**FINAL INTERIM REPORT
VERIFICATION SURVEY
ACTIVITIES IN FINAL STATUS
SURVEY UNITS 7, 8, 9, 10, 11, 13 AND
14 AT THE SEPARATIONS PROCESS
RESEARCH UNIT, NISKAYUNA,
NEW YORK**

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**FINAL INTERIM REPORT
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AT THE SEPARATIONS PROCESS RESEARCH UNIT,
NISKAYUNA, NEW YORK**

INTRODUCTION

The Separations Process Research Unit (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. The research activities ceased following the successful development of the reduction/oxidation and plutonium/uranium extraction processes that were subsequently used by the Hanford and the Savannah River sites. The SPRU site was never a production plant but served only as a laboratory scale research facility for developing reprocessing operations. Decommissioning of SPRU began in October 1953 and continued through the 1990s. The SPRU site is currently undergoing cleanup of chemical and radiological contaminants of impacted soils from these former operations (aRc 2008).

The U.S. Department of Energy (DOE) requested that the Oak Ridge Institute for Science and Education (ORISE) conduct verification activities within Final Status Survey (FSS) Units 7, 8, 9, 10, 11, 13, and 14 at the SPRU Lower Level Parking Lot (LLPL) project site. On November 11 through 17, 2009, an independent verification team (IVT) from ORISE conducted verification activities in FSS units 7, 8, 9, 10, and 11. This effort focused on performing gamma radiation scans and collecting soil samples for radiological analysis and metals analysis. On December 17 through 18, 2009, ORISE conducted verification activities in FSS units 13 and 14. This effort also focused on performing gamma radiation scans and collecting soil samples for radiological analysis and metals analysis. On December 21 through 23, 2009, ORISE continued verification activities in FSS units 13 and 14. This effort focused solely on collecting samples for Resource Conservation and Recovery Act (RCRA) purposes.

The radionuclides of concern (ROCs) for the LLPL are provided in Table 1 with respective derived concentration guideline levels (DCGLs); however, the most prominent ROC identified has been Cs-137. Soil cleanup objectives (SCOs) for the chemical constituents of concern (COCs) are provided in Table 2.

PROCEDURES

ORISE site verification activities were performed on the aforementioned dates in accordance with a Project-Specific Plan (PSP) submitted to and approved by DOE (ORISE 2008a), the ORISE Survey Procedures (ORISE 2008b), and the Oak Ridge Associated Universities (ORAU) Quality Program Manuals (ORAU 2009). Boundaries for the specified survey areas were obtained from coordinates provided by the remediation contractor and uploaded to a global positioning system (GPS). Once the survey area was bounded, GPS equipment was integrated with gamma radiation detectors coupled to ratemeter-scalers with audible output to provide gamma radiation count rate data linked to a specific position during walkover scans. The GPS equipment was also used to locate soil sampling locations and mark any judgmental locations found during the surveys.

Surface Scans

ORISE performed gamma surface scans using a SPA-3, 2 inch $\times$ 2 inch (2 $\times$ 2) sodium iodide (NaI) scintillation detector. High, medium, and low density scans of accessible surfaces were performed in FSS units 7, 8, 9, 10, 11, 13, and 14; these scans are shown in Figures 1, 2, and 3. The ambient background radiation levels ranged from 10,000 to 14,000 counts per minute (cpm) for the 2 $\times$ 2. Relatively high count rates were measured along the southeast portion of FSS 9; one judgmental soil sample was obtained from this location. It is important to note that the *a priori* scan Minimum Detectable Concentration (MDC) was approximately 6.4 pCi/g for Cs-137, which was estimated from Table 6.4 of NUREG-1507 (NRC 1997). This value is less than the site-specific DCGL of 30 picocuries per gram (pCi/g.)

Soil Sampling

Tables 3, 4, and 5 present relevant coordinate, rank, and identification data for the fifty soil samples obtained across FSS 9, 10, 13, and 14 using Ranked Set Sampling (RSS) methodology and random sampling; the following paragraphs go into more detail of these sampling methods. Figures 4, 7, and 8 present the locations of these samples within their respective units. Soil samples were not collected from FSS units 7, 8, and 11 due to a low potential for contamination and no areas of elevated radiation being detected. This decision was also based on the knowledge that samples were not required to be collected from every FSS unit in order to achieve the initial goals set forth in the PSP (ORISE 2008a). The FSS units selected for sampling were chosen on the basis of historical site data, results from aRc sampling and walkovers, walkovers performed by ORISE, and professional judgment.

RSS Ranking

Thirty-six RSS measurement locations were generated using the Visual Sampling Plan (VSP) software (PNNL 2007) for FSS units 13 and 14. The statistically-based RSS design was used for determining the number of random samples required to estimate that the mean concentration of the analytes of concern would not exceed the site cleanup objectives. Static one-minute count gamma measurements were collected at each RSS location and then each measurement ranked according to the ranking rules established in the PSP (ORISE 2008a). Of the thirty-six measurement locations, twelve locations were selected for soil sampling using the RSS method. Two soil samples from each of the twelve locations were obtained, one each for metals and radiological analysis (Figure 4). One judgmental radiological soil sample was obtained from FSS 13 due to elevated radiation levels being observed.

Random Sampling

Twelve randomly generated locations were created for FSS 9 and FSS 10 using VSP software in lieu of the typical RSS method; one minute static counts were collected at these locations (Table 3). This decision was prompted by a significant portion of FSS 9 not being accessible due to a large excavation filled with water and multiple smaller excavations scattered throughout the FSS. FSS 10 had multiple excavations as well as two large fractional distillation tanks located within the boundary. With the approval of both ORISE and SPRU personnel, a decision was made to generate six random locations within FSS 9, and six random locations within FSS 10 for soil sampling. These points were randomly generated using VSP software in a similar fashion to the RSS approach. The

overall number of samples obtained was not impacted by this decision. Two soil samples from each of the twelve locations were obtained, one each for metals and radiological analysis (Figures 7 and 8). One judgmental radiological soil sample was obtained from FSS 9 due to elevated radiation levels being identified.

RCRA Sampling

In addition to the RSS and random samples mentioned above, RCRA samples were obtained from FSS 13 and FSS 14 at the request of the DOE. Thirteen soil samples were obtained and analyzed for total metals. The samples were selected using a combination of RCRA and the State of New York Department of Environmental Conservation's Division of Environmental Remediation (DER) DER-10 guidance (NYSDEC 2002), results from aRc data, and professional judgment. A decision was made to sample every sixty feet along the sidewalls of the excavation and bottom of the excavation; one additional sample was taken from excavation 15C resulting in thirteen samples. The sample locations are shown in Figure 5; Figure 6 depicts which type of samples correspond to a given location.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Soil samples obtained for the purpose of radiological analysis were returned to the ORISE laboratory in Oak Ridge, TN for analysis and interpretation. Sample analyses were performed in accordance with the ORISE Laboratory Procedures Manual (ORISE 2010). Radiological soil samples were analyzed by gamma spectroscopy and alpha spectroscopy. The primary ROC for SPRU is Cs-137; however, gamma spectra were reviewed for any other gamma-emitting radionuclides. Since alpha emitting radionuclides had been identified at SPRU, alpha spectroscopy was also performed to identify any quantifiable radionuclides; specifically Am-241, Pu-238 through Pu-241, and U-234, U-235, and U-238. Spectroscopy results are reported in units of pCi/g. Analytical results were compared to the DCGLs provided in Table 1 and are shown in Tables 6 through 9.

Samples obtained for the purpose of metals analysis, specifically arsenic concentrations, were analyzed by Analytical Chemistry & Testing Services (ALS) Laboratory Group in Fort Collins, Colorado, a DOE Oak Ridge Operations Sample Management Office-approved facility. ALS performed analyses in accordance with EPA-approved Solid Waste-846 methods 6010 and 7471 (EPA 2007) for total metals. The results are reported in units of micrograms per kilogram ($\mu\text{g}/\text{kg}$) and converted to units of milligrams per kilogram (mg/kg). Data were compared with the approved site SCOs provided in Table 2; analytical results are shown in Tables 10 through 13.

VERIFICATION SURVEY MEASUREMENTS

FSS 7 - A low density scan was chosen due to a low expectation for contamination in this specific FSS unit. Scanning confirmed no hot spots therefore no samples were obtained from FSS 7. The scan range in FSS 7 was 10-12 kcpm.

FSS 8 - High density scanning was chosen due its small size and ease of accessibility even though no hot spots were expected in this area. Scanning confirmed no hot spots; therefore no samples were obtained from FSS 8. The scan range in FSS 8 was 10-13 kcpm.

FSS 9 - High density scanning was performed in accessible areas of FSS 9 due to the identification of pre-remediation contamination. One hot spot was identified during scanning and was sampled (sample number S038). The judgmental location exhibited count rates of approximately 33 kcpm. The general area scan range in FSS 9 was approximately 12-14 kcpm.

FSS 10 - High density scanning was performed in accessible areas of FSS 10. No elevated radiation levels were identified during scanning activities. The scan range in FSS 10 was approximately 12-14 kcpm.

FSS 11 - Medium density scanning was performed in FSS 11. A medium density scan was chosen because a significant portion of FSS 11 is located on a steep hillside and is not easily accessible; also, no contamination was expected on the hillside portion of FSS 11. No elevated radiation levels were identified during scanning activities. The scan range in FSS 11 was approximately 11-14 kcpm.

FSS 13 - High density scanning was performed in FSS 13. One judgmental sample was obtained (sample number S075) from excavation 15C and analyzed for radiological contamination. This judgmental location was chosen because no RSS locations fell within excavation 15C and SPRU requested a sample from this excavation. The scan range in FSS 13 was 5-6 kcpm in the asphalt portion of the unit, and 10-12 kcpm in the excavated dirt portion of the unit.

FSS 14 - High density scanning was performed in FSS 14 using a 2 inch x 2 inch NaI detector coupled to a 2221 ratemeter. Twelve RSS soil samples were obtained from FSS 13; six for radiological analysis and six for metals analysis. The scan range in FSS 14 was 5-6 kcpm in the asphalt portion of the unit, and 10-12 kcpm in excavated dirt portion of the unit.

SAMPLE RESULTS

Radiological

Gamma spectroscopy results from FSS units 9 and 10 are provided in Table 6; gamma spectroscopy results from FSS 13 and 14 are provided in Table 8. Concentrations of the primary ROC, Cs-137, ranged from 0.03 to 3.95 pCi/g, all well below the limit of 30 pCi/g. Alpha spectroscopy results from FSS units 9 and 10 are reported in Table 7; alpha spectroscopy results from FSS 13 and 14 are reported in Table 9. All ROCs were well below established DCGLs. The sum-of-fractions (SOF) for all radionuclides of concern were evaluated and determined to be below the threshold of 1.0.

Metals

Analytical results for metals in soil are provided in Tables 10 and 11 for FSS units 9 and 10; results for FSS 13 and 14 are provided in Tables 12 and 13. The primary COC in these areas was determined to be arsenic. Arsenic concentrations ranged from 3.8 to 170 mg/kg, three sample locations were above the SCO for arsenic: S040 from FSS 10, S045 from FSS 9, and S076 from FSS 14. Additional cleanup work has been performed in these three FSS units in response to these exceedances over the SCO for arsenic. All other contaminants were below the SCOs, the concentrations of metals listed as COCs for the site are listed in Tables 10 through 13.

RCRA

Results for the RCRA sampling event are provided in Tables 12 and 13. Of these samples, two were shown to be over SCO limits: S076 for arsenic at 24 mg/kg, and S084 for mercury at 1.4 mg/kg. Both locations of these exceedances were remediated shortly after these results were forwarded to the site. Concentrations for all other samples were below the SCOs.

CONCLUSION

ORISE performed independent verification of FSS Units 7, 8, 9, 10, 11, 13, and 14 during the months of November and December of 2009. Gamma scans to identify residual elevated radioactivity were performed using detectors sensitive to gamma emitters. Soil samples were collected at a total of twenty-four random locations, twenty-four RSS locations, and two judgmental locations. In addition to these samples, thirteen samples were obtained to assist with the evaluation of RCRA requirements.

Scanning identified one location of elevated direct gamma radiation in the southeast corner of FSS Unit 9 which was shown to be below site-specific DCGLs. Results of radiological analysis of soil samples were all below the approved site DCGLs. Results of metals analysis of soil samples identified exceedances in FSS units 9, 10, 13, and 14. The exceedances in FSS units 13 and 14 were remediated prior to the writing of this report. The exceedances in FSS units 9 and 10 must be re-evaluated to determine if further cleanup is necessary due to the knowledge that former rail line activities may have caused these results. Based on the results of the ORISE verification activities at the SPRU site, it is ORISE's opinion that FSS units 7, 8, 13, and 14 meet the applicable site cleanup objectives for radiological and chemical contaminants. FSS units 9 and 10 should be re-evaluated to determine whether any further actions are required for the residual arsenic concentrations.

FIGURE 1: NaI Gamma Scan of Final Status Survey Units 7, 8, 9, 10, & 11

FIGURE 2: NaI Gamma Scan of Final Status Survey Units 13 & 14 Paved Area

FIGURE 3: NaI Gamma Scan of Final Status Survey Units 13 & 14 Soil Area

FIGURE 4: Radiological Sample Locations in Final Status Survey Unit 13 & 14

FIGURE 5: RCRA Sample Locations in Final Status Survey Units 13 & 14

FIGURE 6: RCRA Plan in Final Status Survey Units 13 & 14

FIGURE 7: Metals Samples in Final Status Survey Units 7, 8, 9, 10, & 11

FIGURE 8: Radiological Samples in Final Status Survey Units 7, 8, 9, 10, & 11

TABLE 1 RADIONUCLIDES OF CONCERN DCGLs SEPARATIONS PROCESS RESEARCH UNIT NISKAYUNA, NEW YORK	
ROC^a	DCGL^b (pCi/g)
Am-241	5.74E+02
Cs-137	3.00E+01
Co-60	9.78E+00
Eu-152	2.18E+01
Eu-154	2.01E+01
Eu-155	8.52E+02
H-3	1.04E+06
Ni-63	5.10E+06
Pu-238	7.92E+02
Pu-239	7.14E+02
Pu-240	7.15E+02
Pu-241	1.91E+04
Pm-147	1.59E+06
Sm-151	6.59E+06
Sr-90	4.65E+03
Tc-99	1.43E+06
Th-232	9.05E+00
U-234	1.16E+03
U-235	1.88E+02
U-238	8.51E+02
Zr-93	1.34E+06

^aROC = radionuclide of concern.

^bDCGL = derived concentration guideline level.

TABLE 2 CHEMICAL CONSTITUENTS OF CONCERN AND SOIL CLEANUP OBJECTIVES SEPARATIONS PROCESS RESEARCH UNIT NISKAYUNA, NEW YORK	
COC^a	SCO^b (mg/kg)^c
Antimony	1 ^d
Arsenic	16
Cadmium	2.5
Trivalent Chromium	36
Cobalt	30 ^e
Copper	270
Lead	400
Mercury	0.73
Silver	8.3
Thallium	2 ^d
Vanadium	150 ^e
Zinc	2200

^aCOC = chemical constituent of concern.

^bSCO = soil cleanup objective.

^cmg/kg = milligrams per kilogram.

^dReporting Limit for ALS Laboratory Group.

^eTAGM 4046 recommended cleanup levels (aRc 2008).

TABLE 3 STATIC GAMMA MEASUREMENTS FINAL STATUS SURVEY UNITS 9 & 10 SEPARATIONS PROCESS RESEARCH UNIT NISKAYUNA, NEW YORK				
Grid Coordinate^{a,b}		FSS Number	Gamma Counts	Sample Number (Radiological)
Easting	Northing			
625202	1029715	9	12,481	S032/S045
625237	1029759	9	12,251	S033/S046
625289	1029631	9	13,115	S034/S047
625280	1029624	9	10,808	S035/S048
625284	1029608	9	7,528	S036/S049
625348	1029625	9	10,151	S037/S050
625257	1029660	9	32,856	S038 Judgmental Rad.
625161	1029712	10	10,169	S026/S039
625167	1029728	10	11,107	S027/S040
625142	1029747	10	12,284	S028/S041
625128	1029750	10	12,868	S029/S042
625042	1029716	10	8,920	S030/S043
625029	1029710	10	10,930	S031/S044
624839	1030375	14	6,487	S051
624763	1030443	14	9,031	S052
624772	1030404	14	8,176	S053
624881	1030426	14	6,885	S054
624836	1030509	14	8,411	S055
624791	1030434	14	7,929	S056
624903	1030533	13	7,521	S057
624976	1030459	13	7,536	S058
625040	1030463	13	8,585	S059
624858	1030464	13	9,397	S060
624944	1030494	13	10,550	S061
625025	1030471	13	7,454	S062
624968	1030477	13	9,922	S075 Judgmental Rad.

^aRefer to Figures 4, 5, 6, & 9.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

TABLE 4 RANKED SET SAMPLING GAMMA MEASUREMENTS FINAL STATUS SURVEY UNIT 14 SEPARATIONS PROCESS RESEARCH UNIT NISKAYUNA, NEW YORK								
Grid Coordinate ^{a,b}		RSS			Gamma	Sample Area	Ranking L=Low M=Medium H=High	Sample Number (Radiological)
Easting	Northing	Cycle	Set	#	Counts			
624840	1030375	1	1	1 ■	6,487	FSS 14	L	S051
624797	1030403	1	1	2 ■	8,668	FSS 14	L	
624877	1030438	1	1	3 ■	7,532	FSS 14	L	
624830	1030394	1	2	1 ▲	9,529	FSS 14	M	
624831	1030534	1	2	2 ▲	8,041	FSS 14	M	
624764	1030443	1	2	3 ▲	9,031	FSS 14	M	S052
624917	1030433	1	3	1 ●	7,251	FSS 14	H	
624803	1030499	1	3	2 ●	8,127	FSS 14	H	
624772	1030405	1	3	3 ●	8,176	FSS 14	H	S053
624860	1030391	2	1	1 ■	10,809	FSS 14	L	
624805	1030410	2	1	2 ■	7,968	FSS 14	L	
624881	1030426	2	1	3 ■	6,885	FSS 14	L	S054
624798	1030449	2	2	1 ▲	8,487	FSS 14	M	
624865	1030365	2	2	2 ▲	6,468	FSS 14	M	
624837	1030509	2	2	3 ▲	8,411	FSS 14	M	S055
624911	1030450	2	3	1 ●	6,146	FSS 14	H	
624899	1030445	2	3	2 ●	6,149	FSS 14	H	
624791	1030435	2	3	3 ●	7,929	FSS 14	H	S056

^aRefer to Figures 4 & 5.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

<p>TABLE 5</p> <p>RANKED SET SAMPLING GAMMA MEASUREMENTS</p> <p>FINAL STATUS SURVEY UNIT 13</p> <p>SEPARATIONS PROCESS RESEARCH UNIT</p> <p>NISKAYUNA, NEW YORK</p>								
Grid Coordinate ^{a,b}		RSS			Gamma Counts	Sample Area	Ranking L=Low M=Medium H=High	Sample Number (Radiological)
Easting	Northing	Cycle	Set	#				
624876	1030453	1	1	1 ■	11522	FSS 13	L	
624904	1030534	1	1	2 ■	7521	FSS 13	L	S057
624953	1030455	1	1	3 ■	10305	FSS 13	L	
624976	1030459	1	2	1 ▲	7536	FSS 13	M	S058
624856	1030488	1	2	2 ▲	10595	FSS 13	M	
624966	1030413	1	2	3 ▲	9911	FSS 13	M	
624966	1030456	1	3	1 ●	6220	FSS 13	H	
624996	1030461	1	3	2 ●	6975	FSS 13	H	
625041	1030463	1	3	3 ●	8585	FSS 13	H	S059
624968	1030478	2	1	1 ■	9922	FSS 13	L	
624898	1030481	2	1	2 ■	12496	FSS 13	L	
624859	1030505	2	1	3 ■	9397	FSS 13	L	S060
624944	1030494	2	2	1 ▲	10550	FSS 13	M	S061
624876	1030485	2	2	2 ▲	11237	FSS 13	M	
624908	1030519	2	2	3 ▲	9656	FSS 13	M	
624956	1030403	2	3	1 ●	5771	FSS 13	H	
625025	1030471	2	3	2 ●	7454	FSS 13	H	S062
625014	1030478	2	3	3 ●	7339	FSS 13	H	

^aRefer to Figures 4 & 5.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

TABLE 6

**RADIONUCLIDE CONCENTRATIONS IN SOIL
BY GAMMA SPECTROSCOPY FSS 9 & 10
SEPARATIONS PROCESS RESEARCH UNIT
NISKAYUNA, NEW YORK**

Sample ID ^a	Easting	Northing	Sample Area	Radionuclide Concentration in Soil Samples (pCi/g)				
				Co-60	Cs-137	Eu-152	Eu-154	Eu-155
S026	625161	1029712	FSS 10	-0.04 ± 0.05 ^c	0.38 ± 0.05	-0.02 ± 0.04	-0.02 ± 0.03	0.07 ± 0.03
S027	625167	1029728	FSS 10	-0.01 ± 0.05	0.30 ± 0.04	-0.02 ± 0.04	-0.01 ± 0.03	0.07 ± 0.06
S028	625142	1029747	FSS 10	-0.03 ± 0.07	0.26 ± 0.04	0.05 ± 0.08	0.00 ^d ± 0.06	0.04 ± 0.11
S029	625128	1029750	FSS 10	-0.01 ± 0.05	0.26 ± 0.04	0.00 ± 0.05	0.00 ± 0.03	0.08 ± 0.03
S030	625042	1029716	FSS 10	-0.01 ± 0.05	0.38 ± 0.06	0.00 ± 0.04	-0.01 ± 0.03	0.08 ± 0.06
S031	625029	1029710	FSS 10	0.05 ± 0.06	0.20 ± 0.03	-0.06 ± 0.08	0.01 ± 0.05	0.02 ± 0.11
S032	625202	1029715	FSS 9	-0.01 ± 0.06	1.58 ± 0.13	0.00 ± 0.06	-0.03 ± 0.04	0.05 ± 0.08
S033	625237	1029759	FSS 9	0.00 ± 0.05	3.30 ± 0.32	0.05 ± 0.05	0.01 ± 0.03	0.02 ± 0.07
S034	625289	1029631	FSS 9	-0.02 ± 0.06	3.95 ± 0.29	-0.07 ± 0.07	0.00 ± 0.05	0.13 ± 0.09
S035	625280	1029624	FSS 9	-0.02 ± 0.07	0.53 ± 0.07	-0.01 ± 0.08	0.03 ± 0.05	-0.02 ± 0.10
S036	625284	1029608	FSS 9	0.00 ± 0.04	0.08 ± 0.02	-0.01 ± 0.03	0.01 ± 0.02	0.00 ± 0.04
S037	625348	1029625	FSS 9	0.00 ± 0.07	0.39 ± 0.06	-0.01 ± 0.09	0.02 ± 0.06	-0.06 ± 0.12
S038	625257	1029660	FSS 9	-0.03 ± 0.06	0.18 ± 0.03	-0.06 ± 0.08	0.02 ± 0.05	0.23 ± 0.06

^aRefer to Figure 9.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

^cUncertainties are at the 95% confidence level based on total propagated uncertainties.

^dZero values for sample results are due to rounding.

TABLE 7

**RADIONUCLIDE CONCENTRATIONS IN SOIL
BY ALPHA SPECTROSCOPY FSS 9 & 10
SEPARATIONS PROCESS RESEARCH UNIT
NISKAYUNA, NEW YORK**

Sample ID ^a	Easting	Northing	Sample Area	Radionuclide Concentration in Soil Samples (pCi/g dry weight)						
				Am-241	Pu-238	Pu-239/240	U-234	U-235	U-238	Total U ^c
S026	625161	1029712	FSS 10	0.01 ± 0.02	0.02 ± 0.02	0.01 ± 0.01	0.55 ± 0.08	0.02 ± 0.02	0.55 ± 0.08	1.12 ± 0.12
S027	625167	1029728	FSS 10	0.01 ± 0.02	0.01 ± 0.01	0.01 ± 0.01	0.83 ± 0.11	0.02 ± 0.02	0.90 ± 0.11	1.75 ± 0.16
S028	625142	1029747	FSS 10	0.02 ± 0.02	0.03 ± 0.02	0.02 ± 0.01	0.98 ± 0.12	0.07 ± 0.03	1.02 ± 0.12	2.07 ± 0.17
S029	625128	1029750	FSS 10	0.00 ± 0.02	0.01 ± 0.02	0.02 ± 0.01	0.90 ± 0.11	0.08 ± 0.03	0.83 ± 0.11	1.80 ± 0.16
S030	625042	1029716	FSS 10	0.00 ± 0.01	0.05 ± 0.03	0.01 ± 0.01	1.09 ± 0.13	0.03 ± 0.02	1.12 ± 0.14	2.24 ± 0.19
S031	625029	1029710	FSS 10	0.03 ± 0.02	0.03 ± 0.02	0.01 ± 0.01	0.83 ± 0.13	0.02 ± 0.02	0.71 ± 0.11	1.56 ± 0.17
S032	625202	1029715	FSS 9	0.03 ± 0.02	0.00 ± 0.02	0.01 ± 0.01	0.92 ± 0.11	0.06 ± 0.02	0.97 ± 0.11	1.95 ± 0.16
S033	625237	1029759	FSS 9	0.03 ± 0.02	0.03 ± 0.02	0.01 ± 0.01	0.90 ± 0.11	0.04 ± 0.02	0.91 ± 0.11	1.85 ± 0.16
S034	625289	1029631	FSS 9	0.02 ± 0.01	0.02 ± 0.02	0.02 ± 0.01	0.80 ± 0.11	0.03 ± 0.02	0.82 ± 0.11	1.65 ± 0.15
S035	625280	1029624	FSS 9	0.02 ± 0.02	0.02 ± 0.02	0.02 ± 0.01	0.72 ± 0.09	0.03 ± 0.02	0.67 ± 0.09	1.43 ± 0.13
S036	625284	1029608	FSS 9	0.01 ± 0.02	0.03 ± 0.02	0.01 ± 0.01	0.33 ± 0.06	0.01 ± 0.01	0.37 ± 0.06	0.71 ± 0.09
S037	625348	1029625	FSS 9	0.02 ± 0.03	0.03 ± 0.02	0.01 ± 0.01	1.04 ± 0.12	0.05 ± 0.02	1.09 ± 0.13	2.18 ± 0.18
S038	625257	1029660	FSS 9	0.01 ± 0.02	0.05 ± 0.02	0.01 ± 0.01	3.97 ± 0.36	0.19 ± 0.04	3.85 ± 0.35	8.01 ± 0.50

^aRefer to Figure 9.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

^cTotal U is calculated by U-234 + U-235 + U-238.

^dUncertainties are at the 95% confidence level based on total propagated uncertainties.

^eZero values are due to equal count in the sample and background region of interest for the contaminant of concern.

TABLE 8

**RADIONUCLIDE CONCENTRATIONS IN SOIL
BY GAMMA SPECTROSCOPY FSS 13 & 14
SEPARATIONS PROCESS RESEARCH UNIT
NISKAYUNA, NEW YORK**

Sample ID ^a	Easting	Northing	Sample Area	Radionuclide Concentration in Soil Samples (pCi/g)				
				Co-60	Cs-137	Eu-152	Eu-154	Eu-155
S051	624840	1030375	FSS 14	0.00 ^c ± 0.04 ^d	0.04 ± 0.01	0.00 ± 0.04	-0.02 ± 0.03	0.03 ± 0.06
S052	624764	1030443	FSS 14	0.00 ± 0.05	0.35 ± 0.05	-0.01 ± 0.05	0.01 ± 0.03	0.01 ± 0.06
S053	624772	1030405	FSS 14	-0.03 ± 0.07	0.28 ± 0.04	0.01 ± 0.07	0.01 ± 0.05	0.06 ± 0.09
S054	624881	1030426	FSS 14	0.00 ± 0.06	0.03 ± 0.04	-0.02 ± 0.07	0.02 ± 0.05	-0.04 ± 0.10
S055	624837	1030509	FSS 14	0.03 ± 0.05	0.27 ± 0.04	0.01 ± 0.05	-0.01 ± 0.03	0.01 ± 0.07
S056	624791	1030435	FSS 14	0.00 ± 0.06	0.32 ± 0.05	0.01 ± 0.05	0.00 ± 0.03	0.06 ± 0.07
S057	624904	1030534	FSS 13	-0.01 ± 0.07	0.97 ± 0.09	0.00 ± 0.06	0.03 ± 0.04	0.06 ± 0.09
S058	624976	1030459	FSS 13	0.05 ± 0.06	0.04 ± 0.04	-0.03 ± 0.07	0.01 ± 0.05	0.04 ± 0.10
S059	625041	1030463	FSS 13	0.02 ± 0.05	0.45 ± 0.05	-0.05 ± 0.04	-0.01 ± 0.03	0.08 ± 0.03
S060	624859	1030505	FSS 13	0.00 ± 0.05	0.11 ± 0.02	0.00 ± 0.04	-0.02 ± 0.03	0.04 ± 0.06
S061	624944	1030494	FSS 13	0.01 ± 0.06	0.03 ± 0.02	0.00 ± 0.05	0.00 ± 0.04	0.12 ± 0.08
S062	625025	1030471	FSS 13	0.03 ± 0.06	0.39 ± 0.05	-0.01 ± 0.07	-0.06 ± 0.06	0.02 ± 0.11
S075	624968	1030478	FSS 13	-0.03 ± 0.04	0.21 ± 0.03	-0.01 ± 0.04	-0.01 ± 0.03	0.04 ± 0.06

^aRefer to Figure 4.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

^cUncertainties are at the 95% confidence level based on total propagated uncertainties.

^dZero values for sample results are due to rounding.

TABLE 9
RADIONUCLIDE CONCENTRATIONS IN SOIL
BY ALPHA SPECTROSCOPY FSS 13 & 14
SEPARATIONS PROCESS RESEARCH UNIT
NISKAYUNA, NEW YORK

Sample ID ^a	Easting	Northing	Sample Area	Radionuclide Concentration in Soil Samples (pCi/g dry weight)						
				Am-241	Pu-238	Pu-239/240	U-234	U-235	U-238	Total U ^c
S051	624840	1030375	FSS 14	0.00 ± 0.02	0.01 ± 0.02	0.02 ± 0.01	0.78 ± 0.10	0.04 ± 0.02	0.77 ± 0.10	1.59 ± 0.14
S052	624764	1030443	FSS 14	0.00 ± 0.01	0.02 ± 0.01	0.03 ± 0.02	0.78 ± 0.10	0.06 ± 0.02	0.77 ± 0.10	1.60 ± 0.14
S053	624772	1030405	FSS 14	0.01 ± 0.02	0.03 ± 0.02	0.02 ± 0.01	0.71 ± 0.09	0.06 ± 0.02	0.81 ± 0.10	1.58 ± 0.14
S054	624881	1030426	FSS 14	0.01 ± 0.01	0.04 ± 0.02	0.01 ± 0.01	0.65 ± 0.09	0.03 ± 0.02	0.70 ± 0.09	1.37 ± 0.13
S055	624837	1030509	FSS 14	0.00 ± 0.02	0.02 ± 0.03	0.02 ± 0.01	0.86 ± 0.10	0.05 ± 0.02	0.83 ± 0.10	1.74 ± 0.15
S056	624791	1030435	FSS 14	0.02 ± 0.02	0.01 ± 0.02	0.01 ± 0.02	1.45 ± 0.16	0.05 ± 0.02	1.38 ± 0.15	2.88 ± 0.22
S057	624904	1030534	FSS 13	0.00 ± 0.01	0.01 ± 0.02	0.02 ± 0.01	0.82 ± 0.10	0.04 ± 0.02	0.75 ± 0.10	1.61 ± 0.14
S058	624976	1030459	FSS 13	0.01 ± 0.02	0.02 ± 0.02	0.03 ± 0.02	0.63 ± 0.08	0.04 ± 0.02	0.65 ± 0.09	1.32 ± 0.12
S059	625041	1030463	FSS 13	0.01 ± 0.01	0.00 ± 0.01	0.01 ± 0.01	0.52 ± 0.07	0.04 ± 0.02	0.48 ± 0.07	1.03 ± 0.10
S060	624859	1030505	FSS 13	0.02 ± 0.02	0.01 ± 0.02	0.03 ± 0.01	0.68 ± 0.09	0.03 ± 0.02	0.72 ± 0.09	1.43 ± 0.13
S061	624944	1030494	FSS 13	0.02 ± 0.02	0.03 ± 0.02	0.02 ± 0.01	1.15 ± 0.13	0.08 ± 0.03	1.09 ± 0.12	2.32 ± 0.18
S062	625025	1030471	FSS 13	0.01 ± 0.02	0.02 ± 0.02	0.02 ± 0.01	0.68 ± 0.09	0.03 ± 0.02	0.61 ± 0.08	1.32 ± 0.12
S075	624968	1030478	FSS 13	-0.02 ± 0.03	0.03 ± 0.03	0.03 ± 0.02	1.01 ± 0.13	0.07 ± 0.03	0.88 ± 0.12	1.97 ± 0.17

^aRefer to Figure 4.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

^cTotal U is calculated by U-234 + U-235 + U-238.

^dUncertainties are at the 95% confidence level based on total propagated uncertainties.

^eZero values are due to equal count in the sample and background region of interest for the contaminant of concern.

TABLE 10
CONCENTRATIONS OF METALS
IN SOIL SAMPLES FSS 9 & 10
SEPARATIONS PROCESS RESEARCH UNIT
NISKAYUNA, NEW YORK

Sample ID ^a	Easting	Northing	Sample Area	Contaminant of Concern (mg/kg)					
				Sb	As	Cd	Cr	Co	Cu
S039	625161	1029712	FSS 10	0.99 B ^e J ^d	4	0.99 BJ	12	7.2	18
S040	625167	1029728	FSS 10	1.2 J	21	1.4	12	11	31
S041	625142	1029747	FSS 10	1.3 J	13	1.6	19	16	39
S042	625128	1029750	FSS 10	1.2 J	8.7	1.6	18	13	33
S043	625042	1029716	FSS 10	0.83 BJ	5.7	1.1 BJ	14	9.3	19
S044	625029	1029710	FSS 10	0.87 BJ	5.4	1.2 BJ	13	8.2	21
S045	625202	1029715	FSS 9	1.7 NJ	170	1.4	15	12	46
S046	625237	1029759	FSS 9	1.4 J	13	1.2 BJ	18	14	53
S047	625289	1029631	FSS 9	1.1 BJ	7.6	0.88 BJ	16	12	33
S048	625280	1029624	FSS 9	1.2 BJ	7.3	1.4	11	9	42
S049	625284	1029608	FSS 9	0.3 U ^c J	4.9	0.35 BJ	2.6	2	1.7
S050	625348	1029625	FSS 9	1 BJ	12	1.1 BJ	16	12	42

^aRefer to Figure 8.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

^cU=Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is included and corrected for dilution and percent moisture.

^dJ = Indicates an estimated value. This flag is used when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero.

^eB = Value was less than the CRDL (Contract Required Detection Limit) or RRL (Required Reporting Limit) specified, but greater than or equal to the IDL (Instrument Detection Limit)/MDL (Method Detection Limit).

TABLE 11
CONCENTRATIONS OF METALS
IN SOIL SAMPLES FSS 9 & 10
SEPARATIONS PROCESS RESEARCH UNIT
NISKAYUNA, NEW YORK

Sample ID ^a	Easting	Northing	Sample Area	Contaminant of Concern (mg/kg)					
				Pb	Hg	Ag	Tl	V	Zn
S039	625161	1029712	FSS 10	10	0.033	0.16 B ^e J ^d	1.4 U ^c	17	54 J
S040	625167	1029728	FSS 10	13	0.033	0.05 U	1.3 U	22	59 J
S041	625142	1029747	FSS 10	20	0.049	0.052 U	1.4 U	24	81 J
S042	625128	1029750	FSS 10	19	0.054	0.052 U	1.4 U	32	72 J
S043	625042	1029716	FSS 10	25	0.091	0.059 U	1.6 U	26	61 J
S044	625029	1029710	FSS 10	23	0.082	0.059 U	1.6 U	25	65 J
S045	625202	1029715	FSS 9	38	0.065	0.047 U	1.3 U	22	78 NJ
S046	625237	1029759	FSS 9	38	0.076	0.055 U	1.5 U	35	100 J
S047	625289	1029631	FSS 9	15	0.036	0.047 U	1.3 U	21	74 J
S048	625280	1029624	FSS 9	18	0.032	0.052 U	0.7 U	17	120 J
S049	625284	1029608	FSS 9	2.7	0.006 BJ	0.044 U	0.59 U	4.5	13 J
S050	625348	1029625	FSS 9	20	0.043	0.053 U	1.4 U	30	76 J

^aRefer to Figure 8.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

^cU=Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is included and corrected for dilution and percent moisture.

^dJ = Indicates an estimated value. This flag is used when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero.

^eB = Value was less than the CRDL (Contract Required Detection Limit) or RRL (Required Reporting Limit) specified, but greater than or equal to the IDL (Instrument Detection Limit)/MDL (Method Detection Limit).

TABLE 12

RCRA SAMPLES
FSS 13 & 14
SEPARATIONS PROCESS RESEARCH UNIT
NISKAYUNA, NEW YORK

Sample ID ^a	Easting	Northing	Sample Area	Contaminant of Concern (mg/kg)					
				Sb	As	Cd	Cr	Co	Cu
S076	624821	1030424	FSS 14	1.1 B ^{cJ} ^d	24	0.21 BJ	10	6.1	28
S077	624844	1030399	FSS 14	1.3 J	5.7	0.01 BJ	19	13	27
S078	624866	1030409	FSS 14	1.1 J	6.7	0.11 BJ	19	13	29
S079	624844	1030436	FSS 14	0.59 BJ	5	0.11 BJ	11	8.9	21
S080	624857	1030497	FSS 13	1.0 BJ	5.9	0.3 BJ	14	8.3	27
S081	624869	1030476	FSS 13	0.79 BJ	6.8	0.13 BJ	16	8.9	27
S082	624893	1030466	FSS 13	0.92 BJ	4.5	0.29 BJ	17	7.4	26
S083	624897	1030532	FSS 13	0.74 BJ	4.3	0.22 BJ	13	7.2	13
S084	624923	1030539	FSS 13	1.5 BJ	7.3	0.44 BJ	19	12	50
S085	624916	1030525	FSS 13	0.75 BJ	4.6	0.12 BJ	12	8.1	22
S086	624936	1030500	FSS 13	1.5 J	4.7	1.1	11	4.8	22
S087	624979	1030482	FSS 13	0.67 BJ	5.3	0.14 BJ	12	8.3	25
S088	624921	1030481	FSS 13	1.0 BJ	7.1	0.62	16	12	37

^aRefer to Figure 6.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

^cU=Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is included and corrected for dilution and percent moisture.

^dJ = Indicates an estimated value. This flag is used when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero.

^eB = Value was less than the CRDL (Contract Required Detection Limit) or RRL (Required Reporting Limit) specified, but greater than or equal to the IDL (Instrument Detection Limit)/MDL (Method Detection Limit).

TABLE 13									
RCRA SAMPLES									
FSS 13 & 14									
SEPARATIONS PROCESS RESEARCH UNIT									
NISKAYUNA, NEW YORK									
Sample ID /Location ^a	Easting	Northing	Sample Area	Contaminant of Concern (mg/kg)					
				Pb	Hg	Ag	Tl	V	Zn
S076	624821	1030424	FSS 14	30	0.11	0.13 B ^e J ^d	0.42 U ^c	26	120
S077	624844	1030399	FSS 14	15	0.037	0.14 U	0.9 U	31	79
S078	624866	1030409	FSS 14	16	0.056	0.12 U	0.82 U	24	77
S079	624844	1030436	FSS 14	12	0.045	0.12 U	0.8 U	17	61
S080	624857	1030497	FSS 13	47	0.21	0.13 U	0.83 U	29	79
S081	624869	1030476	FSS 13	20	0.015BJ	0.14 U	0.47 U	20	64
S082	624893	1030466	FSS 13	40	0.089	0.14 U	0.46 U	49	77
S083	624897	1030532	FSS 13	23	0.1	0.17 U	0.56 U	55	57
S084	624923	1030539	FSS 13	34	1.4	0.36 BJ	0.64 U	79	120
S085	624916	1030525	FSS 13	15	0.17	0.15 U	0.48 U	29	58
S086	624936	1030500	FSS 13	38	0.18	0.13 U	0.41 U	14	68
S087	624979	1030482	FSS 13	15	0.23	0.12 U	0.82 U	24	51
S088	624921	1030481	FSS 13	18	0.59	0.13 U	0.85 U	36	72

^aRefer to Figure 6.

^bNew York State Plane Coordinate System East 3101 NAD 1927 US Foot.

^cU=Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is included and corrected for dilution and percent moisture.

^dJ = Indicates an estimated value. This flag is used when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero.

^eB = Value was less than the CRDL (Contract Required Detection Limit) or RRL (Required Reporting Limit) specified, but greater than or equal to the IDL (Instrument Detection Limit)/MDL (Method Detection Limit).

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