmerica
CONFIDENTIALITY AND PROPRIETARY INFORMATION AGREEMENT

TestAmerica and their predecessors, in their businesses, have developed and use commercially valuable technical and non-technical information and to guard the legitimate interests of TestAmerica and its clients, it is necessary to protect certain information as confidential and proprietary.

I, _____ , understand and acknowledge that during the term of my employment by TestAmerica, I will be privy to and entrusted with certain confidential information and trade secrets of TestAmerica and its clients.

Confidential information and trade secrets include, but are not limited to: customer and client lists; price lists; marketing and sales strategies and procedures; operational and equipment techniques; standard operating procedures; business plans and systems; quality control procedures and systems; special projects and technological research, including projects, research and reports for any government entity or client; client's plans and processes; client's manner of operation; the trade secrets of clients; client's data; vendor or supplier pricing; employee lists and personal information, and any other records, data, files, drawings, inventions, discoveries, applications, or processes which are not in the public domain.

I agree as follows:

1. I will not in any way, during the term of my employment, or at any time thereafter, except as authorized in writing by the Legal Department of TestAmerica or the client where client data is involved, disclose to others, use for my own benefit, remove from TestAmerica's premises (except to the extent off-site work is approved by my supervisor), copy or make notes of any confidential information and/or trade secrets of TestAmerica or its clients, excepting only that information which may be public knowledge. Technical and business information of any previous employer or other third party which I may disclose to TestAmerica shall be limited to that which was acquired legitimately and disclosed to me without restriction as to secrecy.

2. I agree that all inventions (whether or not patentable) conceived or made by me during the period of my employment by TestAmerica shall belong to TestAmerica, provided such inventions grow out of my work for TestAmerica and are related to the business of TestAmerica. I agree to disclose and assign such inventions to TestAmerica. In California, this provision shall not apply to any invention which qualifies fully under Section 2870 of the California Labor Code.

3. On termination of my employment from TestAmerica, I will deliver to TestAmerica all documents, records, notes, data, memoranda, files, manuals, equipment and things of any nature which relate in any way to confidential information and/or trade secrets of TestAmerica or its clients and which are in my possession or under my control.

4. I agree that during the period of my employment and for one (1) year from and after the termination (for any reason) of my employment with TestAmerica, I shall not directly or indirectly (without first obtaining the written permission of TestAmerica), recruit for employment, or induce to terminate his or her employment with TestAmerica, any person who is an active employee of TestAmerica on the last day of my employment with TestAmerica.

5. I acknowledge that if I were to breach any provision of this Confidentiality Agreement, money damages will be inadequate, and I hereby agree that TestAmerica shall be entitled, where appropriate, to specific performance and/or injunctive relief (i.e. to require me to comply with this Agreement). I further acknowledge that the willingness of TestAmerica to hire me or to continue my employment constitutes full and adequate consideration for the agreements, and obligations to which I have agreed as set forth in this document.

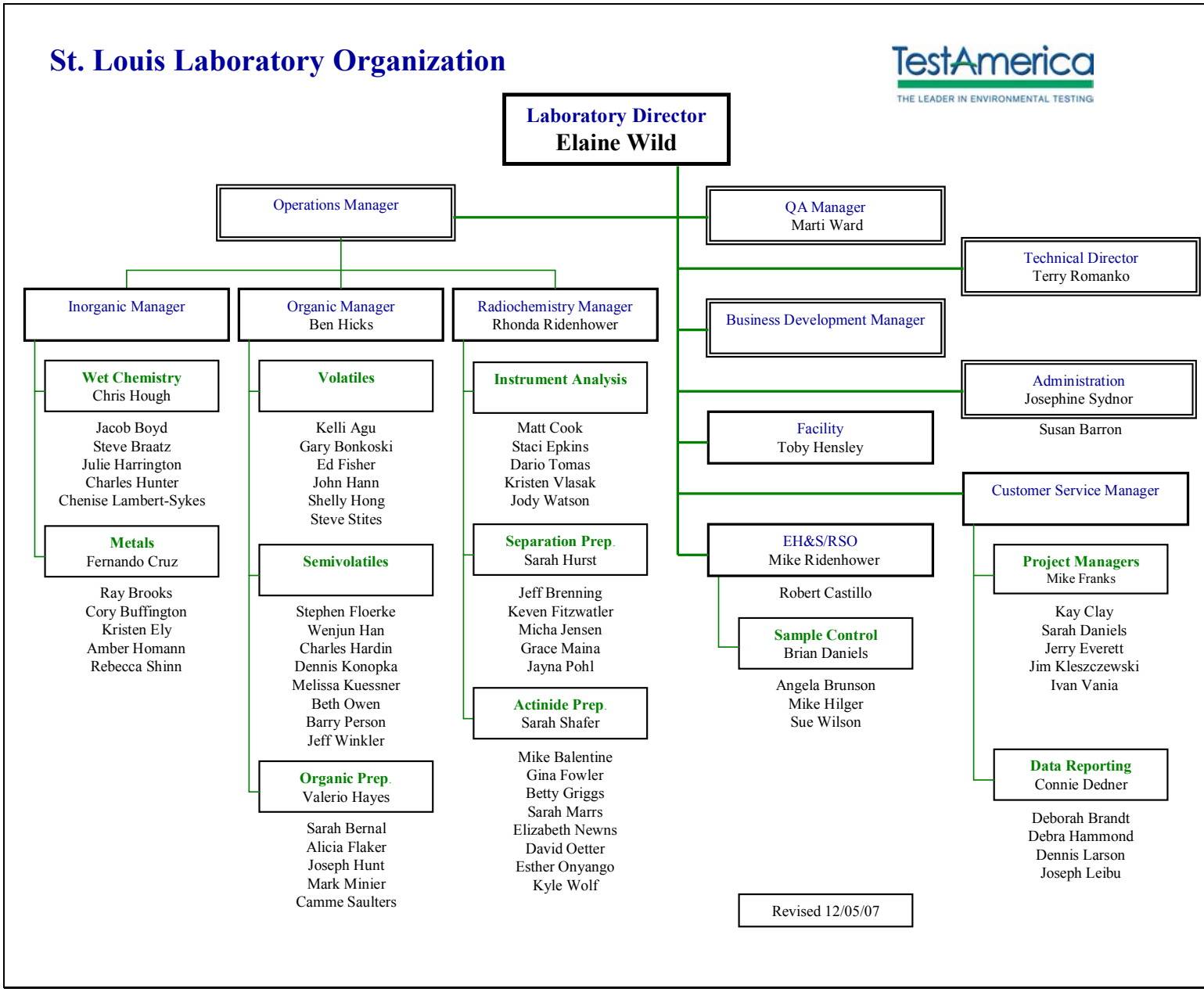
I have executed this Agreement, intending to be legally bound.

_____	_____	_____
Printed Name	*Signature*	*Date*

Work Instruction No. CA-WI-006

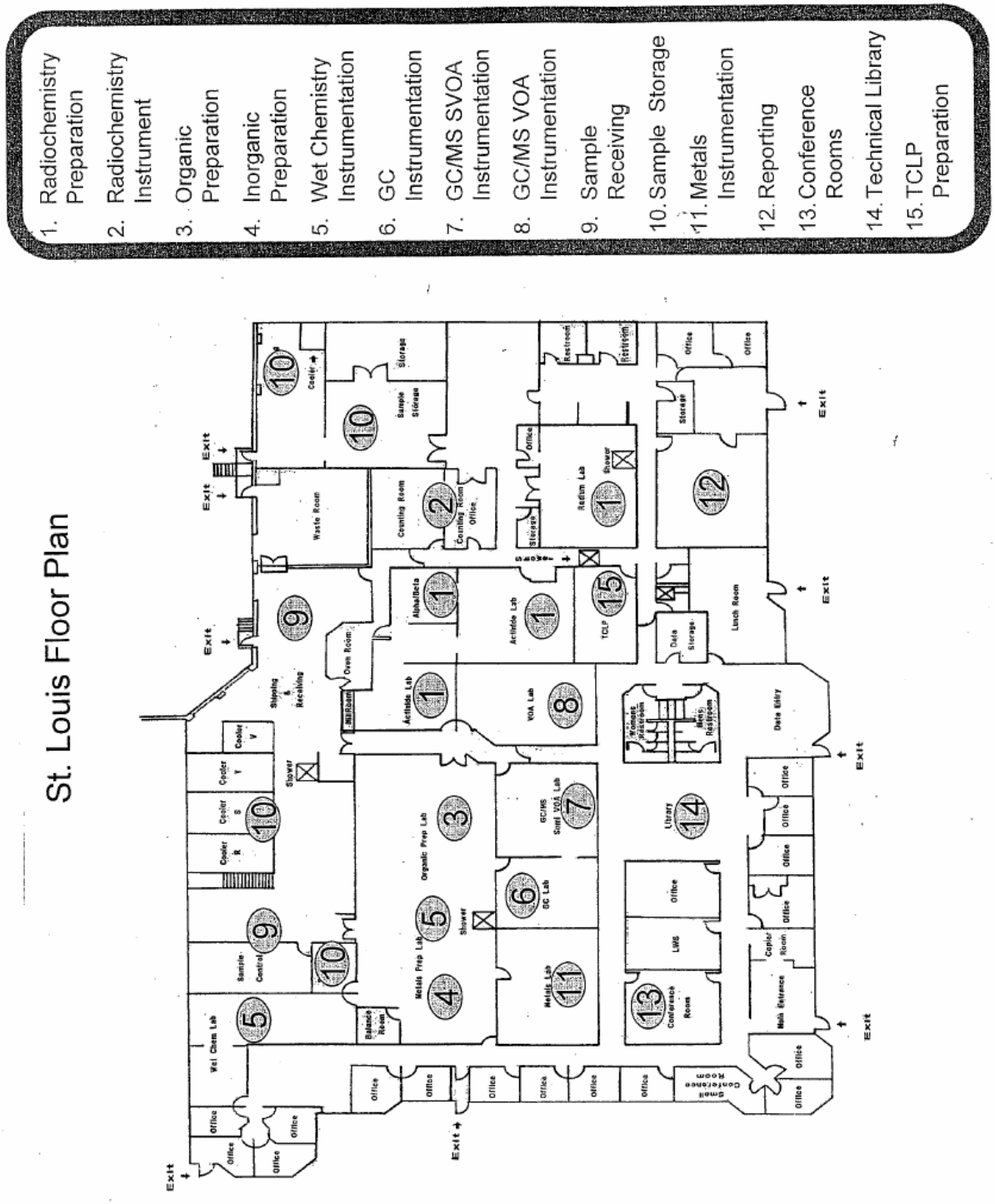
Appendix 2.

TestAmerica St. Louis Laboratory Organization Chart



Appendix 3.

Laboratory Floor Plan



Appendix 4.

List of Tests Performed at TestAmerica St. Louis

	GC Semi-Volatiles
608	PCB (608)
608	Pesticides/PCB (608)
8011	EDB and DBCP by GC (8011)
8015	Hydrocarbons, Extractable Petroleum (8015 MOD)
8082	PCBs (8082)
6850	Perchlorates LC/MS/MS
8081A	Pesticides (8081A)
8151A	Herbicides (8151A)
OA-2	Hydrocarbons, Petroleum (OA-2, Extractable) - Iowa
8310	Hydrocarbons, Polynuclear Aromatic (HPLC - 8310)
8321	Nitroaromatics & Nitramines: Explosives LC/MS/MS
8330	Nitroaromatics & Nitramines: Explosives (8330)
	GC Volatiles
8015	Hydrocarbons, Volatile Petroleum (8015 MOD)
8015B - Alcohols	Volatile Organics (8015B) - Alcohols
8015B-DMAC	Volatile Organics (8015B)DMAC ONLY
8021B	Volatile Organics (8021B)
OA-1	Volatile Organics (Iowa OA-1)
	GCMS
624	Volatile Organics, GC/MS (624) - unpreserved
8260B	Volatile Organics, GC/MS (8260B)
8260B - Unp.	Volatile Organics, GC/MS (8260B) - Unpreserved
625	Base/Neutrals and Acids (625)
8270C	Base/Neutrals and Acids (8270C)
	Metals
6010C	Inductively Coupled Plasma (6010B Trace)
200.8	ICP-Mass Spectrometry (200.8)
200.7	Inductively Coupled Plasma (200.7 Trace)
6020	Inductively Coupled Plasma Mass Spectrometry(6020)
245.1	Mercury (245.1, Cold Vapor)
245.2	Mercury (245.2, Cold Vapor)
245.5	Mercury in Sediment (245.5, cold vapor)
7470A	Mercury (7470A, Cold Vapor) - Liquid
7470A - MOD	Mercury in Solids by Modified 7470A
7471A	Mercury (7471A, Cold Vapor) - Solids
	Wet Chemistry
120.1	Conductance, Specific "Conductivity" (120.1)
130.2	Hardness, Total (130.2, titrimetric)

150.1	pH - Aqueous (150.1)
160.1	Solids, Filterable "TDS" (160.1)
160.2	Solids, Total Suspended "TSS" (160.2)
160.3 MOD	Moisture, Percent (160.3)
160.3	Solids, Total "TS" (160.3)
160.5	Solids, Settleable (160.5)
180.1	Turbidity (180.1)
300.0	Fluoride (300.0, Ion Chromatography)
300.0	Nitrate as N (300.0, Ion Chromatography)
300.0	Chloride (300.0, Ion Chromatography)
300.0	Sulfate (300.0, Ion Chromatography)
300.0	Phosphate as P, Ortho (300.0, Ion Chromatography)
300.0	Bromide (300.0, Ion Chromatography)
300.0	Nitrite as N (300.0, Ion Chromatography)
310.1	Alkalinity, Total (310.1)
310.1	Alkalinity, Carbonate (310.1)
310.1	Alkalinity, Bicarbonate (310.1)
310.1	Alkalinity, Total (310.1)
335.1	Cyanide, Amenable to Chlorination (335.1)
335.4	Cyanide, Total (335.4)
350.1	Nitrogen, Ammonia (350.1, Automated)
353.1	Nitrate-Nitrite (353.1)
354.1	Nitrite (354.1)
365.2	Phosphorus, All Forms
376.1	Sulfide (376.1)
405.1	Demand, Biochemical Oxygen (405.1)
410.4	Demand, Chemical Oxygen - Low Level (410.4)
413.1	Oil and Grease (Gravimetric - 413.1)
415.1	Carbon, Total Organic "TOC" (415.1)
420.2	Phenolics (420.2, Automated)
450.1	Halogens, Total Organic "TOX" (450.1)
1010	Flash Point (1010, Closed Cup)
1664A	Oil and Grease (N-Hexane; HEM)
7196A	Chromium, Hexavalent (7196A)
9010B/9012A	Cyanide Amenable (9010B-Dist/9012A Automated)
9012A	Cyanide, Total (9012A, Automated)
SW7.3.3	Cyanide, Reactive (SW7.3.3)
9020B	Halogens, Total Organic "TOX" (9020B)
9030	Sulfide (9030)
SW7.3.4	Sulfide, Reactive (SW7.3.4)
9040	pH (9040) - Aqueous
9045	pH (9045) - Non-Aqueous
9050	Conductance, Specific "Conductivity" (9050)

9060	Carbon, Total Organic "TOC" (9060)
9066	Phenolics (9066, Automated)
9090	Paint Filter Test (9095, Free Liquids)
9056A	Fluoride (9056A, Ion Chromatography)
9056A	Chloride (9056A, Ion Chromatography)
9056A	Nitrite as N (9056A, Ion Chromatography)
9056A	Bromide (9056A, Ion Chromatography)
9056A	Nitrate as N (9056A, Ion Chromatography)
9056A	Phosphate, ortho as P (9056A, Ion Chromatography)
9056A	Sulfate (9056A, Ion Chromatography)
9070	Oil and Grease, Tot Recoverable (9070,Gravimetric)
9071B	Oil and Grease (Gravimetric - 9071B)
2580B	Oxidation-Reduction Potential (2580B)
2710F	Density (2710 F Modified)
D92-90	Flashpoint (Cleveland Open Cup - D92-90)
	Radiochemistry
GAMMA	Gamma Cs-137 & Hits by DOE GA-01-R MOD.
GAMMA	Gamma Cs-137 & Hits by EPA 901.1 MOD
GAMMA	Gamma Iodine by GA-01-R MOD
GAMMA	Gamma Ra-226 & Hits By DOE GA-01-R Mod.
ALPHA SPEC	ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD
ALPHA SPEC	Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD
ALPHA SPEC	Plutonium-242 by DOE A-01-R Mod
ALPHA SPEC	PO-210 by Alpha Spectrometry
ALPHA SPEC	Ra226 by Alpha Spectroscopy
ALPHA SPEC	Iso THORIUM (LONG CT) DOE A-01-R MOD
ALPHA SPEC	Thorium-229 by DOE A-01-R Mod
ALPHA SPEC	Iso URANIUM (SHORT CT) DOE A-01-R MOD
ALPHA SPEC	Iso URANIUM-232 by DOE A-01-R Mod
LIQUID SCIN	Carbon 14 by EERF C-01-1
LIQUID SCIN	I-129,I-131 low level by EPA 902 MOD
LIQUID SCIN	Iron-55 by Liquid Scint. Spectrometry
LIQUID SCIN	NFT Total Activity Screen by LSC
LIQUID SCIN	Ni-59 & Ni-63 by Liquid Scint. Spec.
LIQUID SCIN	Pb-210 by Liquid Scint. Counting
LIQUID SCIN	Plutonium-241 by Liquid Scintillation
LIQUID SCIN	Promethium 147 by Liquid Scintillation Counting
LIQUID SCIN	TC-99 by LSC by DOE TC-02-RC Mod.
LIQUID SCIN	TRITIUM (Distill) by EPA 906.0 MOD
LIQUID SCIN	Tritium by LSC by DOE H3-04-RC MOD.
GAS FLOW	Chlorine-36 by GFPC
GAS FLOW	GROSS A/B BY GFPC SW846 9310 MOD
GAS FLOW	Gross A/B by NJ EPA 900 PWTA

GAS FLOW	Gross Alpha/Beta EPA 900
GAS FLOW	Phosphorus-32/33 by GFPC
GAS FLOW	RA-226 BY EPA-903.0 MOD
GAS FLOW	RA-226 BY DOE RA-06-RC MOD
GAS FLOW	RA-226 BY SW846 9315 MOD
GAS FLOW	RA-228 BY GFPC EPA 904 MOD
GAS FLOW	RA-228 BY GFPC DOE RA-06-RC MOD
GAS FLOW	RA-228 BY GFPC SW846 9320 MOD
GAS FLOW	SR-89 BY GFPC DOE SR-01-RC MOD
GAS FLOW	SR-89 BY GFPC EPA 905.0 MOD
GAS FLOW	SR-90 BY GFPC DOE SR-03-RC MOD
GAS FLOW	Sulfur-32/35 by GFPC
GAS FLOW	Total Alpha Ra EPA 903.0 MOD
GAS FLOW	Total Alpha Radium SW846 9315 MOD
GAS FLOW	Total Radium by DOE RA-06-RC
GAS FLOW	Total SR BY GFPC EPA-905 MOD
GAS FLOW	Total SR BY GFPC DOE SR-03-RC MOD
KPA	Total Uranium by KPA ASTM 5174-91

Appendix 5. Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:
The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority:
The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (NELAC) [1.5.2.3]

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS) It reflects the total error associated with a measurement.

Analyst:
The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Assessment:
The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Assessment Criteria:
The measures established by NELAC and applied in establishing the extent to which an applicant is in conformance with NELAC requirements. (NELAC)

Assessment Team:
The group of people authorized to perform the on-site inspection and proficiency testing data evaluation required to establish whether an applicant meets the criteria for NELAP accreditation. (NELAC)

Assessor:
One who performs on-site assessments of accrediting authorities and laboratories’ capability and capacity for meeting NELAC requirements by examining the records and other physical evidence for each one of the tests for which accreditation has been requested. (NELAC)
Audit:
A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch:
Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee) Instrument conditions must be the same for all standards, samples and QC samples. Each analytical batch may contain up to 20 environmental samples, a method blank, and a single Laboratory Control Sample (LCS) and either a Matrix Spike/Matrix Spike Duplicate (MS/MSD) pair or a Matrix Spike and a Sample Duplicate, depending on the analysis requested.

Blank:
A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample:
A sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration:
To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve:
The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method:
A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Carrier:
Carriers are stable counterparts of the radioactive isotope(s) to be measured. When used, carriers are added to all samples in an analytical batch so that each sample has a specific measurable QC parameter (yield). The carrier yield is used in the date calculations to correct for all sources of analytical losses. The term carrier can also be used for a non-radioactive compound added to assist in isolation of the target analyte(s).

Certified Reference Material (CRM):

A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30–2.2)

Chain of Custody:
An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples. (NELAC) [5.12.4]

Clean Air Act:
The enabling legislation in 42 U>S>C> 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and enforce them. (NELAC)

Clouseau:
TestAmerica custom software developed to document, track and trend non-conformance throughout the laboratory. The software interfaces with our laboratory information management system, QuantIMS and our report narrative generating software, KATO to provide the laboratory with a complete corrective action system.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/SUPERFUND):
The enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites. (NELAC)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (NELAC)

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation
Alternate wavelength
Derivatization
Mass spectral interpretation (including spectra obtained by diode array)
Alternative detectors or
Additional Cleanup procedures

(NELAC)

Conformance:
An affirmative indication or judgement that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Control Chart:
A graphical QC tool to monitor method performance over time and to establish acceptance limits.

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction:
The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability (DOC):
Procedure to establish the ability to generate acceptable accuracy and precision.

Detection Limit:
The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Document Control:
The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses:
The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Environmental Detection Limit (EDL):
The smallest level at which a radionuclide in an environmental medium can be unambiguously distinguished for a given confidence interval using a particular combination of sampling and measurement procedures, sample size, analytical detection limit, and processing procedure. The EDL shall be specified for the 0.95 or greater confidence interval. The EDL shall be

established initially and verified annually for each test method and sample matrix. (NELAC Radioanalysis Subcommittee)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC) This is a field QC parameter and thus the choice of terminology (equipment blank, rinsate blank, etc.) is determined by the client.

External Standard Calibration:
Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA):
The enabling legislation under 7 U.S.C. 135 et seq., as amended, that empowers the EPA to register insecticides, fungicides, and rodenticides. (NELAC)

Federal Water Pollution Control Act (Clean Water Act, CWA):
The enabling legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Testing:
NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required to submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff). (NELAC)

Finding:
An assessment conclusion that identifies a condition having a significant effect on an item or activity. As assessment finding is normally a deficiency and is normally accompanied by specific examples of the observed condition. (NELAC)

Holding Times (Maximum Allowable Holding Times):
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Inspection:
An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Internal Standard:
A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (NELAC)

Internal Standard Calibration:
Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL):
The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ±100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Instrument Response:
Instrument response is normally expressed as either peak area or peak height however it may also reflect a numerical representation of some type of count on a detector (e.g. Photomultiplier tube, or Diode array detector) and is used in this document to represent all types.

Internal Chain of Custody:
An unbroken trail of accountability that ensures the physical security of samples, data and records. Internal Chain of Custody refers to additional documentation procedures implemented within the laboratory that includes special sample storage requirements, and documentation of all signatures and/or initials, dates and times of personnel handling specific samples or sample aliquots.

Laboratory:
A defined facility performing environmental analyses in a controlled and scientific manner. (NELAC)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):
A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), there is no LCS. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

For aqueous samples, the blank matrix consists of DI water. For solid samples, the blank matrix may consist of sand, glass beads or another inert solid material. If an inert material is not easily identified, the laboratory will use DI water that is taken through the sold sample preparation.

Note: NELAC standards allow a matrix spike to be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. (NELAC)

Laboratory Duplicate:
Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Least Squares Regression (1st Order Curve):
The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit of Detection (LOD):
An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory dependent. (Analytical Chemistry, 55, p.2217, December 1983, modified) See also Method Detection Limit. TestAmerica St. Louis does not use the term LOD in its' SOPs or reports.

Manager (however named):
The individual designed as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Marginal Exceedance (ME): A large number of analytes in a Laboratory Control Sample make it statistically likely that a few will be outside control limits. This may not indicate that the system is out of control. Upper and lower marginal exceedance (ME) limits are established to determine when corrective action is required. An ME is defined as being byond the LCS control limits (3 standard deviations), but within the ME limits. The ME limits are set at 4 standard deviations around the mean. For DOE work, the ME applies only to organic analyses.

Matrix:
The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

> Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
>
> Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.
>
> Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with, <15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, wipes, filters and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Duplicate (MD):
Duplicate aliquot of a sample processed and analyzed independently; under the same laboratory conditions; also referred to as Sample Duplicate; Laboratory Duplicate. TestAmerica St. Louis distinguishes that a Sample Duplicate is a replicate sample collected in the field for analysis where as a Laboratory Duplicate is a replicate aliquot of a single field sample. Sample Duplicates are analyzed like an environmental sample and results are reported accordingly. Laboratory Duplicates are performed as part of laboratory batch QC requirements for precision.

Matrix Spike (spiked sample or fortified sample) (MS):
Prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. Matrix spikes shall be performed at a frequency of one in 20 samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate) (MSD):
A second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Matrix spike duplicates or laboratory duplicates shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document their procedure to select the use of an appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate. (QAMS)

Method Blank:
A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target

analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC) For aqueous samples, the blank matrix consists of DI water. For solid samples, the blank matrix may consist of sand, glass beads or another inert solid material. If inert material is not easily identified, the laboratory will use DI water that is taken through the solid sample preparation.

Method Detection Limit:
The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Minimum Detectable Activity or Concentration (MDA/MDC):
For radiological analyses, it is the smallest amount of activity that can be detected given the conditions of a specific sample. It is reported at the 95% confidence interval, meaning that there is a 5% chance that a false signal was reported as activity and a 5% chance that true activity went undetected.

National Environmental Laboratory Accreditation Conference (NELAC):
A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP):
The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

NELAC Standards:
The plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference. (NELAC)

Non-conformance:
An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation. A deviation from an established protocol or plan. The deviation may be the result of laboratory or client actions, or related to the behavior of the sample. Non-conformance memorandums (NCMs) are documented using the Clouseau software program.

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS):
A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control:
Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC) Precision is expressed either as Relative Standard Deviation (RSD) for greater than two measurements or as Relative Percent Difference (RPD) for two measurements. Precision is determined, in part, by analyzing date from aggregate LCS results, MS, MSD, and MD. For radiochemical determinations, counting statistics can also provide and estimate of uncertainty.

Preservation:
Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT):
A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Quality Assurance:
An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance [Project] Plan (QAPP):
A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control:
The overall system of technical activities which purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample:
An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or

analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality Manual:
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC (ANSI/ASQC-E-41994)

QuantIMS:
The laboratory's information tracking system.

Quantitation Limits:
The maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC) The QL can be based on the MDL, and is generally calculated as 3-5 times the MDL, however, there are analytical techniques and methods where this relationship is not applicable. Also referred to as Practical Quantitation Level (PQL), Estimated Quantitation Level (EQL), and Limit of Quantitiation (LOQ). TestAmerica St. Louis equated the Quantitation Limit to the Reporting Limit. Please see "Reporting Limit" definition.

RadCapture:
Software used to process and report radiochemical data.

Range:
The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Raw Data:
Any original information from a measurement activity or study recorded in laboratory notebooks, worksheets, records, memoranda, notes, or exact copies thereof and that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data my include photography, microfilm or microfiche copies, computer printouts, magnetic/optical media, including dictated observations, and recorded data from automated instruments. Reports specifying inclusion of "raw data" do not need all of the above included, but sufficient information to create the reported data.

Reagent Blank (method reagent blank):
A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Record Retention:
The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material:
A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Method:
A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard:
A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.0-8)

Replicate Analyses:
The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Reporting Limit (RL):
The level to which date is reported for a specific test method and/or sample. The RL is generally related to the QL. The RL must be minimally at or above the MDL. The Reporting Limit takes into consideration: 305 times the MDL value, technical judgment and publications f analyte performance, and market demand for quantitiation. For multi-point calibration methodologies, the reporting limit must be substantiated by analyzing a low level standard which is approximately equal to the reporting limit.

Requirement:
Denotes a mandatory specification; often designated by the term “shall”. (NELAC)

Resource Conservation and Recovery Act (RCRA):
The enabling legislation under 42 USC 321 et seq. (1976), that gives EPA the authority to control hazardous waste from the “cradle-to-grave”, including its generation, transportation, treatment, storage, and disposal. (NELAC)

Safe Drinking Water Act (SDWA):
The enabling legislation, 42 USC 300f et seq. (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Sample Duplicate:
Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)

Sample Transfer Utility (STU):
TestAmerica custom software developed to document, and track samples through the laboratory. The software interfaces with our laboratory information management system, QuantIMS. STU employs barcode technology for rapid processing of sample transfer events including removal from storage, transfer between personnel, and sample disposal.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument

response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:
(Analytical chemistry) the capability of a test method or instrument to respond to a target substance of constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Spike:
A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number (at a minimum 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.. (NELAC)

Standard:
The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Operating Procedures (SOPs):
A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Storage Blank:
A blank matrix stored with field samples of a similar matrix. TestAmerica St. Louis uses DI or HPLC water for all storage blanks.

Standardized Reference Material (SRM):
A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named):
The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees,

supply and instrument adequacy and upkeep, quality assurance/quality control duties, and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate:
A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Surveillance:
Monitors compliance with TestAmerica St. Louis' quality system as defined in laboratory or Corporate Standard Operating Procedures, the TestAmerica Quality Management Plan (QMP), the TestAmerica St. Louis Laboratory Quality Manual (LQM) and other associated official policies and procedures, including any client-specific requirements. The spot assessments of TestAmerica St. Louis' systems are performed monthly.

Systems Audit (also Technical Systems Audit):
A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Target:
Instrument acquisition software used for GC and GC/MS analyses.

Technical Director:
Individuals(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test:
A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process, or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method:
An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Toxic Substances Control Act (TSCA):
The enabling legislation in 15 USC 2601 et seq., (1976) that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)

Traceability:
The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

Tracer:
Tracers are radioactive and/or massless. Where used, they are added to all samples in an analytical batch so that each sample has a specific measurable QC parameter (yield). Tracers are counted and the yield is used in the data calculations to correct for any and all sources of analytical losses.

TRAQAR:
A computer module interfaced to QuantIMS, which provides a means of producing control charts and limits.

Trip Blank:
A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples. TestAmerica St. Louis purchases pre-prepared trip blanks from our sample container provider. In the event that trip blanks are prepared by TestAmerica St. Louis, we use HPLC water for all Trip Blanks.

Uncertainty:
A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

United States Environmental Protection Agency (EPA):
The Federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends. (US-EPA)

Validation:
The process of substantiating specified performance criteria. (EPA-QAD)

Verification:
Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell:
A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Acronyms:

BS – Blank Spike
BSD – Blank Spike Duplicate
CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
CRS – Change Request Form
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DU – Duplicate
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
MD – Matrix Duplicate
MDA/MDC – Minimum Detectable Activity/Concentration
MDL – Method Detection Limit
ME – Marginal Exceedance
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NCM – non-conformance memo
NELAC - National Environmental Laboratory Accreditation Conference
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RL – Reporting Limit
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 6.

Laboratory Certifications, Accreditations, Validations

TestAmerica St. Louis maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

Organization	Certificate Number	Organization	Certificate Number
AFCEE	n/a	USACE	n/a
Alaska	MO54-08	USEPA Region 5	n/a
California	2093	USDA	S-37573
Connecticut	PH-0241	USDOE	n/a
Florida	E87689	US NRC	24-24817-01
Illinois	200023	Washington	C1310
Iowa	373		
Kansas	E-10236		
Kentucky	90125		
Louisiana DHH	LA020012		
Louisiana DEQ	4080		
Maryland	310		
Missouri	780		
NFESC	NFESC 413		
Nevada	MO00542007A		
New Jersey	MO002		
New York	11616		
Pennsylvania	68-540		
South Carolina	85002		
Texas	T104704193-06-TX		
Utah	QUAN4		

The certificates and parameter lists (which may differ) for each organization may be found on the corporate web site and are posted in the laboratory.

Claims of Accreditation Status

TestAmerica St. Louis has agreed to make only valid claims as to its accreditation/certification status by any authority by ensuring that the expiration dates are not exceeded and the method-specific scope or parameter lists are supportable, as required by each. Any false claims would be reported to that authority. The agreement covers the use of the authority's name, such as "Authority-Accredited," logo, or certificate number. The only valid proof of accreditation/certification is the current certificate and scope of the authority. It is the responsibility of the laboratory to make these documents available to all staff, and it is the staff's duty to reference only the current documents.

A report with scope and non-scope analytes may only be presented on the same report if the non-accredited results are clearly and unambiguously identified. No report with non-scope analytes may be associated with the logo, "Authority accredited" phrase, or the certificate number. Only the analytes specified by a unique method are valid within the scope. There shall be no intentional misleading of the users of the laboratory's services in this regard.

No opinions and/or interpretations based on results outside the laboratory's scope may be presented on a document referenced by "Authority-accredited, the logo, or the certificate number. If these are made, they must be written in a separate letter which is not endorsed by the authority.

The "Authority-accredited" logo may only be affixed to equipment calibrated by a laboratory that is accredited by the authority. If calibration labels contain the logo, they must also show the calibration laboratory's name or its certificate number, the instrument's unique identification, the date of the last calibration, and a cross-reference to the last calibration certificate.

Should the company decide to use the "Authority-accredited" logo in marketing activities, no misrepresentation may occur. Only reference to the accredited scope at a specific laboratory site is allowed. If any "Authority-accredited" language is used in proposals or quotations, any non-scope analytes must be clearly denoted as not accredited by that authority. The same is true for any use of laboratory letterhead with the "Authority-accredited" wording or logo. The logo may not be affixed to any material, item, product, part, or packaging, thereby implying accreditation status to that piece. In literature, any use of the logo must be positioned adjacent to the accredited laboratory's name and clearly state that the presence of the logo does not imply certification/approval of the products tested. At no time may the logo appear to suggest that a person is accredited. Misrepresentation of accreditation status is never allowed and must be reported if it occurs. If in doubt, the idea of the logo's use may be presented to the authority for approval.

If accreditation is terminated or suspended, the laboratory will immediately cease to use the "Authority-accredited" wording, the logo, or the certificate number reference in any way and inform clients impacted by the change.

Appendix 7. Data Qualifiers

Organic Qualifier	Inorganic Qualifiers	Footnotes
U	U	Analyte analyzed for but was not detected
J	B	Estimated Result. Result is less than RL
E	E	Estimated Result. Result concentration exceeds the calibration range.
A	N	Spiked analyte recovery outside stated control limits
B	J	Associated Method Blank contains the target analyte at a reportable level.
P	*	RPD is outside stated control limits
*		Surrogate recovery outside stated control limits
PG		Percent difference between primary and confirmation columns is greater than 40%.

Appendix 8: Calculations

Common Calculations

- Percent Recoveries *(ICV, CCV, LCS, Surrogates, Tracers) are calculated according to the equation:*

$$\%R = 100\left(\frac{Found}{True}\right)$$

- Matrix Spike Recoveries *are calculated according to the following equation:*

$$\%R = 100\left(\frac{SSR - SR}{SA}\right)$$

Where:
SSR = Spike Sample Result
SR = Sample Result
SA = Spike Added

- The relative percent difference (RPD*) of matrix spike/matrix spike duplicates is calculated according to the following equation:*

$$RPD = 100\left[\frac{|MSD - MS|}{\left(\frac{MSD + MS}{2}\right)}\right]$$

Where:
MS = determined spiked sample concentration
MSD = determined matrix spike duplicate concentration

- The relative percent difference (RPD) *of sample/sample duplicates is calculated according to the following equation:*

$$RPD = 100\left[\frac{|SR - SD|}{\left(\frac{SR + SD}{2}\right)}\right]$$

Where:
SR = sample result
SD = sample duplicate result

- The percent difference (%D) is calculated as follows*:*

$$\%Difference = \frac{|R_1 - R_2|}{R_1} \times 100$$

Where:
R_1 = First result
R_2 = Second result

- Standard Deviation (SD) is calculated as follows:

$$SD = \sqrt{\sum_{i=1}^{N} \frac{(X_i - X)^2}{N-1}}$$

Where:

X_i = Value of X as i through N
N = Number of points
X = Average value of X_i

ADDITIONAL Calculations for Metals

- The final concentration for a digested aqueous sample is calculated as follows:

$$mg/L = \frac{C \times V1 \times D}{V2}$$

Where:
C = Concentration (mg/L) from instrument readout
D = Instrument dilution factor
V1 = Final volume in liters after sample preparation
V2 = Initial volume of sample digested in liters

- *The final concentration determined in digested solid samples when reported on a dry weight basis is calculated as follows:*

$$mg/Kg, dry\ weight = \frac{C \times V \times D}{W \times S}$$

Where:
C = Concentration (mg/L) from instrument readout
D = Instrument dilution factor
V = Final volume in liters after sample preparation
W = Weight in Kg of wet sample digested
S = Percent solids/100

Note: A Percent Solids determination must be performed on a separate aliquot when dry weight concentrations are to be reported. If the results are to be reported on wet weight basis the "S" factor should be omitted from the above equation.

Additional Calculations for Organics

- *The calibration factor for an external calibration standard is calculated as follows:*

$$Calibration\ Factor\ (CF) = \frac{Area\ or\ Height\ of\ Peak}{Mass\ Injected\ (ng)}$$

- *Relative Standard Deviation (%RSD), applicable to initial calibration, is calculated as follows:*

$$\%RSD = \frac{SD}{CF_{avg}} \times 100$$

Where:

CF_{avg} = The average of the initial CFs for a compound

SD = The standard deviation (using n-1) of the initial calibration CFs for a compound

- *Aqueous sample concentration using external standard calibration is calculated as follows:*

$$Concentration\,(mg/L) = \frac{(A_x \times V_t \times D_f)}{(CF \times V_i \times V_s)}$$

Where:

A_x = Response for the analyte in the sample
V_i = Volume of extract injected, µL
D_f = Dilution factor
V_t = Volume of total extract, µL
V_s = Volume of sample extracted or purged, mL
CF = Calibration factor, area or height/ng

- *Non-aqueous sample concentration using external standard calibration is calculated as follows:*

$$Concentration\,(mg/kg) = \frac{(A_x \times V_t \times D_f)}{(CF \times V_i \times W \times D)}$$

Where:

A_x = Response for the analyte in the sample
V_i = Volume of extract injected, µL
D_f = Dilution factor
V_t = Volume of total extract, µL
CF = Calibration factor, area or height/ng
W = Weight of sample extracted or purged, g

$$D = \frac{100 - \%Moisture}{100}$$ (D = 1 if wet weight is required)

Additional Calculations for GC/MS SVOA

- Concentration calculation using average response factor:

$$C_{ex} = \frac{R_x C_{is}}{R_{is} \overline{RF}}$$

- Concentration calculation using linear fit:

$$C_{ex} = A + B\frac{(R_x C_{is})}{R_{is}}$$

Where:
C_{ex} = Concentration in extract, µg/ml
R_x = Response for analyte
R_{is} = Response for internal standard
C_{is} = Concentration of internal standard
A = Intercept
B = Slope

- Concentration calculation using quadratic fit:

$$C_{ex} = A + B\left(\frac{R_x C_{is}}{R_{is}}\right) + C\left(\frac{R_x C_{is}}{R_{is}}\right)$$

Where:
C = Curvature

- Aqueous sample concentration is calculated as follows:

$$Concentration, ug/L = \frac{C_{ex} V_t}{V_o}$$

Where:
V_t = Volume of total extract, µL, taking into account dilutions
V_o = Volume of water extracted (ml)

- Sediment/soil, sludge and waste concentration is calculated as follows:

$$Concentration, ug/kg = \frac{C_{ex} V_t}{W_s D}$$

Where:
W_s = Weight of sample extracted or diluted in grams
D = (100 - % moisture in sample)/100, for a dry weight basis or 1 for a wet weight basis

Additional Calculations for GC/MS VOA

- Calculation *(x)* for water and water-miscible waste:

$$x = \frac{(A_x)(I_s)(D_f)}{(A_{is})(V_o)}$$

Where:
A_x = Area of characteristic ion for the compound being measured
A_{is} = Area of the characteristic ion for the internal standard
I_s = Amount of internal standard added in ng
V_o = Volume of water purged, mL

$$D_f = Dilution\ Factor = \frac{Total\ volume\ purged\ (mL)}{Volume\ of\ original\ sample\ used\ (mL)}$$

- Calculation *(x)* for medium level soils:

$$x = \frac{(A_x)(I_s)(V_t)(1000)(D_f)}{(A_{is})(V_a)(W_s)(D)}$$

Where:
A_x, I_s, D_f, A_{is} are the same as for water
V_t = Volume of total extract, mL (typically 25 mL)
V_a = Volume of extract added for purging, µL
W_s = Weight of sample extracted, g

$$D = \frac{100 - \%\,moisture}{100}$$

- Calculation *(x)* for low level soils:

$$x = \frac{(A_x)(I_s)}{(A_{is})(W_s)(D)}$$

Where:
A_x, I_s, A_{is} are the same as for water
D is the same as for medium level soils
W_s = Weight of sample added to the purge vessel, g

Gamma Activity Concentration

The activity concentration of a sample will be calculated using the following equation.

$$ACT_S = \frac{Net_Counts}{2.22 * E * t_S * Ab * V_A * D_C * D_S}$$

where:

ACT_S	=	the activity in pCi/(units of the volume)
Net_Counts	=	the net area of a peak
2.22	=	the correction factor to pCi
E	=	the efficiency – corrected for transmission
t_S	=	the count time in minutes
Ab	=	the gamma abundance factor
V_A	=	the sample aliquot volume
D_C	=	the decay correction during the analysis
D_S	=	the decay correction from collection date to start of analysis

Gamma Uncertainty of Concentration (at 2σ confidence level)

The Total Promulgated Uncertainty (TPU) will be calculated using the following equation.

The software calculates the 2σ TPU term by incorporating the stochastic counting uncertainty and by examinging the nuclide library for the error in the nuclide half-life and abundance for their respective contributions. The software routine also includes the standard certificate file and the calibration standard uncertainties. Finally, a 1% factor is added in quadrature due to the uncertainty in the preparation of the sample. This is attributed to the maximum allowable variability of the balances.

$$TPU_S = 1.96 * ACT_S * \sqrt{\left(\frac{\Delta P}{P}\right)^2 + \left(\frac{\Delta Ab}{Ab}\right)^2 + \left(\frac{\Delta \varepsilon}{\varepsilon}\right)^2 + \left(\frac{\Delta V}{V}\right)^2 + \left(\frac{sys}{100}\right)^2 + (\Delta Decay)^2}$$

Where:

$$\Delta\ Decay = \left[\frac{\Delta T_{1/2}}{T_{1/2}}\right] * \left[\frac{\lambda E_r}{1 - e^{-\lambda E_r}} - \lambda (T_S + E_r) - 1\right]$$

Where:

TPU_S	= the 2σ uncertainty of the activity of the sample
ACT_S	= the activity in pCi/(units of volume)
1.96	= the statistical multiplication factor for 95% confidence level
ΔP	= the uncertainty in the peak area
ΔAb	= the uncertainty in gamma abundance
$\Delta\varepsilon$	= the uncertainty in the efficiency ε
ΔV	= the uncertainty in the volume
sys	= the systematic error estimate (in %)*
$\Delta T_{1/2}$	= the uncertainty in the half-life
$T_{1/2}$	= the half life of the nuclide of interest
λ	= the decay constant
E_r	= the elapsed real time during count
T_s	= the sample collection time

Gamma MDC

The minimum detectable concentation will be calculated using the following equation.

$$MDC = \frac{4.65 * \sqrt{R_B * t_S} + 2.71}{2.22 * E * t_S * Ab * V_A * D_C * D_S}$$

Where:

MDC	=	Minimum Detectable Activity of the sample
R_B	=	Count rate of detector background (in cpm)
t_S	=	Count time for analysis
E	=	Detector efficiency
Ab	=	Abundance of the gamma emission
V_A	=	sample aliquot volume
D_C	=	Decay during sample analysis
D_S	=	Decay from collection to start of analysis

Alpha Activity Concentration for each region of interest (ROI) in pCi/unit volume.

$$ACT_S = \frac{(C_S - C_B)}{2.22 * E * Ab * Y * D * V_S * t_S)}$$

Where:

ACT_S	=	Activity of the sample
C_S	=	Sample Counts
C_B	=	Background counts
E	=	Detector efficiency
Ab	=	Abundance of the alpha emission
Y	=	Yield
D	=	Decay
t_s	=	Count time for analysis
V_A	=	Sample aliquot volume

Alpha Uncertainty of Concentration (at 2s confidence level)

The 2-sigma (s) Total Propagated Uncertainty (TPU) term for each region of interest (pCi/unit volume) is calculated by the computer software. The software calculates the stochastic counting uncertainty and software reviews the nuclide library for the error in the nuclide half-life and abundance. The software also reviews the standard certificate file to review the calibration standard uncertainty. A 5% factor is added in quadrature (the square root of the sum of the squares) due to the error in the sample volume, the chemical yield and geometry reproducibility.

$$TPU_S = (1.96)\,|ACT_S|\sqrt{U_C^2 + U_E^2 + U_{Ab}^2 + U_{t1/2}^2 + U_Y^2 + U_V^2 + U_{Prep}^2}$$

Where:

U_C^2	=	Stochastic counting uncertainty
U_E^2	=	Uncertainty in efficiency
U_{Ab}^2	=	Uncertainty in abundance
$U_{t1/2}^2$	=	Uncertainty in half-life
U_Y^2	=	Uncertainty in yield
U_V^2	=	Uncertainty in volume
U_{Prep}^2	=	Uncertainty in prep

Following is the alpha spectroscopy Minimum Detectable Concentration (MDC)

$$MDC = \frac{4.65 * \sqrt{R_B * t_S} + 2.71}{2.22 * E * Ab * Y * D * V_A * t_S}$$

Where:

MDC	=	Minimum Detectable Activity/Concentration of the sample
RB	=	Count rate of detector background (in cpm)
E	=	Detector efficiency
Ab	=	Abundance of the alpha emission
Y	=	Yield
D	=	Decay
t_s	=	Count time for analysis
V_A	=	Sample aliquot volume

Tracer Yield Recovery

$$Y = \frac{(C_T - C_B)}{E * A_T * t_S}$$

Where:

Y	=	Chemical Yield
C_T	=	Tracer Counts
C_B	=	Tracer ROI background counts
A_T	=	Tracer dpm
t_s	=	Count time for analysis
E	=	Detector efficiency

Upon request, and with discussion as to the specification of the application, the laboratory will provide MDAs calculated using non-paired observations as noted below in the DOE QSAS.

When sample and background counts are different, the following equation is used.

$$MDA = \frac{3.29\sqrt{\frac{b}{T_s} + \frac{b}{T_b}}}{K} + \frac{3}{K * Ts}$$

where

b = background count rate in cpm
T = count time in minutes
K = efficiency * $e^{\lambda t}$ * aliquot taken * tracer recovery * ABN
Efficiency = detector efficiency
T = time from sample collection to mid-point of count time (or nuclide separation, as applicable)
Λ – Analyte decay constant = ln2/(half-life)
ABN = abundance
T_s = count time of the sample in minutes
T_b = count time of the background in minutes

SEVERN TRENT **STL**

Equations for
Gross Alpha-Beta Solid, Direct Count

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{(SampleCPM - BkgCPM)}{Aliquot \times Efficiency}\right) \times UnitCorrectionFactor$$

Activity, Crosstalk Corrected for Beta

$$\frac{\left(\frac{(BetaSampleCounts - CrossTalkCounts)}{SampleCountDuration}\right) - \left(\frac{BetaBkgCounts}{BkgCountDuration}\right)}{(BetaEfficiency \times Aliquot)} \times UnitConversionFactor \times DilutionFactor$$

NOTE: If crosstalk correction is set to false, crosstalk counts = 0.

Crosstalk Counts, Alpha into Beta

$$AlphaCounts \times \left(Intercept + \left((ResidualMass)^3 \times V3\right) + \left((ResidualMass)^2 \times V2\right) + \left((ResidualMass) \times V1\right)\right)$$

Where:
V3 = 3rd Order Cross Talk Variable
V2 = 2nd Order Cross Talk Variable
V1 = 1st Order Cross Talk Variable

NOTE: If crosstalk correction is set to false, crosstalk counts = 0.

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(SampleCPM - BkgCPM) + 2.71}{Aliquot \times Efficiency \times SampleCountDuration}\right)} \times UnitCorrectionFactor$$

Efficiency

$$Intercept + \left((ResidualMass)^3 \times V3\right) + \left((ResidualMass)^2 \times V2\right) + \left((ResidualMass) \times V1\right)$$

Where:
V3 = 3rd Order Efficiency Variable
V2 = 2nd Order Efficiency Variable
V1 = 1st Order Efficiency Variable

MDA

$$\left(\frac{4.65\sqrt{(BkgCPM \times CountDuration)} + 2.71}{Aliquot \times Efficiency \times CountDuration}\right) \times UnitCorrectionFactor$$

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \frac{SampleCounts + BkgCounts}{\sqrt{(SampleCounts - BkgCounts)^2}}$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for
Plutonium-241 by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{(SampleDPM - BkgDPM)}{Aliquot \times Yield} \times UnitCorrectionFactor$$

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(SampleCPM - BkgCPM) + 2.71}{Aliquot \times Efficiency \times SampleCountDuration}\right)} \times UnitCorrectionFactor$$

MDA

$$\left(\frac{4.65\sqrt{(BkgCPM \times CountDuration)} + 2.71}{Aliquot \times Efficiency \times CountDuration}\right) \times UnitCorrectionFactor$$

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for
Technecium-99 by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{(SampleDPM - BkgDPM)}{Aliquot \times Yield}\right) \times UnitCorrectionFactor$$

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(SampleCPM - BkgCPM) + 2.71}{Aliquot \times Efficiency \times SampleCountDuration}\right)} \times UnitCorrectionFactor$$

MDA

$$\left(\frac{4.65\sqrt{(BkgCPM \times CountDuration)} + 2.71}{Aliquot \times Efficiency \times CountDuration}\right) \times UnitCorrectionFactor$$

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for
Carbon-14 by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{(\text{SampleDPM} - \text{BkgDPM})}{\text{Aliquot}} \times \text{UnitCorrectionFactor}$$

DER (Normalized Absolute Difference)

$$\text{abs}\left(\frac{(\text{SampleActity} - \text{SampleDuplicateActity})}{\sqrt{(\text{SampleUncertainty})^2 + (\text{SampleDuplicateUncertainty})^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(\text{SampleCPM} - \text{BkgCPM}) + 2.71}{\text{Aliquot} \times \text{Efficiency} \times \text{SampleCountDuration}}\right)} \times \text{UnitCorrectionFactor}$$

MDA

$$\left(\frac{4.65\sqrt{(\text{BkgCPM} \times \text{CountDuration})} + 2.71}{\text{Aliquot} \times \text{Efficiency} \times \text{CountDuration}}\right) \times \text{UnitCorrectionFactor}$$

RER (DOE Alberqueque)

$$\text{abs}\left(\frac{(\text{SampleActivity} - \text{SampleDuplicateActivity})}{(\text{SampleUncertainty} + \text{SampleDuplicateUncertainty})}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2}}$$

Uncertainty, Total

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for

Tritium in Liquid by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{(\text{SampleDPM} - \text{BkgDPM})}{\text{Aliquot}} \times \text{UnitCorrectionFactor}$$

DER (Normalized Absolute Difference)

$$\text{abs}\left(\frac{(\text{SampleActivity} - \text{SampleDuplicateActivity})}{\sqrt{(\text{SampleUncertainty})^2 + (\text{SampleDuplicateUncertainty})^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(\text{SampleCPM} - \text{BkgCPM}) + 2.71}{\text{Aliquot} \times \text{Efficiency} \times \text{SampleCountDuration}}\right)} \times \text{UnitCorrectionFactor}$$

MDA

$$\left(\frac{4.65\sqrt{(\text{BkgCPM} \times \text{CountDuration})} + 2.71}{\text{Aliquot} \times \text{Efficiency} \times \text{CountDuration}}\right) \times \text{UnitCorrectionFactor}$$

RER (DOE Alberqueque)

$$\text{abs}\left(\frac{(\text{SampleActivity} - \text{SampleDuplicateActivity})}{(\text{SampleUncertainty} + \text{SampleDuplicateUncertainty})}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2}}$$

Uncertainty, Total

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2} + 0.0025}$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for

Tritium in Soil by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{(SampleDPM - BkgDPM)}{Aliquot} \times \frac{VolumeWaterAdded + (Aliquot \times PercentMoisture)}{VolumeCounted} \times UnitCorrectionFactor$$

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(SampleCPM - BkgCPM) + 2.71}{Aliquot \times Efficiency \times SampleCountDuration}\right)} \times UnitCorrectionFactor$$

MDA

$$\left(\frac{4.65 \sqrt{(BkgCPM \times CountDuration)} + 2.71}{Aliquot \times Efficiency \times CountDuration}\right) \times UnitCorrectionFactor$$

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

Company Confidential & Proprietary

SEVERN TRENT STL

Equations for

Uranium, Total by KPA

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

DER (Normalized Absolute Difference)

$$\text{abs}\left(\frac{(\text{SampleActivity}-\text{SampleDuplicateActivity})}{\sqrt{(\text{SampleUncertainty})^2+(\text{SampleDuplicateUncertainty})^2}}\right)$$

As defined by DOE QSAS, Revision 2

RER (DOE Alberqueque)

$$\text{abs}\left(\frac{(\text{SampleActivity}-\text{SampleDuplicateActivity})}{(\text{SampleUncertainty}+\text{SampleDuplicateUncertainty})}\right)$$

As Defined by the DOE Alberqueque SOW

Result

$$\left(\frac{(\text{InstrumentConc}_{(ug/L)}\times\text{InstrumentDilution}\times\text{DigestionVolume})}{\text{Aliquot}\times 1000}\right)\times\text{UnitCorrectionFactor}$$

Uncertainty, Count

$$\text{Result}\times\text{Sigma}\times\frac{\text{InstrumentUncertainty}}{\text{InstrumentConc}}$$

Uncertainty, Total

$$\text{Result}\times\text{Sigma}\times\sqrt{\left(\frac{\text{InstrumentUncertainty}}{\text{InstrumentConc}}\right)^2+0.025}$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for

Radium-226

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{(SampleCPM - BkgCPM)}{Aliquot \times Efficiency \times IngrowthFactor \times BaYield}\right) \times UnitCorrectionFactor$$

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$\left(\frac{1.645\sqrt{2 \times (BkgCPM \times SampleCountDuration)}}{Aliquot \times Efficiency \times IngrowthFactor \times BaYield \times SampleCountDuration}\right) \times UnitCorrectionFactor$$

MDA

$$\left(\frac{(4.66 \times \sqrt{BkgCPM \times SampleCountDuration}) + 2.71}{Aliquot \times Efficiency \times IngrowthFactor \times BaYield \times SampleCountDuration}\right) \times UnitCorrectionFactor$$

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for
Radium, Total Alpha-Emitting

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{(SampleCPM - BkgCPM)}{Aliquot \times Efficiency \times IngrowthFactor \times BaYield}\right) \times UnitCorrectionFactor$$

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$\left(\frac{1.645\sqrt{2 \times (BkgCPM \times SampleCountDuration)}}{Aliquot \times Efficiency \times IngrowthFactor \times BaYield \times SampleCountDuration}\right) \times UnitCorrectionFactor$$

MDA

$$\left(\frac{\left(4.66 \times \sqrt{BkgCPM \times SampleCountDuration}\right) + 2.71}{Aliquot \times Efficiency \times IngrowthFactor \times BaYield \times SampleCountDuration}\right) \times UnitCorrectionFactor$$

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for

Radium-228

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{(SampleCPM - BkgCPM) \times \lambda \times t_2 \times UnitCorrectionFactor}{Aliquot \times Efficiency \times Ingrowth \times Ba\ Yield \times Y\ Yield \times \left(1 - EXP\left(-\lambda \times \left(\frac{t_2}{1440}\right)\right)\right) \times (1 - EXP(-\lambda \times t_3)) \times EXP(-\lambda t_1)}$$

Where:
t_1 = Count Start Time × YPrecipitation Time
t_2 = Sample Count Duration
t_3 = YPrecipitation Time - Y Ingrowth Start Time
λ = Ac - 228 Half life (in days)

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$\frac{1.645 \times \sqrt{2 \times BkgCPM \times t_2} \times \lambda \times t_2}{Aliquot \times Efficiency \times Ingrowth \times Ba\ Yield \times Y\ Yield \times \left(1 - EXP\left(-\lambda \times \left(\frac{t_2}{1440}\right)\right)\right) \times (1 - EXP(-\lambda \times t_3)) \times EXP(-\lambda t_1)} \times UnitCorrectionFactor$$

Where:
t_1 = Count Start Time × YPrecipitation Time
t_2 = Sample Count Duration
t_3 = YPrecipitation Time - Y Ingrowth Start Time
λ = Ac - 228 Half life (in days)

MDA

$$\frac{\left(4.66 \times \sqrt{BkgCPM \times t_2}\right) + 2.71) \times \lambda \times t_2}{Aliquot \times Efficiency \times Ingrowth \times Ba\ Yield \times Y\ Yield \times \left(1 - EXP\left(-\lambda \times \left(\frac{t_2}{1440}\right)\right)\right) \times (1 - EXP(-\lambda \times t_3)) \times EXP(-\lambda t_1)} \times UnitCorrectionFactor$$

Where:
t_1 = Count Start Time × YPrecipitation Time
t_2 = Sample Count Duration
t_3 = YPrecipitation Time - Y Ingrowth Start Time
λ = Ac - 228 Half life (in days)

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for
Strontium-90 by GFPC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

DER (Normalized Absolute Difference)

$$\mathrm{abs}\left(\frac{(\mathrm{SampleActivity}-\mathrm{SampleDuplicateActivity})}{\sqrt{(\mathrm{SampleUncertainty})^2+(\mathrm{SampleDuplicateUncertainty})^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645\times\sqrt{\left(\frac{2\times(\mathrm{SampleCPM}-\mathrm{BkgCPM})}{\mathrm{Aliquot}\times\mathrm{Efficiency}\times\mathrm{IngrowthFactor}\times\mathrm{Y90Yield}\times\mathrm{TotalSrYield}\times\mathrm{SampleCountDuration}\times\mathrm{Y90DecayFactor}}\right)}\times\mathrm{UnitCorrectionFactor}$$

Ingrowth Factor

$$1-\mathrm{Exp}\left(\frac{-0.693\times(\mathrm{EndSr90IngrowthTime}-\mathrm{BeginSr90IngrowthTime})}{2.6708}\right)$$

MDA

$$\frac{4.65\sqrt{(\mathrm{BkgCPM})}+2.71}{\mathrm{Aliquot}\times\mathrm{Efficiency}\times\mathrm{IngrowthFactor}\times\mathrm{Y90Yield}\times\mathrm{SampleCountDuration}\times\mathrm{Y90DecayFactor}}\times\mathrm{UnitCorrectionFactor}$$

RER (DOE Alberqueque)

$$\mathrm{abs}\left(\frac{(\mathrm{SampleActivity}-\mathrm{SampleDuplicateActivity})}{(\mathrm{SampleUncertainty}+\mathrm{SampleDuplicateUncertainty})}\right)$$

As Defined by the DOE Alberqueque SOW

Sr-90 Activity

$$\frac{\mathrm{SampleCPM}-\mathrm{BkgCPM}}{\mathrm{Y90Decay}\times\mathrm{Efficiency}\times\mathrm{IngrowthFactor}\times\mathrm{Aliquot}\times\mathrm{Y90Yield}\times\mathrm{TotalSrYield}}\times\mathrm{UnitCorrectionFactor}$$

Uncertainty, Count

$$\mathrm{Activity}\times\mathrm{Sigma}\times\sqrt{\frac{\mathrm{SampleCounts}+\mathrm{BkgCounts}}{(\mathrm{SampleCounts}-\mathrm{BkgCounts})^2}}$$

Uncertainty, Total

$$\mathrm{Activity}\times\mathrm{Sigma}\times\sqrt{\frac{\mathrm{SampleCounts}+\mathrm{BkgCounts}}{(\mathrm{SampleCounts}-\mathrm{BkgCounts})^2}+0.0025}$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for
Strontium-89 by GFPC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

DER (Normalized Absolute Difference)

$$\text{abs}\left(\frac{(\text{SampleActivity}-\text{SampleDuplicateActivity})}{\sqrt{(\text{SampleUncertainty})^2+(\text{SampleDuplicateUncertainty})^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645\times\sqrt{\left(\frac{2\times(\text{SampleCPM}-\text{BkgCPM})}{\text{Aliquot}\times\text{Efficiency}\times\text{IngrowthFactor}\times\text{Y90Yield}\times\text{TotalSrYield}\times\text{SampleCountDuration}\times\text{Y90DecayFactor}}\right)}\times\text{UnitCorrectionFactor}$$

MDA

$$\frac{4.65\sqrt{(\text{BkgCPM})}+2.71}{\text{Aliquot}\times\text{Efficiency}\times\text{IngrowthFactor}\times\text{Y90Yield}\times\text{SampleCountDuration}\times\text{Y90DecayFactor}}\times\text{UnitCorrectionFactor}$$

RER (DOE Alberqueque)

$$\text{abs}\left(\frac{(\text{SampleActivity}-\text{SampleDuplicateActivity})}{(\text{SampleUncertainty}+\text{SampleDuplicateUncertainty})}\right)$$

As Defined by the DOE Alberqueque SOW

Sr-89 Activity

$$(\text{TSrActivity}-\text{Sr90Activity})$$

Sr-90 Activity

$$\frac{\text{SampleCPM}-\text{BkgCPM}}{\text{Y90Decay}\times\text{Efficiency}\times\text{IngrowthFactor}\times\text{Aliquot}\times\text{Y90Yield}\times\text{TotalSrYield}}\times\text{UnitCorrectionFactor}$$

Total Strontium Activity

$$\frac{\text{TotalSrSampleCPM}-\text{TotalSrBkgCPM}}{\text{Efficiency}\times\text{Y90IngrowthFactor}\times\text{Aliquot}\times\text{TotalSrYield}}\times\text{UnitCorrectionFactor}$$

Uncertainty, Count

$$\text{Activity}\times\text{Sigma}\times\sqrt{\frac{\text{SampleCounts}+\text{BkgCounts}}{(\text{SampleCounts}-\text{BkgCounts})^2}}$$

Uncertainty, Total

$$\text{Activity}\times\text{Sigma}\times\sqrt{\frac{\text{SampleCounts}+\text{BkgCounts}}{(\text{SampleCounts}-\text{BkgCounts})^2}+0.0025}$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for

Iron-55 by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{(SampleDPM - BkgDPM)}{Aliquot \times Yield}\right) \times UnitCorrectionFactor \times DilutionFactor$$

Aliquot

$$SampleAliquot - \left(SampleAliquot \times \frac{TracerSplitFinal}{ElutionVolume}\right)$$

NOTE: This value is used in the Activity equation. The Aliquot is adjusted to account for the portion of sample removed for yield determination.

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

Yield

$$\frac{TracerConcFinal \times \left(\frac{ElutionVolume}{TracerSplitFinal}\right)}{TracerConcInitial \times \left(\frac{DigestionVolume}{TracerSplitInitial}\right)} \times DilutionFactor$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for
Strontium, Total by GFPC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

DER (Normalized Absolute Difference)

$$\text{abs}\left(\frac{(\text{SampleActivity}-\text{SampleDuplicateActivity})}{\sqrt{(\text{SampleUncertainty})^2+(\text{SampleDuplicateUncertainty})^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645\times\sqrt{\frac{2\times(\text{SampleCPM}-\text{BkgCPM})}{\text{Aliquot}\times\text{Efficiency}\times\text{IngrowthFactor}\times\text{TotalSrYield}\times\text{SampleCountDuration}}}\times\text{UnitCorrectionFactor}$$

Ingrowth

$$1-\text{EXP}\left(\frac{-0.693}{2.6708}\times\left((\text{BeginTotalSrCountTime}-\text{EndY90IngrowthTime})+\left(\frac{\text{TotalSrCountDuration}\times 1440}{2}\right)\right)\right)$$

MDA

$$\frac{4.65\sqrt{(\text{BkgCPM})}+2.71}{\text{Aliquot}\times\text{Efficiency}\times\text{IngrowthFactor}\times\text{TotalSrYield}\times\text{SampleCountDuration}}\times\text{UnitCorrectionFactor}$$

RER (DOE Alberqueque)

$$\text{abs}\left(\frac{(\text{SampleActivity}-\text{SampleDuplicateActivity})}{(\text{SampleUncertainty}+\text{SampleDuplicateUncertainty})}\right)$$

As Defined by the DOE Alberqueque SOW

Total Strontium Activity

$$\frac{\text{TotalSrSampleCPM}-\text{TotalSrBkgCPM}}{\text{Efficiency}\times\text{Y90IngrowthFactor}\times\text{Aliquot}\times\text{TotalSrYield}}\times\text{UnitCorrectionFactor}$$

Uncertainty, Count

$$\text{Activity}\times\text{Sigma}\times\sqrt{\frac{\text{SampleCounts}+\text{BkgCounts}}{(\text{SampleCounts}-\text{BkgCounts})^2}}$$

Uncertainty, Total

$$\text{Activity}\times\text{Sigma}\times\sqrt{\frac{\text{SampleCounts}+\text{BkgCounts}}{(\text{SampleCounts}-\text{BkgCounts})^2}}+0.0025$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for
Lead-210 by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{(SampleDPM - BkgDPM)}{Aliquot \times Yield}\right) \times UnitCorrectionFactor \times DilutionFactor$$

Aliquot

$$SampleAliquot - \left(SampleAliquot \times \frac{TracerSplitFinal}{ElutionVolume}\right)$$

NOTE: This value is used in the Activity equation. The Aliquot is adjusted to account for the portion of sample removed for yield determination.

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

Yield

$$\frac{TracerConcFinal \times \left(\frac{ElutionVolume}{TracerSplitFinal}\right)}{TracerConcInitial \times \left(\frac{DigestionVolume}{TracerSplitInitial}\right)} \times DilutionFactor$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for

Iodine-129, Precipitation Method by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{(SampleDPM - BkgDPM)}{Aliquot \times Yield} \times UnitCorrectionFactor \times DilutionFactor$$

Aliquot

$$SampleAliquot - \left(SampleAliquot \times \frac{TracerSplitFinal}{ElutionVolume}\right)$$

NOTE: This value is used in the Activity equation. The Aliquot is adjusted to account for the portion of sample removed for yield determination.

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

Yield

$$\frac{TracerConcFinal \times \left(\frac{ElutionVolume}{TracerSplitFinal}\right)}{TracerConcInitial \times \left(\frac{DigestionVolume}{TracerSplitInitial}\right)} \times DilutionFactor$$

Company Confidential & Proprietary

SEVERN TRENT **STL**

Equations for

Radium-226 by Ba-133 Tracer

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{(\text{SampleCPM} - \text{BkgCPM})}{\text{Aliquot} \times \text{Efficiency} \times \text{IngrowthFactor} \times \text{BaYield}}\right) \times \text{UnitCorrectionFactor}$$

DER (Normalized Absolute Difference)

$$\text{abs}\left(\frac{(\text{SampleActivity} - \text{SampleDuplicateActivity})}{\sqrt{(\text{SampleUncertainty})^2 + (\text{SampleDuplicateUncertainty})^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$\left(\frac{1.645\sqrt{2 \times (\text{BkgCPM} \times \text{SampleCountDuration})}}{\text{Aliquot} \times \text{Efficiency} \times \text{IngrowthFactor} \times \text{BaYield} \times \text{SampleCountDuration}}\right) \times \text{UnitCorrectionFactor}$$

MDA

$$\left(\frac{\left(4.66 \times \sqrt{\text{BkgCPM} \times \text{SampleCountDuration}}\right) + 2.71}{\text{Aliquot} \times \text{Efficiency} \times \text{IngrowthFactor} \times \text{BaYield} \times \text{SampleCountDuration}}\right) \times \text{UnitCorrectionFactor}$$

RER (DOE Alberqueque)

$$\text{abs}\left(\frac{(\text{SampleActivity} - \text{SampleDuplicateActivity})}{(\text{SampleUncertainty} + \text{SampleDuplicateUncertainty})}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2}}$$

Uncertainty, Total

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for
Total Activity by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{\text{SampleDPM} - \text{BkgDPM}}{\left(\frac{\text{VolumeCounted}}{\text{VolumeCollected}}\right) \times \text{Aliquot}}\right) \times \text{UnitConversionFactor}$$

DER (Normalized Absolute Difference)

$$\text{abs}\left(\frac{(\text{SampleActity} - \text{SampleDuplicateActity})}{\sqrt{(\text{SampleUncertainty})^2 + (\text{SampleDuplicateUncertainty})^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(\text{SampleCPM} - \text{BkgCPM}) + 2.71}{\text{Aliquot} \times \text{Efficiency} \times \text{SampleCountDuration}}\right)} \times \text{UnitCorrectionFactor}$$

MDA

$$\left(\frac{4.65\sqrt{(\text{BkgCPM} \times \text{CountDuration})} + 2.71}{\text{Aliquot} \times \text{Efficiency} \times \text{CountDuration}}\right) \times \text{UnitCorrectionFactor}$$

Uncertainty, Count

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2}}$$

Uncertainty, Total

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for

Tritium in Silica Gel, Brookhaven

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{\text{SampleDPM} - \text{BkgDPM}}{\dfrac{\text{Aliquot} \times \text{VolumeCounted}}{\left(\text{SilicaGelWeight}_{\text{Final}} - \text{SilicaGelWeight}_{\text{Initial}}\right)}}\right) \times \text{UnitConversionFactor}$$

DER (Normalized Absolute Difference)

$$\text{abs}\left(\frac{(\text{SampleActity} - \text{SampleDuplicateActity})}{\sqrt{(\text{SampleUncertainty})^2 + (\text{SampleDuplicateUncertainty})^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(\text{SampleCPM} - \text{BkgCPM}) + 2.71}{\text{Aliquot} \times \text{Efficiency} \times \text{SampleCountDuration}}\right)} \times \text{UnitCorrectionFactor}$$

MDA

$$\left(\frac{4.65\sqrt{(\text{BkgCPM} \times \text{CountDuration})} + 2.71}{\text{Aliquot} \times \text{Efficiency} \times \text{CountDuration}}\right) \times \text{UnitCorrectionFactor}$$

RER (DOE Alberqueque)

$$\text{abs}\left(\frac{(\text{SampleActivity} - \text{SampleDuplicateActivity})}{(\text{SampleUncertainty} + \text{SampleDuplicateUncertainty})}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2}}$$

Uncertainty, Total

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for
Promethium-147 by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{SampleDPM - BkgDPM}{\left(\frac{VolumeCounted}{FinalVolume}\right) \times Aliquot \times Yield}\right) \times UnitConversionFactor$$

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(SampleCPM - BkgCPM) + 2.71}{Aliquot \times Efficiency \times SampleCountDuration}\right)} \times UnitCorrectionFactor$$

MDA

$$\left(\frac{4.65\sqrt{(BkgCPM \times CountDuration)} + 2.71}{Aliquot \times Efficiency \times CountDuration}\right) \times UnitCorrectionFactor$$

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for

Gross Alpha-Beta, Total Dissolution

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\left(\frac{(SampleCPM - BkgCPM)}{Aliquot \times Efficiency}\right) \times UnitCorrectionFactor$$

Activity, Crosstalk Corrected for Beta

$$\frac{\left(\frac{(BetaSampleCounts - CrossTalkCounts)}{SampleCountDuration}\right) - \left(\frac{BetaBkgCounts}{BkgCountDuration}\right)}{(BetaEfficiency \times Aliquot)} \times UnitConversionFactor \times DilutionFactor$$

NOTE: If crosstalk correction is set to false, crosstalk counts = 0.

Crosstalk Counts, Alpha into Beta

$$AlphaCounts \times \left(Intercept + \left((ResidualMass)^3 \times V3\right) + \left((ResidualMass)^2 \times V2\right) + \left((ResidualMass) \times V1\right)\right)$$

Where:
V3 = 3rd Order Cross Talk Variable
V2 = 2nd Order Cross Talk Variable
V1 = 1st Order Cross Talk Variable

NOTE: If crosstalk correction is set to false, crosstalk counts = 0.

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(SampleCPM - BkgCPM) + 2.71}{Aliquot \times Efficiency \times SampleCountDuration}\right)} \times UnitCorrectionFactor$$

Efficiency

$$Intercept + \left((ResidualMass)^3 \times V3\right) + \left((ResidualMass)^2 \times V2\right) + \left((ResidualMass) \times V1\right)$$

Where:
V3 = 3rd Order Efficiency Variable
V2 = 2nd Order Efficiency Variable
V1 = 1st Order Efficiency Variable

MDA

$$\left(\frac{4.65\sqrt{(BkgCPM \times CountDuration)} + 2.71}{Aliquot \times Efficiency \times CountDuration}\right) \times UnitCorrectionFactor$$

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

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Uncertainty, Total

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for
Tritium, Cryogenic

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{(SampleDPM - BkgDPM)}{Aliquot} \times \frac{VolumeWaterAdded + (Aliquot \times PercentMoisture)}{VolumeCounted} \times UnitCorrectionFactor$$

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(SampleCPM - BkgCPM) + 2.71}{Aliquot \times Efficiency \times SampleCountDuration}\right)} \times UnitCorrectionFactor$$

MDA

$$\left(\frac{4.65\sqrt{(BkgCPM \times CountDuration)} + 2.71}{Aliquot \times Efficiency \times CountDuration}\right) \times UnitCorrectionFactor$$

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for
Chlorine-36 by GFPC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{SampleCPM - BkgCPM}{Efficiency \times Aliquot \times Yield} \times UnitCorrectionFactor \times DilutionFactor$$

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(SampleCPM - BkgCPM) + 2.71}{Aliquot \times Efficiency \times SampleCountDuration}\right)} \times UnitCorrectionFactor$$

MDA

$$\left(\frac{4.65\sqrt{(BkgCPM \times CountDuration)} + 2.71}{Aliquot \times Efficiency \times CountDuration}\right) \times UnitCorrectionFactor$$

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for
Carbon-14 by GFPC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{SampleCPM - BkgCPM}{Efficiency \times Aliquot \times CarbonRatio} \times UnitCorrectionFactor \times DilutionFactor$$

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

DLC

$$1.645 \times \sqrt{\left(\frac{(SampleCPM - BkgCPM) + 2.71}{Aliquot \times Efficiency \times SampleCountDuration}\right)} \times UnitCorrectionFactor$$

MDA

$$\left(\frac{4.65 \sqrt{(BkgCPM \times CountDuration)} + 2.71}{Aliquot \times Efficiency \times CountDuration}\right) \times UnitCorrectionFactor$$

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

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Uncertainty, Total

$$\text{Activity} \times \text{Sigma} \times \sqrt{\frac{\text{SampleCounts} + \text{BkgCounts}}{(\text{SampleCounts} - \text{BkgCounts})^2} + 0.0025}$$

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SEVERN TRENT **STL**

Equations for
Nickel-59/63 by LSC

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Activity

$$\frac{(SampleDPM - BkgDPM)}{Aliquot \times Yield \times DecayFactor} \times UnitCorrectionFactor \times DilutionFactor$$

Aliquot

$$SampleAliquot - \left(SampleAliquot \times \frac{TracerSplitFinal}{ElutionVolume}\right)$$

NOTE: This value is used in the Activity equation. The Aliquot is adjusted to account for the portion of sample removed for yield determination.

DER (Normalized Absolute Difference)

$$abs\left(\frac{(SampleActity - SampleDuplicateActity)}{\sqrt{(SampleUncertainty)^2 + (SampleDuplicateUncertainty)^2}}\right)$$

As defined by DOE QSAS, Revision 2

RER (DOE Alberqueque)

$$abs\left(\frac{(SampleActivity - SampleDuplicateActivity)}{(SampleUncertainty + SampleDuplicateUncertainty)}\right)$$

As Defined by the DOE Alberqueque SOW

Uncertainty, Count

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2}}$$

Uncertainty, Total

$$Activity \times Sigma \times \sqrt{\frac{SampleCounts + BkgCounts}{(SampleCounts - BkgCounts)^2} + 0.0025}$$

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Appendix 9

TestAmerica St. Louis SOP List

Department	Document Number	Rev	Active Date	SOP Title
GC/HPLC	STL-GC-0005	12	2/22/2007	Extractable Total Petroleum Hydrocarbons
GC/HPLC	STL-GC-0013	9	1/31/2007	Extraction and analysis of Phenols
GC/HPLC	STL-GC-0014	6	3/23/2007	Aromatic Volatiles and Volatile Petroleum Hydrocarbons
GC/HPLC	STL-GC-0015	5	10/26/2007	PCB GC Analysis
GC/HPLC	STL-GC-0016	6	3/23/2007	Pesticide GC Analysis
GC/HPLC	STL-GC-0017	5	3/21/2007	Herbicide GC Analysis
GC/HPLC	STL-GC-0018	5	4/4/2007	Analysis of Water Miscible Non-Halogenated Organic Compounds
Health & Safety	STL-HS-0001	5	7/9/2007	Waste Minimization Plan
Health & Safety	STL-HS-0002	8	7/9/2007	Facility Addendum to Corporate Safety Manual
Health & Safety	STL-HS-0003	3	7/9/2007	St. Louis Facility Contingency Plan
Health & Safety	STL-HS-0004	10	7/9/2007	Hazardous Waste Management Plan
Health & Safety	STL-HS-0005	2	1/27/2007	Laboratory Security Systems
Health & Safety	STL-HS-0006	1	1/27/2007	Quarantine Soils Procedure
Inorganic Prep	STL-IP-0001	8	1/10/2006	Reactive Cyanide & Sulfide
Inorganic Prep	STL-IP-0002	8	5/18/2007	Acid Digestion of soil
Inorganic Prep	STL-IP-0004	6	5/21/2007	Labware Prep for Inorganic & Trace Metal Analysis
Inorganic Prep	STL-IP-0005	7	1/18/2006	Cyanide Distillation
Inorganic Prep	STL-IP-0006	4	1/26/2006	Distillation of Phenols
Inorganic Prep	STL-IP-0013	13	5/30/2007	Acid Digestion of Aqueous Samples & Extracts
Inorganic Prep	STL-IP-0014	4	3/1/2006	Alkaline Digestion of Hexavalent Chromium
Inorganic Prep	STL-IP-0015	4	7/27/2007	Filtration Procedure for Dissolved Metals Analysis
Inorganic Prep	STL-IP-0016	6	11/26/2007	TCLP/SPLP and CWET Procedures
Inorganic Prep	STL-IP-0018	3	7/27/2007	Kd Leaching Procedure
Inorganic Prep	STL-IP-0019	3	6/20/2007	Sulfide Distillation
Information Systems	STL-IS-0001	4	5/31/2007	Software Change Management
Information Systems	STL-IS-0002	6	2/24/2007	Software Testing, Validation & Verification
Information Systems	STL-IS-0003	4	5/31/2007	Information Systems
GC/HPLC	STL-LC-0001	6	7/19/2007	HPLC Analysis of PAH/PNA
GC/HPLC	STL-LC-0002	10	11/21/2007	Analysis of Nitroaromatic & Nitroamine Explosives
GCMS	STL-MS-0001	8	7/25/2007	GC/MS Analysis based on 8270C and 625
GCMS	STL-MS-0002	9	5/23/2007	Volatile Organics by GCMS
Metals	STL-MT-0001	9	5/30/2007	Metals by ICP/MS
Metals	STL-MT-0003	7	5/30/2007	Metals by ICP-AES
Metals	STL-MT-0005	5	11/21/2007	Mercury in Aqueous Samples by CVAA
Metals	STL-MT-0007	5	3/10/2007	Mercury in Solid Samples by CVAA
Organic Prep	STL-OP-0001	11	8/2/2007	Labware Preparation for Organic Analysis
Organic Prep	STL-OP-0002	9	8/13/2007	Extraction & Cleanup of Organic Compounds
Organic Prep	STL-OP-0007	6	11/21/2007	Extraction of Herbicieds - Water & Soil
Organic Prep	STL-OP-0008	0	5/24/2007	Extraction of Nitroaromatics
Project Management	STL-PM-0001	1	9/27/2007	Project Setup and Quote
Project Management	STL-PM-0002	9	8/13/2007	Sample Receipt & Chain of Custody

Project Management	STL-PM-0003	6	6/14/2007	Bottle Kit Preparation
Project Management	STL-PM-0004	4	6/15/2007	Data Review, Verification & Reporting
Quality Assurance	STL-QA-0002	8	5/15/2007	Standard and Reagent Preparation
Quality Assurance	STL-QA-0005	14	5/17/2007	Calbration & Verification Procedure for Thermometers
Quality Assurance	STL-QA-0014	9	10/5/2007	Evaluation of Accuracy and Precision via Control C
Quality Assurance	STL-QA-0016	9	7/18/2007	IDL/MDL Determination
Quality Assurance	STL-QA-0021	6	1/22/2007	Internal Surveillance
Quality Assurance	STL-QA-0023	5	7/10/2007	Document Control
Quality Assurance	STL-QA-0024	5	1/22/2007	Preventative Maintenance
Quality Assurance	STL-QA-0028	6	1/15/2007	Water System Maintenance & Monitoring
Quality Assurance	STL-QA-0031	6	7/5/2007	VOA Holding Blank Analysis
Quality Assurance	STL-QA-0035	7	10/23/2007	Preparation and Management of SOPs
Quality Assurance	STL-QA-0036	4	2/22/2007	Non-Conformance Memo Process
Quality Assurance	STL-QA-0037	4	1/22/2007	Procurement of Quality Related Items
Quality Assurance	STL-QA-0038	3	7/18/2007	Procedure for Compositing and Subsampling
Quality Assurance	STL-QA-0039	2	4/17/2007	Sample Transfer Utility
Quality Assurance	STL-QA-0040	1	1/22/2007	Manual Integration Procedure
Rad Prep	STL-RC-0002	7	8/24/2007	Planchet Prep for Radiochemistry
Rad Prep	STL-RC-0003	8	8/24/2007	Drying & Grinding of Soil & Solid Samples
Rad Prep	STL-RC-0004	13	10/29/2007	Prep of Soil, Sludge, Filter, Biota &)/G Samples
Rad Prep	STL-RC-0010	7	8/24/2007	Screening Samples for Presence of Radioactive Materials
Rad Prep	STL-RC-0015	5	8/24/2007	Total Activity Screening Procedure by LSC
Rad Prep	STL-RC-0020	10	8/31/2007	Determination of Gross Alpha/Beta Activity
Rad Prep	STL-RC-0021	9	8/24/2007	Gross Alpha Radiation in Water – Coprecipitation
Rad Prep	STL-RC-0025	6	2/16/2007	Preparation of Samples for Gamma Spectroscopy
Rad Prep	STL-RC-0030	6	2/14/2007	Determination of Tritium in Water, Fluids, Soil
Rad Prep	STL-RC-0031	4	9/10/2007	Tritium Determination by Cryogenic Distillation
Rad Prep	STL-RC-0036	3	8/31/2007	Determination of Chlorine-36 in Various Matrices
Rad Prep	STL-RC-0040	6	7/23/2007	Total Alpha Emitting Isotopes of Radium
Rad Prep	STL-RC-0041	5	2/19/2007	Radium 228 in Water
Rad Prep	STL-RC-0042	3	10/1/2007	Iodine-129 in Water
Rad Prep	STL-RC-0050	5	4/3/2007	Preparation of Strontium 89 & 90
Rad Prep	STL-RC-0055	3	8/13/2007	Determination of Fe55, Ni59 & Ni63 by LSC
Rad Prep	STL-RC-0056	3	8/3/2007	Carbon-14 by LSC
Rad Prep	STL-RC-0100	11	9/10/2007	Actinide Coprecipitation
Rad Prep	STL-RC-0125	4	10/19/2007	Determination of TC99 using Eichrom Teva Resin
Rad Prep	STL-RC-0210	3	10/23/2007	Determination of Po210 by Alpha Spectrometry
Rad Prep	STL-RC-0211	4	11/12/2007	Determination of Pb210 by LSC
Rad Prep	STL-RC-0232	11	11/1/2007	Isotopic Th/Np in Various Matrices by Eichrom Teva
Rad Prep	STL-RC-0238	9	10/29/2007	Isotopic U by Eichrom UTEVA Resin for Various Matrices
Rad Prep	STL-RC-0240	8	10/29/2007	Isotopic Am/Cu/Pu/Th/U in Various Matrices Eichrom
Rad Prep	STL-RC-0241	5	10/29/2007	Am/Pu/Cu/U in Various Matrices by Eichrom UTEVA
Rad Prep	STL-RC-0242	10	10/29/2007	Isotopic Th/Pu/U in Various Matrices by Eichrom Separation
Rad Prep	STL-RC-0245	2	2/10/2006	Determination of Pu241 by LSC
Rad Prep	STL-RC-0246	1	10/29/2007	Isotopic Am/Cu/U in Various Matrices by Eichrom

				Separation
Rad Prep	STL-RC-0247	1	8/24/2007	Promethium247 & Samarium151 Lanthide Resin Separation
Rad Prep	STL-RC-0300	3	4/21/2006	NJ 48 Hour Gross Alpha Testing PWTA
Rad Prep	STL-RC-5006	10	8/24/2007	Decontamination of Lab Glassware, Labware & Equipment
RAD	STL-RD-0102	4	7/31/2007	Gamma Vision Analysis
RAD	STL-RD-0210	4	5/23/2007	Alpha spectroscopy
RAD	STL-RD-0302	9	7/9/2007	Liquid Scintillation Counter Analysis
RAD	STL-RD-0403	6	5/30/2007	Low Background Gas Flow Proportional Counting
Radiation Protection	STL-RP-0001	4	6/7/2007	Radiation Protection Program
Radiation Protection	STL-RP-0005	5	6/7/2007	ALARA Program
Radiation Protection	STL-RP-0010	5	6/7/2007	Internal Exposure Control
Radiation Protection	STL-RP-0020	5	6/7/2007	External Exposure Control
Radiation Protection	STL-RP-0030	5	6/7/2007	Radiological Contamination
Radiation Protection	STL-RP-0031	5	6/7/2007	Radiation Work Permits
Radiation Protection	STL-RP-0032	6	4/30/2007	Instrumentation and surveillance
Radiation Protection	STL-RP-0033	5	6/7/2007	Radiological Areas and Posting
Radiation Protection	STL-RP-0034	5	6/7/2007	Engineered Controls
Radiation Protection	STL-RP-0042	5	6/7/2007	Handling of Sealed Sources
Radiation Protection	STL-RP-0050	5	6/7/2007	Purchase, Receipt, Handling and ID of Radioactive
Radiation Protection	STL-RP-0051	5	6/7/2007	Packaging/Transportation of Radioactive Material
Radiation Protection	STL-RP-0100	5	6/7/2007	Radiation Protection Records
Radiation Protection	STL-RP-0110	5	6/7/2007	Radiation Protection Training
Radiation Protection	STL-RP-0120	5	6/7/2007	Emergency Response & notification
Radiation Protection	STL-RP-0140	5	6/7/2007	Quality Assurance in Radiological Protection
Wet Chemistry	STL-WC-0001	3	2/27/2006	Turbidity
Wet Chemistry	STL-WC-0002	5	2/28/2006	Cyanide Analysis by Technicon TRAACS 800
Wet Chemistry	STL-WC-0003	8	10/18/2007	Hardness
Wet Chemistry	STL-WC-0004	7	10/18/2007	Chemical Oxygen Demand
Wet Chemistry	STL-WC-0005	6	6/15/2007	Percent Solids Determination
Wet Chemistry	STL-WC-0006	5	2/27/2006	Total Organic Halides in Water (TOX) and Soil(EOX)
Wet Chemistry	STL-WC-0009	7	2/27/2006	Oil & Grease (Partition-Gravimetric Method)
Wet Chemistry	STL-WC-0011	9	10/18/2007	Analysis of pH in Water & Soil
Wet Chemistry	STL-WC-0012	6	10/19/2007	Analysis of Sulfide in Water
Wet Chemistry	STL-WC-0013	5	10/19/2007	Phosphorus, all Forms
Wet Chemistry	STL-WC-0014	6	2/3/2006	Analysis of Ammonia as N in Water & Soil
Wet Chemistry	STL-WC-0015	6	10/23/2007	Biochemical Oxygen Demand
Wet Chemistry	STL-WC-0016	8	10/18/2007	Total Organic Carbon
Wet Chemistry	STL-WC-0017	3	1/24/2006	Phenolics, Total Recoverable
Wet Chemistry	STL-WC-0018	6	7/10/2007	Acidity of Water & Wastewater
Wet Chemistry	STL-WC-0019	7	10/23/2007	Alkalinity in Water & Soil
Wet Chemistry	STL-WC-0023	6	4/21/2006	Nitriate/Nitrite analysis by TRAACS
Wet Chemistry	STL-WC-0025	6	11/26/2007	Conductivty in Water & Soil
Wet Chemistry	STL-WC-0026	7	7/31/2006	Flashpoint by Pensky-Martens Closed Cup
Wet Chemistry	STL-WC-0028	9	10/23/2007	Anions by Ion Chromatography
Wet Chemistry	STL-WC-0031	5	2/14/2006	Paint Filter

Wet Chemistry	STL-WC-0033	7	6/16/2006	Hexavalent Chromium
Wet Chemistry	STL-WC-0034	5	5/1/2007	Heat of Combustion
Wet Chemistry	STL-WC-0036	6	10/23/2007	Determination of Solids in Water and Wastewater
Wet Chemistry	STL-WC-0039	3	2/28/2006	Method 1664, N-Hexane Extractable Material
Wet Chemistry	STL-WC-0046	0	1/6/2006	Reactivity to Air, Water, Physcial Properties
Wet Chemistry	STL-WC-0110	4	4/23/2007	Total Uranium by KPA