ATTACHMENT 4

Survey Results at Vitrification Test Facility Waste Storage Area

UNCONTROLLED DOCUMENT

1.0 SITE DESCRIPTION

The Vitrification Test Facility Waste Storage Area was an approximately 72 m^2 excavated pad. It is mostly covered by gravel and is located in the northwestern portion of Waste Management Area (WMA) 2. WMA 5 is to the north and west. Figure A-4.1 shows the location of the Vitrification Test Facility Waste Storage Area within WMA 2. Also shown for reference is the Maintenance Triangle, discussed in Attachment 1.

Figure A-4.1. Northwestern Portion of WMA 2 Showing Vitrification Test Facility Waste Storage Area

Data provided in the Characterization Sampling and Analysis Plan (CSAP) indicates that the soil in the area possibly exceeds the Cleanup Goal (CG_w). The contamination could be part of the Cesium Prong. In 1968, a ventilation system filter in the Process Building (in WMA 1) failed, releasing contaminated particulate up the Process Building stack. A mixture of radionuclides was released, with Cs-137 predominant. Approximately 0.33 Ci particulate gross beta radioactivity was released. The contaminated particulate was deposited on surface soils, resulting in a large area of contamination around the Process Building and to the north-northwest. Detectable deposits extend several miles, including beyond the WVDP premises.

Gamma exposure rate surveys were performed in the area around the Vitrification Test Facility Waste Storage Area in 1982 and 1990–1991. Results showed readings up to 2,000 μR/hr in the immediate area. These elevated exposure rates are a result of elevated gamma radiation sources in nearby buildings more so than contamination deposited on soil.

2.0 SURVEY RESULTS

Soil data and gamma radiation data was collected. Gamma walkover data is discussed in Section 2.1. Soil data is discussed in Section 2.2. Gamma data taken 15 cm above each soil sampling location are discussed in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the surface at the Vitrification Test Facility Waste Storage Area with a field instrument for detection of low-energy radiation (FIDLER) detector. The FIDLER was not collimated and the readings were entirely affected by nearby sources of radiation such that it was not possible to discern whether there was gamma emitting radioactivity above natural background at the Vitrification Test Facility Waste Storage Area. The soil sample result is relied upon to determine the radioactivity in the area.

Figure A-4.2 shows the gamma radiation results for the FIDLER. The soil sampling location is also shown on the figures.

2.2 Soil Sample Results

One 0 – 15 cm deep systematic soil sample location was sampled at the 72 m^2 Vitrification Test Facility Waste Storage Area. This meets the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2. The sample location is shown in Figure A-4.2.

Soil sample results were compared to the analytical minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 1 because the soil at the Vitrification Test Facility Waste Storage Area was sand and gravel. The 95 percent upper tolerance limit (UTL) was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that was rejected during data validation was not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231, radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The results are summarized in Tables A-4.1 and A-4.2 for the ROI and PROI, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and was considered inconsistent with background. Bold values reflect whether the result exceeds the

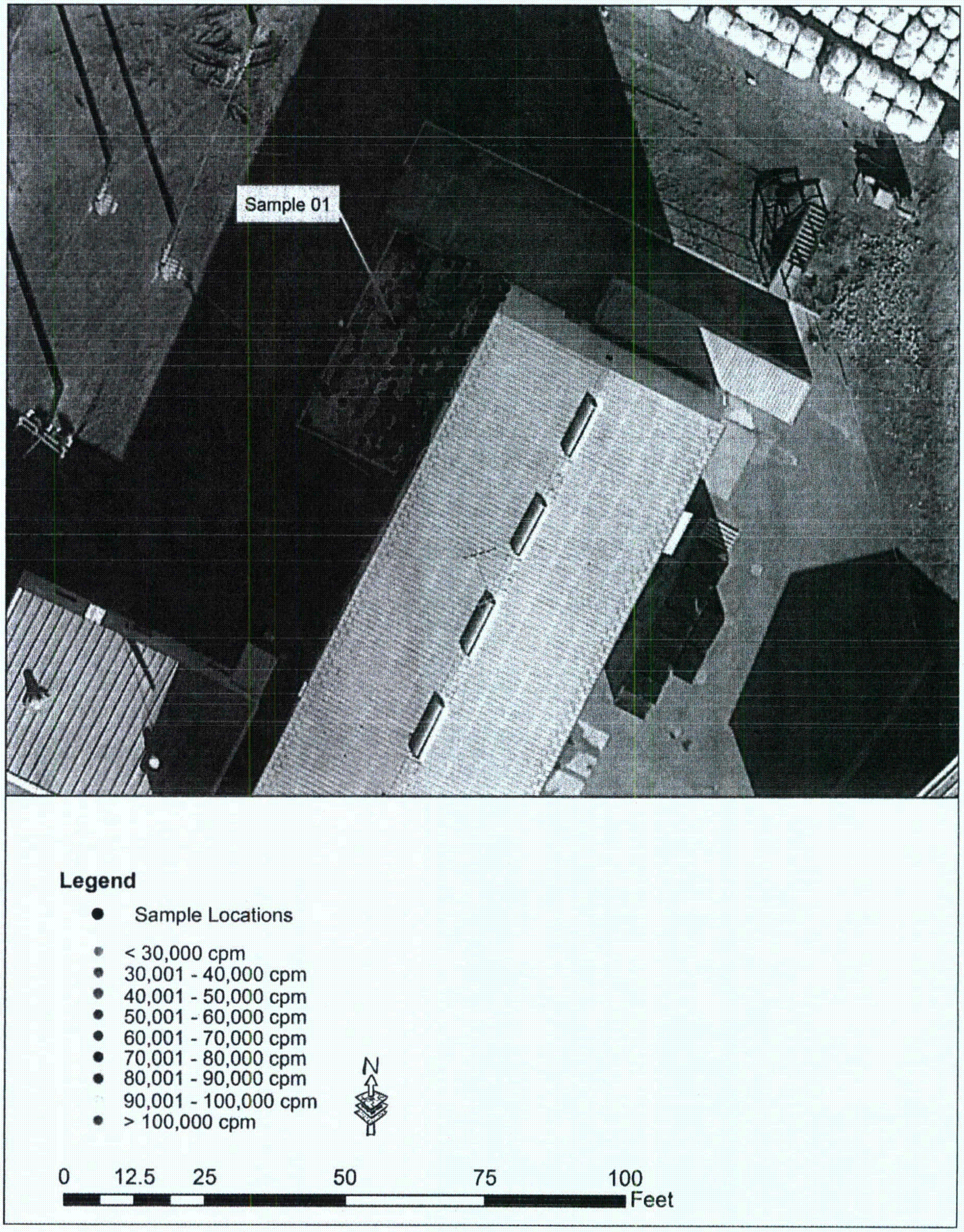

Figure A-4.2. GWS Results with FIDLER

MDA. Underlined values reflect whether the sample was determined inconsistent with background. Shaded results were rejected during data validation. Reasons are shown in the table footnotes. A complete tabulation of soil samples data is provided in Annex A-4.1.

2.3 Gamma Measurements at Sampling Locations

A 30-second gamma measurement was made with each detector type at the sample location before the soil sample was collected. These results are shown in Table A-4.3. The higher-than-background results are indicative of some site source of radiation.

Table A-4.1. Vitrification Test Facility Waste Storage Area ROI Evaluation

Loc. No.	Depth (cm)	Am-241 Result	C-14 Result	Cm-243/ Cm-244 Result	Cs-137 Result	I-129 Result	Np-237 Result	Pu-238 Result	Pu-239/ Pu-240 Result	Pu-241 Result	Sr-90 Result	Tc-99 Result	U-232 Result	U-233/ U-234 Result	U-235 Result	U-238 Result
1	0-15	**0.096**	0.433	-0.010	**0.246**	0.075	0.007	-0.045	0.045	-6.61	-0.126	0.750	0.026	**0.755**	0.026	**0.721**

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results that are inconsistent with background.
4. Shaded results were rejected during data validation. I-129 was rejected due to photo-peak interference with naturally occurring Bi-212 (SEC 2013b).

Table A-4.2. Vitrification Test Facility Waste Storage Area PROI Evaluation

Loc. No.	Depth (cm)	Ac-227 Result	Co-60 Result	Cd-113m Result	Eu-154 Result	H-3 Result	Pa-231 Result	Ra-226 Result	Ra-228 Result	Sb-125 Result	Sn-126 Result	Th-229 Result	Th-232 Result
1	0-15	0.028	-0.001	-0.003	**0.012**	**12.8**	-0.376	**1.68**	**0.666**	0.002	0.000	-0.003	**0.666**

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results that are inconsistent with background.
4. Shaded values were rejected during validation. Pa-231 was rejected due to gamma photo-peak interference with naturally occurring Th-227 (SEC 2013b).

Table A-4.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	NaI (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	30,527	24,764	893363.5239	1129466.018	1,394.725

ANNEX A-4.1

Soil Sample Results

Vitrification Test Facility Waste Storage Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/ 244 Result	Cm-243/ 244 Error	Cm-243/ 244 MDA
01 (0-15 cm)	0.096	0.054	0.046	0.433	0.717	1.13	-0.010	0.012	0.052

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
01 (0-15 cm)	0.246	0.017	0.007	0.075	0.052	0.083	0.007	0.270	0.013

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/ 240 Result	Pu-239/ 240 Error	Pu-239/ 240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
01 (0-15 cm)	-0.045	0.034	0.132	0.045	0.061	0.098	-6.61	9.77	16.3

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
01 (0-15 cm)	-0.126	0.177	0.334	0.750	0.960	1.60	0.026	0.023	0.033

Location	U-233/ 234 Result	U-233/ 234 Error	U-233/ 234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
01 (0-15 cm)	0.755	0.144	0.046	0.026	0.024	0.026	0.721	0.139	0.048

1. Units are pCi/g.
2. Error is total propagated uncertainty at two standard deviations.
3. Shaded values were rejected during data validation. I-129 was rejected due to photo-peak interference with naturally occurring Bi-212 (SEC 2013b).

Vitrification Test Facility Waste Storage Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA	Cd-113m Result	Cd-113m Error	Cd-113m MDA
01 (0-15 cm)	0.028	0.043	0.063	-0.001	0.023	0.010	-0.003	0.005	0.008

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
01 (0-15 cm)	0.012	0.007	0.009	12.8	2.51	3.09	-0.376	0.142	0.227

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
01 (0-15 cm)	1.68	0.170	0.133	0.666	0.049	0.023	0.002	0.010	0.015

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
01 (0-15 cm)	0.000	0.007	0.006	-0.003	0.009	0.017	0.666	0.049	0.023

1. Units are pCi/g.
2. Error is total propagated uncertainty at two standard deviations.
3. Shaded values were rejected during validation. Pa-231 was rejected due to gamma photo-peak interference with naturally occurring Th-227 (SEC 2013b).

ATTACHMENT 5

Survey Results at the Old Warehouse Foundation

1.0 SITE DESCRIPTION

The Old Warehouse was a pre-engineered steel building with three sections. The main warehouse section was 80 feet by 144 feet by approximately 21 feet high at the roof peak. A 38 foot by 42 foot by 15 foot high room was attached to the north end of the building that housed a radiological counting facility. A double-wide office trailer was located on a concrete foundation wall at the south end of the building. It was located in the northern portion of Waste Management Area (WMA) 6, just south of WMA 1. The Old Warehouse has been demolished. Some of the concrete foundation area was excavated and that excavated trench comprises the survey area as shown in Figure A-5.1. The remainder of the soil under the Old Warehouse foundation will be surveyed at a later date.

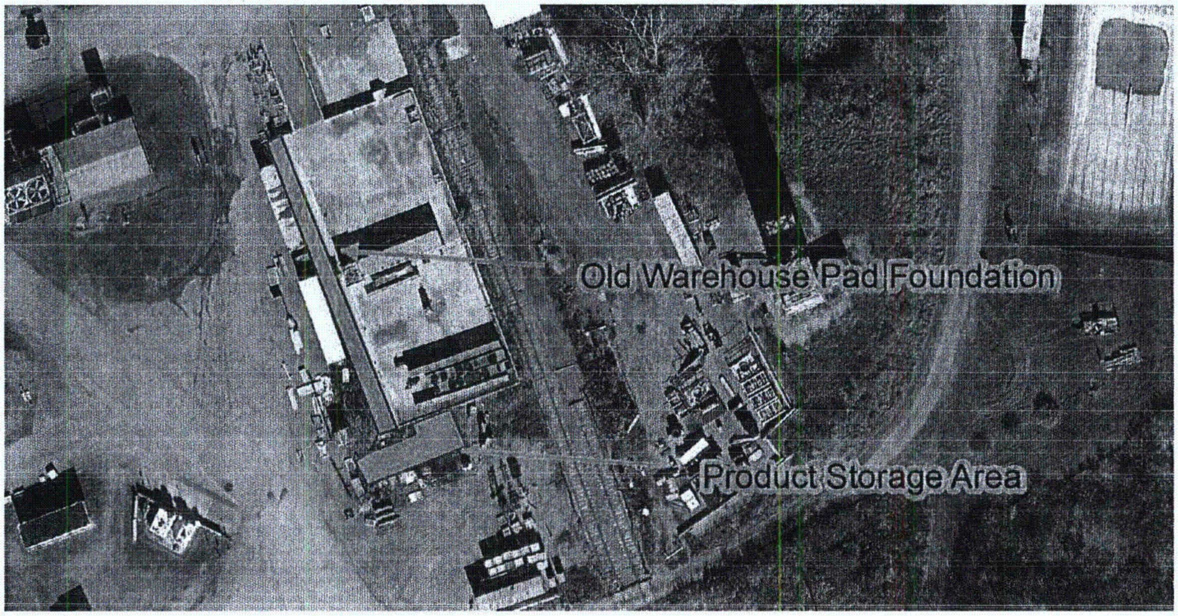

Figure A-5.1. Old Warehouse Foundation Survey Area

WMA 6 surface soils were likely affected by the 1968 airborne releases of radioactivity from the Process Building stack in WMA 1. These impacts would have originally been greatest proximal to the Process Building and decreased as one moved south in WMA 6. Since 1968, however, there has been significant surface soil reworking in the northern portion of WMA 6. These activities could have removed contaminated soil layers, buried those layers under clean backfill, and/or redistributed/mixed contamination in surface soils.

The soils surrounding the Old Warehouse foundation area could have surface radioactive contamination possibly greater than the cleanup goal (CG). Gamma radiation exposure rates ranged up to 25 μR/hr as measured in a survey performed in 1991. This is approximately three times typical natural background exposure rates. Because the Old Warehouse pre-dates the 1968 airborne releases of radioactivity from the Process Building stack, the assumption is that soils beneath the Old Warehouse foundation are un-impacted (DOE 2011).

The area surveyed was a 106 m^2 trench along the western front portion of the Old Warehouse foundation. The survey area is shown in Figure A-5.2.

Figure A-5.2. Old Warehouse Survey Area

2.0 SURVEY RESULTS

Soil data and gamma radiation data were collected. Gamma walkover data are discussed in Section 2.1. Soil data are discussed in Section 2.2. Gamma data taken 15 cm above each soil sampling location before sample collection are discussed in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the surface at the Old Warehouse foundation with a field instrument for detection of low-energy radiation (FIDLER) detector. The FIDLER was not collimated. The ambient gamma radiation levels in the area were near typical background such that the FIDLER results were able to discern elevated radioactivity from the soils in the excavated area. One area of elevated radiation was identified and a biased sample was located there.

The gamma radiation results for the FIDLER are shown on Figure A-5.3. Soil sampling locations are also shown on the figure.

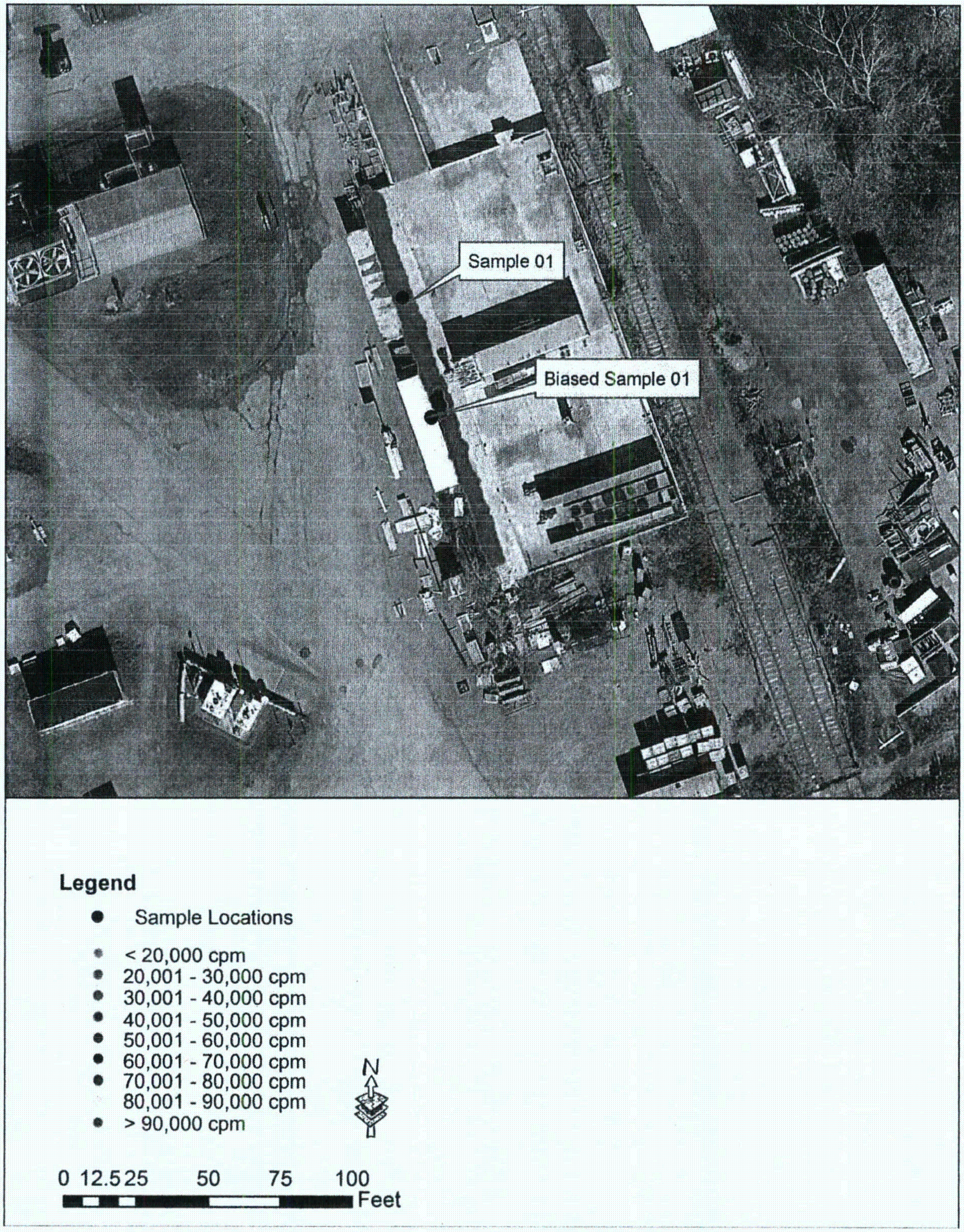

Figure A-5.3. GWS Results with FIDLER

2.2 Soil Sample Results

One systematic sample was collected to a depth of 0 – 15 cm deep in the 106 m^2 trench. This meets the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2.

One biased sample location was selected based on evaluation of the GWS data. Two samples were collected at this location. One of the samples was collected from 0 – 15 cm and the other from 15 – 60 cm at this location. A deeper sample below 60 cm could not be collected with the hand auger because the Lavery till was too dense. However, a gamma radiation reading taken at the 60 cm depth revealed that there was no elevated radioactivity at this depth.

Soil sample results were compared to the analytical minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 2 because the soil at the Old Warehouse foundation was Lavery till. The 95 percent upper tolerance limit (UTL) was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that were rejected during data validation were not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231, radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The soil sample results are summarized in Tables A-5.1 and A-5.2 for the ROIs and PROIs, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and were considered inconsistent with background. Bold values reflect whether the result exceeds the MDA. Underlined values reflect whether the sample was determined inconsistent with background. Shaded results were rejected during data validation. Reasons are shown in the table footnotes. A complete tabulation of soil samples data is provided in Annex A-5.1.

2.3 Gamma Measurements at Sampling Locations

A 30-second gamma measurement was made with each detector type at each location before soil samples were collected. These results are shown in Table A-5.3. The higher-than-background results are indicative gamma radiation from the contaminated soil area.

Table A-5.1. Old Warehouse Foundation ROI Evaluation

Loc. No.	Depth (cm)	Am-241 Result	C-14 Result	Cm-243/ Cm-244 Result	Cs-137 Result	I-129 Result	Np-237 Result	Pu-238 Result	Pu-239/ Pu-240 Result	Pu-241 Result	Sr-90 Result	Tc-99 Result	U-232 Result	U-233/ U-234 Result	U-235 Result	U-238 Result
01	0-15	**0.039**	0.766	0.000	**0.131**	**0.105**	0.007	-0.022	0.010	-5.80	0.029	0.730	**0.084**	**0.770**	0.029	**0.863**
02 (Biased)	0-15	**0.206**	0.401	0.007	**34.2**	0.177	0.015	-0.017	0.017	-6.69	0.222	-0.400	0.025	**0.588**	0.018	**0.588**
02 (Biased)	15-60	**0.051**	1.05	-0.004	**21.6**	-0.394	0.005	-0.035	0.033	-11.9	0.118	0.640	0.006	**0.871**	0.022	**0.634**

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results that are inconsistent with background.
4. Shaded values were rejected during data validation. I-129 was rejected due to photo-peak interference with naturally occurring Bi-212 (SEC 2013b).

Table A-5.2. Old Warehouse Foundation PROI Evaluation

Loc. No.	Depth (cm)	Ac-227 Result	Co-60 Result	Cd-113m Result	Eu-154 Result	H-3 Result	Pa-231 Result	Ra-226 Result	Ra-228 Result	Sb-125 Result	Sn-126 Result	Th-229 Result	Th-232 Result
01	0-15	0.024	0.000	-0.001	0.000	**24.2**	-0.575	**1.95**	**0.917**	0.001	0.001	0.019	**0.917**
02 (Biased)	0-15	0.071	**0.253**	-0.006	-0.005	**17.8**	-0.488	**2.55**	**1.13**	0.014	-0.003	-0.119	**1.13**
02 (Biased)	15-60	0.040	**0.178**	0.000	-0.002	**9.82**	-0.471	**2.48**	**1.08**	0.003	0.000	-0.096	**1.08**

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results that are inconsistent with background.
4. Shaded values were rejected during validation. Pa-231 was rejected due to gamma photo-peak interference with naturally occurring Th-227 (SEC 2013b).

Table A-5.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	NaI (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	30,527	24,764	892487.38	1129243.51	1,405.33
02 (Biased)	56,804	45,974	892445.79	1129253.73	1,408.32

ANNEX A-5.1

Soil Sample Results

Old Warehouse Foundation Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/ 244 Result	Cm-243 244 Error	Cm-243/244 MDA
01 (0-15 cm)	0.039	0.039	0.027	0.766	0.726	0.942	0.000	0.019	0.027
02 (0-15 cm)	0.206	0.079	0.019	0.401	0.656	1.03	0.007	0.014	0.019
02 (15-60 cm)	0.051	0.042	0.043	1.05	0.854	0.965	-0.004	0.008	0.043

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
01 (0-15 cm)	0.131	0.012	0.007	0.105	0.054	0.085	0.007	0.460	0.026
02 (0-15 cm)	34.2	2.11	0.015	0.177	0.116	0.150	0.015	0.349	0.015
02 (15-60 cm)	21.63	1.76	0.013	-0.394	0.103	0.134	0.005	0.344	0.016

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/ 240 Result	Pu-239/ 240 Error	Pu-239/ 240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
01 (0-15 cm)	-0.022	0.050	0.124	0.010	0.030	0.066	-5.80	5.14	8.35
02 (0-15 cm)	-0.017	0.052	0.131	0.017	0.044	0.089	-6.69	5.91	9.58
02 (15-60 cm)	-0.035	0.054	0.150	0.033	0.047	0.074	-11.9	9.82	15.6

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
01 (0-15 cm)	0.029	0.193	0.337	0.730	0.940	1.60	0.084	0.042	0.047
02 (0-15 cm)	0.222	0.222	0.353	-0.400	1.10	1.90	0.025	0.025	0.039
02 (15-60 cm)	0.118	0.214	0.358	0.640	0.900	1.50	0.006	0.020	0.039

1. Units are pCi/g.
2. Error is total propagated uncertainty at two standard deviations.
3. Shaded results were rejected during validation. I-129 was rejected due to photo-peak interference with naturally occurring Bi-212 (SEC 2013b).

Location	U-233/234 Result	U-233/234 Error	U-233/234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
01 (0-15 cm)	0.770	0.154	0.075	0.029	0.029	0.041	0.863	0.165	0.071
02 (0-15 cm)	0.588	0.120	0.045	0.018	0.021	0.031	0.588	0.121	0.050
02 (15-60 cm)	0.871	0.155	0.037	0.022	0.025	0.038	0.634	0.124	0.032

1. Units are pCi/g.
2. Error is total propagated uncertainty at two standard deviations.

Old Warehouse Foundation Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA	Cd-113m Result	Cd-113m Error	Cd-113m MDA
01 (0-15 cm)	0.024	0.044	0.066	0.000	0.006	0.011	-0.001	0.005	0.008
02 (0-15 cm)	0.071	0.118	0.130	0.253	0.012	0.010	-0.006	0.018	0.029
02 (15-60 cm)	0.040	0.082	0.102	0.178	0.011	0.009	0.000	0.012	0.020

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
01 (0-15 cm)	0.000	0.007	0.011	24.2	3.47	3.13	-0.575	0.173	0.256
02 (0-15 cm)	-0.005	0.013	0.022	17.8	2.81	2.87	-0.488	0.404	0.663
02 (15-60 cm)	-0.002	0.012	0.019	9.82	1.99	2.50	-0.471	0.345	0.543

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
01 (0-15 cm)	1.95	0.208	0.157	0.917	0.069	0.023	0.001	0.014	0.017
02 (0-15 cm)	2.55	0.337	0.345	1.13	0.079	0.031	0.014	0.041	0.071
02 (15-60 cm)	2.48	0.315	0.288	1.08	0.079	0.022	0.003	0.031	0.056

1. Units are pCi/g.
2. Error is total propagated uncertainty at two standard deviations.
3. Shaded results were rejected during validation. Pa-231 was rejected due to gamma photo-peak interference with naturally occurring Th-227 (SEC 2013b).

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
01 (0-15 cm)	0.001	0.004	0.007	0.019	0.014	0.022	0.917	0.069	0.023
02 (0-15 cm)	-0.003	0.013	0.008	-0.119	0.022	0.033	1.13	0.079	0.031
02 (15-60 cm)	0.000	0.004	0.007	-0.096	0.019	0.028	1.08	0.079	0.022

1. Units are pCi/g.
2. Error is total propagated uncertainty at two standard deviations.

ATTACHMENT 6

Vitrification Diesel Fuel Oil Storage Tank Building

1.0 SITE DESCRIPTION

The Vitrification Diesel Fuel Oil Storage Tank Building was a 31 m^2 area. The building had previously been removed, and the foundation was removed in August 2013. It was located in the northeastern portion of Waste Management Area (WMA) 10 with WMA 5 to the north and 3 to the east. Figure A-6.1 shows the location of the Vitrification Diesel Fuel Storage Tank Building within WMA 10.

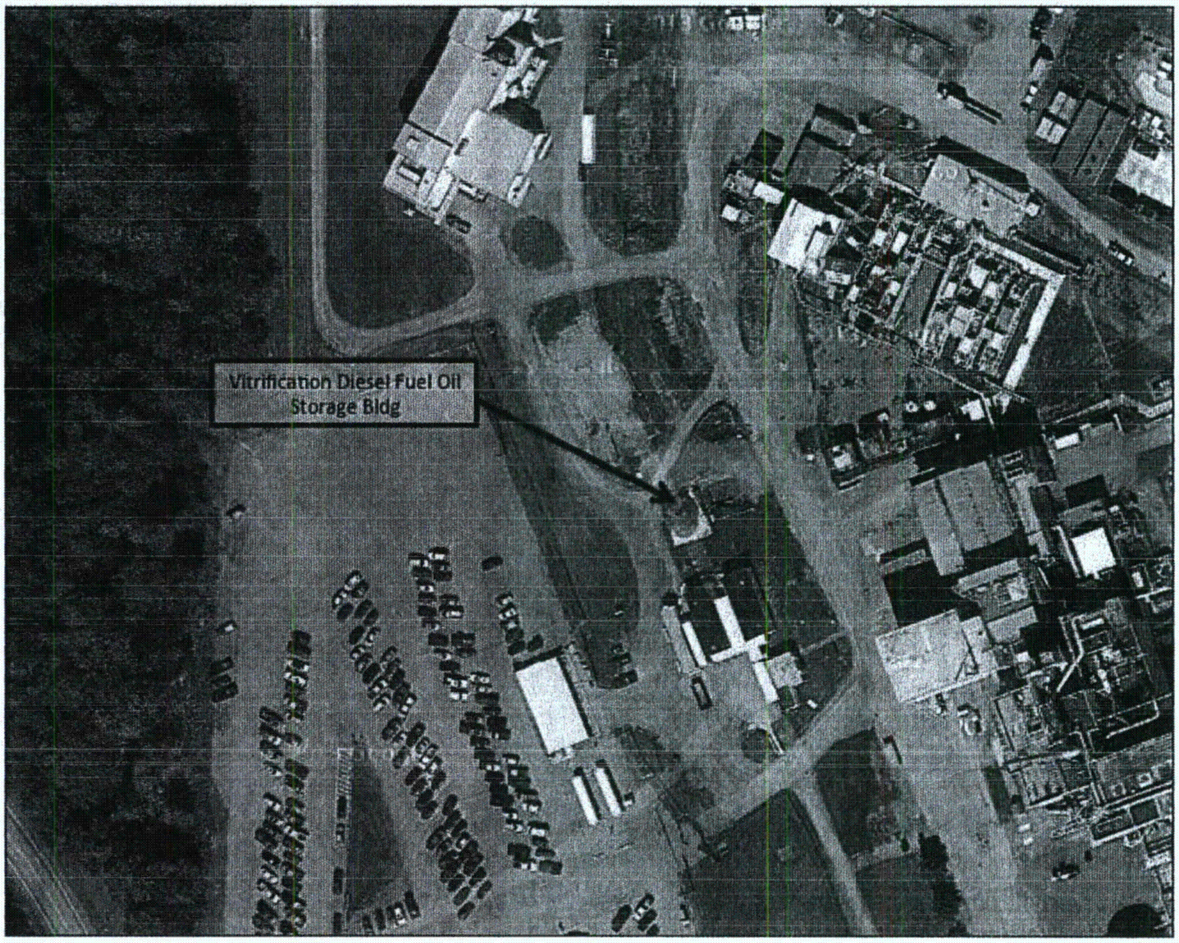

Figure A-6.1. Northern Portion of WMA 10 Showing Vitrification Diesel Fuel Oil Storage Tank Building Location

Data provided in the Characterization Sampling and Analysis Plan (CSAP) indicate that the soil in the area possibly exceeds the Cleanup Goal (CG_w). The contamination could be part of the Cesium Prong. In 1968, a ventilation system filter in the Process Building (in WMA 1) failed, releasing contaminated particulate up the Process Building stack. A mixture of radionuclides was released, with Cs-137 predominant (DOE 2011a). Approximately 0.33 Curies of particulate radioactivity was released. The contaminated particulate was deposited on surface soils, resulting in a large area of contamination around the Process Building and to the north-northwest. Detectable deposits extend several miles, including beyond the West Valley Demonstration Project (WVDP) premises.

Gamma exposure rate surveys were performed in the area around the Vitrification Fabrication Shop Pad in 1982 and 1990–1991. Results showed readings greater than 100 μR/hr in the immediate area. These elevated exposure rates are a result of elevated gamma radiation sources in nearby buildings more so than contamination deposited on soil.

2.0 SURVEY RESULTS

Soil data and gamma radiation data were collected. Gamma walkover data are discussed in Section 2.1. Soil data are discussed in Section 2.2. Gamma data taken 15 centimeters (cm) above each soil sampling location before sample collection is presented in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the surface at the Vitrification Diesel Fuel Storage Tank Building with a field instrument for detection of low-energy radiation (FIDLER) detector. The FIDLER was not collimated and the readings were entirely affected by nearby sources of radiation such that it was not possible to discern whether there was gamma emitting radioactivity above natural background at the Vitrification Diesel Fuel Storage Tank Building. The additional area surveyed to the east demonstrates the effect of shine from the nearby facilities to the east. Because the survey area was only 31 m^2, one systematically-located soil sample location was considered sufficient to characterize the area.

Figure A-6.2 shows the gamma radiation results for the FIDLER. The soil sampling location is also shown on the figure as is the boundary of the ground disturbance permit (GDP) where soil samples were authorized. Even though the survey results were affected by nearby shine, there was no reason to suspect that there were areas of gamma radiation indicating that surface clean-up goals (CGs) were exceeded because there were no localized elevated levels of gamma radiation detected. No biased samples were collected.

2.2 Soil Sample Results

One 15 cm deep systematic soil sample location was sampled at the 31 m^2 Vitrification Diesel Fuel Storage Tank Building. The sample was taken from 60 – 75 cm below ground surface because the top 60 cm in the area was all gravel fill. This meets the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2. The sample location is shown in Figure A-6.2.

Soil sample results were compared to the analytical minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 1 because the soil at the Vitrification Diesel Fuel Storage Tank Building was sand and gravel. The 95 percent upper tolerance limit (UTL) was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that were rejected during data validation were not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231,

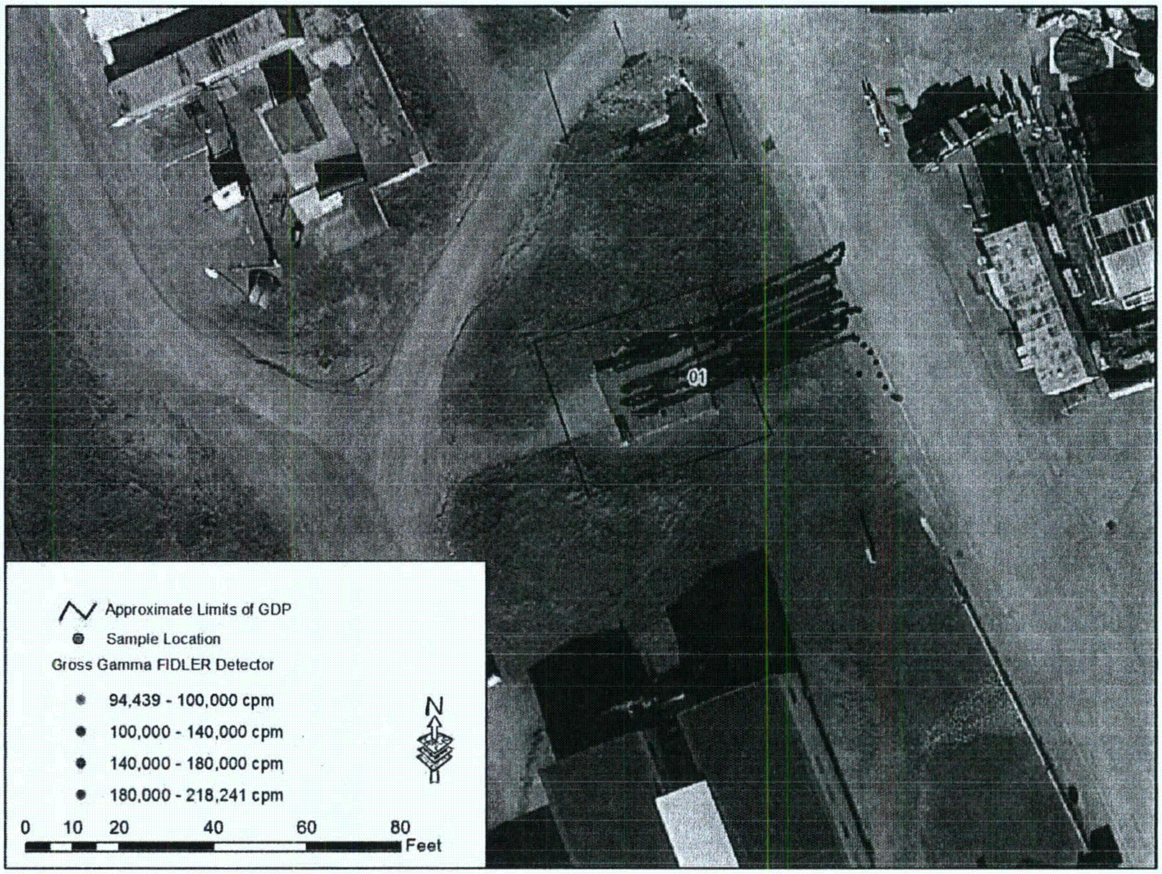

Figure A-6.2. GWS Results

radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The results are summarized in Tables A-6.1 and A-6.2 for the ROI and PROI, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and was considered inconsistent with background. Bold values reflect whether the result exceeds the MDA. Underlined values reflect whether the sample was determined inconsistent with background. Shaded results were rejected during data validation. Reasons are shown in the table footnotes. A complete tabulation of soil samples data is provided in Annex A-6.1.

2.3 Gamma Measurements at Sampling Locations

A 30-second gamma measurement was made with each detector type at each location before soil samples were collected. These results are shown in Table A-6.3. The higher-than-background results are indicative of radiation from sources from within nearby buildings.

Table A-6.1. Vitrification Diesel Fuel Storage Tank Building ROI Evaluation

Loc. No.	Depth (cm)	Am-241	C-14	Cm-243/ Cm-244	Cs-137	I-129	Np-237	Pu- 238	Pu-239/ Pu-240	Pu-241	Sr-90	Tc-99	U 232	U-233/ U-234	U-235	U-238
1	60-75	-0.014	0.711	0.051	**0.192**	-0.048	0.011	-0.017	0.062	1.21	0.262	-0.749	0.007	**0.640**	0.017	**0.711**

1. Results are in pCi/g.
2. **Bold** values represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results inconsistent with background.

Table A-6.2. Vitrification Diesel Fuel Storage Tank Building PROI Results

Loc. No.	Depth (cm)	Ac-227	Co-60	Eu-154	H-3	Pa-231	Ra-226	Ra-228	Sb-125	Sn-126	Th-229	Th-232
1	60-75	-0.087	-0.027	-0.037	6.51	-0.223	**0.804**	**1.01**	0.002	0.000	0.098	**1.01**

1. Results are gross pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results that are inconsistent with background.
4. Sn-126 result rejected due to interference from other nearby photo-peaks.

Table A-6.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	140,316	893008.95	1128687.36	Not collected

ANNEX A-6.1

Soil Sample Results

Vitrification Diesel Fuel Storage Tank Building Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/ 244 Result	Cm-243/ 244 Error	Cm-243/ 244 MDA
1	-0.014	0.062	0.161	0.711	0.796	1.34	0.051	0.099	0.137

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
1	0.192	0.066	0.047	-0.048	0.223	0.386	0.011	0.020	0.034

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/ 240 Result	Pu-239/ 240 Error	Pu-239/ 240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
1	-0.017	0.045	0.121	0.062	0.071	0.088	1.21	6.29	10.8

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
1	0.262	0.236	0.385	-0.749	1.16	2.05	0.007	0.021	0.035

Location	U-233/234 Result	U-233/ 234 Error	U-233/ 234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
1	0.640	0.131	0.106	0.017	0.052	0.096	0.711	0.133	0.090

1. Units are pCi/g.
2. Error is total propagated uncertainty.

Vitrification Diesel Fuel Storage Tank Building Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA
1	-0.087	0.149	0.275	-0.027	0.024	0.039

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
1	-0.037	0.071	0.126	6.51	11.3	19.5	-0.223	0.891	1.66

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
1	0.804	0.107	0.078	1.01	0.209	0.146	0.002	0.059	0.108

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
1	0.000	0.07301	0.078	0.098	0.115	0.125	1.01	0.209	0.146

1. Units are pCi/g.
2. Error is total propagated uncertainty.
3. Sn-126 result rejected due to interference from other nearby photo-peaks.

ATTACHMENT 7

Vitrification Hill Trailer Area

1.0 SITE DESCRIPTION

The Vitrification Hill Trailer Area was a 349 m^2 area. A break trailer was removed in August 2013. The other trailers still remain. The break trailer was located in the northeastern portion of Waste Management Area (WMA) 10 with WMA 5 to the north and WMA 3 to the east. Figure A-7.1 shows the location of the Vitrification Hill Trailer Area within WMA 10. The photograph was taken before the break trailer was removed.

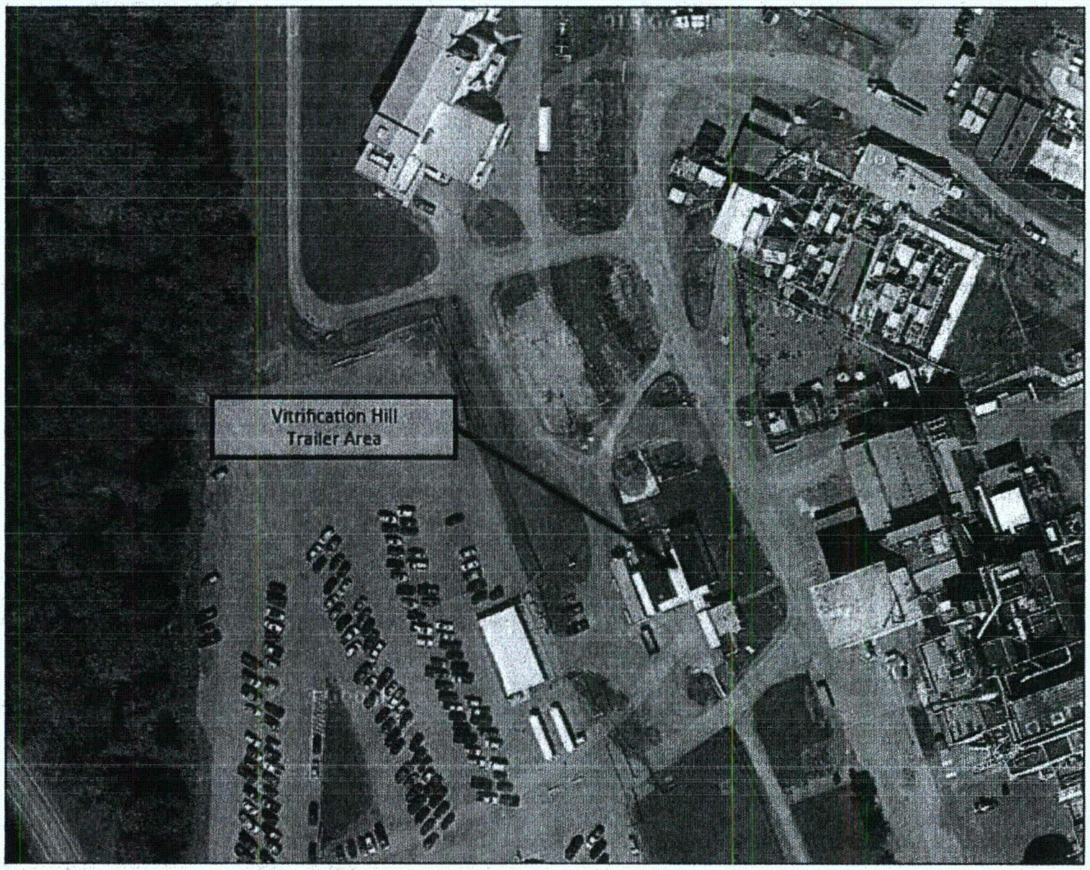

Figure A-7.1. Northern Portion of WMA 10 Showing Vitrification Hill Trailer Area Location

Data provided in the Characterization Sampling and Analysis Plan (CSAP) indicates that the soil in the area possibly exceeds the Cleanup Goal (CG_w). The contamination could be part of the Cesium Prong. In 1968, a ventilation system filter in the Process Building (in WMA 1) failed, releasing contaminated particulate up the Process Building stack. A mixture of radionuclides was released, with Cs-137 predominant (DOE 2011a). Approximately 0.33 Curies of particulate radioactivity was released. The contaminated particulate was deposited on surface soils, resulting in a large area of contamination around the Process Building and to the north-northwest. Detectable deposits extend several miles, including beyond the West Valley Demonstration Project (WVDP) premises.

Gamma exposure rate surveys were performed in the area around the Vitrification Fabrication Shop Pad in 1982 and 1990 – 1991. Results showed readings greater than 100 μR/hr in the immediate area. These elevated exposure rates are a result of elevated gamma radiation sources in nearby buildings more so than contamination deposited on soil.

2.0 SURVEY RESULTS

Soil data and gamma radiation data were collected. Gamma walkover data are discussed in Section 2.1. Soil data are discussed in Section 2.2. Gamma data taken 15 centimeters (cm) above each soil sampling location before sample collection is presented in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the surface at the Vitrification Hill Trailer Area with a field instrument for detection of low-energy radiation (FIDLER) detector. The FIDLER was not collimated and the readings were entirely affected by nearby sources of radiation such that it was not possible to discern whether there was gamma-emitting radioactivity above natural background at the Vitrification Hill Trailer Area. The radiation was mostly emitted from residual inventory remaining in the Waste Tank Farm as shown to the northeast in Figure A-7.4.

Figure A-7.2 shows the gamma radiation results for the FIDLER. Soil sampling locations are also shown on the figures. One of the two systematically-located samples was within the area most influenced by the shine and thus reasonably helps properly characterize this area.

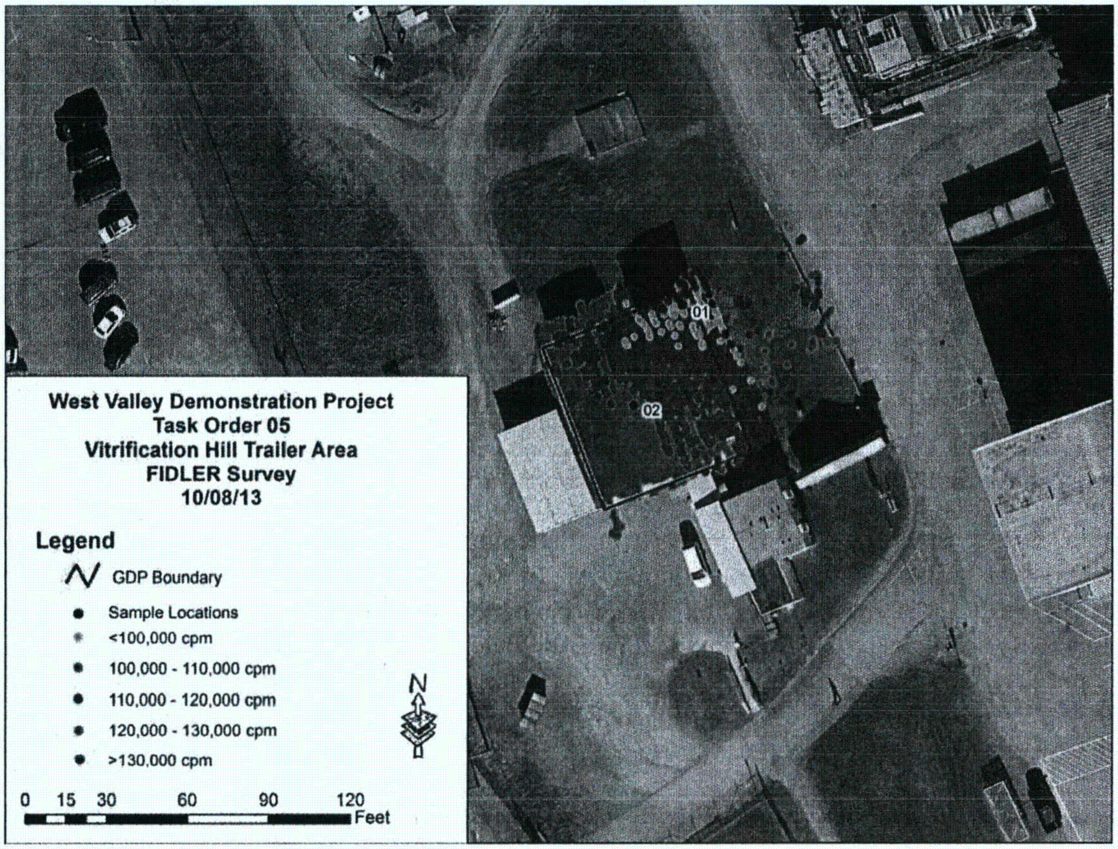

Figure A-7.2. Results of FIDLER GWS

Shown in Figure A-7.3 is a gamma count rate plot taken with an unshielded NaI detector. The radiation levels plotted on the figure are those after the original readings were adjusted using a linear regression developed to convert the readings to those that would occur if the NaI detector were placed in a one-inch thick lead collimator. The regression was developed by taking shielded and unshielded NaI readings in several site areas influenced by radiation shine. The radiation readings still show the radiation shine from the nearby building; however, the results also seem to indicate that there are no elevated spots of radiation coming directly from the ground surface. Therefore, no biased soil sample locations were chosen.

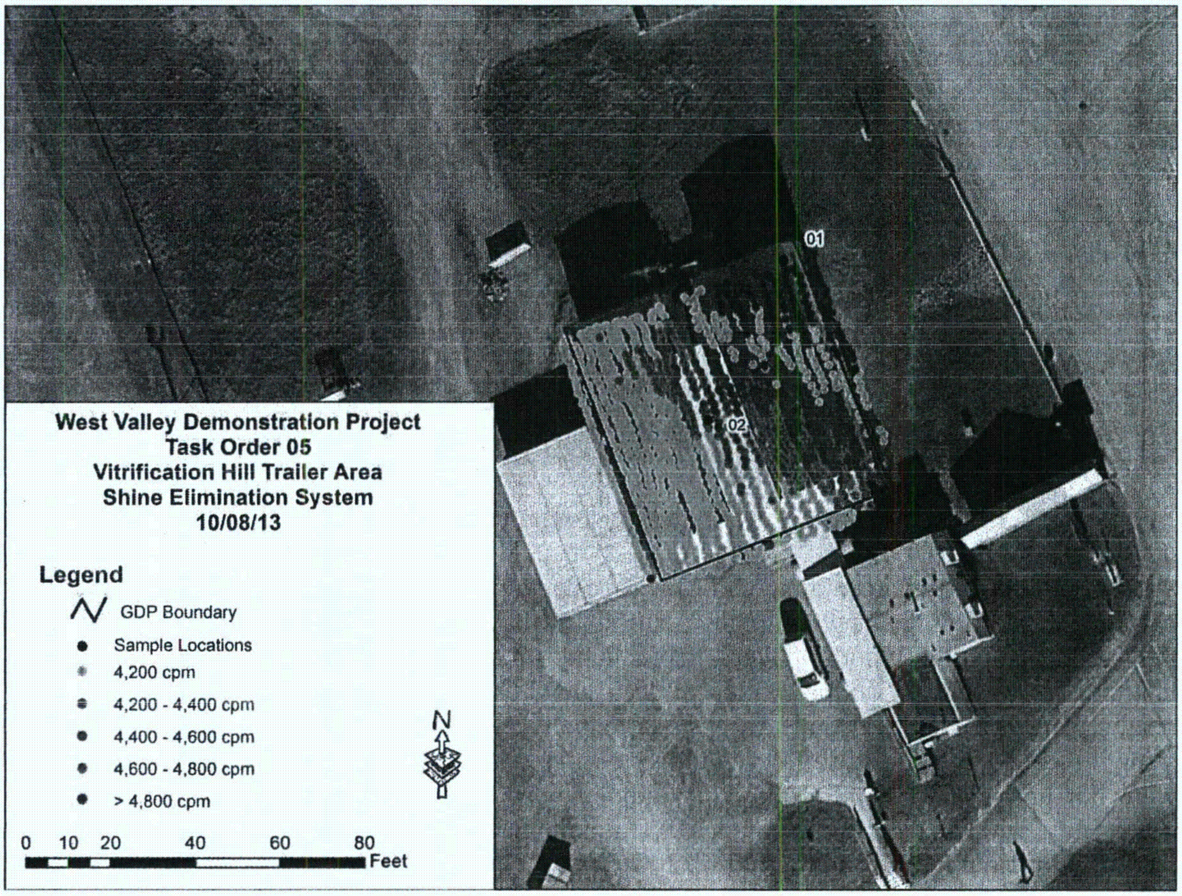

Figure A-7.3. GWS with NaI Detector and Shine Elimination System Algorithm Applied

2.2 Soil Sample Results

Two 15-cm deep systematic soil samples were collected at the 349 m^2 Vitrification Hill Trailer Area. The samples were taken from 0 – 15 cm below ground surface. This meets the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2. The sample locations are shown in Figures A-7.2 and A-7.3.

Soil sample results were compared to the minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 1 because the soil at the Vitrification Hill Trailer Building was sand and gravel. The

Figure A-7.4. Typical Conditions Showing Nearby Sources of Radiation within Buildings

95 percent upper tolerance limit (UTL) was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that were rejected during data validation were not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231, radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The results are summarized in Tables A-7.1 and A-7.2 for the ROI and PROI, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and was considered inconsistent with background. Bold values reflect whether the result exceeds the MDA. Underlined values reflect whether the sample was determined inconsistent with background. A complete tabulation of soil samples data is provided in Annex A-7.1.

2.3 Gamma Measurements at Sampling Locations

A 30-second gamma measurement was made with each detector type at each location before soil samples were collected. These results are shown in Table A-7.3. The higher-than-background results are indicative of radiation from sources from within nearby buildings.

Table A-7.1. Vitrification Hill Trailer Area ROI Evaluation

Loc. No.	Depth (cm)	Am-241	C-14	Cm-243/ Cm-244	Cs-137	I-129	Np-237	Pu-238	Pu-239/ Pu-240	Pu-241	Sr-90	Tc-99	U-232	U-233/ U-234	U-235	U-238
1 Dup.	0-15	0.113	0.695	0.017	**0.083**	0.203	-0.003	-0.012	0.072	-0.768	-0.030	1.47	0.010	**0.517**	0.111	**0.517**
1	0-15	-0.058	0.907	-0.038	**0.090**	-0.288	0.000	-0.089	0.013	-0.637	0.516	1.09	0.022	**0.499**	**0.178**	**0.402**
2	0-15	0.168	-0.110	0.039	**3.45**	-0.247	-0.004	0.035	0.052	-1.89	0.134	1.02	0.184	**0.612**	**0.085**	**0.833**

1. Results are in pCi/g.
2. **Bold** values represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results inconsistent with background.

Table A-7.2. Vitrification Hill Trailer Area PROI Results

Loc. No.	Depth (cm)	Ac-227	Co-60	Eu-154	H-3	Pa-231	Ra-226	Ra-228	Sb-125	Sn-126	Th-229	Th-232
1 Dup.	0-15	0.113	0.009	0.055	-1.81	-0.522	**0.475**	0.185	-0.038	0.044	-0.095	0.185
1	0-15	-0.058	0.003	0.004	-0.579	0.816	**0.453**	0.047	-0.008	-0.009	0.150	0.047
2	0-15	0.168	-0.007	-0.044	-2.06	-0.625	**0.701**	**0.437**	0.040	0.017	0.118	**0.437**

1. Results are gross pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results that are inconsistent with background.

Table A-7.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	109,164	892941.85	1128711.25	1,424.53
2	94,624	892904.07	1128693.40	1,425.35

ANNEX A-7.1

Soil Sample Results

Vitrification Hill Trailer Area Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/244 Result	Cm-243/244 Error	Cm-243/244 MDA
1 Dup.	0.113	0.154	0.296	0.695	0.894	1.51	0.017	0.173	0.362
1	-0.058	0.169	0.310	0.907	0.900	1.51	-0.038	0.115	0.324
2	0.168	0.193	0.365	-0.110	0.867	1.50	0.039	0.250	0.511

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
1 Dup.	0.083	0.046	0.041	0.203	0.550	1.21	-0.003	0.009	0.024
1	0.090	0.042	0.049	-0.288	0.333	0.616	-0.000	0.013	0.028
2	3.45	0.140	0.047	-0.247	0.509	0.897	-0.004	0.010	0.026

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/240 Result	Pu-239/240 Error	Pu-239/240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
1 Dup.	-0.012	0.058	0.141	0.072	0.113	0.169	-0.768	5.23	9.19
1	-0.089	0.086	0.267	0.013	0.078	0.148	-0.637	5.41	9.50
2	0.035	0.133	0.246	0.052	0.153	0.278	-1.89	5.25	9.30

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
1 Dup.	-0.030	0.461	0.862	1.47	1.35	2.23	0.011	0.074	0.141
1	0.516	0.445	0.718	1.09	1.35	2.29	0.022	0.109	0.201
2	0.134	0.435	0.784	1.02	1.10	1.84	0.184	0.143	0.185

Location	U-233/234 Result	U-233/234 Error	U-233/234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
1 Dup.	0.517	0.193	0.218	0.111	0.100	0.137	0.517	0.171	0.136
1	0.499	0.187	0.123	0.178	0.123	0.124	0.402	0.176	0.154
2	0.612	0.221	0.188	0.085	0.088	0.051	0.833	0.238	0.051

1. Units are pCi/g.
2. Error is total propagated uncertainty.

Vitrification Hill Trailer Area Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA
1 Dup.	0.113	0.154	0.296	0.009	0.022	0.046
1	-0.058	0.169	0.310	0.003	0.027	0.053
2	0.168	0.193	0.365	-0.007	0.023	0.042

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
1 Dup.	0.055	0.062	0.137	-1.81	5.69	11.9	-0.522	0.919	1.61
1	0.004	0.078	0.150	-0.579	5.89	11.8	0.816	0.929	1.85
2	-0.044	0.069	0.121	-2.06	5.01	10.6	-0.625	1.06	1.85

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
1 Dup.	0.475	0.111	0.079	0.185	0.129	0.242	-0.038	0.053	0.095
1	0.453	0.118	0.081	0.047	0.116	0.225	-0.008	0.069	0.124
2	0.701	0.103	0.089	0.437	0.142	0.135	0.040	0.087	0.158

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
1 Dup.	0.044	0.046	0.069	-0.095	0.165	0.467	0.185	0.129	0.242
1	-0.009	0.051	0.089	0.150	0.222	0.324	0.047	0.116	0.225
2	0.017	0.071	0.091	0.118	0.170	0.205	0.437	0.142	0.135

1. Units are pCi/g.
2. Error is total propagated uncertainty.

ATTACHMENT 8

Old Warehouse and Count Lab

1.0 SITE DESCRIPTION

The Old Warehouse and Counting Lab were pre-engineered steel buildings. The main warehouse section was 80 feet by 144 feet by approximately 21 feet high at the roof peak. A 38 foot by 42 foot by 15 foot high room was attached to the north end of the building that housed a radiological counting facility. A double-wide office trailer was located on a concrete foundation wall at the south end of the building. It was located in the northern portion of Waste Management Area (WMA) 6, just south of WMA 1.

The Old Warehouse has been demolished. The concrete foundation area was excavated and the broken up concrete foundation pieces were piled up over much of the area when the survey work was performed. A trench was excavated to the north where the counting lab was. The trench extended along the western portion of the area. The excavated trench comprised the survey area as labeled "approximate limit of GDP" (Ground Disturbing Permit) in Figure A-8.1. The remainder of the soil under the Old Warehouse foundation that was not within the survey area will be surveyed at a later date.

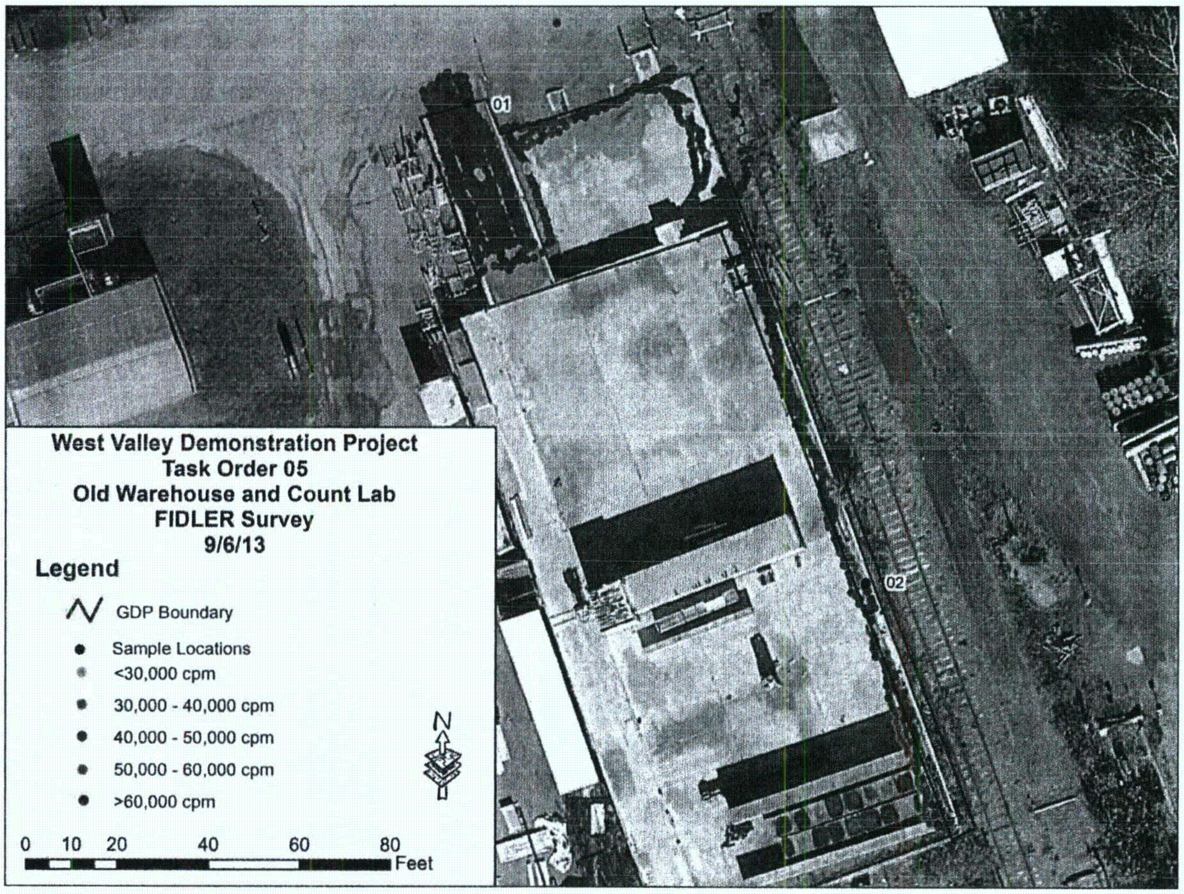

Figure A-8.1. Results of FIDLER GWS

WMA 6 surface soils were likely affected by the 1968 airborne releases of radioactivity from the Process Building stack in WMA 1. These impacts would have originally been greatest proximal to the Process Building and decreased as one moved south in WMA 6. Since 1968, however, there has been significant surface soil reworking in the northern portion of WMA 6. These activities could have removed contaminated soil layers, buried those layers under clean backfill, and/or redistributed/mixed contamination in surface soils. The soils surrounding the Old Warehouse foundation area could have surface radioactive contamination possibly greater than the cleanup goal (CG). Gamma radiation exposure rates ranged up to 25 μR/hr as measured in a survey performed in 1991. This is approximately three times typical natural background exposure rates. Because the Old Warehouse pre-dates the 1968 airborne releases of radioactivity from the Process Building stack, the assumption is that soils beneath the Old Warehouse foundation are un-impacted (DOE 2011).

2.0 SURVEY RESULTS

Soil data and gamma radiation data were collected. Gamma walkover data are discussed in Section 2.1. Soil data are discussed in Section 2.2. Gamma data taken 15 centimeters (cm) above each soil sampling location before sample collection is presented in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the surface at the trench that is the survey area with a field instrument for detection of low-energy radiation (FIDLER) detector. Figure A-8.1 shows the gamma radiation results for the FIDLER. Soil sampling locations are also shown on the figure.

The FIDLER was not collimated. While the readings were affected by shine from the process building, the uniform distribution of data provided no reason to suspect localized concentrations of gamma-emitting radionuclides within the survey unit in excess of the areas selected for systematic sampling. No biased samples were collected.

2.2 Soil Sample Results

Two 15 cm deep systematic soil sample locations were sampled at the 288 m^2 trench north and west of the Old Warehouse and Counting Lab foundation. The samples were taken from 0 – 15 cm below ground surface. This meets the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2. The sample locations are shown in Figure A-8.1.

Soil sample results were compared to the analytical minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 1 because the soil at the Old Warehouse and Counting Lab was sand and gravel. The 95 percent upper tolerance limit (UTL) was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that were rejected during data validation were not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231, radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The results are summarized in Tables A-8.1 and A-8.2 for the ROI and PROI, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and was considered inconsistent with background. Bold values reflect whether the result exceeds the MDA. Underlined values reflect whether the sample was determined inconsistent with background. Shaded results were rejected during data validation. Reasons are shown in the table footnotes. A complete tabulation of soil samples data is provided in Annex A-8.1.

2.3 Gamma Measurements at Sampling Locations

A 30-second gamma measurement was made with each detector type at each location before soil samples were collected. These results are shown in Table A-8.3. The higher-than-background results are indicative of radiation from sources from within nearby buildings.

Table A-8.1. Old Warehouse and Counting Lab ROI Evaluation

Loc. No.	Depth (cm)	Am-241	C-14	Cm-243/ Cm-244	Cs-137	I-129	Np-237	Pu-238	Pu-239/ Pu-240	Pu-241	Sr-90	Tc-99	U-232	U-233/ U-234	U-235	U-238
1	0-15	-0.015	0.878	0.036	**0.485**	-0.269	0.012	0.055	0.012	-0.404	0.035	-1.04	-0.005	**0.859**	**0.055**	**0.910**
2	0-15	0.032	0.377	-0.051	**3.16**	0.043	0.018	0.070	0.084	3.14	0.034	-0.759	0.001	**0.741**	**0.080**	**0.906**

1. Results are in pCi/g.
2. **Bold** values represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results inconsistent with background.

Table A-8.2. Old Warehouse and Counting Lab PROI Results

Loc. No.	Depth (cm)	Ac-227	Co-60	Eu-154	H-3	Pa-231	Ra-226	Ra-228	Sb-125	Sn-126	Th-229	Th-232
1	0-15	-0.008	0.012	0.041	4.69	-0.413	**0.995**	**1.12**	0.006	0.000	-0.053	**1.12**
2	0-15	0.093	-0.055	-0.078	-7.73	-0.367	**0.925**	**1.26**	0.124	0.000	0.039	**1.26**

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results that are inconsistent with background.
4. Sn-126 results rejected due to interference from other nearby photo-peaks.

Table A-8.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	19,193	892572.01	1129234.43	1,405.17
2	13,276	892466.64	1129322.24	*

1. * Location was in a posted Contamination Area. Surveyor did not enter.

ANNEX A-8.1

Soil Sample Results

UNCONTROLLED DOCUMENT

Old Warehouse and Counting Lab Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/244 Result	Cm-243/244 Error	Cm-243/244 MDA
1	-0.015	0.044	0.123	0.878	0.771	1.28	0.036	0.081	0.139
2	0.032	0.109	0.201	0.377	0.710	1.21	-0.051	0.072	0.234

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
1	0.485	0.076	0.0536	-0.269	0.295	0.430	0.012	0.024	0.036
2	3.16	0.152	0.058	0.043	0.174	0.456	0.018	0.027	0.041

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/240 Result	Pu-239/240 Error	Pu-239/240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
1	0.055	0.065	0.071	0.012	0.053	0.103	-0.404	6.84	11.9
2	0.070	0.077	0.102	0.084	0.082	0.101	3.14	6.88	11.7

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
1	0.035	0.208	0.379	-1.04	1.21	2.15	-0.005	0.026	0.057
2	0.034	0.186	0.342	-0.759	1.25	2.20	0.001	0.018	0.035

Location	U-233/234 Result	U-233/234 Error	U-233/234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
1	0.859	0.136	0.051	0.055	0.036	0.016	0.910	0.139	0.036
2	0.741	0.140	0.103	0.080	0.048	0.048	0.906	0.145	0.048

1. Units are pCi/g.
2. Error is total propagated uncertainty.

Old Warehouse and Counting Lab Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA
1	-0.008	0.203	0.350	0.012	0.032	0.064
2	0.093	0.254	0.454	-0.055	0.036	0.054

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
1	0.041	0.089	0.173	4.69	10.9	19.1	-0.413	1.19	2.16
2	-0.078	0.098	0.166	-7.73	9.00	17.9	-0.367	1.45	2.51

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
1	0.995	0.130	0.105	1.12	0.248	0.223	0.006	0.075	0.136
2	0.925	0.131	0.118	1.26	0.261	0.224	0.124	0.108	0.198

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
1	0.000	0.08703	0.097	-0.053	0.160	0.449	1.12	0.248	0.223
2	0.000	0.089	0.121	0.039	0.106	0.184	1.26	0.261	0.224

1. Units are pCi/g.
2. Error is total propagated uncertainty.
3. Sn-126 results rejected due to interference from other nearby photo-peaks.

ATTACHMENT 9

Waste Tank Farm Test Towers

1.0 SITE DESCRIPTION

The Waste Tank Farm Test Towers were pre-engineered structures erected as a stack of modules including ladders, handrails, and grating. The towers were 16 feet by 16 feet by 48 feet high. One tower had been previously removed. The second tower was torn down in 2013 and the concrete foundation was removed in August 2013. They are located in the northern part of Waste Management Area (WMA) 6 as shown in Figure A-9.1. The surface area of the tower removed in 2013 was 24 m^2.

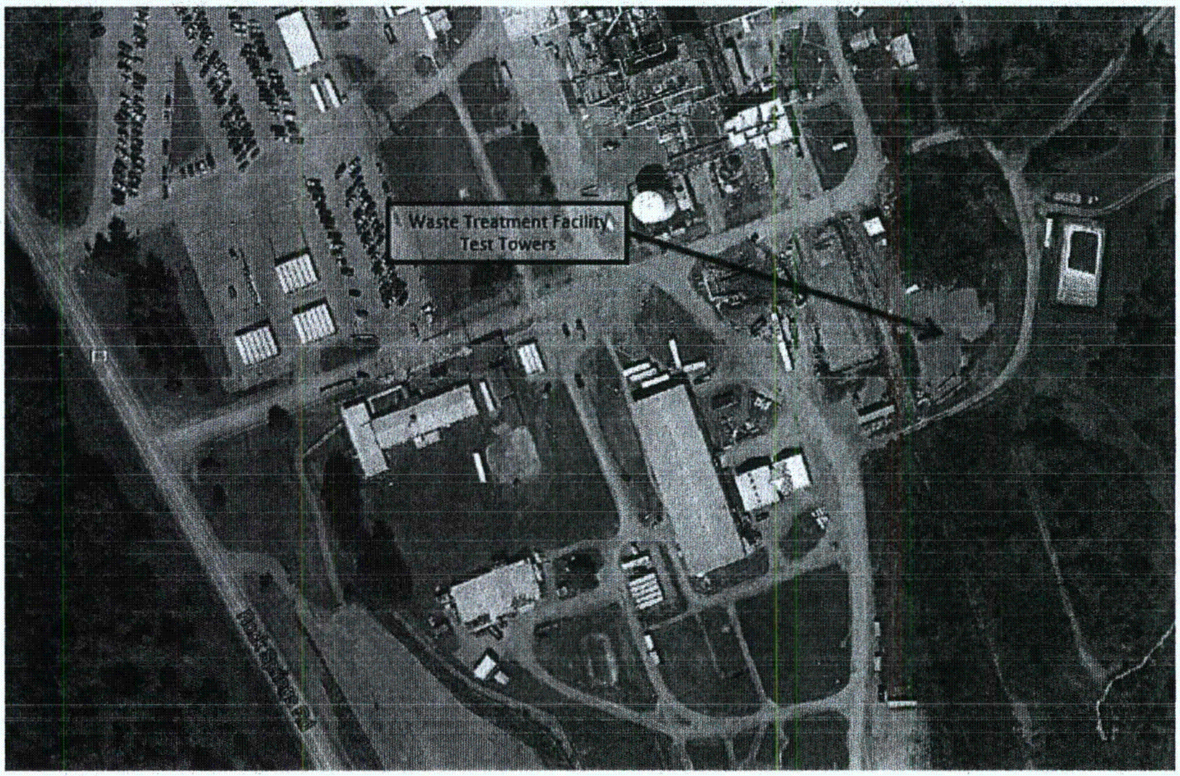

Figure A-9.1. Waste Tank Farm Test Towers in WMA 6

WMA 6 surface soils were likely affected by the 1968 airborne releases of radioactivity from the main process building stack in WMA 1. These impacts would have originally been greatest proximal to the Process Building and decreased as one moved south in WMA 6. Since 1968, however, there has been significant surface soil reworking in the northern portion of WMA 6. These activities could have removed contaminated soil layers, buried those layers under clean backfill, and/or redistributed/mixed contamination in surface soils. The soils surrounding the Waste Tank Farm Test Towers could have surface radioactive contamination possibly greater than the cleanup goal (CG). Gamma radiation exposure rates ranged up to 25 μR/hr as measured in a survey performed in 1991. This is approximately three times typical natural background exposure rates.

2.0 SURVEY RESULTS

Soil data and gamma radiation data were collected. Gamma walkover data are discussed in Section 2.1. Soil data are discussed in Section 2.2. Gamma data taken 15 centimeters (cm) above each soil sampling location before sample collection is presented in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the 24 m^2 surface area where the foundation was removed with a field instrument for detection of low-energy radiation (FIDLER) detector. Additional surrounding area was included in the survey. The FIDLER was not collimated and the readings were affected by shine from the main process building. This is seen as the count rate increases from south to north across the survey unit and beyond the footprint of the WTF Tower to the north. The shine did not impact the results in a way that obscured possible areas of gamma-emitting radioactivity in excess of the clean-up goals (CGs) within the boundary of where the test tower was removed. No biased samples were collected. There is an area with a higher gamma count rate shown beyond the footprint of where the tower was removed in the northwest corner of the area surveyed. This area will be surveyed with a shielded detector during planned characterization of the entire WMA. The shielding will reduce the impact of possible shine and should allow a determination as to whether there is soil contamination in the area. Figure A-9.2 shows the gamma radiation results for the FIDLER. The soil sampling location is also shown on the figure.

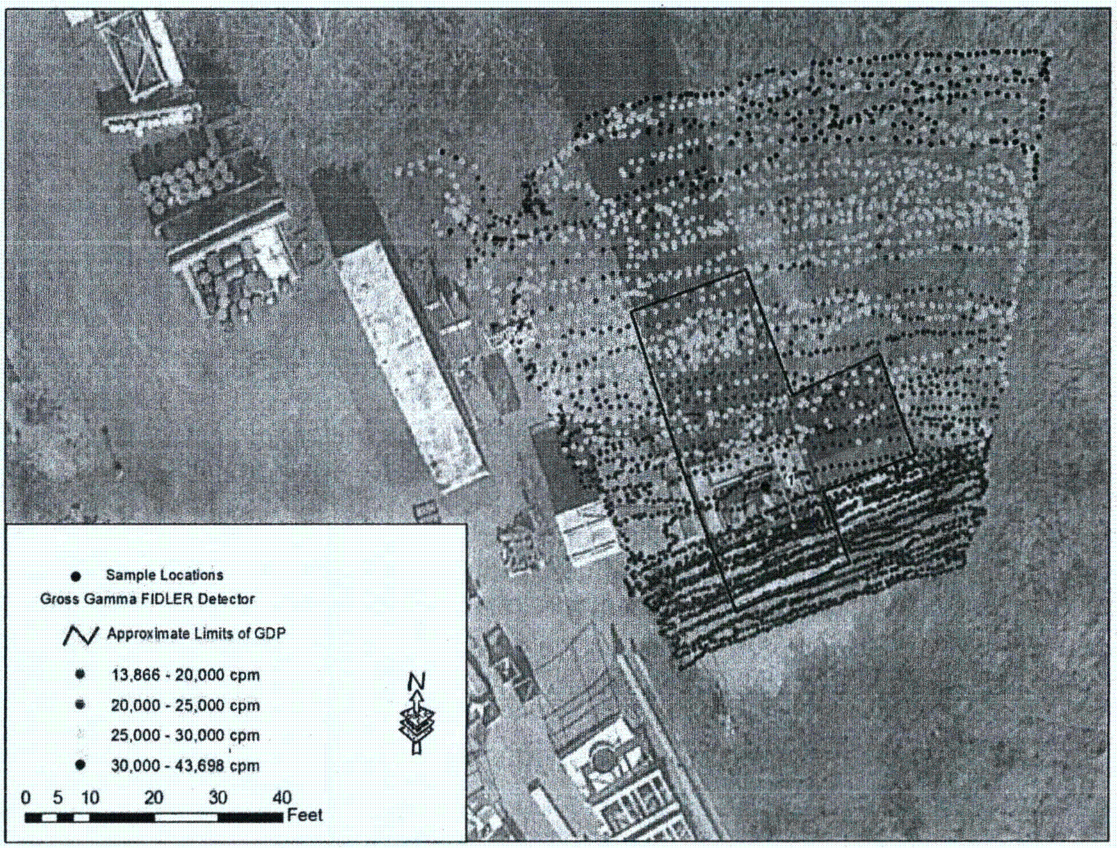

Figure A-9.2. Results of FIDLER GWS Waste Tank Farm Test Towers

2.2 Soil Sample Results

One 15 cm deep systematic location was sampled from the 24 m^2 survey unit. The sample was taken from 60 – 75 cm below ground surface because of the gravel fill covering the survey unit. This meets the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2. The sample location is shown in Figure A-9.2.

Soil sample results were compared to the analytical minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 1 because the soil at the Waste Tank Farm Test Towers was sand and gravel. The 95 percent upper tolerance limit (UTL) was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that were rejected during data validation were not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231, radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The results are summarized in Tables A-9.1 and A-9.2 for the ROI and PROI, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and was considered inconsistent with background. Bold values reflect whether the result exceeds the MDA. Underlined values reflect whether the sample was determined inconsistent with background. Shaded results were rejected during data validation. Reasons are shown in the table footnotes. A complete tabulation of soil samples data is provided in Annex A-9.1.

2.3 Gamma Measurements at Sampling Locations

A 30-second gamma measurement was made with the FIDLER detector type at the sampling location before the soil sample was collected. This result is shown in Table A-9.3. The higher-than-background results are indicative of radiation from sources from within nearby buildings.

Table A-9.1. Waste Tank Farm Test Towers ROI Evaluation

Loc. No.	Depth (cm)	Am-241	C-14	Cm-243/ Cm-244	Cs-137	I-129	Np-237	Pu-238	Pu-239/ Pu-240	Pu-241	Sr-90	Tc-99	U-232	U-233/ U-234	U-235	U-238
1	60-75	0.026	0.380	0.02	**<u>2.10</u>**	-0.055	-0.002	0.009	0.064	-0.906	0.291	-0.253	-0.007	**0.733**	**<u>0.062</u>**	**0.928**

1. Results are in pCi/g.
2. **Bold** values represent analytical results greater than the respective MDA.
3. <u>Underlined</u> values represent analytical results inconsistent with background.

Table A-9.2. Waste Tank Farm Test Towers PROI Results

Loc. No.	Depth (cm)	Ac-227	Co-60	Eu-154	H-3	Pa-231	Ra-226	Ra-228	Sb-125	Sn-126	Th-229	Th-232
1	60-75	0.041	0.004	-0.030	2.14	-1.33	**0.930**	**<u>1.05</u>**	0.051	0.080	-0.013	**<u>1.05</u>**

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. <u>Underlined</u> values represent analytical results that are inconsistent with background.
4. Sn-126 results rejected due to interference from other nearby photo-peaks.

Table A-9.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	31,742	892460.65	1129471.73	1,406.60

ANNEX A-9.1

Soil Sample Results

Waste Tank Farm Test Towers Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/244 Result	Cm-243/244 Error	Cm-243/244 MDA
1	0.026	0.089	0.165	0.380	0.794	1.35	0.020	0.089	0.174

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
1	2.10	0.124	0.053	-0.055	0.341	0.606	-0.002	0.016	0.034

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/240 Result	Pu-239/240 Error	Pu-239/240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
1	0.009	0.052	0.100	0.064	0.081	0.100	-0.906	6.72	11.7

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
1	0.291	0.244	0.395	-0.253	1.09	1.91	-0.007	0.024	0.057

Location	U-233/234 Result	U-233/234 Error	U-233/234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
1	0.733	0.121	0.052	0.062	0.038	0.034	0.928	0.134	0.015

1. Units are pCi/g.
2. Error is total propagated uncertainty.

Waste Tank Farm Test Towers Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA
1	0.041	0.236	0.419	0.004	0.036	0.067

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
1	-0.030	0.102	0.183	2.14	11.3	20.2	-1.33	1.35	2.24

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
1	0.930	0.124	0.099	1.05	0.222	0.188	0.051	0.099	0.175

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
1	0.080	0.081	0.114	-0.013	0.090	0.220	1.05	0.222	0.188

1. Units are pCi/g.
2. Error is total propagated uncertainty.
3. Sn-126 results rejected due to interference from other nearby photo-peaks.

ATTACHMENT 10

Expanded Laboratory (ELAB)

1.0 SITE DESCRIPTION

Radiological surveys were performed twice for the Expanded Environmental Laboratory. The first survey was performed in November 2013 when the building was demolished and the concrete foundation was removed. The second survey was performed in April 2014 when the footers for the concrete slab were removed.

The Expanded Environmental Laboratory is located south of the Administration Building. It was constructed during the early 1990s. The laboratory was 92 feet long and 50 feet wide, and consisted of eight one-story modular units supported by 72 concrete piers. It was manufactured from light wood framing, metal roofing, and siding. An addition, 20 feet wide and 50 feet long on a concrete foundation wall, was built on the east side of the laboratory. This facility was removed in the fall of 2013. It was located in the central part of Waste Management Area (WMA) 10 as shown in Figure A-10.1. Conditions at the time of the survey are as shown in Figure A-10.2.

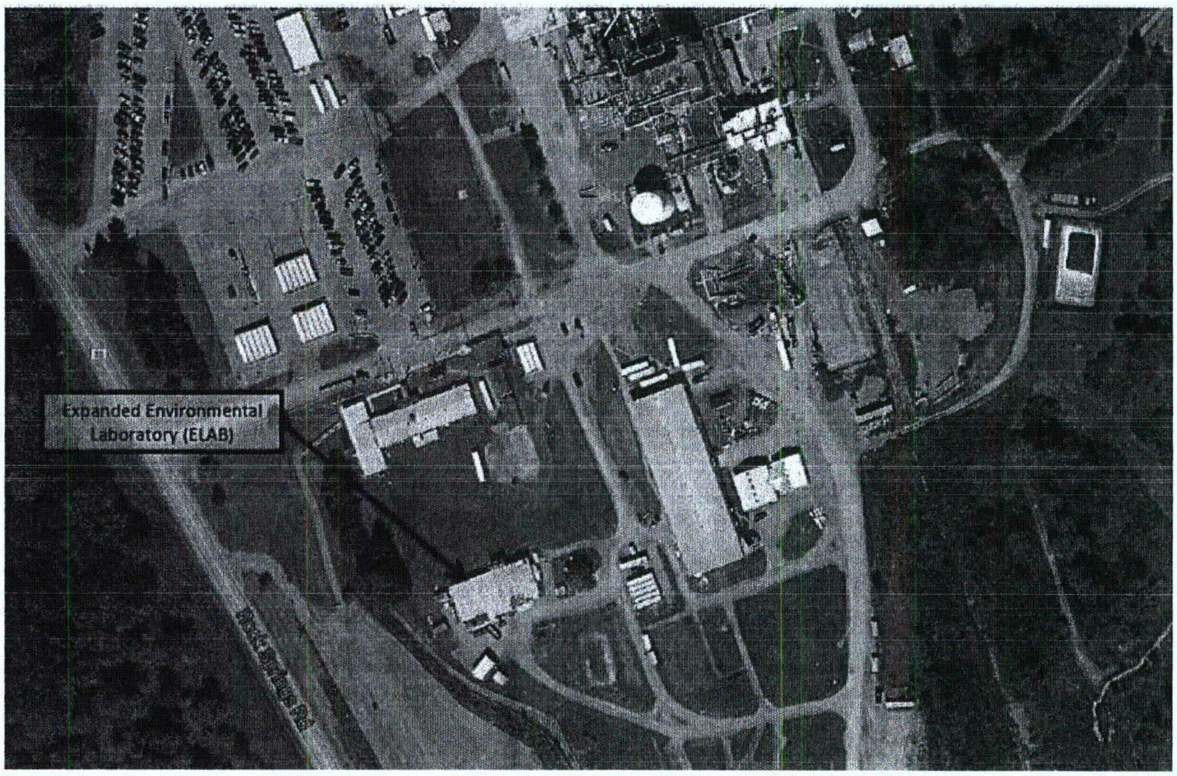

Figure A-10.1. ELAB in WMA 10

WMA 10 surface soils where the ELAB was located were probably not affected by the 1968 airborne releases of radioactivity from the Process Building stack in WMA 1 because the release was not in the direction of ELAB. Since 1968 there has been significant surface soil reworking in this portion of WMA 10. However, this portion of the West Valley Demonstration Project (WVDP) is very unlikely to have radioactive contamination greater than the DCGL (DOE 2011a).

Figure A-10.2. Conditions During Survey

2.0 SURVEY RESULTS

Soil data and gamma radiation data were collected. Gamma walkover data are discussed in Section 2.1. Soil data are discussed in Section 2.2. Gamma data taken 15 centimeters (cm) above each soil sampling location before sample collection is presented in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the 684 m^2 surface area where the foundation was removed in November 2013 and additional surrounding area with a field instrument for detection of low-energy radiation (FIDLER) detector. Figure A-10.3 shows the gamma radiation results for the FIDLER for the survey performed in November 2013. When the survey team was mobilized at the site, no biased samples were collected based on the walkover results. However, further review of the data after demobilization indicated that there may have been elevated radioactivity at two locations indicated in Figure A-10.3.

Three concrete slab footers were removed in 2014 and the locations where they were removed were surveyed in April using a FIDLER. Areas surrounding the locations that may have shown elevated concentrations of radioactivity in November 2013 were also resurveyed in April 2014. Survey results are shown on Figure A-10.4 and the areas surveyed are denoted within the borders outlined on the figure. These newly surveyed (in April 2014) areas were pasted onto the original figure produced in November 2013 which depicts the final "as-left" conditions in April 2014. No elevated radiation signal was detected in April 2014.

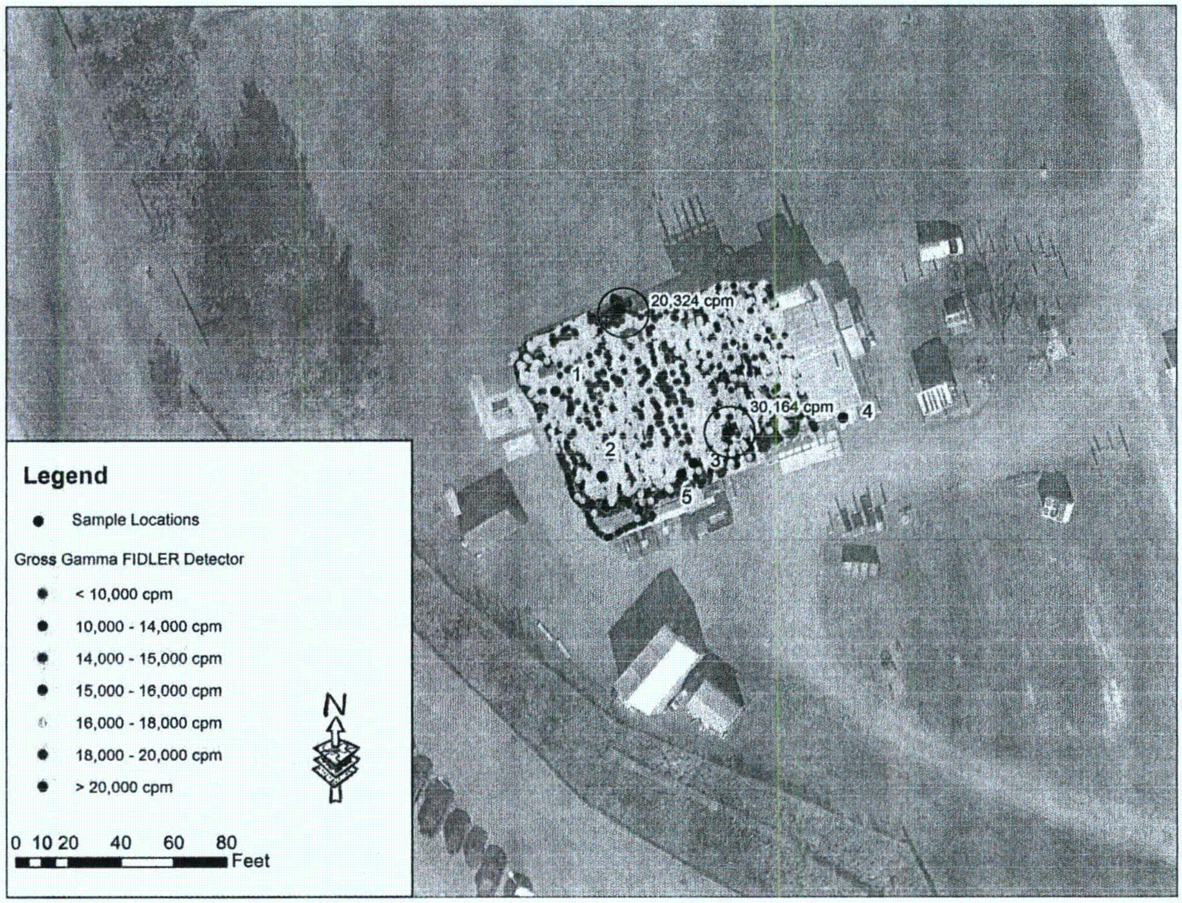

Figure A-10.3. Results of FIDLER GWS in November 2013

2.2 Soil Sample Results

Five 15-cm deep systematic locations were sampled at the 684 m^2 survey unit in November 2013. This exceeded the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2. No samples were collected in April 2014 because there was no reason to suspect elevated concentrations of radioactivity based on the GWS results performed in April 2014 and the area had previously been adequately sampled. The sample locations are shown in Figure A-10.3. The sampling locations were planned as systematic and evenly spaced. Obstructions like utility lines and excavated holes caused all locations to be moved elsewhere from the original plan. There were two parts to the foundation and sample locations 3 and 5 were placed in one of the two parts. They were placed as shown if Figure A-10.3 because of obstacles in other parts of the excavated area.

Soil sample results were compared to the analytical minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 1 because the soil at the ELAB was sand and gravel. The 95 percent upper tolerance limit (UTL) was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15

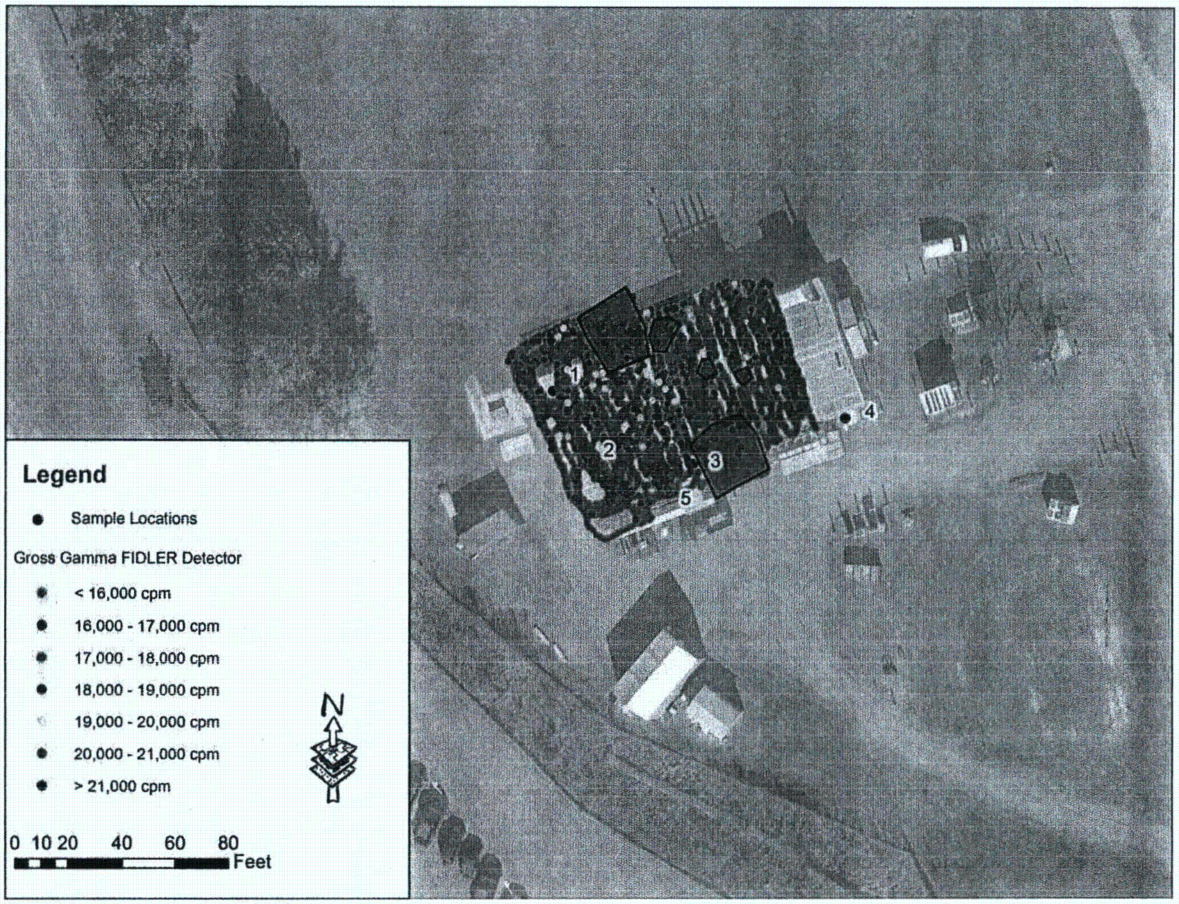

Figure A-10.4. Results of FIDLER GWS in April 2014

cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that were rejected during data validation were not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231, radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The results are summarized in Tables A-10.1 and A-10.2 for the ROI and PROI, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and was considered inconsistent with background. Bold values reflect whether the result exceeds the MDA. Underlined values reflect whether the sample was determined inconsistent with background. Shaded results were rejected during data validation. Reasons are shown in the table footnotes. A complete tabulation of soil samples data is provided in Annex A-10.1.

2.3 Gamma Measurements at Sampling Locations

A 30-second gamma measurement was made with the FIDLER detector type at the sampling location before the soil sample was collected. This result is shown in Table A-10.3. The higher-than-background results are indicative of radiation from sources from within nearby buildings.

Table A-10.1. ELAB ROI Evaluation

Loc. No.	Depth (cm)	Am-241	C-14	Cm-243/ Cm-244	Cs-137	I-129	Np-237	Pu-238	Pu-239/ Pu-240	Pu-241	Sr-90	Tc-99	U-232	U-233/ U-234	U-235	U-238
1	0-15	0.095	-0.651	-0.086	0.022	-0.250	0.011	-0.035	-0.035	-0.388	0.298	**0.903**	-0.051	**0.939**	**<u>0.127</u>**	**0.524**
2	0-15	0.078	-0.064	0.000	**0.153**	0.135	0.014	0.000	0.082	-3.14	-0.136	0.323	-0.056	**1.01**	**<u>0.115</u>**	**0.685**
3	0-15	0.049	0.065	0.045	**<u>0.638</u>**	0.287	0.004	-0.021	0.056	-0.200	0.178	0.653	<u>0.091</u>	**0.864**	**<u>0.132</u>**	**0.849**
4	0-15	-0.055	0.264	-0.036	**0.097**	0.146	0.008	-0.017	0.109	-3.77	-0.578	0.805	-0.057	**<u>1.38</u>**	**<u>0.231</u>**	**1.15**
5	0-15	0.024	-0.350	-0.060	**0.147**	-0.433	-0.002	0.000	-0.020	3.37	-0.105	**0.969**	-0.038	**0.799**	**<u>0.346</u>**	**0.799**

1. Results are in pCi/g.
2. **Bold** values represent analytical results greater than the respective MDA.
3. <u>Underlined</u> values represent analytical results inconsistent with background.

Table A-10.2. ELAB PROI Results

Loc. No.	Depth (cm)	Ac-227	Co-60	Eu-154	H-3	Pa-231	Ra-226	Ra-228	Sb-125	Sn-126	Th-229	Th-232
1	0-15	<u>0.149</u>	0.008	-0.027	<u>6.02</u>	**2.33**	**0.901**	**<u>1.18</u>**	0.000	0.074	-0.031	**<u>1.18</u>**
2	0-15	<u>0.127</u>	-0.017	0.042	-7.58	0.009	**0.935**	**<u>1.12</u>**	-0.010	0.000	0.006	**<u>1.12</u>**
3	0-15	-0.141	-0.004	-0.006	-5.15	-0.090	**0.803**	**0.466**	0.014	**0.125**	-0.036	**0.466**
4	0-15	-0.119	0.003	0.031	<u>7.43</u>	0.408	**0.657**	**0.514**	0.052	0.084	0.149	**0.514**
5	0-15	-0.423	-0.004	-0.060	<u>8.66</u>	0.184	**0.911**	**0.739**	0.000	0.000	-0.062	**0.739**

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. <u>Underlined</u> values represent analytical results that are inconsistent with background.
4. Sn-126 result rejected due to interference from other nearby photo-peaks.

Table A-10.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	14,290	892091.11	1128765.03	1,423.62
2	15,321	892058.79	1128782.60	1,422.73
3	15,839	892063.81	1128817.59	1,422.68
4	17,123	892081.02	1128874.48	1,421.96
5	8,448	892059.72	1128812.95	1,422.74

ANNEX A-10.1

Soil Sample Results

ELAB Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/244 Result	Cm-243/244 Error	Cm-243/244 MDA
1	0.095	0.601	0.324	-0.651	1.52	0.858	-0.086	0.593	0.200
2	0.078	0.491	0.292	-0.064	1.55	0.895	0.000	0.303	0.204
3	0.049	0.652	0.319	0.065	1.53	0.888	0.045	0.482	0.252
4	-0.055	0.466	0.166	0.264	1.51	0.883	-0.036	0.417	0.160
5	0.024	0.512	0.245	-0.350	1.59	0.907	-0.060	0.506	0.180

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
1	0.022	0.068	0.036	-0.250	1.16	0.670	0.011	0.037	0.021
2	0.153	0.069	0.064	0.135	0.966	0.489	0.014	0.032	0.023
3	0.638	0.062	0.096	0.287	0.853	0.359	0.004	0.024	0.013
4	0.097	0.054	0.060	0.146	0.672	0.298	0.008	0.028	0.016
5	0.147	0.065	0.068	-0.433	0.846	0.499	-0.002	0.029	0.014

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/240 Result	Pu-239/240 Error	Pu-239/240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
1	-0.035	0.408	0.156	-0.035	0.408	0.156	-0.388	13.4	7.69
2	0.000	0.247	0.166	0.082	0.247	0.231	-3.14	13.5	7.67
3	-0.021	0.421	0.182	0.056	0.853	0.417	-0.200	11.6	6.66
4	-0.017	0.343	0.148	0.109	0.397	0.250	-3.77	12.6	7.12
5	0.000	0.255	0.172	-0.020	0.408	0.176	3.37	12.0	7.05

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
1	0.298	0.786	0.457	0.903	1.48	0.883	-0.051	0.289	0.138
2	-0.136	0.871	0.454	0.323	1.72	1.01	-0.056	0.287	0.133
3	0.178	0.752	0.425	0.653	1.70	1.00	0.091	0.055	0.095
4	-0.578	0.876	0.393	0.805	1.57	0.936	-0.057	0.307	0.144
5	-0.105	0.758	0.393	0.969	1.59	0.948	-0.038	0.211	0.091

Location	U-233/234 Result	U-233/234 Error	U-233/234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
1	0.939	0.173	0.270	0.127	0.139	0.118	0.524	0.138	0.203
2	1.01	0.219	0.275	0.115	0.049	0.096	0.685	0.125	0.217
3	0.864	0.134	0.245	0.132	0.134	0.116	0.849	0.050	0.238
4	1.38	0.257	0.345	0.231	0.147	0.151	1.15	0.058	0.296
5	0.799	0.262	0.271	0.346	0.139	0.171	0.799	0.139	0.247

1. Units are pCi/g.
2. Error is total propagated uncertainty.

UNCONTROLLED DOCUMENT

ELAB Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA
1	0.149	0.436	0.425	0.008	0.075	0.039
2	0.127	0.419	0.222	-0.017	0.071	0.041
3	-0.141	0.427	0.246	-0.004	0.068	0.036
4	-0.119	0.425	0.246	0.003	0.0607	0.031
5	-0.423	0.355	0.235	-0.004	0.067	0.040

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
1	-0.027	0.212	0.139	6.02	21.5	12.4	2.33	2.51	1.60
2	0.042	0.223	0.118	-7.58	21.3	11.3	0.009	2.31	1.27
3	-0.006	0.225	0.120	-5.15	21.6	11.6	-0.090	2.43	1.36
4	0.031	0.199	0.102	7.43	21.1	12.3	0.408	2.37	1.30
5	-0.060	0.210	0.119	8.66	23.1	13.5	0.184	2.43	1.34

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
1	0.901	0.104	0.149	1.18	0.200	0.216	0.000	0.084	0.075
2	0.935	0.117	0.151	1.12	0.249	0.294	-0.010	0.148	0.100
3	0.803	0.128	0.153	0.466	0.261	0.278	0.014	0.163	0.091
4	0.657	0.125	0.140	0.514	0.229	0.211	0.052	0.162	0.083
5	0.911	0.114	0.150	0.739	0.240	0.243	0.000	0.168	0.161

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
1	0.074	0.115	0.086	-0.031	0.352	0.135	1.18	0.200	0.216
2	0.000	0.105	0.082	0.006	0.942	0.459	1.12	0.249	0.294
3	0.125	0.159	0.106	-0.036	0.415	0.159	0.466	0.261	0.278
4	0.084	0.153	0.091	0.149	0.400	0.264	0.514	0.229	0.211
5	0.000	0.085	0.068	-0.062	0.540	0.208	0.739	0.240	0.243

1. Units are pCi/g.
2. Error is total propagated uncertainty.
3. Sn-126 result rejected due to interference from other nearby photo-peaks.

ATTACHMENT 11

New Cooling Tower

UNCONTROLLED DOCUMENT

1.0 SITE DESCRIPTION

The New Cooling Tower was 20 feet by 20 feet by 11 feet high and it stood on a concrete basin. The floor of the basin was an 8-inch-thick concrete slab. It was located in the northern portion of Waste Management Area (WMA) 6, just south of WMA 1, as shown in Figure A-11.1

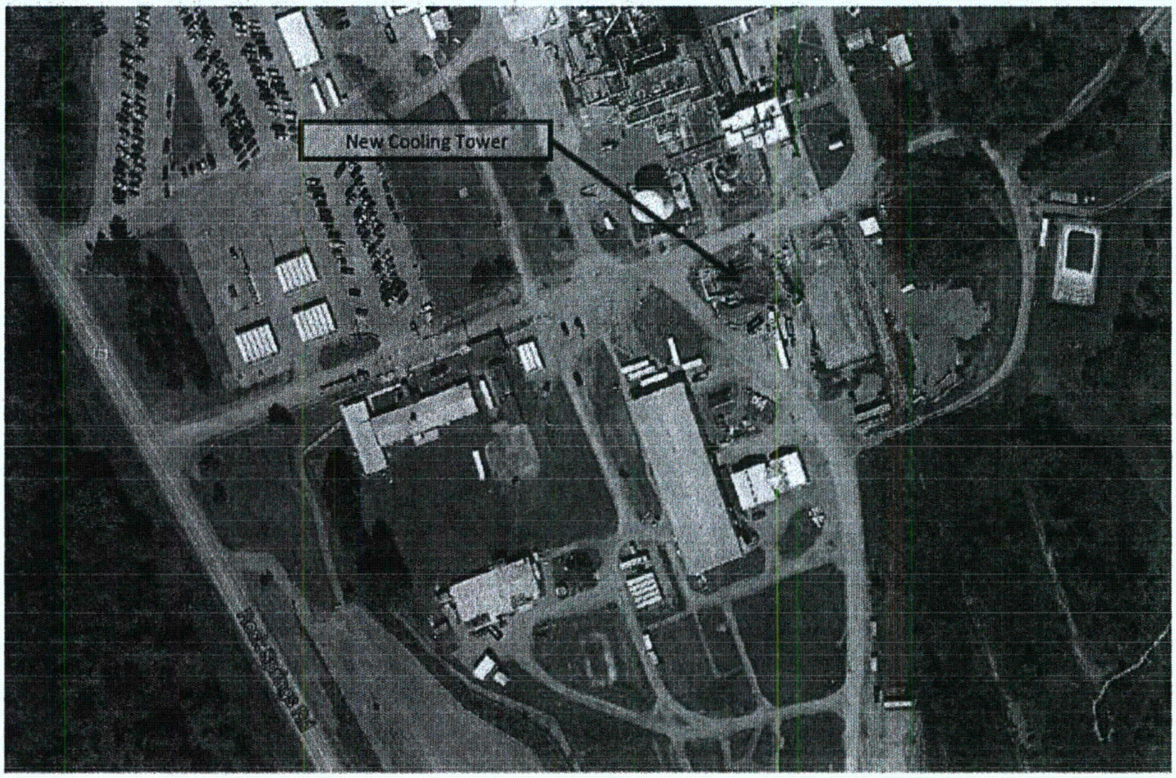

Figure A-11.1. New Cooling Tower

WMA 6 surface soils were likely affected by the 1968 airborne releases of radioactivity from the Process Building stack in WMA 1. These impacts would have originally been greatest proximal to the Process Building and decreased as one moved south in WMA 6. Since 1968, however, there has been significant surface soil reworking in the northern portion of WMA 6. These activities could have removed contaminated soil layers, buried those layers under clean backfill, and/or redistributed/mixed contamination in surface soils. The soils surrounding the New Cooling Tower area could have surface radioactive contamination possibly greater than the cleanup goal (CG). Gamma radiation exposure rates ranged up to 25 μR/hr as measured in a survey performed in 1991. This is approximately three times typical natural background exposure rates.

2.0 SURVEY RESULTS

Soil data and gamma radiation data were collected. Gamma walkover data are discussed in Section 2.1. Soil data are discussed in Section 2.2. Gamma data taken 15 centimeters (cm) above each soil sampling location before sample collection is presented in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the surface at the survey area with a field instrument for detection of low-energy radiation (FIDLER) detector. The FIDLER was not collimated and the readings were affected by nearby sources of radiation such that it was difficult to discern whether there was gamma emitting radioactivity above natural background at the New Cooling Tower Area. The radiation was mostly emitted from the main process building. One suspect area of elevated radiation signal can be seen in the southwestern part of the survey area on the gamma walkover map. When soil samples were collected, readings were taken in this area with a 2-inch by 2-inch NaI detector with a 1-inch lead collimator on it. Results of these measurements showed no reason to suspect elevated radiation from the underlying soil. The Project Manager and the Radiological Engineer were unable to discern gamma count rates that exceeded that of the immediate surrounding area. No biased sample was collected.

Figure A-11.2 shows the gamma radiation results for the FIDLER. Soil sampling locations are also shown on the figure.

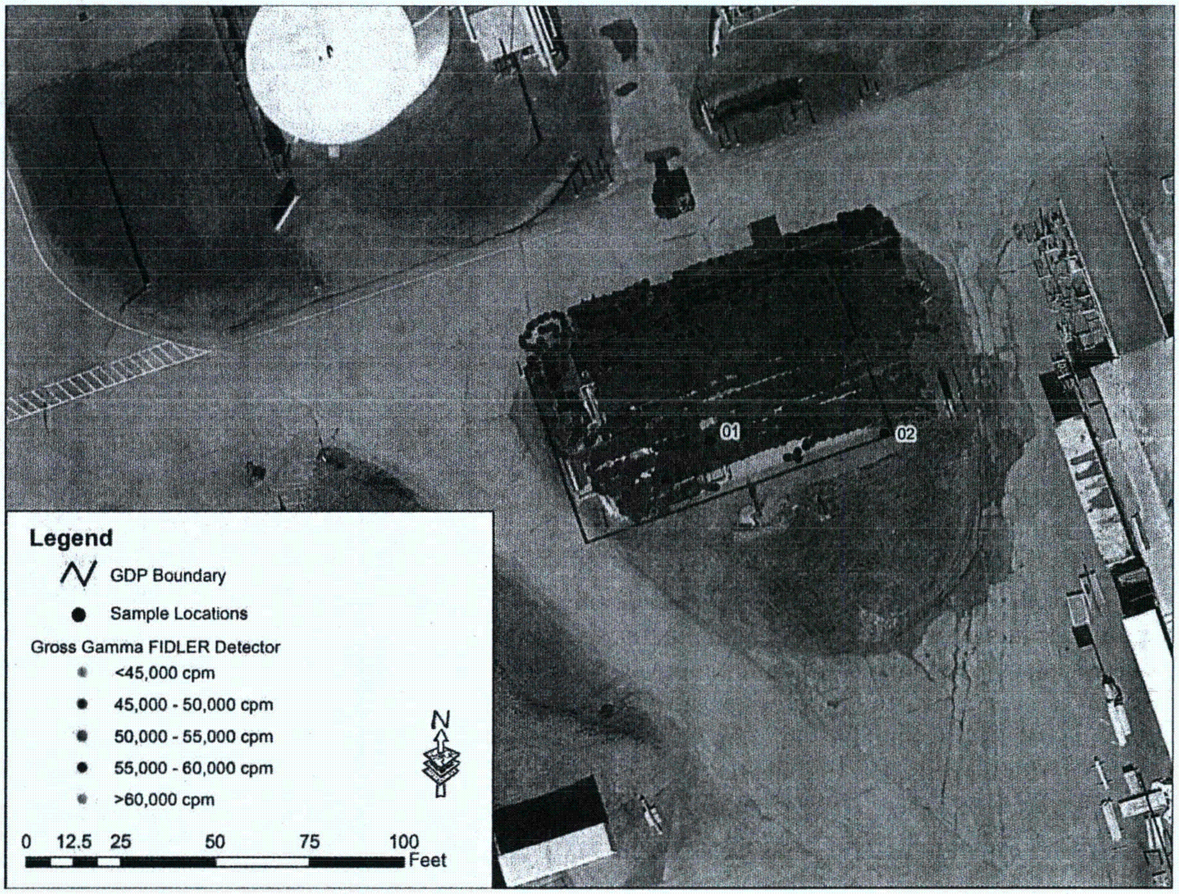

Figure A-11.2. Results of FIDLER GWS

2.2 Soil Sample Results

Two 15-cm deep systematic soil sample locations were sampled in the approximately 300 m^2 area. The samples were taken from 0 – 15 cm below ground surface. This meets the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2. The sample locations are shown in Figure A-11.2.

Soil sample results were compared to the analytical minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 1 because the soil at the New Cooling Tower was sand and gravel. The 95 percent upper tolerance limit (UTL) was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that were rejected during data validation were not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231, radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The results are summarized in Tables A-11.1 and A-11.2 for the ROI and PROI, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and was considered inconsistent with background. Bold values reflect whether the result exceeds the MDA. Underlined values reflect whether the sample was determined inconsistent with background. Shaded results were rejected during data validation. Reasons are shown in the table footnotes. A complete tabulation of soil samples data is provided in Annex A-11.1.

2.3 Gamma Measurements at Sampling Locations

A 30-second gamma measurement was made with each detector type at each location before soil samples were collected. These results are shown in Table A-11.3. The higher-than-background results are indicative of radiation from sources from within nearby buildings.

Table A-11.1. New Cooling Tower ROI Evaluation

Loc. No.	Depth (cm)	Am-241	C-14	Cm-243/ Cm-244	Cs-137	I-129	Np-237	Pu-238	Pu-239/ Pu-240	Pu-241	Sr-90	Tc-99	U-232	U-233/ U-234	U-235	U-238
1	0-15	0.053	-0.184	-0.033	**0.331**	-0.450	0.005	0.015	-0.016	5.34	0.761	0.842	-0.011	**0.752**	**<u>0.084</u>**	**0.979**
2	0-15	0.382	0.121	-0.057	**0.461**	-0.030	0.007	-0.001	0.042	3.25	0.451	-0.192	0.000	**0.884**	**<u>0.127</u>**	**0.833**

1. Results are in pCi/g.
2. **Bold** values represent analytical results greater than the respective MDA.
3. <u>Underlined</u> values represent analytical results inconsistent with background.

Table A-11.2. New Cooling Tower PROI Results

Loc. No.	Depth (cm)	Ac-227	Co-60	Eu-154	H-3	Pa-231	Ra-226	Ra-228	Sb-125	Sn-126	Th-229	Th-232
1	0-15	-0.086	-0.001	0.021	<u>7.10</u>	-0.105	**0.992**	**<u>1.26</u>**	-0.054	0.000	0.211	**<u>1.26</u>**
2	0-15	-0.218	0.005	-0.050	-0.009	0.116	**0.940**	**<u>1.07</u>**	-0.044	0.101	-0.071	**<u>1.07</u>**

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. <u>Underlined</u> values represent analytical results that are inconsistent with background.
4. Sn-126 result rejected due to interference from other nearby photo-peaks.

Table A-11.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	48,327	892505.23	1129132.10	1,409.22
2	49,223	892507.18	1129178.58	1,409.47

ANNEX A-11.1

Soil Sample Results

New Cooling Tower Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/244 Result	Cm-243/244 Error	Cm-243/244 MDA
1	0.053	0.198	0.333	-0.184	0.898	1.55	-0.033	0.145	0.380
2	0.382	0.364	0.468	0.121	0.838	1.44	-0.057	0.133	0.393

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
1	0.331	0.070	0.059	-0.450	0.509	0.362	0.005	0.016	0.028
2	0.461	0.070	0.070	-0.030	0.465	0.949	0.007	0.013	0.011

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/240 Result	Pu-239/240 Error	Pu-239/240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
1	0.015	0.093	0.176	-0.016	0.102	0.239	5.34	5.28	8.83
2	-0.001	0.132	0.281	0.042	0.123	0.223	3.25	6.40	10.9

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
1	0.761	0.532	0.832	0.842	1.03	1.74	-0.011	0.121	0.234
2	0.451	0.513	0.861	-0.192	1.10	2.05	0.000	0.108	0.211

Location	U-233/234 Result	U-233/234 Error	U-233/234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
1	0.752	0.192	0.091	0.084	0.070	0.036	0.979	0.214	0.036
2	0.884	0.219	0.140	0.127	0.099	0.121	0.833	0.213	0.140

1. Units are pCi/g.
2. Error is total propagated uncertainty.

New Cooling Tower Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA
1	-0.086	0.221	0.399	-0.001	0.036	0.066
2	-0.218	0.237	0.412	0.005	0.037	0.073

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
1	0.021	0.128	0.207	7.10	7.24	11.9	-0.105	1.30	2.37
2	-0.050	0.127	0.194	-0.009	5.79	11.4	0.116	1.37	2.53

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
1	0.992	0.170	0.115	1.26	0.276	0.225	-0.054	0.084	0.142
2	0.940	0.146	0.113	1.07	0.377	0.250	-0.044	0.104	0.157

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
1	0.00	0.082	0.112	0.211	0.313	0.458	1.26	0.276	0.225
2	0.101	0.105	0.149	-0.071	0.134	0.412	1.07	0.377	0.250

1. Units are pCi/g.
2. Error is total propagated uncertainty.
3. Sn-126 result rejected due to interference from other nearby photo-peaks.

ATTACHMENT 12

Building T-FS-04

1.0 SITE DESCRIPTION

Building T-FS-04 was used as a monitoring shed for instruments in the base pad of the drum cell. It was located in the northwest of Waste Management Area (WMA) 9, just south of WMA 6 along the railroad tracks, as shown in Figure A-12.1.

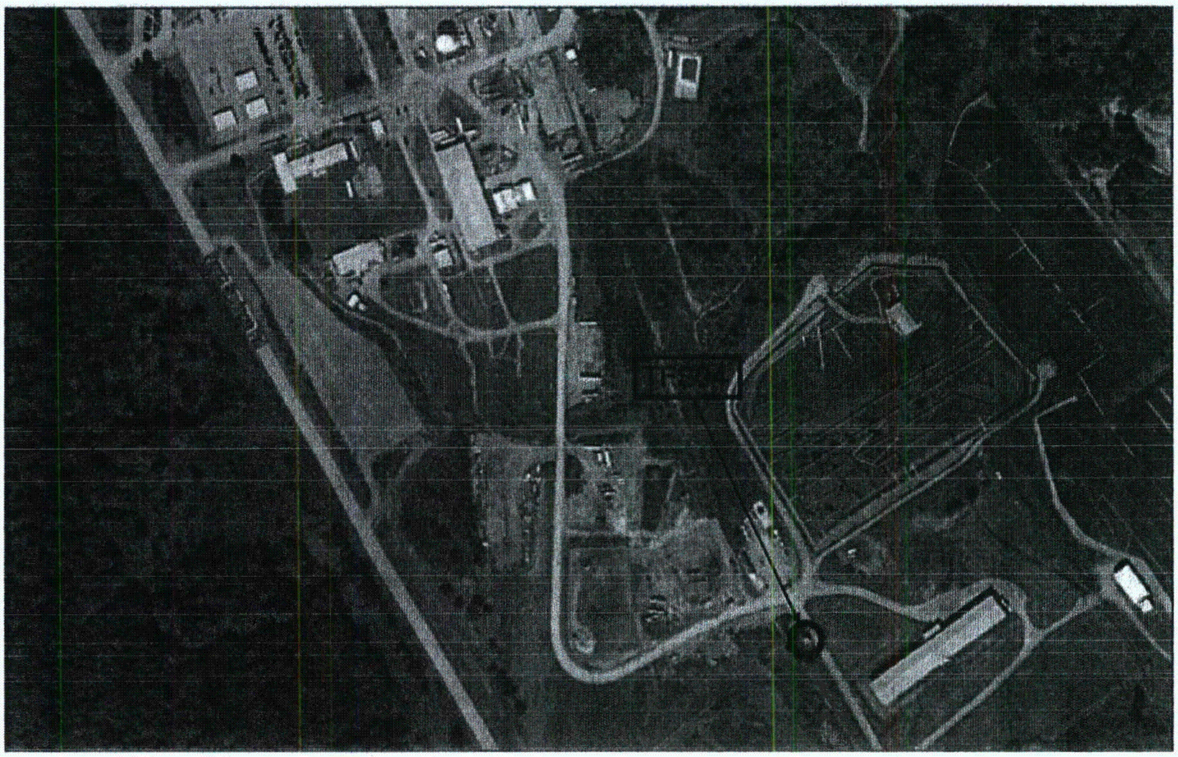

Figure A-12.1. Building T-FS-04 Location Within WMA 9

Historical WMA 9 site activities have primarily included open land surface storage and storage of cement solidified radioactive waste in steel drums within the Drum Cell. Although no significant releases have been reported for this area, it is possible that there were releases associated with storage activities. These would likely have been low-level releases, and would have been confined to surface soils. There is the possibility that the construction of the current configuration of hardstands might have buried surface contamination that existed prior to their construction. Gamma radiation above background was detected along the railroad tracks during a gamma walkover survey performed by SEC in the fall of 2013. However, no radiation above background was detected near T-FS-04.

The approximately 30 m^2 survey area just prior to the survey was as shown in Figure A-12.2. The area had been excavated to a depth of approximately 4 ft. The standing water was pumped from the excavation before the survey was performed.

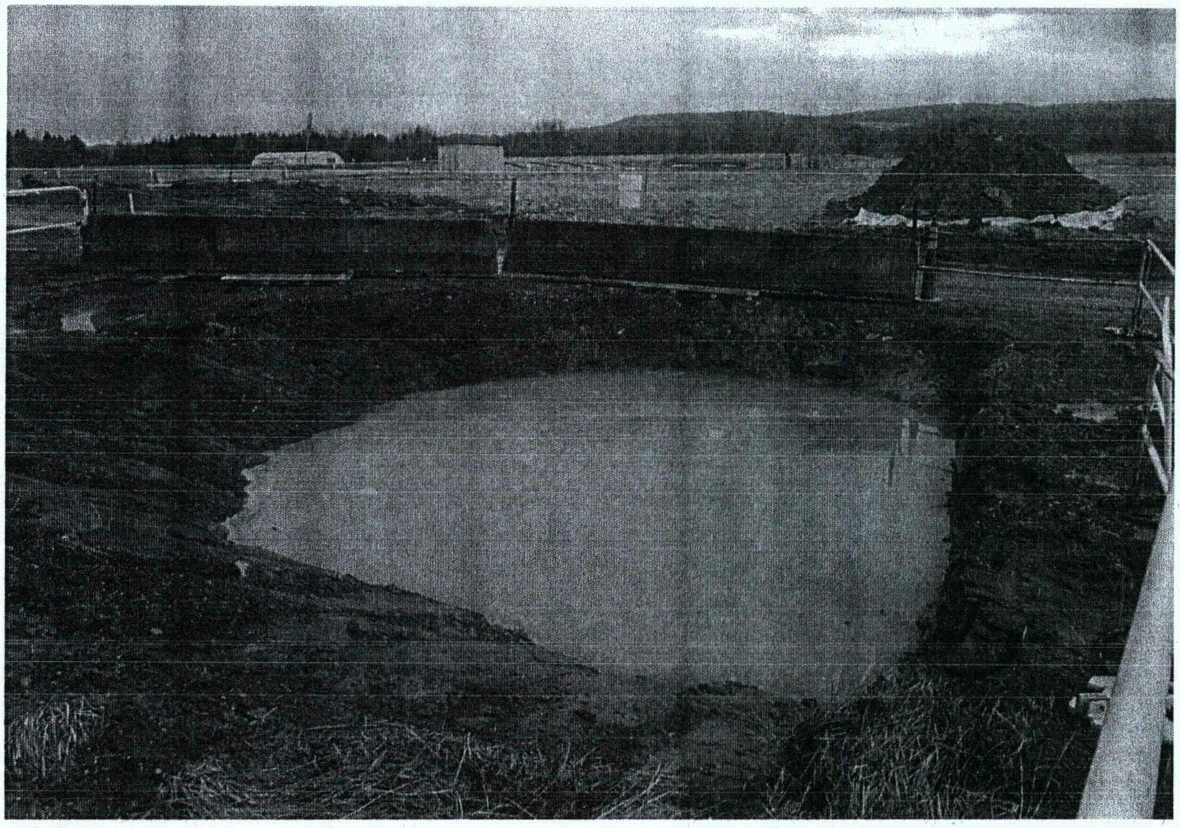

Figure A-12.2. Building T-FS-04 Excavation Before the Standing Water was Pumped to Allow Access

2.0 SURVEY RESULTS

Soil data and gamma radiation data were collected. Gamma walkover data are discussed in Section 2.1. Soil data are discussed in Section 2.2. Gamma data taken 15 centimeters (cm) above each soil sampling location before sample collection are presented in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the surface at the survey area with a field instrument for detection of low-energy radiation (FIDLER) detector. Figure A-12.3 shows the gamma radiation results for the FIDLER. Soil sampling locations are also shown on the figure.

The gamma count rates from 14,000 to 18,000 counts per minute (cpm) were taken in the deepest part of the excavation. These higher count rates shown on the figure are a function of radiation surrounding the detector in the excavated area and are not a function of signal from contamination.

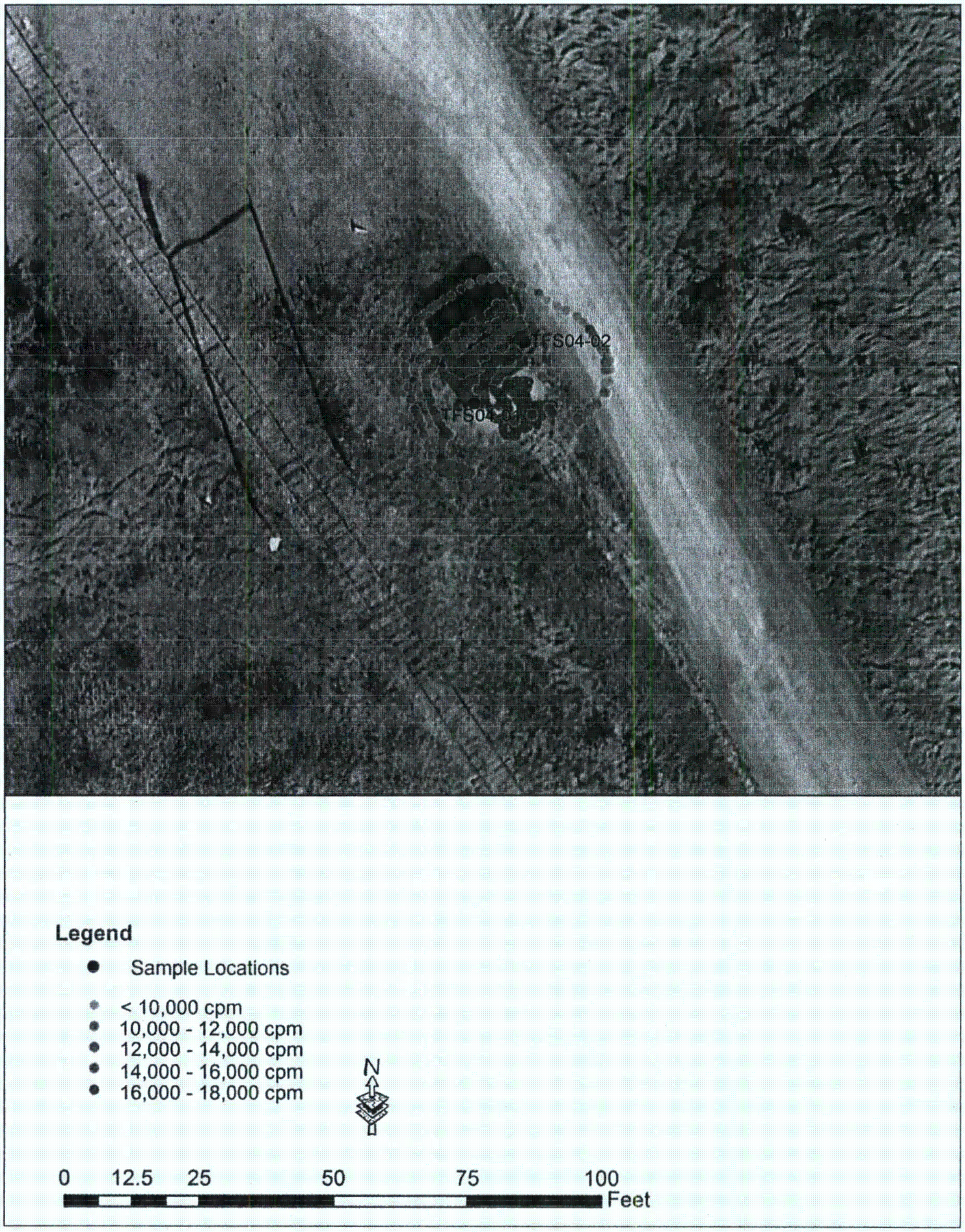

Figure A-12.3. Results of FIDLER GWS

2.2 Soil Sample Results

Two 15-cm deep systematic soil sample locations were sampled in the approximately 30 m^2 area. The samples were taken from 0 – 15 cm below ground surface. This exceeds the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2. The sample locations are shown in Figure A-12.3.

Soil sample results were compared to the analytical minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 2 because the soil at Building T-FS-04 was in the South Plateau where Lavery till is prevalent. The subsurface upper tolerance limit (UTL) values were used for comparison because the samples were taken in a 4-ft excavation. The 95 percent UTL was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that were rejected during data validation were not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231, radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The results are summarized in Tables A-12.1 and A-12.2 for the ROI and PROI, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and was considered inconsistent with background. Bold values reflect whether the result exceeds the MDA. Underlined values reflect whether the sample was determined inconsistent with background. Shaded results were rejected during data validation. Reasons are shown in the table footnotes. A complete tabulation of soil samples data is provided in Annex A-12.1.

2.3 Gamma Measurements at Sampling Locations

A 60-second gamma measurement was made with a FIDLER and NaI detector at each location before soil samples were collected. These results are shown in Table A-12.3.

Table A-12.1. Building T-FS-04 Evaluation

Loc. No.	Depth (cm)	Am-241	C-14	Cm-243/ Cm-244	Cs-137	I-129	Np-237	Pu-238	Pu-239/ Pu-240	Pu-241	Sr-90	Tc-99	U-232	U-233/ U-234	U-235	U-238
1	0-15	0.095	0.445	0.060	**0.287**	0.002	0.006	0.046	0.038	3.77	-0.105	1.47	0.031	**0.769**	0.039	**0.878**
2	0-15	0.099	0.212	0.038	**0.682**	0.038	-0.004	0.048	-0.013	3.10	-0.080	-0.050	0.008	**0.754**	0.062	**0.946**
2 (Dup)	0-15	0.015	0.082	0.078	**0.236**	-0.049	0.002	0.051	0.082	4.56	-0.069	1.11	-0.008	**1.02**	**0.101**	**0.965**

1. Results are in pCi/g.
2. **Bold** values represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results inconsistent with background.

Table A-12.2. Building T-FS-04 PROI Results

Loc. No.	Depth (cm)	Ac-227	Co-60	Eu-154	H-3	Pa-231	Ra-226	Ra-228	Sb-125	Sn-126	Th-229	Th-232
1	0-15	-0.006	-0.003	0.045	8.95	-1.43	**0.979**	**0.937**	-0.005	0.001	-0.105	**0.937**
2	0-15	-0.088	-0.002	-0.035	4.85	1.65	**1.22**	**1.32**	0.024	0.000	-0.217	**1.32**
2 (Dup)	0-15	0.022	-0.011	-0.047	3.74	-0.496	**0.846**	**1.13**	0.013	0.000	0.100	**1.13**

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. Underlined values represent analytical results that are inconsistent with background.
4. Sn-126 result rejected due to interference from other nearby photo-peaks.

Table A-12.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	NaI (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	12,581	10,987	891147.98	1129907.44	NA
2	14.761	12,152	891159.58	1129916.90	NA

NA – Not Available. Water inundated excavation before civil survey could be performed.

ANNEX A-12.1

Soil Sample Results

Building T-FS-04 Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/ 244 Result	Cm-243/ 244 Error	Cm-243/ 244 MDA
1	0.095	0.109	0.135	0.445	0.849	1.44	0.060	0.087	0.105
2	0.099	0.107	0.121	0.212	0.883	1.51	0.038	0.075	0.103
2 (Dup)	0.015	0.152	0.318	0.082	0.802	1.38	0.078	0.180	0.285

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
1	0.287	0.081	0.068	0.002	0.056	0.115	0.006	0.010	0.014
2	0.682	0.106	0.078	0.038	0.043	0.080	-0.004	0.009	0.020
2 (Dup)	0.236	0.050	0.040	-0.049	0.058	0.081	0.002	0.016	0.030

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/ 240 Result	Pu-239/ 240 Error	Pu-239/ 240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
1	0.046	0.074	0.102	0.038	0.075	0.121	3.77	5.08	8.48
2	0.048	0.070	0.084	-0.013	0.038	0.107	3.10	6.16	10.5
2 (Dup)	0.051	0.070	0.095	0.082	0.082	0.095	4.56	5.50	9.13

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
1	-0.105	0.149	0.336	1.47	0.960	1.56	0.031	0.082	0.147
2	-0.080	0.184	0.382	-0.050	1.05	1.81	0.008	0.050	0.102
2 (Dup)	-0.069	0.240	0.481	1.11	0.774	1.26	-0.008	0.071	0.164

Location	U-233/234 Result	U-233/ 234 Error	U-233/ 234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
1	0.769	0.244	0.096	0.039	0.052	0.039	0.878	0.266	0.085
2	0.754	0.263	0.108	0.062	0.074	0.079	0.946	0.303	0.079
2 (Dup)	1.02	0.308	0.119	0.101	0.087	0.094	0.965	0.295	0.100

1. Units are pCi/g.
2. Error is total propagated uncertainty.

Building T-FS-04 Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA
1	-0.006	0.263	0.457	-0.003	0.035	0.064
2	-0.088	0.299	0.506	-0.002	0.037	0.067
2 (Dup)	0.022	0.171	0.320	-0.011	0.024	0.040

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
1	0.045	0.120	0.226	8.95	10.4	17.2	-1.43	1.43	2.28
2	-0.035	0.149	0.220	4.85	9.05	15.5	1.65	1.77	2.86
2 (Dup)	-0.047	0.080	0.131	3.74	10.4	18.1	-0.496	1.09	1.79

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
1	0.979	0.168	0.121	0.937	0.323	0.257	-0.005	0.089	0.162
2	1.22	0.183	0.139	1.32	0.337	0.254	0.024	0.106	0.191
2 (Dup)	0.846	0.128	0.090	1.13	0.248	0.152	0.013	0.060	0.109

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
1	0.001	0.103	0.160	-0.105	0.271	0.732	0.937	0.323	0.257
2	0.000	0.101	0.121	-0.217	0.319	0.940	1.32	0.337	0.254
2 (Dup)	0.000	0.104	0.089	0.100	0.383	0.709	1.13	0.248	0.152

1. Units are pCi/g.
2. Error is total propagated uncertainty.
3. Sn-126 result rejected due to interference from other nearby photo-peaks.

ATTACHMENT 13

Biovent System Shack

1.0 SITE DESCRIPTION

The Biovent System Shack was located in the northern portion of Waste Management Area (WMA) 6, west of the Old Warehouse and Counting Lab (discussed in Attachment 8) as shown in Figure A-13.1.

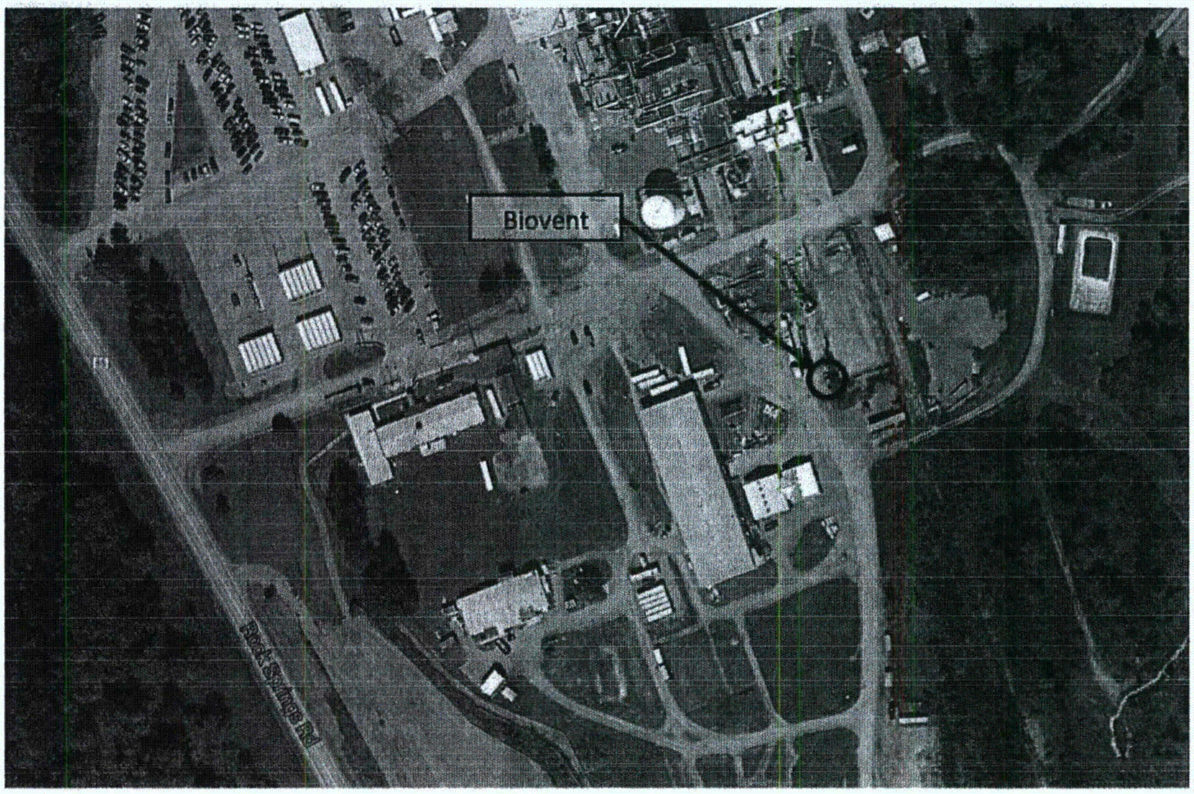

Figure A-13.1. Biovent System Shack

WMA 6 surface soils were likely affected by the 1968 airborne releases of radioactivity from the Process Building stack in WMA 1. These impacts would have originally been greatest proximal to the Process Building and decreased as one moved south in WMA 6. Since 1968, however, there has been significant surface soil reworking in the northern portion of WMA 6. These activities could have removed contaminated soil layers, buried those layers under clean backfill, and/or redistributed/mixed contamination in surface soils. The soils surrounding the Biovent System Shack foundation area could have surface radioactive contamination possibly greater than the cleanup goal (CG). Gamma radiation exposure rates ranged up to 25 μR/hr as measured in a survey performed in 1991 (DOE 2013a). This is approximately three times typical natural background exposure rates. The exposure rates measured in 1991 were likely caused by radiation shine from the main process building, based on radiation measurements made during the April 2014 survey.

The approximately 40 m^2 survey area just prior to the survey was as shown in Figure A-13.2. The area had been excavated to a depth of approximately 3 ft.

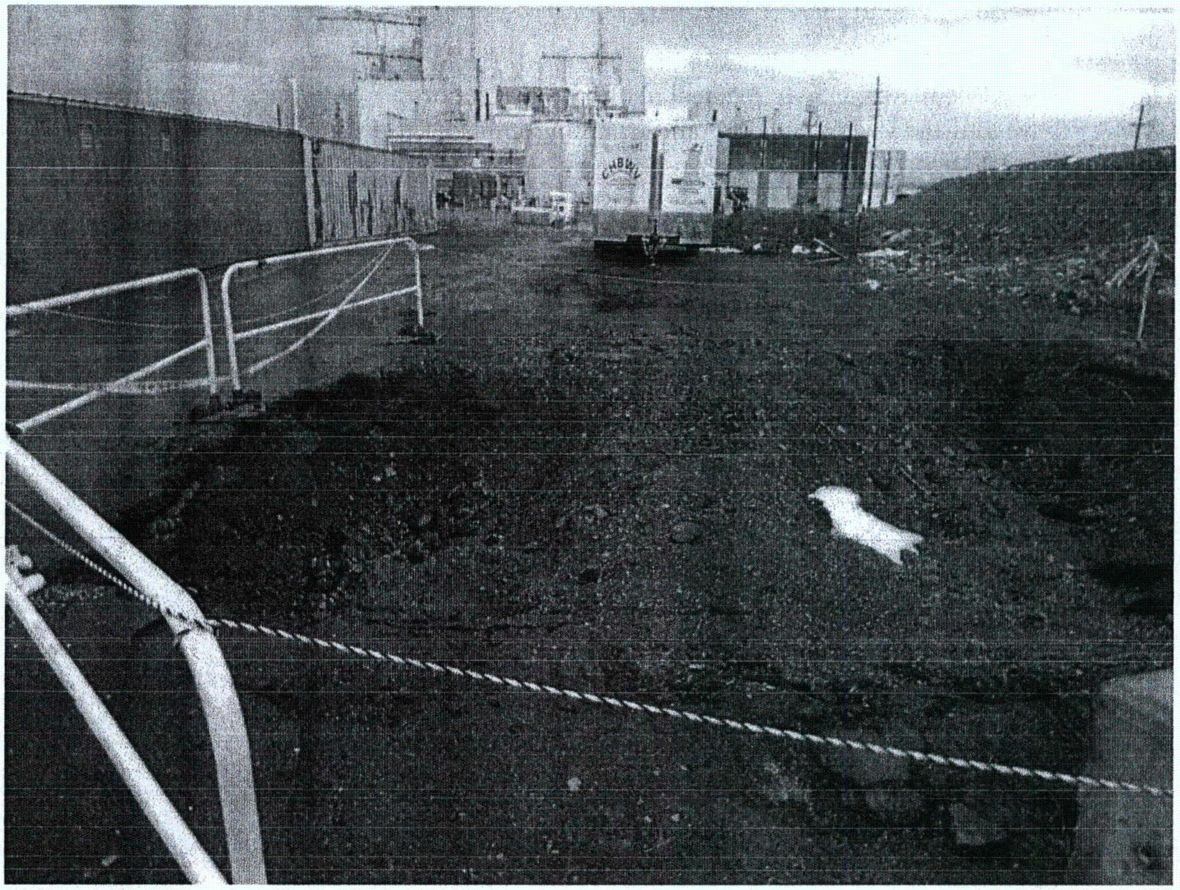

Figure A-13.2. Biovent System Shack Excavation When Surveyed

2.0 SURVEY RESULTS

Soil data and gamma radiation data were collected. Gamma walkover data are discussed in Section 2.1. Soil data are discussed in Section 2.2. Gamma data taken 15 centimeters (cm) above each soil sampling location before sample collection is presented in Section 2.3.

2.1 Gamma Walkover Survey Results

SEC performed a gamma walkover survey (GWS) of 100 percent of the surface at the survey area with a field instrument for detection of low-energy radiation (FIDLER) detector. Figure A-13.3 shows the gamma radiation results for the FIDLER. Soil sampling locations are also shown on the figure.

Elevated gamma radiation signal was detected during the GWS along the top of the excavation on the east wall at sampling location B1. Careful evaluation using an NaI detector found a lens of contamination just under the asphalt paving running along the southern two thirds along the east excavation wall. The lens of contamination was less than 15-cm thick. The Biovent System Shack excavation is due south of a similar area of elevated radiation signal found west of the Old Warehouse slab and reported in Attachment 5. In both cases the radiation signal was directly under the same asphalt paving.

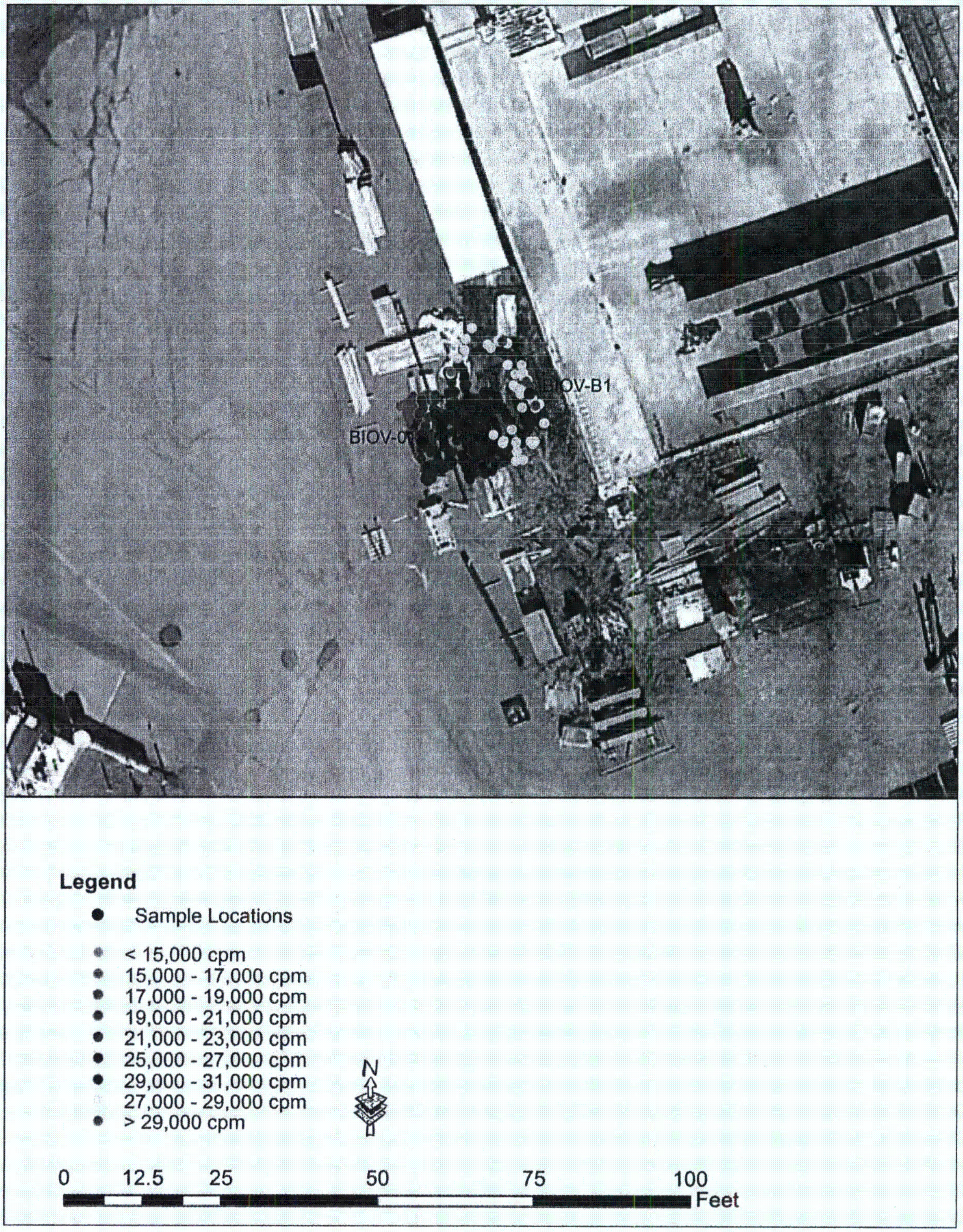

Figure A-13.3. Results of FIDLER GWS

2.2 Soil Sample Results

One 15-cm deep systematic soil location was sampled in the approximately 40 m^2 area. The sample was taken from 0 – 15 cm below ground surface. This exceeds the Field Sampling Plan (FSP) specification to collect one sample per approximately 200 m^2. The sample location is shown in Figure A-13.3.

Two samples were taken into the sidewall of the excavation at location B1. The samples were collected directly under the asphalt to identify the radionuclides present. The first sample represents material from 0-5 cm into the side wall. This was done because in situ gamma signal indicated that the majority of the contamination resided within this sample. The second sample was taken from 5 – 15 cm into the sidewall to complete the full 15-cm sampling interval. No sample could be obtained deeper into the sidewall because rocks obstructed further sampling. Analytical results showed that Cs-137 was the primary contributor to the elevated radiation signal. This was also the case with the sample collected at the Old Warehouse slab excavation and reported in Attachment 5.

Soil sample results were compared to the analytical minimum detectable activity (MDA) and to background. Comparisons to background were made to the data from Background Reference Area 1 because the soil was a sand and gravel. The 95 percent upper tolerance limit (UTL) was calculated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results. The raw sample results were used to perform this calculation regardless of whether sample results were considered detections or not. Data that were rejected during data validation were not used. The naturally occurring radionuclides evaluated in this manner were tritium, carbon-14, uranium-234, uranium-235, uranium-238, actinium-227, protactinium-231, radium-226, radium-228, and thorium-232. Cesium-137 was the only anthropogenic radionuclide present in fallout with enough data above the MDA for a meaningful comparison to the 95 percent UTL. Sample results for these radionuclides were considered inconsistent with background if the activity concentration of one or more radionuclides exceeded its respective 95 percent UTL. All other radionuclides of interest (ROIs) and potential radionuclides of interest (PROIs) were considered inconsistent with background when a soil sample result was greater than three times its reported uncertainty (DOE 2011a).

The results are summarized in Tables A-13.1 and A-13.2 for the ROI and PROI, respectively. The tables show the analytical result along with notations whether the result exceeds the MDA and was considered inconsistent with background. Bold values reflect whether the result exceeds the MDA. Underlined values reflect whether the sample was determined inconsistent with background. Shaded results were rejected during data validation. Reasons are shown in the table footnotes. A complete tabulation of soil samples data is provided in Annex A-13.1.

2.3 Gamma Measurements at Sampling Locations

A 60-second gamma measurement was made with both a FIDLER and NaI detector at each location before soil samples were collected. These results are shown in Table A-13.3.

Table A-13.1. Biovent System Shack ROI Evaluation

Loc. No.	Depth (cm)	Am-241	C-14	Cm-243/ Cm-244	Cs-137	I-129	Np-237	Pu-238	Pu-239/ Pu-240	Pu-241	Sr-90	Tc-99	U 232	U-233/ U-234	U-235	U-238
1	0-15	0.120	0.173	0.050	<u>**1.09**</u>	0.028	0.004	0.033	0.012	6.00	0.003	0.472	0.029	**0.839**	<u>0.080</u>	**0.730**
B1 (0-5 cm)	0-15	0.300	-0.039	-0.047	<u>**40.9**</u>	0.039	-0.006	0.049	0.091	1.52	0.001	0.423	0.012	**0.801**	<u>0.064</u>	**0.915**
B1 (5-15 cm)	0-15	0.051	0.287	-0.048	<u>**6.55**</u>	0.052	0.002	0.001	0.062	5.73	0.170	0.554	-0.013	**0.750**	0.000	**0.884**

1. Results are in pCi/g.
2. **Bold** values represent analytical results greater than the respective MDA.
3. <u>Underlined</u> values represent analytical results inconsistent with background.

Table A-13.2. Biovent System Shack PROI Results

Loc. No.	Depth (cm)	Ac-227	Co-60	Eu-154	H-3	Pa-231	Ra-226	Ra-228	Sb-125	Sn-126	Th-229	Th-232
1	0-15	0.103	0.016	-0.000	<u>4.62</u>	-0.397	**0.970**	<u>**1.20**</u>	0.098	0.099	0.592	<u>**1.20**</u>
B1 (0-5 cm)	0-15	0.127	<u>**0.298**</u>	0.01	1.62	0.509	**0.956**	<u>**1.02**</u>	-0.037	0.000	0.100	<u>**1.02**</u>
B1 (5-15 cm)	0-15	-0.061	0.024	0.018	<u>12.1</u>	-1.10	**0.989**	<u>**1.16**</u>	0.107	0.000	0.038	<u>**1.16**</u>

1. Results are pCi/g.
2. **Bold** results represent analytical results greater than the respective MDA.
3. <u>Underlined</u> values represent analytical results that are inconsistent with background.
4. Sn-126 result rejected due to interference from other nearby photo-peaks.

Table A-13.3. Gamma Measurements at Each Sample Location

Location	FIDLER (cpm)	NaI (cpm)	Northing (ft)	Easting (ft)	Elevation (ft)
1	15,995	11,630	892394.28	1129249.93	1,404.10
B1 (at 5 cm)	30,964	24,571	892401.91	1129267.06	1,407.55
B1 (at 15 cm)	26,429	Not recorded	892401.91	1129267.06	1,407.55

ANNEX A-13.1

Soil Sample Results

Biovent System Shack Sample ROIs

Location	Am-241 Result	Am-241 Error	Am-241 MDA	C-14 Result	C-14 Error	C-14 MDA	Cm-243/244 Result	Cm-243/244 Error	Cm-243/244 MDA
1	0.120	0.124	0.121	0.173	0.825	1.42	0.050	0.086	0.075
B1 (0-5 cm)	0.300	0.345	0.428	-0.039	0.796	1.38	-0.047	0.213	0.536
B1 (5-15 cm)	0.051	0.191	0.322	0.287	0.844	1.44	-0.048	0.144	0.405

Location	Cs-137 Result	Cs-137 Error	Cs-137 MDA	I-129 Result	I-129 Error	I-129 MDA	Np-237 Result	Np-237 Error	Np-237 MDA
1	1.09	0.141	0.076	0.028	0.041	0.129	0.004	0.015	0.026
B1 (0-5 cm)	40.9	3.43	0.058	0.039	0.054	0.118	-0.006	0.011	0.025
B1 (5-15 cm)	6.55	0.582	0.079	0.052	0.052	0.094	0.002	0.013	0.025

Location	Pu-238 Result	Pu-238 Error	Pu-238 MDA	Pu-239/240 Result	Pu-239/240 Error	Pu-239/240 MDA	Pu-241 Result	Pu-241 Error	Pu-241 MDA
1	0.033	0.058	0.088	0.012	0.052	0.101	6.00	5.50	8.91
B1 (0-5 cm)	0.049	0.068	0.092	0.091	0.086	0.099	1.52	4.96	8.54
B1 (5-15 cm)	0.001	0.055	0.123	0.062	0.093	0.145	5.73	7.05	11.7

Location	Sr-90 Result	Sr-90 Error	Sr-90 MDA	Tc-99 Result	Tc-99 Error	Tc-99 MDA	U-232 Result	U-232 Error	U-232 MDA
1	0.003	0.174	0.346	0.472	0.809	1.37	0.029	0.057	0.078
B1 (0-5 cm)	0.001	0.269	0.494	0.423	0.609	1.03	0.012	0.054	0.105
B1 (5-15 cm)	0.170	0.248	0.424	0.554	0.877	1.48	-0.013	0.039	0.108

Location	U-233/234 Result	U-233/234 Error	U-233/234 MDA	U-235 Result	U-235 Error	U-235 MDA	U-238 Result	U-238 Error	U-238 MDA
1	0.839	0.285	0.102	0.080	0.083	0.080	0.730	0.260	0.080
B1 (0-5 cm)	0.801	0.279	0.112	0.064	0.077	0.082	0.915	0.302	0.082
B1 (5-15 cm)	0.750	0.255	0.074	0.000	0.031	0.046	0.884	0.284	0.085

1. Units are pCi/g.
2. Error is total propagated uncertainty.

Biovent System Shack Sample PROIs

Location	Ac-227 Result	Ac-227 Error	Ac-227 MDA	Co-60 Result	Co-60 Error	Co-60 MDA
1	0.103	0.287	0.533	0.016	0.053	0.102
B1 (0-5 cm)	0.127	0.290	0.514	0.298	0.049	0.035
B1 (5-15 cm)	-0.061	0.300	0.540	0.024	0.060	0.101

Location	Eu-154 Result	Eu-154 Error	Eu-154 MDA	H-3 Result	H-3 Error	H-3 MDA	Pa-231 Result	Pa-231 Error	Pa-231 MDA
1	-0.000	0.142	0.267	4.62	10.7	18.5	-0.397	1.86	3.21
B1 (0-5 cm)	0.01	0.060	0.109	1.62	8.61	15.2	0.509	1.65	2.98
B1 (5-15 cm)	0.018	0.119	0.230	12.1	9.49	14.8	-1.10	1.88	3.29

Location	Ra-226 Result	Ra-226 Error	Ra-226 MDA	Ra-228 Result	Ra-228 Error	Ra-228 MDA	Sb-125 Result	Sb-125 Error	Sb-125 MDA
1	0.970	0.194	0.164	1.20	0.420	0.368	0.098	0.138	0.245
B1 (0-5 cm)	0.956	0.158	0.108	1.02	0.220	0.131	-0.037	0.146	0.250
B1 (5-15 cm)	0.989	0.212	0.142	1.16	0.352	0.254	0.107	0.158	0.273

Location	Sn-126 Result	Sn-126 Error	Sn-126 MDA	Th-229 Result	Th-229 Error	Th-229 MDA	Th-232 Result	Th-232 Error	Th-232 MDA
1	0.099	0.089	0.099	0.592	0.719	1.10	1.20	0.420	0.368
B1 (0-5 cm)	0.000	0.083	0.094	0.100	0.529	1.04	1.02	0.220	0.131
B1 (5-15 cm)	0.000	0.119	0.139	0.038	0.368	0.751	1.16	0.352	0.254

1. Units are pCi/g.
2. Error is total propagated uncertainty.
3. Sn-126 result rejected due to interference from other nearby photo-peaks.

ENCLOSURE 4

FIELD SAMPLING PLAN

for

TASK ORDER 5
WEST VALLEY DEMONSTRATION PROJECT
ENVIRONMENTAL CHARACTERIZATION SERVICES
WEST VALLEY, NEW YORK

SEC-FSP
Rev. 2

June 2014

Prepared for:
U.S. Department of Energy
West Valley Demonstration Project (WVDP)
Environmental Characterization Services (ECS)
West Valley, New York

Prepared by:
Safety and Ecology Corporation (SEC)
2800 Solway Road
Knoxville, TN 37931

UNCONTROLLED DOCUMENT

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Field Sampling Plan (FSP)
U.S. Department of Energy,
West Valley Demonstration Project
Environmental Characterization Services
West Valley, New York

Contract No.: DE-EM0001242

FSP APPROVALS

By their specific signature, the undersigned certify that they prepared, reviewed, or provided comments on this Field Sampling Plan for the DOE West Valley Demonstration Project, Environmental Characterization Services, and West Valley, New York.

PREPARED BY:

Project Manager Steven Green	June 19, 2014 Date
Independent Technical Reviewer Jason Hubler	June 19, 2014 Date

APPROVED BY:

Corporate Quality Assurance Manager Darrell Srdoc	June 19, 2014 Date
Program Manager Andrew Lombardo, CHP	June 19, 2014 Date
Project Manager Steven Green, CHP, PMP	June 19, 2014 Date
	TBD BY PM/RM Effective Date

UNCONTROLLED DOCUMENT

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

ALARA	As Low As Reasonably Achievable
ASME	American Society Of Mechanical Engineers
BOSF	Balance of Site Facilities
CFR	Code of Federal Regulations
CG	Cleanup Goal
CHBWV	CH2M-Hill B&W West Valley, LLC
CLP	Contract Laboratory Procedure
COC	Chain of Custody
cpm	counts per minute
CRQL	Contract Required Quantification Level
CSAP	Characterization Sampling and Analysis Plan
DCGL	Derived Concentration Guideline Level
DMS	Data Management System
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DP	Decommissioning Plan
DQO	Data Quality Objective
ECS	Environmental Characterization Services
EDBA	Environmental Database Administrator
EDD	Electronic Data Deliverable
EDP	EQuIS Data Processor
ELIMS	Environmental Laboratory Information Management System
EPA	U.S. Environmental Protection Agency
ES&H	Environmental Safety and Health
FIDLER	Field Instrument for Detection of Low-Energy Radiation
FPD	Federal Project Director
FSP	Field Sampling Plan
FSS	Final Status Survey
FSSP	Final Status Survey Plan
ft	foot
GC	Gas Chromatography
GPS	Global Positioning System
GM	Geiger-Muller
GWS	Gamma Walkover Survey
HLW	High-level Waste
ID/IQ	Indefinite Delivery/Indefinite Quantity
IDW	Investigation Derived Waste
ISMS	Integrated Safety Management System
LCS	Laboratory Control Sample
LIDAR	Light Detection and Ranging
LLRW	Low-level Radioactive Waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	Minimum Detectable Activity
MDC	Minimum Detectable Concentration
MDL	Minimum Detection Level
MS	Matrix Spike

MSD	Matrix Spike Duplicate
NAD 83	North American Datum 1983
NaI	Sodium Iodide
NFS	Nuclear Fuel Services, Inc.
NIST	National Institute of Standards and Technology
NQA	National Quality Assurance
NYSDEC	New York State Department of Environmental Conservation
NYSERDA	New York State Energy Research and Development Authority
NYSDOH	New York State Department of Health
PM	Project Manager
PPE	Personal Protective Equipment
PQL	Project Quantification Level
PROI	Potential Radionuclide of Interest
QA	Quality Assurance
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
RADCON	Radiation Control
RE	Relative Error
ROI	Radionuclide of Interest
RPD	Relative Percent Difference
RPP	Radiation Protection Program
RSD	Relative Standard Deviation
SDG	Sample Delivery Group
SEC	Safety and Ecology Corporation
SOP	Standard Operating Procedures
TCLP	Toxicity Characteristic Leaching Procedure
THOREX	Thorium Extraction
TIC	Tentatively Identified Compound
TRU	Transuranic
UTL	Upper Tolerance Level
WNYNSC	Western New York Nuclear Service Center
WRS	Wilcoxon Rank Sum
WVDP	West Valley Demonstration Project

EXECUTIVE SUMMARY

This plan provides the technical basis associated with the protocols for the collection of survey and sample data associated with Remedial Action Surveys in support of the Balance of Site Facilities (BOSF) remediation. This field sampling plan (FSP) provides guidance to collect the appropriate quality and quantity of data to support BOSF remediation which is a part of the West Valley Demonstration Project (WVDP) Phase 1 Decommissioning Plan (DOE 2009).

This FSP uses a combination of gamma walkover surveys (GWSs), biased, and systematic samples to address the contamination status of surface and subsurface soils at BOSF facilities following their removal. This FSP is structured to implement the Phase 1 Characterization Sampling and Analysis Plan for the WVDP [Characterization Sampling and Analysis Plan (CSAP)] (DOE 2011a) and support the Phase 1 Final Status Survey Plan (FSSP) for the WVDP (DOE 2011b). If Remedial Action Survey data collected using this FSP indicates that a specific area at WVDP meets the Cleanup Goals (CGs) specified in the FSSP, a Final Status Survey (FSS) may be performed, if requested by the U.S. Department of Energy (DOE).The data will be collected in a manner that minimizes sampling and maximizes results. This will be done by recognizing that an ultimate goal at WVDP is to meet FSSP requirements for release of the site. This end goal was used to structure the data collection specified in this FSP. Data collected under this FSP will be used to document the condition of soils following removal of BOSF and to build an expanding data set that directly supports the FSSP thereby minimizing additional sample collection.

1.0 INTRODUCTION

1.1 Site Description

The West Valley Demonstration Project (WVDP) (established to implement the WVDP Act) is located on approximately 152 acres within the 3,338-acre Western New York Nuclear Service Center (WNYNSC), owned by the New York State Energy Research and Development Authority (NYSERDA) in rural Cattaraugus County, about 35 miles south of Buffalo, New York. The WVDP site is complex, involving a large number of potential radionuclides of concern and a variety of historical processes and events that are known to have or may have released contaminants into the environment. Known affected environmental media include surface soils, subsurface soils, groundwater, surface water, and sediments. The decommissioning of the WVDP site will involve a sequential set of activities that will vary significantly depending on the exact location and activity purpose.

The WVDP is a unique operation within the U.S. Department of Energy (DOE). The West Valley Demonstration Project Act of 1980 directed the Secretary of Energy to undertake five major activities, as follows:

- Solidify the liquid high-level waste (HLW) stored at WNYNSC into a form suitable for transportation and disposal (completed);
- Develop containers for the solidified HLW suitable for permanent disposal of the HLW (completed);
- Transport the waste to a federal repository for disposal (pending);
- Dispose of low-level radioactive waste (LLRW) and transuranic (TRU) waste produced by the Project (in progress); and
- Decontaminate and decommission the HLW storage tanks (PUREX and THOREX HLW tanks deactivated, July 2003), the HLW solidification facilities (in progress), and any material and hardware used in connection with the Project (in progress).

1.2 Project Description

DOE has awarded Safety and Ecology Corporation (SEC) an Indefinite Delivery/Indefinite Quantity (ID/IQ) prime contract for Environmental Characterization Services (ECS). The work scope includes, but is not limited to, soil, sediment, and groundwater characterization and environmental monitoring and associated regulatory documentation supporting decommissioning activities at WVDP. The purpose of this ECS contract is to implement the Characterization Sampling and Analysis Plan (CSAP) and Final Status Survey Plan (FSSP).

This Field Sampling Plan (FSP) has been prepared to support work during remediation of the Balance of Site Facilities (BOSF) which are a part of the *Phase 1 Decommissioning Plan for the West Valley Demonstration Project* (Phase 1 DP). Refer to that document for a discussion of project history and contaminants.

There are approximately 50 BOSFs. They range in size from 12 square meters (m^2) to 2,400 m^2. The WVDP Site Contractor, CH2M-Hill B&W West Valley, LLC (CHBWV) will be removing the BOSF. These BOSF include buildings, electrical substations, site infrastructure, and gravel and concrete pads. The CSAP has provisions for performing Remedial Action Surveys to evaluate the contamination status of removed infrastructure footprints as part of the BOSF removal process. The SEC sampling team will perform the Remedial Action Surveys of the excavation footprints in series once BOSF are removed. After the completion of the CSAP sampling, SEC may also be required to perform Phase 1 Final Status Surveys (FSSs) in accordance with the FSSP.

SEC will maintain direct, concise, and daily contact/coordination with the DOE Project Manager (PM) and site operating contractor, CHBWV concerning field operations and scheduling field activities. Notations in logbooks and/or in the Work Package Status Log, a requirement of SEC-ISMS-002, *Project Integrated Work Control Plan,* will document this coordination and communication. All fieldwork described in this FSP will follow the Work Control Requirements in SEC-ISMS-002.

1.3 Objective

The objective of this FSP is to perform Remedial Action Surveys to evaluate the contamination status of surface soils exposed within infrastructure footprints associated with removal of BOSF at WVDP. The remedial action surveys will be performed in accordance with the CSAP. The required surveys include GWSs and biased and systematic surface and subsurface soil sampling. The biased and systematic soil samples will be analyzed for the 18 radionuclides of interest (ROIs) and 11 potential radionuclides of interest (PROIs) as described in the CSAP. Cd-113m is listed in the CSAP as a PROI; however, there is no commercially available method of analyzing for this radionuclide. Results for Cd-113m cannot be provided.

Where possible, surrogate radionuclides such as Cs-137 and Sr-90, will be used to limit the analyte list. This will be done if and when it can clearly be shown that if the surrogate radionuclides do not exceed their cleanup goal (CG), then it is highly unlikely that other ROIs or PROIs exceed their CG. Selection of surrogate radionuclides will only be considered after work according to this FSP progresses and a sufficient body of knowledge is obtained to justify their use.

An ultimate goal at WVDP is to meet FSSP requirements for release of the site. This end goal was used to structure the data collection specified in this FSP. Data collected under this FSP will be used to document the condition of soils following removal of BOSF and to build and grow a data set that directly supports the FSSP thereby minimizing additional sample collection. The GWS, which collects data for surface soils, is sensitive enough to detect the cleanup goal (CG) – Elevated Measurement Concentration (CG_{emc}) established in the FSSP for 1 square meter (m^2) areas for all gamma-emitting radionuclides. The GWS is sensitive enough to detect the CG_{emc} for 100 m^2 areas for most gamma-emitting radionuclides. Those that cannot be detected at the CG_{emc} for 100 m^2 areas, such as I-129, are likely to be comingled with those that can be detected such that they will likely be detected by biased sampling. If radionuclides that cannot be detected by the GWS are not collocated with radionuclides that can be detected by the GWS, this will have to be accounted for during the FSS for the site.

The CG_{emc} refers to radionuclide-specific activity concentrations that must be met over areas smaller than individual survey units as defined in the FSSP. The CG_w refers to radionuclide-specific activity concentrations that must be met, on average, for each individual survey unit. The objective of the GWS is to determine if localized areas exceed the CG_{emc} (either for 1 m^2 or

100 m^2) and to provide an indicator of whether the area exceeds the CG_w by comparing detector response to background. Even though the GWS data is not necessarily sensitive enough to detect the CG_w for all gamma-emitting ROI or PROI, the technique, when compared to the local gamma background, will provide an indicator of whether the CG_w is met.

The objective of biased soil sampling is to validate the GWS indication that the CG_{emc} was exceeded and to establish location(s) for subsurface soil sampling. A subsurface sample obtained at a location with a higher surface radionuclide concentration provides an indicator of the depth of contamination in the localized area from which it was obtained.

The objective of systematic soil sampling is to assess the average concentration of ROI and PROI in the area for comparison to the CG_w. Systematic samples are also needed to determine the concentration of ROI and PROI that do not emit gamma radiation and thus cannot be measured by the GWS. Systematic samples evaluated in conjunction with the GWS also provide an indication of the areal extent of contamination.

1.4 Scope

This section identifies the overall scope and the specific objectives of Task Order No. 5 and the field measurement and sampling activities that will be used to satisfy this scope. The guidance contained herein serves to ensure that the data collected during this effort will be of sufficient quantity and quality to accurately determine the presence or absence of contamination in excess of CGs, to help define the depth and lateral extent of contaminated areas, and to help define the lateral extent of areas requiring no further remediation.

There are a number of Phase 1 activities that will result in the removal of concrete pads, hardstands, etc., outside the footprint of planned deep excavations at the site. In each of these cases, the characterization of soils underlying this infrastructure, referred to as Remedial Action Surveys, will be performed according to this FSP. The performance of Remedial Action Surveys, as defined and discussed in the CSAP, comprises the primary scope of this FSP.

- In some cases, this infrastructure will exist in areas where there is known contamination at depths greater than 1 meter. At these locations, the area will not be a candidate for Phase 1 FSS data collection, even if there is not a reason to believe surface soils exposed by infrastructure removal are contaminated above surface soil CG levels. In these cases, the purpose of Remedial Action Survey data collection after infrastructure removal is to document the contamination status of the exposed soils for Phase 2 planning purposes.

- In other cases, the exposed soils themselves may clearly pose surface soil CG concerns. At these locations, DOE may choose to remove contaminated soils as part of Phase 1 activities until surface soil CG standards have been achieved. In these cases, the purpose of Remedial Action Surveys is to support the removal of contaminated soils and to indicate when surface soil CG standards have likely been achieved.

- Finally, there may be cases where there is no evidence of subsurface contamination at depths greater than 1 meter, and the exposed soils resulting from infrastructure removal likely meet surface soil CG requirements. At these locations, the purpose of the Remedial Action Survey data collection is to document the contamination status of the exposed soils in preparation for

Phase 1 FSS data collection, should DOE choose to perform Phase 1 FSS activities. A goal of this FSP in these cases is to already have collected sufficient data in the area to support the FSS Report.

In all three of the cases described above, the following minimum remedial action survey data collection will take place. A logged GWS will be performed consistent with the FSS protocols (as defined in the Phase 1 FSSP). If there are indications of surface soil CG exceedances based on scan results, biased samples will be collected from those locations and submitted for analysis. If DOE chooses to remove soils exceeding surface soil CG standards, soil removal will take place and logged GWS combined with biased soil sampling will be repeated for the affected areas. If DOE chooses not to remove soils or scan/biased sampling data indicate contamination levels likely meet surface soil CG requirements, one sample per 200 m^2 area will be collected to a depth of 15 cm and submitted for analysis.

In some instances, there may be concerns about subsurface contamination beneath infrastructure that could not be fully addressed until the infrastructure was removed. In these cases, the minimum Remedial Action Survey data collection described above may be supplemented with vertical soil cores from an appropriate depth, with down-hole bore scans every 15 cm and selective biased sampling of specific vertical subsurface soil layers based on scan results. In the case of biased sampling, the samples will be submitted for analysis.

SEC will mobilize the appropriate equipment and qualified personnel to perform the required data collection activities associated with the task. This FSP discusses the GWS methods, civil surveying, field instrumentation, soil sampling methods, sample chain of custody documentation, quality assurance (QA)/quality control (QC) procedures, laboratory analytical methods, and statistical data evaluation methods.

1.5 Radionuclides of Interest and Cleanup Goals

The Phase 1 DP identified 18 ROIs for the project premises, and Derived Concentration Guideline Level (DCGL) values for each of the ROIs were developed to meet the unrestricted release criteria of 25 millirem per year (mrem/yr) in 10 Code of Federal Regulations (CFR) 20.1402. The DCGL requirements included a $DCGL_w$ value to be applied as an area-averaged goal to FSS units and $DCGL_{emc}$ values applicable to areas of 100 square meters (m^2) and 1 m^2. The Phase 1 DP also provides area factors that can be used to calculate additional $DCGL_{emc}$ requirements for areas smaller than FSS units. In addition, the Phase 1 DP distinguishes between DCGL values for surface soils (defined as soils to a depth of 1 m), subsurface soils (defined as soils at a depth greater than 1 meter that would be temporarily exposed by proposed Phase 1 excavation activities), and streambed sediments.

These DCGL values were further refined to reflect cumulative dose concerns, resulting in a final set of DCGL values listed in Table 5-14 of the Phase 1 DP. Table 5-14 of the Phase 1 DP refers to these as cleanup goals (CGs). The CGs are more conservative than the DCGL requirements since they account for the possibility of cumulative dose. To be consistent with the Phase 1 DP terminology, from this point forward, the term "cleanup goals" or CGs will be used to refer to the requirements that must be met. Specifically, the term CG_w refers to radionuclide-specific activity concentrations that must be met, on average, for each individual survey unit, and the term CG_{emc} refers to radionuclide-specific activity concentrations that must be met over areas smaller than individual survey units. Table 5-14 of the Phase 1 DP is reproduced as Table 1-1 in this FSP.

Table 1-1. Phase 1 Cleanup Goals [picocuries per gram (pCi/g)]
(Source: WVDP Phase 1 Final Status Survey Plan Revision 1, Table 1)

	Surface Soil		Subsurface Soil		Streambed Sediment	
Nuclide	CG_w (1)	CG_{emc} (2)	CG_w	CG_{emc}	CG_w	CG_{emc}
Am-241	2.6E+01	3.9E+03	2.8E+03	1.2E+04	1.0E+03	2.1E+04
C-14	1.5E+01	1.6E+06	4.5E+02	8.0E+04	1.8E+02	5.9E+05
Cm-243	3.1E+01	7.5E+02	5.0E+02	4.0E+03	3.1E+02	2.8E+03
Cm-244	5.8E+01	1.2E+04	9.9E+03	4.5E+04	3.8E+03	3.6E+05
Cs-137 (3)	1.4E+01	3.0E+02	1.4E+02	1.7E+03	1.0E+02	9.4E+02
I-129	2.9E-01	6.0E+02	3.4E+00	3.4E+02	7.90E+01	2.0E+04
Np-237	2.3E-01	7.5E+01	4.5E-01	4.3E+01	3.2E+01	1.1E+03
Pu-238	3.6E+01	7.6E+03	5.9E+03	2.84E+04	1.2E+03	1.7E+05
Pu-239	2.3E+01	6.9E+03	1.4E+03	2.6E+04	1.2E+03	1.7E+05
Pu-240	2.4E+01	6.9E+03	1.5E+03	2.6E+04	1.2E+03	1.7E+05
Pu-241	1.0E+03	1.3E+05	1.1E+05	6.8E+05	3.4E+04	7.5E+05
Sr-90 (3)	3.7E+00	7.9E+03	1.3E+02	7.3E+03	4.7E+02	7.1E+04
Tc-99	1.9E+01	2.6E+04	2.7E+02	1.5E+04	6.6E+04	4.2E+06
U-232	1.4E+00	5.9E+01	3.3E+01	4.2E+02	2.2E+01	2.1E+02
U-233	7.5E+00	8.0E+03	8.6E+01	9.4E+03	2.2E+03	4.4E+04
U-234	7.6E+00	1.6E+04	9.0E+01	9.4E+03	2.2E+03	2.1E+05
U-235	3.1E+00	6.1E+02	9.5E+01	3.3E+03	2.3E+02	2.0E+03
U-238	8.9E+00	2.9E+03	9.5E+01	9.9E+03	8.2E+02	8.2E+03

Notes:

(1) CG_w refers to activity concentrations that must be achieved, on average, over areas the size of FSS units.

(2) CG_{emc} refers to activity concentrations that must be achieved, on average, over 1-m^2 areas.

(3) CG requirements provided for this table for Cs-137 and Sr-90 assume one half-life of decay will occur before the possible release of the site in 2041. As part of the FSS process, these values will be decay-corrected reflecting the date of the data collection to ensure that the desired dose standard is achieved.

In addition to the 18 ROIs contained in the Phase 1 DP, another 12 radionuclides have been identified as potentially being of interest; these 12 PROIs are listed in Table 1-2. The identification process relied on historical process knowledge. To date only Ra-226 has been observed in samples at levels that would be of dose concern. None of the other PROIs have been yet detected at significant levels in environmental media (DOE 2011a). Several of the PROIs have short half-lives relative to the history of WVDP/Nuclear Fuel Services, Inc. (NFS) activities; others would have had very low abundance within the spent fuel that would have been processed at the site, compared to Cs-137 and Sr-90. FSP data collection will provide supporting data to determine whether any of the PROIs should be of interest.

Table 1-2. Twelve Radionuclides of Potential Interest
(Source: WVDP Phase 1 Characterization Sampling and Analysis Plan, Revision 1, Table 3)

Radionuclide	Naturally Occurring		Typical Soil Background Activity Concentrations (pCi/g)	Required Laboratory Sensitivity (pCi/g)
	Yes / No	Half Life (years)		
Ac-227	Yes	21.8	~ 0.05	0.5
Co-60	No	5.3	Not applicable	0.5
Cd-113m	No	14.1	Not applicable	Not applicable
Eu-154	No	8.6	Not applicable	1
H-3	Yes	12.3	Negligible quantities	25
Pa-231	Yes	32,760	~ 0.05	3
Ra-226	Yes	1,602	~ 1	0.5
Ra-228	Yes	5.8	~ 1	0.5
Sb-125	No	2.8	Not applicable	1
Sn-126	No	12.4	Not applicable	1
Th-229	No	7,340	Not applicable	1
Th-232	Yes	1.4E10	~ 1	0.5

2.0 ENVIRONMENT, SAFETY, HEALTH, QUALITY, AND RADIATION PROTECTION

Work for this FSP will be performed according to the SEC Environment, Safety, Health, Quality and Radiation Protection Programs (RPPs) along with supporting procedures and subordinate plans. These documents have been prepared by SEC and approved by DOE. These approved documents are implementing mechanisms of the SEC *Integrated Safety Management System*, SEC-ISMS, and include the following:

- Worker Safety and Health Program (SEC-WSHP)
- Radiation Protection Program (SEC-RPP)
- Quality Assurance Program (SEC-QAP)
- Environmental Protection Program (SEC-EPP)
- Waste Management Plan (SEC-WMP)
- Emergency Preparedness Plan (SEC-EmPP)
- Conduct of Operations Program (SEC-COP)
- Contractor Assurance Program (SEC-CAP)
- Corporate Operating Experience Program (SEC-COEP)
- Integrated Security Plan (SEC-ISP)

3.0 ROLES AND RESPONSIBILITIES

This section identifies the roles and responsibilities of project personnel.

3.1 Key Project Personnel

Project personnel key to performing this FSP are the PM, Environmental Safety and Health (ES&H) Manager, Radiological Engineer, and Subcontractor Field Lead for performing Geoprobe® sampling. These individuals, at a minimum, will be at the site when soil sampling fieldwork is performed at depths greater than 15 cm below any surficial hardstand material (crushed gravel, asphalt, etc.). When only GWS data is collected, only the PM or Radiological Engineer and the ES&H Manager must be at the site. Individuals may serve dual roles for short duration sampling events (i.e., less than two weeks) when qualified. For example, the PM may serve as the ES&H Manager or as the Radiological Engineer.

3.1.1 SEC Project Manager

The PM performs the following functions, may assist others with their duties, and has the following responsibilities:

- Serves as the primary point of contact with DOE;
- Ensures coordination of management, safety and health, radiation control (RADCON), and QA functions;
- Manages subcontractors operating the Geoprobe® and performing data verification/ validation;
- Allocates resources to the project to ensure successful execution and completion of milestones;
- Demonstrates commitment and implementation of Integrated Safety Management System (ISMS) and Quality Assurance Plan (QAP);
- Coordinates with the Radiological Engineer to ensure work is performed with appropriate level of quality and in accordance with specifications and requirements;
- Maintains signature authority to commit SEC; and
- Ensures all work and project activities are executed in accordance with established regulatory requirements and SEC programs, plans, and procedures.

3.1.2 Radiological Engineer

The radiological engineer performs the following functions, and may assist others with their duties:

- Manages the collection of field data;
- Maintains field logbooks;
- Ensures execution of quality requirements;
- Produces tables and figures of GWS and Sample Data;
- Provides daily updates to the SEC PM;
- Completes sample chain of custody and ships samples for laboratory analysis;
- Prepares and packages soil samples; and

- Acts for the Radiological Protection Manager when not at the site to implement the SEC RPP, maintain exposure records, and keep radiation exposures as low as reasonably achievable (ALARA).

3.1.3 SEC Environmental Safety and Health (ES&H) Manager

The ES&H Manager:

- Recognizes, evaluates, recommends, and implements policies and procedures to assure awareness of and compliance with ES&H requirements of the organization;
- Monitors and prevents adverse exposure to chemical, biological, and physical hazards throughout the work sites;
- Directs audits of the ES&H programs to identify and correct program deficiencies, and will keep fully informed on all existing and proposed changes in occupational health and safety regulations;
- Provides basic ES&H training to employees and promotes communication programs to enhance and encourage employee awareness of accident prevention, industrial hygiene, and environmental compliance; and
- Ensures all work and project activities are executed in accordance with established regulatory requirements and SEC programs, plans, and procedures.

3.1.4 Subcontractor Field Lead

The Subcontractor Field Lead:

- Directs the operation of the Geoprobe®,
- Obtains the soil cores, and
- Decontaminates the sampling probe in between sampling locations.

4.0 FIELD ACTIVITIES

A number of field activities will be conducted as part of this effort. The principle activities include:

- GWSs,
- Biased Sampling,
- Systematic Sampling, and
- Civil Surveying.

4.1 Gamma Walkover Surveys (GWSs)

GWS data will be collected with at least one detector capable of detecting low-energy gamma-emitting radionuclides such as ^{241}Am [e.g., Field Instrument for Detection of Low-Energy Radiation (FIDLER)]. GWSs will be conducted to provide complete coverage of exposed soil surfaces in the footprint of the excavated BOSF, with a data density of, on average, at least one measurement per square meter. All GWS data will be electronically logged and include coördinates in New York West State Plane, North American Datum 1983 (NAD 83). Coordinate quality on the x, y plane will include sub-meter accuracy. Areas that are inaccessible due to terrain or standing water will be clearly demarcated on a map.

There may be situations where it is beneficial to perform GWS measurements in areas surrounding the removed BOSF. This could provide an indication that the surrounding area was uncontaminated by gamma-emitting radionuclides and could also define the lateral extent of contamination that might be present. If measurements are made outside the BOSF excavated footprint, approval will first be obtained from DOE. Concurrence may be signified by notation in the field logbook.

GWSs will be performed with a global position system (GPS) capable of recording a survey measurement and a paired position approximately every second. The GPS will be capable of sub-meter accuracy (x, y data). The GWS will focus on ROIs that have photon (gamma ray and x-ray) emissions. Of the 18 ROIs, 14 have photon emissions that will allow them to be detected in the field. Table 4-1 provides a summary of the minimum detectable activities (MDAs) documented in the FSSP associated with the field detection of the 14 ROIs that have photon emissions. It should be noted that assumption is made that radionuclides will be commingled. The GWS will be used to determine areas that are not consistent with background conditions.

GWSs will be performed in accordance with the GWS procedure attached in Appendix A. GWS data will be submitted in the appropriate electronic data deliverable (EDD) format as described in Appendix F. In general, GWSs will be performed by a technician traversing areas on foot at a rate approximately 0.5 meters per second carrying a backpack mounted GPS and the detectors. In some instances, either where terrain allows or where shielded detectors are required, a cart mounted FIDLER/ GPS setup may be deployed. The cart will be pushed by the technician or pulled by a vehicle at the same scan rate. The data will have a minimum density of 1 data point per square meter.

Table 4-1. Estimated Scanning Minimum Detectable Activities (MDCs)
(Source: WVDP Phase 1 Final Status Survey Plan Revision 1, Table 5)

Radionuclide	Type of Detector	Scan MDC (pCi/g)
Am-241	FIDLER	30
C-14	NA(1)	
Cm-243	2" x 2" NaI	50
Cm-244	FIDLER	300
Cs-137	2" x 2" NaI	7(2)
I-129	FIDLER	60
Np-237	FIDLER	30
Pu-238	FIDLER	100(3)
Pu-239	FIDLER	200(3)
Pu-240	FIDLER	100
Pu-241	NA(1)	
Sr-90	NA(1)	
Tc-99	NA(1)	
U-232	FIDLER	60
U-233	FIDLER	500
U-234	FIDLER	60
U-235	FIDLER	30
U-238	FIDLER	60

Notes:

(1) NA means not applicable: either there are no photons associated with the radionuclide, or the photon yield is too low for detection by field scanning instruments.

(2) A specific calculation of the scanning minimum detectable count rate for Cs-137 in soil performed in connection with the preparation of the Phase 1 Decommissioning Plan yielded a value equivalent to 7 pCi/g of Cs-137. A comparable value of 6.4 pCi/g is given in Table 6.7 of the MARSSIM when units are given in pCi/g.

(3) While scan MDCs of 10 and 20 pCi/g are reported for Pu-238 and Pu-239, respectively, in Appendix H of MARSSIM, much larger values are reported elsewhere. The values given here are those expected to be reasonably achievable under field conditions.

The GPS data will produce data with final coordinates in New York State Plan West, NAD83. Data will be presented graphically and in electronic table form. The data at a minimum will contain counts per minute (cpm), northing and easting (x, y), and dilution of precision (PDOP), date, and time.

If multiple detectors are deployed in a survey, a 100 m^2 area will be surveyed by all instruments with the data logged by coordinate location and stored electronically. Multiple detectors may be deployed as a means of surveying site areas more quickly or resolving elevated gamma radiation signal from nearby buildings, waste containers, or waste storage areas, referred to as "shine." When multiple detectors are used to address localized elevated background, at least one detector will be completely unshielded and one or more detectors will be collimated with lead in an attempt to resolve the signal from the ground surface and elevated localized background signal.

GWSs will use a FIDLER. GWSs may also use other types of sensitive gamma detecting instruments such as 2-inch-by-2-inch sodium iodide (NaI) detectors, as these may prove useful for evaluating contamination status. For example a shielded 2-inch-by-2-inch NaI may prove useful for resolving shine. To evaluate FIDLER detector performance and to determine whether a 2×2 or 3×3 NaI detector is necessary, data collection activities specified in Section 6.11.1 of the CSAP will be performed. This will include a reference area with a portion (100 m^2) used for detector evaluation (see Sections 5.0 and 6.2 for more details). Each gross gamma activity detector will be evaluated by surveying and logging the data for this area. Key parameters will include average response of the detector and the variability in data results observed. Data density will be at least one reading per square meter; data will be collected in a manner that results in relatively uniform coverage for the area. In addition, static counts will be made with each detector type prior to collecting soil samples and the data will be used to evaluate the minimum detectable concentration (MDC) of each detector type as discussed in Section 4.2.

4.2 Sample Collection

Samples will be collected using hand trowels, hand augers, Geoprobes®, or a power auger for samples deeper than 15 cm. Hand augers shall be used in cases where there are concerns over buried utilities or infrastructure. More details regarding use of the Geoprobes® are presented in Section 4.2.1.

A sufficient volume of soil will be collected to allow all 18 ROIs and the PROIs to be analyzed. Sufficient volume is approximately 900 g (see Table 6-1 where the sum of the minimum volumes equals 825 g) because of the extensive list of ROI and PROI. This will be satisfied by collecting samples from 10-cm (4-inch) diameter holes 15 cm deep, and for deeper samples (either 85 cm or 100 cm), a 5-cm (2-inch) diameter hole will suffice.

Samples of 15 cm depth from ground surface or below hardstand will be collected with a hand auger. The hand auger was chosen for the shallow samples instead of a Geoprobe® to minimize the size (and cost) of the drill rig needed to obtain 10-cm diameter samples. Hand auguring the first 15 cm is also a safety measure to prevent contact with underground utilities that may not have been identified as being present in the area. The auger will bore a hole a minimum of 10 cm in diameter to assure sufficient soil is collected. When hardstand or asphalt makes it difficult to use the hand auger, the drilling subcontractor will first break through the hardstand or asphalt and then the hand auger will be used.

The hand or power auger sample cuttings will be brought up onto plastic sheeting and placed in stainless steel mixing bowls to be homogenized and packaged as samples. Geoprobe® samples will be collected in acetate liners. The liners will be opened and the sample will be extracted into the mixing bowl for homogenization and sampling. Samples will be collected, handled, and packaged according the procedure shown in Appendix C.

Surface and subsurface samples will be scanned for gamma radiation before they are homogenized. A shielded detector may be used to minimize ambient background radiation. This will help determine if there are discrete horizons of radioactive contamination in the soil cores.

Field notes for biased and systematic samples will include a 30-second static FIDLER count and/or 30-second NaI detector counts at a distance of 15 cm above the ground surface prior to acquiring the sample. A physical description of the material sampled, date, and time shall be included. Additionally, the location (coordinates) of the sample will be recorded in NY State Plane West NAD83 with a quality of ± a hundredth of a foot (± 0.01 ft) for each sample.

Static readings will be recorded in a fashion that allows them to be paired with the analytical results associated with the sampled location. These paired results will be preserved and reviewed according to the specifications in Section 6.11.1 of the CSAP as work progresses. Data meeting the CSAP specifications (i.e., near or above CG_w requirements for Cs-137) in an area likely affected primarily by Cs-137 impacts, an absence of any shine concerns, no surface cover, relative constant gross activity readings over a small area (2 to 3 m^2), and an area that will unlikely be immediately affected by Phase 1 remediation activities), will be used to allow monitoring of FIDLER performance and determination of field MDC values for the FIDLER and/or NaI detectors by performing regression analyses.

4.2.1 Geoprobe Sampling

Because of the depth of the average sample terminating at 1 meter, a direct push Geoprobe® or equivalent system will be utilized for samples collected from 15 cm below ground surface or hardstand to 1 meter and for samples collected from ground surface or directly below hardstand to 1 meter below ground surface. This is discussed further in the subsections below.

The Geoprobe® subcontractor's procedure is shown as Appendix B. A direct push system uses a hydraulic or pneumatic pressure to push a sample tube to a required depth. Specific intervals are then sampled as the sample tooling is advanced to depth.

The Macro-Core Sampler is driven one sampling interval into the subsurface and retrieved using the direct push machine. The sample length will be 4 feet. The collected soil core is removed from the sampler along with the acetate inner liner. The liners are cut to the required sample interval; the sample is extracted, homogenized, and packaged.

The direct push core diameter will be a minimum of 5 cm as stated above. Samples will be collected, handled, and packaged in accordance with the procedure shown in Appendix C.

Open tube samplers will be used for stable soils. In the open tube configuration, coring starts at the ground surface with a sampler that is open at the leading end. The sampler is driven into the subsurface and then pulled from the ground to retrieve the sample.

In unstable soils which tend to collapse into the core hole, the sampler will be equipped with a center rod closed-point assembly. The point fits firmly into the cutting shoe and is held in place by the center rod. This prevents collapsed soil from entering the sampler as it is advanced to the bottom of an existing hole, thus ensuring collection of a representative sample. When a closed point sampler is needed, the soil sampler is secured with a vinyl end cap. Loose soils are prevented from falling from the bottom of the sampler as it is retrieved from depth. A core catcher on the bottom of the sample tube prevents loss of unconsolidated material.

Soil samples are removed by unthreading the cutting shoe and pulling out the liner. A few sharp taps on the cutting shoe with a pipe wrench will often loosen the threads to allow hand removal. If needed, the interior of the cutting shoe has wrench flats for attaching a wrench and loosening tight threads. When the cutting shoe is removed, the liner may be removed. Undisturbed samples are collected by cutting the liner.

4.2.2 Biased Soil Sampling

The purpose of biased samples is to determine whether the CG_{emc} is exceeded. Biased samples will be collected to target specific locations where there is concern about exceeding the CG_{emc} within the footprint where BOSF was removed (DOE 2011a).

Biased samples will be collected in excavated areas from the excavated ground surface to a depth of 1 meter. Biased sampling will be performed as necessary based on locations exhibiting elevated GWS results. "Elevated GWS results" is somewhat subjective as it depends on ambient background, type of surface cover, elevation (whether in a ditch or on a rise), and shine from buildings and waste containers. Locations having a gamma signal greater than three standard deviations above local background will be considered for biased sampling. In areas where it is less obvious that there is an elevated gamma signal coming from the soil surface, a normal probability plot will be used to look for gamma signal that is not normally distributed. Background signal tends to be normally distributed. The normal probability plot is a tool used to identify where a second data population (in addition to background) exists. Such a second population would represent gamma signal from contamination plus local background signal.

In general, the one location within a BOSF footprint with the highest gamma signal above local area background will be sampled. The number of samples collected will be a function of the heterogeneity or homogeneity of the GWS results. The results will be compared to the CG_{emc} for 100 m^2 areas. These samples will be useful to determine the depth of excavation, to support future Phase 2 planning, and the ultimate FSS for the WVDP. The number and location of biased soil samples will be coordinated with the appropriate DOE personnel prior to collection. Concurrence may be signified by notation in the field logbook.

Biased locations will also be chosen in a manner that will most effectively help to determine the maximum depth of contamination in the BOSF footprint. Samples will be collected in a manner that is representative of a 1 meter depth for each location for open excavations. If sample locations are chosen outside of a BOSF footprint, two samples from each location will be collected; one will represent the 0 to 15 cm soil interval and one will represent the 15 to 100 cm deep soil interval, in accordance with the CSAP. Sampling outside a BOSF footprint will only be conducted when such sampling is useful to identify the radionuclides causing the elevated GWS signal and only with concurrence of the DOE PM or designated representative. Concurrence may be signified by notation in the field logbook.

A gamma radiation profile will be taken by scanning the entire interval of the sample core with a FIDLER or NaI detector in an attempt to determine if there is a lens of buried contamination. A shielded NaI detector will be used for these scans in order to lower the ambient background signal and aid in detection of possible above background radioactivity. Down-hole gamma logging may also be performed if data suggests that there is indeed a lens of buried contamination.

When sufficient data have been collected during the project, and if that data allows selection of surrogate radionuclides, surrogates such as Cs-137 and/or Sr-90 may be used to limit the list radionuclides requiring analysis. An example of when surrogates may be used would be a case where it could be shown that when the surrogate was less than the CG all other ROI or PROI were also less than the CG. Provided that a percentage of samples (e.g., 10%) were always analyzed for all ROI and PROI and the premise for use of the surrogate continued to hold true, the use of the surrogate would be appropriate. Selection of surrogates will follow guidance in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Chapter 4 (EPA 2000). It may also be possible to analyze for total strontium instead of Sr-90 because Sr-89 has a sufficiently short half-life such that it may no longer be present in measurable quantities. Laboratory results for total strontium are obtained approximately one week sooner than results for Sr-90, and this time savings may prove beneficial. The final report will discuss the approach that was applied and the rationale if these techniques are used.

4.2.3 Systematic Soil Sampling

Systematic samples will be collected in accordance with the CSAP under three conditions:

1) When GWS results and biased sampling data indicate contamination levels likely meet surface soil CG requirements and to confirm that CG_{emc} exceedances are not an issue for the areas each systematic sample represents.[3] This data will support the FSS and will be collected in a manner that meets FSSP requirements.

2) When GWS data and/or biased soil samples indicate contamination exceeds the CG and DOE decides not to excavate the contaminated soil. This data will be collected to help guide Phase 2 planning.

3) When soil in a BOSF footprint was excavated at the discretion of DOE to remove contamination. This data will support the FSS and will be collected in a manner that meets FSSP requirements.

When systematic sampling is performed, one sample per 200 m^2 area will be collected to a depth of 15 cm and submitted for analysis in accordance with the CSAP. If a BOSF footprint is less than 200 m^2, one sample will still be collected. Systematic locations will be placed on a random start triangular grid.

Systematic soil samples will be used to evaluate compliance with the CG requirements as listed in Table 1-1 or to document the as left conditions when contaminated soil was not removed. Systematic samples will help define the lateral extent of contamination and will be used to support FSSs in locations that are believed to be free of contamination above the CG_w. Systematic samples are also necessary to document contamination levels of radionuclides that cannot be detected by the GWS. A sufficient volume will be collected for all 18 ROIs and the PROIs to be analyzed, if required. Data evaluation will always take into account the potential opportunity to use surrogate radionuclides to lessen the need to analyze for all ROIs and PROIs.

It may be beneficial to take systematic samples in locations nearby to the BOSF excavated footprint. This could be the case either to determine if a ROI or PROI that could not be detected by GWS is present or to potentially indicate that a wider area satisfies the CG. If this appears beneficial, concurrence will be obtained from the DOE PM or designated representative before proceeding. Such concurrence will be documented in the field logbook. For areas that are external to excavation (undisturbed ground surface), two samples will be taken. The first will be from the ground surface to 15 cm. The second will be the interval of 15 cm to 100 cm. The samples will be of sufficient volume to allow for the analysis of the 18 ROIs and the PROIs.

4.3 Civil Surveying Requirements

A civil surveyor licensed in New York State will be used to collect topographic survey information. A variety of instrumentation may be utilized to collect the positional data including total stations (robotic and manual), kinematic and real-time kinematic GPS, and Light Detection and Ranging (LIDAR). The appropriate technology will be selected based on the logistical parameters associated with the survey. The surveys will be used to identify excavation boundaries, structures, utilities, and sample locations, both systematic and biased samples. Measurements shall record northing, easting, and elevation, and shall be accurate to ± a hundredth of a foot (± 0.01 ft.).

4.4 Decontamination

Sampling equipment used during surface/subsurface soil sampling will be free from contamination and decontaminated prior to use. Field decontamination should be done near the work area. Special precaution should be taken to contain solids and liquids that are created during the decontamination process. Equipment potentially requiring decontamination may include stainless steel scoops, spoons, bowls, core barrels, etc. Other equipment used during sampling activities that does not directly contact sample materials shall be cleaned to remove potential soil contamination.

The Geoprobe® sampler will be free of dirt, mud, oil, or other contaminants before being permitted on-site. An incoming radiological survey will be performed according to procedures supporting the SEC RPP. If the machine has contamination exceeding the limits in SEC-RP-10, *Contamination Control and Monitoring*, it will be turned away from WVDP.

The Geoprobe® split spoon samplers will be decontaminated after each sample location and before proceeding to the next location. Decontamination will also be performed on all sampling tools after each sample is collected. Since sampling is for radionuclides and not chemicals, the effectiveness of decontamination can be determined by field radiological analysis with swipes. It will be acceptable to wipe off sampling equipment with dry or damp cloths or masslin and to verify that there is no contamination detected using field radiological analyses. If contamination is detected or if dirt or debris remains after wipe-down, then soap, water, and brushes may be used. Rinsing with clear water will follow the use of soap. This approach will avoid large quantities of water and cleaning supplies and will save time and effort. In cases where the sample data will be used to support the FSSP, steam cleaning will be required for all tools in between sampling locations.

4.5 Investigation Derived Waste (IDW)

The field activities in this plan will generate IDW. These materials generally contain soils, water, and used personal protective equipment (PPE). When accumulated, these materials must be managed appropriately to minimize the exposure and risks to human health and the environment while adhering to applicable regulatory requirements. IDW will be managed and disposed of consistent with SEC-WMP, *Waste Management Plan*. The IDW includes all materials generated during project performance that cannot be effectively reused, recycled, or decontaminated in the field. It consists of materials that could potentially pose a risk to human health and the environment (e.g., sampling and decontamination wastes) and also materials that have little potential to pose risk to human health and the environment (e.g., sanitary solid wastes). Two types of IDW will be generated during the implementation of field activities: indigenous and non-indigenous. Indigenous IDW expected to be generated during FSP activities will primarily be soils or soil-like material. Non-indigenous IDW expected to be generated includes decontamination fluid/water and miscellaneous trash, including PPE. When accumulated, the media will be managed appropriately to minimize exposure and risks to human health and the environment while adhering to applicable regulatory requirements.

In some instances, it may be appropriate to return IDW to its original location; an example of this would be returning trenched soils to their trench after characterization work at a particular location is complete. In other cases, returning IDW to its original location is not an option. IDW minimization is a goal.

IDW generated during this FSP will be limited to used PPE and a small volume of decontamination water. This PPE will be characterized for disposal using the results of the soil samples to identify the radioactive contaminants. Shoe covers worn will have the highest potential to be contaminated. Therefore, one in 10 shoe covers will be checked for total and removable surface contamination according to procedures supporting the SEC RPP. The results of these surface contamination measurements, along with the radioactive contaminants identified in the soil samples, will be used to characterize the PPE.

Sampling and drilling tools will be decontaminated. Decontamination will be performed with a steam cleaner in some cases and with a cleaning agent, water, and brushes in others. The steam will not generate any IDW. The quantity of water used will be limited to that squirted onto wipes or dipped onto brushes from a bucket or drum. This water will be allowed to evaporate as possible. If evaporation is not completely successful, the water will be drummed and sampled by dipping a sample from the drum. The sample will be analyzed for radioactivity and the drum contents will be managed and disposed of in accordance with the SEC-WMP.

5.0 REFERENCE AREAS

Two surface soil reference areas have been established. Two locations were required because of differences in the surface geology between the north and south plateau within the site premises (DOE 2011b). Reference Area 1 has a sand and gravel near surface geology. Reference Area 2 has a Lavery till near surface geology. The reference areas were used to establish the background of the detectors used for the GWS and to establish soil sample background for ROIs and PROIs that are present in background when the clean-up goals are near background; notably Ra-226 and uranium isotopes.

The reference areas are approximately 2,000 m^2 and encompass surface soil types and conditions similar to those expected within WVDP premises. The reference areas had no historical evidence of contamination from NFS or WVDP activities and there was no reason to believe such impacts exist.

The perimeter of Reference Area 1 has been clearly demarcated and the interior brush has been removed to allow easy access for gross activity QC surveying as discussed further in Sections 5.1 and 6.2. The area has been protected from intrusion or disturbance for the duration of Phase 1 activities.

5.1 Gross Activity Survey Reference Data Collection

One purpose of Reference Area 1 is to assist in the development of gross activity survey data sets that can be used for background purposes and to evaluate background performance of various detectors that may be deployed on the WVDP premises in support of gamma surveys. A 100 m^2 area within the reference area has been selected and further protected through the use of a removable cover in a manner that maintains relatively stable soil moisture conditions for this area. The purpose of this cover is to allow reproducible results from gross gamma scans and ensure comparability between gross activity scans of this area conducted by different detectors at different times.

5.2 Background Soil Sample Reference Data Collection

Both reference areas were sampled at the initiation of CSAP pre-remedial action activities. The purpose of this sampling and analysis was to (1) to establish a background data set that can be used for Wilcoxon Rank Sum (WRS) statistical tests as part of the FSS process, if that proves necessary; (2) to establish background activity concentrations and their distribution for radionuclides that are naturally occurring to support decision-making during CSAP data collection; and (3) to establish background performance for the analytical methods that will be used to support Phase 1 decommissioning data collection activities.

Sampling and analysis was performed as follows:

1. The reference areas were divided into ten 200-m^2 areas. Two sets of 10 soil samples were collected, with two samples from each of the 10 locations. One set of samples was representative of soils from the surface to a depth of 15 cm. The second set was representative of soils from 15 cm to a depth of 1 m. Sufficient soil mass was collected to allow analysis of all 18 ROIs and the PROIs. Each sample was field homogenized,

containerized, and labeled in a manner that clearly identified the area from which it was taken and the depth profile it represented.

2. The resulting 20 samples (10 samples representing a 15 cm surface soil depth and 10 samples representing the 15 cm – 1 m surface soil depth) were submitted for analysis of all 18 ROIs and the PROIs.

Four soil cores were obtained from within Reference Area 2 to a depth of 1 m into the Lavery Till. The locations of the soil cores were representative of four quadrants within the reference area. Down-hole gamma scans were conducted by taking a 30-second static reading at 15-cm intervals down-hole. Data were recorded to clearly identify the detector type and identifier, the location of the core, the depth of the reading, and gross counts in counts per minute. Soil cores were also scanned ex situ with a suitable detector.

5.3 Radionuclide-Specific Background Activity Concentrations

In many instances, the CSAP pre-remediation decision-making process requires a determination of whether soil sample results are consistent with background conditions or not. The Phase 1 DP provides an analysis of background activity concentrations for ROIs in Section 4.2.2 and Appendix B based on historical data for surface soils and sediments, and based on a combination of historical data and more recent sampling results for subsurface soils. As part of the analysis, average and maximum results were presented.

For CSAP pre-remediation decision-making, background comparisons will be based on results from the reference area surface soil sampling. Background comparisons are based on results from the reference area surface soil sampling analyses. The 95 percent upper tolerance limit (UTL) was estimated for each radionuclide that could be expected to be present in measurable quantities in background soils (i.e., naturally occurring radionuclides and those anthropogenic radionuclides present in background surface soils due to historical fallout) based on the 0 – 15 cm deep sample results and the 15 – 100 cm deep sample results for the Background Reference Areas 1 and 2. The UTL was calculated as follows: $95\%\ \mathrm{UTL} = \mathrm{mean} + t_{\alpha/2} \times \frac{\sigma}{\sqrt{n}}$. The UTL values are published in the Terrestrial Background Study (DOE 2013).

The raw sample results were used to perform the UTL calculations regardless of whether sample results were considered detections or not. The naturally occurring radionuclides evaluated in this manner were C-14, tritium, U-234, U-235, U-238, Ac-227, Pa-231, Ra-226, and Ra-228. Note that the Th-232 results were inferred from the gamma spectroscopy results for Ra-228 and, therefore, the results for these two radionuclides are the same. Review of the overall data set including the background sampling results revealed that Cs-137 was the only anthropogenic radionuclide found in fallout with enough results in excess of the MDA to compute a meaningful 95 percent UTL; and this was only possible for the samples collected from 0 – 15 cm. Sample results for these radionuclides are considered inconsistent with background if the activity concentration of one or more radionuclides exceeds its respective 95 percent UTL. All other ROIs and PROIs are considered inconsistent with background when a soil sample result is greater than three times its reported uncertainty (DOE 2011a).

For samples that fail either the 95 percent UTL or the three-times-uncertainty rule (whichever is applicable), re-analyses may take place to verify that the observed result is not a product of analytical error alone.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

SEC will implement QA/QC measures throughout the project to ensure that all decisions are made on the basis of data of acceptable quality. Pursuant to the contractual requirements, a Program QAP, SEC-QAP, has been prepared and submitted under separate cover which discusses specific requirements for quality assessments, non-conformance, the use of procedures, reporting, document control, and records management. The QAP is an "umbrella" document under which all project work is conducted and assessed. The QAP provides the framework for identifying and achieving compliance to American Society of Mechanical Engineers (ASME) National Quality Assurance (NQA) 1-2008 with the NQA-1a-2009 addenda (or a later edition), *Quality Assurance Program Requirements for Nuclear Facilities Applications*. SEC also implements Parts I and Sections 2.7 and 2.21 of Part II of the NQA-1 standard in a graded approach, as applicable to the activity. The QAP is implemented through SEC QA standard operating procedures (SOPs). The QAP and SOPs are designed to achieve compliance with DOE Order 414.1D, *Quality Assurance,* and 10 CFR Part 830.122, *Quality Assurance Criteria.*

Compliance to requirements identified in the Program QAP is mandatory by all SEC employees and subcontractors and will ensure SEC provides a service of known quality during the performance of this contract. The SEC PM and the Radiological Engineer shall be responsible for ensuring the execution of the quality requirements during the duration of Task Order 5. All workers are responsible for meeting and following quality requirements.

SEC will maintain direct, concise, and daily contact/coordination with the DOE PM or designee concerning field operations and scheduling field activities. The primary point of contact for all communications regarding the project will be the SEC PM.

This section of the FSP outlines the QA/QC requirements specific to the field portion of Task Order 5, including equipment and instrumentation, sample collection methodology and laboratory analysis and data management. QA/QC requirements specific to elements of the fieldwork are discussed in detail below and include:

- Instrument Calibration, Testing and Maintenance Quality Requirements
- Gamma Walkover Survey QA/QC requirements
- Field Documentation
  - Field Logbooks
  - Photographs
- Sample QA/QC
  - Sample Collection
  - Sample Numbering
  - Sample Labeling
  - Sample Packaging
  - Additional Requirements for Radiological Samples
  - Chain of Custody Records
  - Sample Shipping
  - Laboratory Receipt of Sample Forms
  - Sample Documentation Process
  - Corrections to Documentation

- Laboratory and Data Quality Assurance/Quality Control
  - Laboratory Analysis
  - Reporting
- Data Verification and Validation
  - Data Verification
  - Data Validation
- Data Quality Objectives/Indicators
  - Precision
  - Accuracy
  - Representativeness
  - Completeness
  - Comparability

6.1 Radiological Instrument Calibration, Testing and Maintenance Quality Requirements

Calibration: Radiological instruments will be calibrated before first use by the manufacturer or a qualified calibration service in accordance with procedures supporting the SEC RPP. Note that calibration is not required for FIDLER and NaI detectors as they read in count rates relative to the gamma signal at the field location. Daily source checks for all instruments (including FIDLER and NaI detectors) will be performed and documented on project QC forms in accordance with the applicable RPP procedure. Additional operational checks will be conducted if an instrument is suspected of malfunction during data collection, is suspected as damaged, or critical data acquisition procedures require more frequent checks. Any piece of equipment that does not perform according to procedural requirements will be tagged out and not used until it is repaired or appropriately replaced.

QC limits for radiological instrument calibration will be determined during the initial setup and tuning of each detector system in accordance with RPP procedures. New QC limits will be established after subsequent calibrations and significant repairs which may have affected detector performance. A lower control limit and an upper control limit will be determined for each FIDLER and NaI detector system at a two or three sigma tolerance level. Control charts to monitor performance of each detector system will be maintained. Calibration checks will ensure that the instruments are functioning within acceptable QC tolerances. All instrument checks will be documented and the PM or designee will review them. Field QC Documentation will be retained on site in project files and will be maintained as project records.

Each operational check will consist of a background and source check set at a fixed and consistent geometry. The source check involves exposing the detection system to a known radioactive sealed source (for example, 10 microcuries of Cs-137) of specific activity for a predetermined duration (typically one minute). These sealed sources will be exempt quantities. If the QC checks fail, the operational check procedure will be repeated. After three failures, the instrument will be taken out of service until the cause of the failure is determined and corrected. Upon resolution, the instrument must pass the operational checks and QC limits before being returned to service.

Calibration Frequency: All detection systems will be calibrated in accordance with the manufacturer's specifications, or annually. The detector systems will be calibrated if it fails a performance check or after repairs potentially affecting its response. Calibration will be performed by either the manufacturer, qualified vendor, or the project team following the manufacturer's calibration specification and procedures in accordance with American National Standard, Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments, N323A-1997 (IEEE 1997) and American National Standard for Calibration of Germanium Detectors for In-Situ Gamma-Ray Measurements, N42.28-2002 (IEEE 2004), if applicable. Calibration sources will be traceable to the National Institute of Standards and Technology (NIST).

Testing, Inspection, and Maintenance Requirements: All instruments and equipment used will be serviced and maintained only by qualified personnel in accordance with the manufacturer's guidelines and recommendations. Routine equipment maintenance and calibration will be as specified by RPP procedures. Instruments will be operated by the project team according to RPP procedures.

Each radiological instrument will receive a unique identification code to allow easy tracking of equipment and to associate data with the appropriate instrument. This tracking system allows data reviewers to identify instruments that may have malfunctioned, track trends in data which may indicate slow degradation of the detection system, and other adverse conditions affecting data quality.

6.2 Gamma Walkover Survey Quality Assurance/Quality Control Requirements

The following minimum QA/QC requirements will be adhered to when implementing the gross GWSs:

- Daily Inspection: Each detector used on WVDP premises will undergo a documented check source evaluation each day it is used. The purpose of daily check source evaluation is to identify any deviations in the expected detector response. The evaluations will be documented on a control chart that has been developed and maintained specifically for this purpose. The variability, as measured by the standard deviation, will be used to construct two and three standard deviation error bars for the control charts. Daily readings that are more than two standard deviations away from the mean response will require a second measurement. If the second measurement also is more than two standard deviations away from the mean response or the initial measurement was more than three standard deviations from the mean response, the detector will be evaluated for evidence of potential problems and corrective actions taken as necessary before routine use of the detector is resumed. The inspection records will be maintained onsite as project records.

- Background Reference Area: Background Reference Area 1 is established and used for detector data quality evaluation purposes (see Section 5.0), as follows:

    1. A 100 m^2 portion of Reference Area 1 is covered in a manner that maintains relatively stable soil moisture conditions (the cover will be removed prior to each survey). If there are multiple detectors per detector type, each different detector will be used to survey the 100 m^2 area.
    2. Another 100 m^2 area will be marked next to the area covered with the tarp. This area will be surveyed with each detector type. These same detectors will also be used to survey

under the area that is covered with the tarp. The purpose will be to determine if there is a statistical difference in the detector response amongst the two areas. A student t-test will be used to determine if there is a difference at the 95% confidence level.

3. Data from the covered area will be used to compare responses across detectors. The purpose of these comparisons is to allow the development of scaling factors, as necessary, to be used to standardize gamma walkover data from different detectors. Key parameters of interest are the average activity concentration observed, the standard deviation (as a measure of background variability), and the 95 percent and 99 percent UTL for the background concentration.

- Control Point: A surface soil control point will be established and maintained through the life of Phase 1 D&D activities. Each detector deployed on WVDP premises will have two 30-second measurements taken at the control point each day: one at the start of a day's activities and one at the end. These data will be recorded and a control chart developed and maintained for each detector. The purpose of this activity and the control chart is to identify transient soil/meteorological conditions that may be adversely affecting detector response or trends in detector behavior that may be a concern. The variability, as measured by the standard deviation, will be used to construct two and three standard deviation error bars for the control charts. One or more daily controlled measurements would be obtained and added to the control charts. Daily readings that are more than two standard deviations away from the mean response will require a second measurement. If the second measurement also is more than two standard deviations away from the mean response or the initial measurement was more than three standard deviations from the mean response, the detector will be evaluated for evidence of potential problems and corrective actions taken as necessary before routine use of the detector is resumed.

- Identification of Shine Potential: Prior to surveying an area of interest, the potential for shine will be evaluated. Shine may be the result of proximity to a building with a history of structural contamination, or it may be a product of geometry and contamination in excavation walls (i.e., deep excavations). If shine is identified as a potential concern, the potential shine impact will be assessed through the use of shielding and/or comparing results from 15-cm height readings with 1-m height readings. If it is determined that shine impacts could be significant, a mitigating strategy will be used, such as 1) the use of a shielded detector or 2) the application of shine correction factors to acquired data.

- Review of Data: Data that are collected as part of gross gamma activity surveys will be mapped and reviewed for completeness to ensure that there are no areas that lack survey coverage. The review will also determine any data quality problems, either in coordinate information or detector response. Examples of data quality issues would be mapped data lines that deviate significantly from the known path or data points that clearly fall outside the area being surveyed. Examples of the latter are inexplicable trends in sequential readings that appear to be a function of time rather than location. Any gaps that are identified will be discussed with the DOE PM and corrected prior to demobilization.

6.3 Field Documentation

Data collected in the field includes field logbooks, sample collection data, and location information. SEC personnel responsible for the collection of data during the field portion of Task

Order 5 will adhere to the quality requirements outlined for collecting, managing, and recording data. Data will be strictly controlled and, where necessary, checked for accuracy prior to submission to the DOE PM or for use in the Final Project Report. Copies of field data will be maintained in a controlled manner for the duration of the fieldwork. Field log books, chain of custody forms, sample log sheets, photographs, and other pertinent documentation are all considered records and will be managed according to SEC-Q17, *Records Management*.

6.3.1 Field Logbooks

Task Managers, or designees, are required to maintain a field logbook throughout the duration of the project. All information pertinent to field activities, including field instrument calibration data, will be recorded in field logbooks or on the forms specified by SEC RPP procedures. The logbooks will be bound and the pages consecutively numbered. Entries in the logbooks will be made in black waterproof ink and will include, at a minimum, a description of all activities, individuals involved in field activities, dates and times of sampling, weather conditions, any problems encountered, and all field measurements. Instrument calibration information, such as lot numbers, manufacturer names, and expiration dates of standards used for field calibration will also be recorded in field logbooks. The Task Manager will summarize each day's activities in the field logbooks.

Sufficient information will be recorded in the logbooks to permit reconstruction of all field activities conducted. When not being utilized during fieldwork, all field logbooks will be kept in the possession of the Task Manager or designee in a secure place. Upon completion of the field activities, all logbooks will become part of the final project evidence file.

Entries recorded in logbooks will include, but not be limited to, the following information:

- Author, date, and times of arrival to and departure from the work site;
- Purpose of the field activity and summary of daily tasks;
- Names and responsibilities of field crew members;
- Sample collection method;
- Number and volume of samples collected;
- Information regarding sampling changes, scheduling modifications, and change orders;
- Details of sampling locations, including a sketch map illustrating the sampling locations unless they have already been located and identified by global positioning;
- Field observations;
- Types of field instruments used and purpose of use, including calibration methods and results;
- Any field measurements made that were not recorded electronically;
- Sample identification number(s); and
- Sample documentation information.

6.3.2 Photographs

Photographs can be an important source of supplemental information during a site investigation. Examples of when photographs are appropriate include when there is a need for visual evidence of potential contamination, evidence of obstructions that require moving sampling locations, documentation of sampling points, and documentation of anomalous conditions that might affect either data quality or data interpretation.

If photographs are taken to document sampling points to facilitate relocating the point at a later date, two or more permanent reference points should be included within the photograph. In addition to the information recorded in the field logbook, one or more site photograph reference maps will be prepared as required. SEC will provide cameras to DOE personnel at any time during the fieldwork for review and approval of photos taken.

6.4 Sample Quality Assurance/Quality Control

6.4.1 Sample Collection

There are a number of soil samples that are prescribed for collection during the implementation of Task Order 5, as described in Section 4.0. In order to ensure identification and quantification of all sources of error associated with each step of a monitoring program, control samples are collected so that the resulting data will be of known quality.

Soil samples will be collected by using a stainless steel trowel or sampling spoon and will be homogenized in a stainless steel bowl or container prior to containerization. Visually identifiable non-soil components such as stones, twigs, and foreign objects will be manually separated in the field and excluded from the laboratory samples to avoid biasing results low. A label shall be affixed to each sample container in accordance with Section 6.4.3 of this FSP.

Sample QC will be defined with the collection and analysis of field duplicates and matrix spike (MS)/matrix spike duplicates (MSDs) according to the following methodology:

- Field Duplicate: The field duplicate involves collecting two separate (replicate) samples from a single sample location, storing in separate containers, and submitting them for analysis to the laboratory as two separate samples. The field duplicate will provide information on the overall variability or precision of both the sampling technique and the analytical laboratory. The field duplicate samples will be collected at a rate of 1 per 10 samples or at least one sample per BOSF footprint area, whichever is more. Field duplicates may be given a "dummy" sample number at the discretion of the task manager so that the laboratory does not know that the sample is actually a field duplicate. The "dummy" will be a sample location number that does not exist. For example, if there are eight sample locations for a specific BOSF, location 09 could be used as the dummy location for one of the real sample locations. When this is done, a notation will be made in the field logbook to track the sample to its duplicate. Alternately, the sample number may simply be annotated with the letters "DUP" to represent the field duplicate.

- MS/MSD: In order to demonstrate that the extraction or digestion equipment and methods used in the laboratory for sample analysis does not result in contamination of the samples, an additional group of field samples will be analyzed by the laboratory at a rate of at least 1 per 20 of the same matrix. Normal laboratory procedures are used to analyze spikes and duplicates. This is only applicable to tritium, carbon-14, and I-129 analysis, as specified in the laboratory procedures. No separate sample is shipped to the laboratory. The reason MSs are not performed for alpha spectroscopy analysis is because an isotopic tracer is added to each sample to determine extraction yield. This tracer essentially is the same as a traditional MS for chemical analyses. No MS is performed for gamma spectroscopy because no chemical extraction is performed. The sample is analyzed on a calibrated detector using a calibration source with known quantities of gamma emitting radionuclides.

6.4.2 Sample-Numbering System and Electronic Data Deliverables

A unique sample numbering scheme will be used to identify each sample collected for laboratory analysis. The purpose of this numbering scheme is to provide a tracking system for the retrieval of analytical and field data on each sample. Sample identification numbers will be used on all sample labels or tags, field data sheets and/or logbooks, chain of custody records, and all other applicable documentation used during the project. As discussed in the previous section, the sample-numbering scheme used for field samples will also be used for duplicate samples.

The sample numbering system will follow the protocol shown in Appendix F. Appendix F is a step-wise procedure to help assure that samples are numbered, chains of custody are completed, samples are validated, and EDDs are created and checked so that they may be loaded into the WVDP Data Management System (DMS).

6.4.3 Sample Labeling

Labels will be affixed to all sample containers during sampling activities. The laboratory will provide the labels along with the sample containers. Information will be recorded on each sample container label at the time of sample collection. The information to be recorded on the labels will be as follows:

- Sample identification number;
- Sample type;
- Sampled interval (e.g., 0 to 15 cm);
- Site name and sampling station number;
- Analysis to be performed;
- Date and time of sample collection; and
- Sampler's name and initials.

Personnel collecting the samples will provide sample collection information within the field logbook (i.e. time, location, and sample ID) so that a cross-reference can be made if necessary.

6.4.4 Sample Packaging

Field samples will be placed in wide-mouth 500- or 1,000-ml nalgene containers provided by the laboratory. When samples require more than 1,000-ml, the sample may be placed in two 1,000 ml nalgene jars with both jars placed in the same zip lock plastic bag. Both jars and the bag shall bear the same sample number.

The exterior of the containers will be checked for radioactive contamination and decontaminated if any is detected, prior to filling. The containers will be packaged in thermally insulated rigid-body coolers. Sample packaging and shipping will be conducted in accordance with applicable U.S. Department of Transportation (DOT) specifications. The radiological engineer or other qualified individual will be responsible for packaging and shipping the samples and will verify completeness of sample shipment preparations. In addition, the laboratory will document the condition of the environmental samples upon receipt. This documentation will be accomplished by using the *Cooler Receipt Checklist* (SEC-FSP-F01) shown in Appendix E.

The radiological engineer or other qualified individual is responsible for shipping the samples from the field to the laboratory will be responsible for completing the chain of custody form and noting the date and time of shipment. This individual will also inspect the form for completeness and accuracy. After the form has been inspected and determined to be satisfactorily completed, the responsible individual will sign, date, and note the time of transfer on the form. The chain of custody form will be sealed in a plastic bag and placed inside the cooler used for sample transport after the field copy of the form has been detached. The field copy of the form will be appropriately filed and kept at the project premises for the duration of the activities and managed as a project record.

In addition to the chain of custody form, chain of custody seals will also be placed on each cooler used for sample transport. These seals will consist of a tamper-proof adhesive material placed across the lid and body of the coolers. The chain of custody seals will be used to ensure that no sample tampering occurs between the time the samples are placed into the coolers and the time the coolers are opened for analysis at the laboratory. Cooler custody seals will be signed and dated by the individual responsible for completing the chain of custody form contained within the cooler.

6.4.5 Additional Requirements for Samples Classified as Radioactive Materials

Transportation of radioactive materials is regulated by the DOT under 49 CFR 173.401. Samples generated during project activities will be transported in accordance with procedures that ensure compliance with regulatory requirements. The following will be performed for radioactive materials:

- The cooler must have the shipper and receiver addresses affixed to it in case the courier air bill is lost during shipping.
- Samples will be screened prior to packing to determine whether they meet the definition of a DOT class 7 (radioactive) material.
- For samples that meet DOT requirements for radioactive materials:
  - The cooler will be surveyed for radiation and to ensure the package meets the requirements for limited quantity as found in 49 CFR 173.421.
  - A notice must be enclosed on the inside of the cooler that includes the name of the consignor and the statement: "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910." The outside of the inner packaging, or, if there is no inner packaging, the outside of the package itself must be labeled "Radioactive."
- The following labels will be placed on the cooler:
  - Appropriate hazard class label; and
  - If applicable, "Cargo Aircraft Only."
- The air bill for the shipment will be completed and attached to the top of the shipping box/cooler which will then be transferred to the courier for delivery to the laboratory.

6.4.6 Chain of Custody Records

Chain of custody procedures implemented for the project will provide documentation of the handling of each sample from the time of collection until completion of laboratory analysis. The chain of custody form serves as a legal record of possession of the sample. Chain of custody forms will be managed as project records according to procedure SEC-Q-17, *Records Management.* A sample is considered to be under custody if one or more of the following criteria are met:

- The sample is in the sampler's possession,
- The sample is in the sampler's view after being in possession,
- The sample was in the sampler's possession and then was placed into a locked area to prevent tampering, and
- The sample is in a designated secure area.

Sample custody will be documented throughout the project field sampling activities by use of a chain of custody form initiated on each day that samples are collected. The chain of custody form will accompany the samples from the project premises to the laboratory and will be returned to the laboratory coordinator with the final analytical report. All personnel with sample custody responsibilities will be required to sign, date, and note the time on the chain of custody form when relinquishing samples from their immediate custody (except when samples are placed into designated secure areas for temporary storage prior to shipment).

Bills of lading or air bills will be used as custody documentation during times when the samples are being shipped from the project premises to the laboratory, and they will be retained as part of the permanent sample custody documentation.

Chain of custody forms will be used to document the integrity of all samples collected. A sample chain of custody procedure can be found in Appendix D.

6.4.7 Sample Shipping

All samples collected in the field during the project will be shipped in a timely manner that assures receipt of sample analyses in support of the overall task order schedule. During the time period between collection and shipment, all samples will be stored in a secure area. All coolers containing environmental samples will be shipped overnight to the laboratory via Federal Express, similar courier, or laboratory courier.

6.4.8 Laboratory Receipt of Sample Forms

The contracted laboratory will document the receipt of samples by accepting custody of the samples from the approved shipping company. In addition, the contracted laboratory will document the condition of the environmental samples upon receipt on the Cooler Receipt Checklist (SEC-FSP-F01), shown in Appendix E.

6.4.9 Sample Documentation Process

The tracking procedure to be utilized for documentation of all samples collected during the project will involve the following series of steps:

- Collect and place samples into laboratory sample containers.
- Complete sample container label information.
- Complete sample documentation information in the field logbook.
- Complete project and sampling information sections of the chain of custody form(s).
- Complete the airbill for the cooler to be shipped.
- Perform a completeness and accuracy check of the chain of custody form(s).
- Complete the sample relinquishment section of the chain of custody form(s) and place the form(s) into cooler.
- Place chain of custody seals on the exterior of the cooler.
- Package and ship the cooler to the laboratory.
- Receive cooler at the laboratory, inspect contents, and fax (or scan and email) contained chain of custody form(s) and cooler receipt form(s).
- Transmit original chain of custody form(s) with final analytical results from the laboratory.

6.4.10 Corrections to Documentation

All original information and data in field logbooks, on sample labels, on chain of custody forms, and on any other project-related documentation will be recorded in black waterproof ink and in a completely legible manner. Errors made on any accountable document will be corrected by crossing out the error and entering the correct information or data. Any error discovered on a document will be corrected by the individual responsible for the entry. Erroneous information or data will be corrected in a manner that will not obliterate the original entry, and all corrections will be initialed and dated by the individual responsible for the entry.

6.5 Laboratory and Data Quality Assurance/Quality Control

6.5.1 Laboratory Analysis

Onsite Laboratory Services: The soil samples collected in the field may be screened by an on-site laboratory at the discretion of the DOE PM to verify the absence of significant contamination issues (e.g., gamma spectroscopy for Cs-137 and/or liquid scintillation for Sr-90). This would allow real-time decisions to be made regarding continuing excavation, and potentially would reduce the potential for committing resources to off-site laboratory analysis. Data from an onsite-laboratory would not be used to demonstrate CG compliances unless a QA/QC program is established and demonstrated to produce results equivalent to those of an off-site contract laboratory.

Off-site Laboratory Services: Soil samples will be shipped off-site to an approved contract laboratory for analysis. Laboratory methods, instruments, and sensitivities will be in accordance with New York State protocols for environmental analysis. Any laboratory used for environmental sample analysis will have appropriate New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program certification or equivalent. Table 6-1 indicates the target MDCs for radionuclides in laboratory analyses of soil samples as well as the

Table 6-1. Analytical Methods and Minimum Volumes (EML 1997)

Nuclide	Analysis Method	Minimum Volume	MDC (pCi/g)
Am-241	EML HASL 300 A-01-R	5 g	1
C-14	EERF C-01-1	100 g	2
Cm-234	EML HASL 300 A-01-R	-	1
Cm-244	EML HASL 300 A-01-R	-	1
Cs-137	EML HASL 300 Ga-01-R	500 g	0.1
I-129	EML HASL 300 Ga-01-R	100 g	0.1
Np-237	EML HASL 300 A-01-R	5 g	0.03
Pu-238	EML HASL 300 A-01-R	5 g	1
Pu-239	EML HASL 300 A-01-R	-	1
Pu-240	EML HASL 300 A-01-R	-	1
Pu-241	EML HASL 300 A-01-R	-	15
Sr-90	EML HASL 300 Sr-03-RC	5 g	0.9
Tc-99	EML HASL 300 TC-02-RC	-	3
U-232	EML HASL 300 A-01-R	5 g	0.5
U-233/234	EML HASL 300 A-01-R	-	0.2
U235	EML HASL 300 A-01-R	-	0.1
U-238	EML HASL 300 A-01-R	-	0.2
Secondary ROIs			
Ac-227	EML HASL 300 Ga-01-R	-	0.5
Co-60	EML HASL 300 Ga-01-R	-	1
Cd-113m	EML HASL 300 Ga-01-R	-	Not Applicable
Eu-154	EML HASL 300 Ga-01-R	-	1
H-3	EML HASL 300 H3-04-RC	100 g	25
Nuclide	**Analysis Method**	**Minimum Volume**	**MDC (pCi/g)**
Pa-231	EML HASL 300 Ga-01-R	-	3
Ra-226	EML HASL 300 Ga-01-R	-	0.5
Ra-228	EML HASL 300 Ga-01-R	-	0.5
Sb-126	EML HASL 300 Ga-01-R	-	1
Sn-126	EML HASL 300 Ga-01-R	-	1
Th-229	EML HASL 300 Ga-01-R	-	1
Th-232	EML HASL 300 Ga-01-R	-	0.5

analytical methods to be used. All laboratory instrumentation will be calibrated by using NIST-traceable standards.

Soil sample results will be reported as dry weight corrected. Reported results will include, at a minimum, the sample identifier, the matrix analyzed, the date of analysis, the parameter analyzed for, the method used, the estimated activity concentration in pCi/g, the error associated with the estimated activity concentration, any laboratory qualifiers associated with the measurement, an indication if the result is an original analysis or a QC analysis (e.g., replicate), the moisture content, and any sample dilution necessary.

6.5.2 Reporting

All field collected data will be available for DOE review at any point during data collection. Prior to the delivery of the finalized data sets, electronic versions will be transmitted to DOE in suitable format (e.g., Excel spreadsheet for laboratory results, PDF format for supporting laboratory QC documentation) when delivered by the laboratory, recognizing that data are draft and subject to change, replacement, or correction. The purpose of the DOE access and review is to assure that data quality requirements are being achieved while work is underway.

The electronic deliverables will include the following listing in Table 6-2.

Table 6-2. Electronic Deliverables

Deliverable Number	Title	Description	Frequency	Approval Required
T05-8	Sample/Data Location Meta Information	Information including sample/data location name, coordinates (sub meter accuracy), description of the location, and the purpose of the location (Excel)	Within 30 calendar days following completion of fieldwork	DOE FPD Information
T05-9	Laboratory Data (including QC data)	Laboratory data in acceptable EDD format	Within 7 calendar days of receipt from laboratory	DOE FPD Information
T05-10	Field Data	Documentation including GM screening results, soil classification/ description, sample log sheets, etc. (Excel)	Within 30 calendar days following completion of fieldwork	DOE FPD Information
T05-11	Gamma Walkover Data	Survey data including gamma walkover results, coordinates, instrument information, and map/figures (Excel) in acceptable EDD format.	Within 10 calendar days following collection	DOE FPD Information

6.6 Data Verification and Validation

Data verification and validation will be performed by an independent third party under subcontract to SEC.

6.6.1 Data Verification

Data verification will be performed on 100% of the laboratory analytical data. Verification will be performed to assure that samples sent for analysis were analyzed with results returned in hard copy and as an EDD. Verification of completeness of chain of custody records will be performed. Verification that hard copy records from the laboratory match the EDD will be performed.

6.6.2 Data Validation

Data deliverables will meet U.S. Environmental Protection Agency (EPA) Level IV quality. Contract Laboratory Procedure (CLP)-like data packages with raw data will be provided to support independent third party validation. Ten percent of analyses will be validated by an independent third party. The independent third party will be obtained via subcontract to SEC. The subcontract will be awarded before the first set of sample analyses is completed.

EPA Level IV quality data packages should be loaded within the WVDP DMS for all samples as part of the sample quality records.

6.7 Data Quality Objectives/Indicators

Project data quality objectives (DQOs) for this FSP are to characterize soil areas after removal of BOSF to determine if contamination exists in excess of the CGs. If the CGs are exceeded or are likely exceeded, the characterization data will be used to guide further soil excavation during Phase 1 D&D work or to plan Phase 2 remediation. If the characterization data indicate that the CGs are likely satisfied, the data will be used to build and grow a data set that will support a FSS. This will be achieved by guiding and basing sampling efforts on the DQO presented in Section 3.0 of the FSSP.

DQOs are qualitative and quantitative statements that specify the quality of data required supporting decisions during remediation. Overall, the objective is to assure that the data collected during the sampling effort meets qualitative sufficiency standards for adequacy (i.e., how "good" is the data) and to meet quantitative values to document/confirm compliance of the "good" data with respect to some reference standards or values. This requires that data meet certain basic characteristics of satisfactory usability (e.g., precision, accuracy, representativeness, completeness, and comparability) for the intended purpose (i.e., meet or exceed the CG).

The characteristics of precision, accuracy, representativeness, completeness, comparability, and sensitivity are discussed in Sections 6.7.1 through 6.7.5, respectively.

6.7.1 Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Precision in the laboratory results and in direct reading instruments is assessed through the calculation of relative percent differences (RPDs) and relative standard deviations (RSDs) for two or more replicate samples. Precision can be expressed as standard deviation. Precision for laboratory analyses will be established via field duplicates, laboratory duplicates, and spike duplicates. According to the CSAP, precision reflects measurement variability as observed in repeated measurements of the same subsample; for radio-analytical methods, the required precision is reflected by required method detection limits. In other words, specifying the required detection limits is equivalent to specifying the required method precision; therefore, specific tolerance limits for precision are not set in this FSP. The results of precision evaluations will simply be reported after data have been collected and analyzed.

Field duplicates will be the least precise because they introduce all sample uncertainty introduced from field sample collection through laboratory analysis. Field duplicates are collected as sample splits from the same sample mass. Two samples are extracted after homogenization with hand tools. These two samples are sent separately for laboratory analysis and the results are compared to establish a measure of precision.

Laboratory duplicates are obtained by analyzing the same sample twice. Once received from the field, actual samples are analyzed twice. Spike duplicates are samples where a known amount of a tracer is analyzed, and this sample is analyzed twice.

The RPD calculation allows for the comparison of two analysis values in terms of precision with no estimate of accuracy. RPD is calculated as:

$$\text{RPD} = \left(\frac{\text{m} - \text{M}}{\overline{\text{M}}} \right) \times 100$$

Where:
m = First measurement value,
M = Second measurement value, and
$\overline{\text{M}}$ = Mean value of M and m.

6.7.2 Accuracy

Accuracy addresses the potential for bias and lack of precision in laboratory analytical results and is typically monitored through the use of standards, spikes, blanks, and control charts, as appropriate, depending on the method. The accuracy requirement for off-site laboratory analyses set in the CSAP is a relative standard error of 10%, as measured at the CGw value, after correcting for precision.

Two types of analytical check samples can be used: Laboratory Control Sample (LCS) (a blank spike) and MS. Analytical accuracy is expressed as the % recovery of an analyte that has been added to the control samples or a standard matrix (e.g., blank soil, analyte-free water, etc.) at a known concentration prior to analysis.

The accuracy of data is typically summarized in terms of relative error (RE). This calculation reflects the degree to which the measured value agrees with the actual value, in terms of % of the actual value. RE is calculated as:

$$\% \text{ RE} = \frac{\text{Measured Value} - \text{Actual Value}}{\text{Actual Value}} \times 100$$

This way of expressing accuracy allows for a comparison of accuracy at different levels (e.g., different concentrations) and for different parameters of the same type (e.g., different compounds analyzed by the same method). Control sample analyses are typically evaluated using this calculation.

Another calculation is frequently used to assess the accuracy of a procedure. Percent recovery is a calculation used to determine the performance of many of the QC checks, where:

$$\% \text{ Recovery} = \frac{\text{Measured Value}}{\text{Actual Value}} \times 100$$

Another similar calculation used to determine the performance of a method for recovery of a spike concentration added to a sample is the % spike recovery calculation. The % spike recovery is determined as:

$$\% \text{ Spike Recovery} = \frac{[(\text{Measured Sample Value Plus Spike}) - (\text{Measured Sample Value})]}{(\text{Value of Spike Added})} \times 100$$

6.7.3 Representativeness

Representativeness is guaranteed by appropriate sampling and analytical protocols and by collecting sufficient samples or obtaining sufficient measurements such that uncertainties introduced by the heterogeneity of contaminated media are sufficiently controlled for decision making purposes. There is no formal quantitative requirement for representativeness; representativeness is monitored by ensuring that sampling and analytical protocols are, in fact, carried out during field and laboratory work and that the quantity of data collected are sufficient to allow decision-making with the necessary level of confidence.

6.7.4 Completeness

Completeness is a measure of the degree to which the amount of sample data collected meets the scope and a measure of the relative number of analytical data points that meet the acceptance criteria, including accuracy, precision, and any other criteria required by the specific analytical method used. Completeness is defined as a comparison of the actual numbers of valid data points and expected numbers of points expressed as a %. The data completeness goal for the CSAP is 80%, consistent with the Phase 1 FSSP.

Completeness is calculated after the QC data have been evaluated, and the results applied to the measurement data. In addition to results identified as being outside of the QC limits established for the method, broken or spilled samples, or samples that could not be analyzed for any other reason, are included in the assessment of completeness. The % of valid results is reported as completeness. The completeness will be calculated as follows:

$$\text{Completeness (\%)} = \frac{T - (I + NC)}{T} \times 100$$

Where:

T = Total number of expected measurements for a method and matrix;
I = Number of invalidated results for a method and matrix; and
NC = Number of results not collected (e.g., bottles broken, etc.) for a method and a matrix.

6.7.5 Comparability

Comparability refers to how well data sets generated by CSAP work pertain to the decisions that need to be made. Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The comparability of the data, a relative measure, is influenced by sampling and analytical procedures. By providing specific protocols to be used for obtaining and analyzing samples, data sets should be comparable regardless of who obtains the sample or performs the analysis. Comparability (or the lack thereof) is an aggregate QA measure that reflects the overall level of accuracy, precision, completeness, and representativeness.

Data collection will use a variety of on-site and field-based data collection methods. A component of field data collection will be to establish site-specific performance for these methods to ensure data of sufficient quality to satisfy decision-making requirements.

7.0 REFERENCES

DOE 2009. Phase 1 Decommissioning Plan for the West Valley Demonstration Project, Washington Safety Management Solutions, URS Washington Division, and Science Applications International Corporation, December.

DOE 2011a. Phase 1 Characterization Sampling and Analysis Plan, West Valley Demonstration Project, Argonne National Laboratory Environmental Science Division, 9700 South Cass Avenue, Argonne, IL 60439, June.

DOE 2011b. Phase 1 Final Status Survey Plan for the West Valley Demonstration Project, Argonne National Laboratory Environmental Science Division, 9700 South Cass Avenue, Argonne, IL 60439, May.

DOE 2013. West Valley Demonstration Project Terrestrial Background Study for Task Order 5, West Valley Demonstration Project Environmental Characterization Services, West Valley New York, April.

EML 1997. The Procedures Manual of the Environmental Measurements Laboratory, 28th Edition, February.

EPA 2000. Multi-Agency Radiation Survey and Site Investigation Manual, Rev. 1, NUREG 1575, August.

APPENDIX A

Gamma Walkover Procedure

1.0 Definitions

A **gamma walkover survey** refers to the practice of walking or driving over a land surface and scanning for gamma anomalies or areas of elevated count rates.

Global Positioning System (GPS) is method of land surveying utilizing satellites to provide an accurate land position.

Differential Global Positioning (DGPS) is an accurate measurement of the relative positions of two receivers tracking the same GPS signals. The roving receiver collects the survey data, while a fixed or receiver (base station) collects data simultaneously. The base station broadcasts a fixed position based on the errors it records in it position versus its actual location.

2.0 Applicability

This SOP provides guidance on completing characterization surveys of open lands using gamma walkover scanning in combination with a global positioning system. The procedure provides the information necessary to produce initial site characterizations and data packages. Survey packages will be assembled under the Work Plan. This procedure directs the performance of individual surveys.

3.0 References

3.1	Differential GPS Explained	Trimble, 1993
3.2	DOE O 458.1	Radiation Protection of the Public and the Environment.
3.3	10CFR835	Occupational Radiation Protection
3.4	MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual

4.0 Notes and Precautions

4.1 The objective of the task is to delineate and map the existing radiation levels over a specified area.

4.2 Radiological instrumentation types should remain constant throughout the survey. Radiological instrumentation should be determined based on the radionuclides of interest.

4.3 The measurement method affects the scan path spacing. For example, a walking scan with approximately one meter of detector swing, covers a one meter wide strip and the spacing between path should be one meter. Surveying should be conducted with the goal of collecting at least one measurement every square meter.

4.4 If multiple probes are used to collect data in the same survey, a 100 m^2 area at the site will be surveyed with each detector. Data will be normalized according to Section 5.3 of the Phase 1 West Valley Demonstration Project (WVDP) Final Status Survey Plan (FSSP).

4.5 If necessary, the survey may be conducted in two perpendicular directions or with a mixture of riding and walking. For example, a survey area might be surveyed with a North-South pattern, but geography inhibits 100% coverage of a subarea. In this case, the subarea might then be surveyed again in an East-West pattern or the subarea in question might be surveyed by walking. If the survey unit is less than one acre and the method is driving, consider driving the area twice with perpendicular directions to ensure 100% coverage.

5.0 Gamma Walkover Surveys in Concert with GPS Navigational Systems

5.1 Background Determination

A reference area should precede the initial characterization to ensure that instruments and recorders are operable, and that reporting systems are appropriate, per the following guidance.

1) The reference area will be surveyed with the detector and data will be logged consistent with protocols to be used for final status survey (FSS) data collection purposes. These data will be reviewed and compared with existing data sets from similar detectors (if available) to confirm consistency in general detector behavior (average gross activity concentration recorded and observed variability in detector response).

2) Quality Control (QC) data will be obtained from a fixed QC point at a height of six inches above exposed soils from a point established for this purpose outside any areas expected to be remediated. These data will be used to construct a control chart that can be used for QC purposes for subsequent deployments of the detector as part of FSS work.

5.2 Daily Quality Control

1) A stationary reading will be taken from the QC point at the start and end of each day a detector is in use. These QC data will be compared to the control chart to determine that the detector response is consistent with historical responses from that location. If a QC measurement results in a detector response "out of control" at the start of the day, the measurement will be repeated. If the subsequent measurement is still out of control, the reason for the discrepancy will be established before the detector is used. If the out-of-control event occurs at the end of the day and is verified by a subsequent measurement, the reason for the discrepancy will be established before the data collected that day with that detector are considered acceptable for FSS purposes. "Out of control" is defined as a result that is more than two standard deviations above or below the average historical detector response at that control point.

2) Electronically logged data will be reviewed for completeness (e.g., evidence of spatial "holes" in collected data), evidence of erratic detector behavior (e.g., sequential readings during a moving survey that show a marked increase or decrease in gross activity not confirmed by spatially adjacent measurements), or evidence of shine (e.g., systematically elevated readings proximal to structures, buildings, soil piles, storage units or excavated soil walls). In the case of incomplete data, data collection will be conducted to fill the gap. In the event of erratic behavior, the cause will be investigated, suspect data will be flagged as such, and additional data collection will be conducted to address affected areas as appropriate.

5.3 Site Specific Information

Data presentation should be considered prior to collection of data. Ensure that the correct coordinate system used. The data format will be GPS coordinates in NAD 1983 State Plane New York West FIPS 3103.

5.4 Establishing a Daily Survey Area

The daily survey area will depend on the topography and landmarks of the survey unit. The objective is to systematically survey all anomalies or random survey units in each Grid Unit. The survey supervisor will assign data packages. Ensure that the coordinates and photographs match the actual field survey conditions. Cover the survey unit with a maximum one m path spacing at speeds not to exceed 0.5 m/s.

6.0 Data Quality and Presentation

6.1 To ensure the accuracy of GPS survey, files must be differentially corrected. Differential correction is a means of comparing data from a roving receiver with a base station. The base station continuously collects positional information. These observed positions are compared to a known coordinate. The difference between the observed position and the actual position is error cause by the atmosphere or selectively induced errors. Differential correction applies the same offsets to increase the accuracy of the roving receiver.

6.2 Data will be plotted using ArcView in one second increments and organized in a spreadsheet form.

6.3 The daily data submittal will include field notes, quality control tests, and survey graphics.

APPENDIX B

Geoprobe Procedure

UNCONTROLLED DOCUMENT

NATURE'S WAY ENVIRONMENTAL CONSULTANTS & CONTRACTORS, INC.

3553 Crittenden Road, Alden, NY 14004
716-937-6527 Fax 716-937-9360

7 Zuk-Pierce Drive, Central Square, NY 13036
315-668-1031 Fax 315-668-1009

Direct Push Drilling Procedure
Standard Operations Procedure

This document will serve as the standard operation procedure to be followed by personnel of NWEC&C, Inc. Each NWEC&C employee conducting direct push drilling activities is responsible for understanding and managing the direct push unit.

This document is intended to supplement the Simco Drilling Equipment, Inc., (manufacture) Operators Manual for the Earthprobe 200.

The Simco Earthprobe 200 is a hydraulically powered device, capable of driving steel probe rods into the ground for the purpose of sample collection. A 2" OD diameter open 4' long macro-core sampler, fitted with a four foot acetate liner is attached onto the leading probe rod, and advanced (driven) from ground surface to four feet below ground surface. The sampler is then retrieved, the acetate liner containing the sample is removed, and the macro-core sampler is decontaminated. A macro-core sampler is refitted with an acetate liner with extension probe rods attached as necessary to complete this sampling methodology with samples driven and secured to prescribed depth(s).

Macro Core Sampling Operations
Prior to raising the mast, examination of the site for obstruction must be completed. Once the mast is raised the probe hammer assembly is lifted to the highest position to allow for alignment of the sampler. A drive cap is connected to the top end of the sampler (acetate liner fitted macro-core sampler) or probe rod, dependant on sample depth. The sampler (and/or probe rod) is advanced using down feed pressure, and activated hammer as necessary. For sampling continuous intervals (below 4.0' below ground surface), the sampler is lowered down the open hole, extended to surface with additional probe rods to prescribed depth.

To extract the sampler, the drive cap is removed from the sampler/rod, and replaced with a pull cap. The pull plate is lowered, and the sampler is removed utilizing upward feed pressure.

Once the sampler has been removed, the cutting shoe is removed (unscrewed), and the liner is pulled out. The liner may either be cut open for visual classification, or capped to allow for future observation or sample submission. The macro-sampler and cutting shoe are then decontaminated with a non-phosphate soap and clean water rinse, and re-fitted with an acetate liner and cutting shoe.

Hard Surface Operations
Prior to initiating hard surface drilling, the anvil is removed from the hammer assembly, and replaced with the required star bit. A compressed air line is connected to the hammer assembly, allowing circulation of air into the hammer assembly, through the hollow drill steel and out the star bit. The air valve is opened to enable rotation, and operated through use of the down feed pressure and activated hammer as necessary.

APPENDIX C

Soil Sampling Procedure

1.0 PURPOSE

The objective of this procedure is to detail the appropriate methods for the collection of surface and subsurface soil samples.

2.0 SCOPE

This procedure applies to the collection of surface and subsurface soil samples for trace contaminant analysis, which includes volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), pesticides/PCBs (collectively, organic compounds), metals (inorganic), and radiological analyses. Sampling locations, depths and intervals should be defined in the Field Sampling Plan (FSP). Samples for geotechnical or other analyses not considered trace analyses do not need to meet requirements for trace contaminant analyses sampling.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- SEC-ISMS, Integrated Safety Management System
- EPA/R04/SOP/NRN-9102, 1996, "Environmental Investigations Branch Standard Operating Procedures and Quality Assurance Manual," Athens, GA
- 29 CFR 1910.120
- 40 CFR Part 136 Table II
- SEC-EM-309

3.2 Definitions

- Surface soil sample: a soil sample that includes the upper interval or surface material (typically 0-15cm).
- Subsurface soil sample: a soil sample that is collected from soils that is below ground surface (typically 15-100 cm)

4.0 GENERAL

4.1 Responsibilities

4.1.1 Project Manager or Designee

The Project Manager or designee is responsible for obtaining the sample in compliance with this procedure and the Field Sampling Plan (FSP). It is also the responsibility of the Project Manager or designee to follow all requirements for sample containers and holding times, maintaining chain of custody (COC), documenting sampling activities, and quality assurance as required by other procedures.

4.1.2 Radiological Engineer (Sampling Team Lead)

The Sampling Team Lead is the primary supervisor of the sampling team and is responsible for:

- Providing technical direction for the collection of samples and subsequent analyses, field measurements, and field tests
- Overall team supervision
- Obtaining copies of the appropriate work-controlling documents
- Fully understanding this sampling procedure
- Maintaining the field logbook and/or relevant field data acquisition forms
- Responsible for assuring the COC forms are completed and maintained
- Maintaining data quality

- Obtaining all field Quality Control (QC) samples as specified in this procedure
- Maintaining sampling instructions while in the field, including confirmation or performance of functional requirements
- Checks/proper calibration as required by procedure and/or instrument manufacturer instructions

4.1.3 Sampling Technician

Sampling Technician(s) shall receive all instructions from the Sampling Team Lead and actually implement the procedurally prescribed work processes.

4.2 Prerequisites

Personnel collecting samples shall be trained in the use of the specific equipment outlined in this procedure. All sampling personnel shall have the requisite medical examinations, training, and site-specific training in accordance with 29 CFR 1910.120 as described in the Safety and Ecology Corporation (SEC) ISMS and implementing plans and procedures. All waste management and ES&H practices shall follow applicable SEC work controlling documents.

4.3 Precautions

Samples are to be considered potentially contaminated. The following precautions shall be taken:

- Avoid contact with the sample media
- Wear boots and phthalate-free rubber or plastic gloves
- Wear eye protection
- Do not transfer contaminants to other surfaces

Some contaminants can be detected in the parts per billion and/or parts per trillion ranges. Extreme care shall be taken to prevent cross-contamination of these samples. The following precautions shall be taken when trace contaminants are of concern:

- Sampling equipment used for sampling for trace contaminants should be constructed of glass, Teflon, or stainless steel where possible. Plastic equipment should be generally avoided except for inorganic contaminants. Sampling equipment and containers shall be protected from sources of contamination prior to use.
- Sampling equipment should be properly decontaminated in accordance with Procedure SEC-EM-309 prior to use.
- Stage sampling equipment and supplies on plastic sheeting or equivalent to prevent contact with potentially contaminated surfaces. Don a new pair of disposable gloves immediately prior to sampling.
- Samples suspected of containing high concentrations of contaminants shall be placed in separate plastic bags and shall not be stored with environmental samples.
- Sample collection activities should proceed progressively from the suspected least contaminated area to the suspected most contaminated area when possible.
- Some sample tags are equipped with wire ties. Wire ties can rust and/or contaminate the neck and threaded area of sample containers and contaminate the sample. Therefore, wire ties shall not be used.

4.4 Apparatus

While site-specific requirements may vary, apparatus may include:

- Stainless steel hand auger or other soil sampling device
- Stainless steel spoon and bowl (or Pyrex glass pan)
- Decontamination equipment
- Aluminum foil or plastic sheeting (for laying clean equipment on)
- Chemically resistant surgical gloves (i.e., rubber, vinyl, neoprene, etc.)
- Appropriate containers, tags/labels, and custody seals
- COC record and logbook

- Sample cooler, plastic bag, and paper towels
- Packing materials
- HNU/OVA type detector (as appropriate per ES&H plan)

4.5 Records

Chain of Custody record and logbook(s) shall be used to document sample collection. Any data generated from these samples shall be included in the project records' management files. Any end-user data assessment shall also be maintained in the records' management files.

5.0 PROCEDURE

The following is applicable unless otherwise specified in specific work-controlling documents.

5.1 Environmental Safety and Health Guidelines

All environmental safety and health requirements, as listed in the applicable ES&H Plan, shall be met before sampling may proceed. Equipment and supplies shall be handled and/or staged to avoid or minimize contact with potentially contaminated surfaces. When handling onsite surface waters, groundwater, soils, debris, or waste materials, chemically protective gloves shall be worn.

5.2 Sample Identification

Sample containers must be labeled, tagged or marked showing sample identification. Temporarily unmarked samples (in sampling devices, unlabeled jars, etc.) shall not be placed in the vicinity of other similar unmarked samples. Sample data can be invalidated if sample identification is not clear. Documentation of the sample, sampling activity, and sample handling shall be in accordance with the pertinent SAP and procedures.

5.3 Soil Sampling Procedures

A variety of soil sampling tools, typically made of stainless steel, are available for collection of soil samples (e.g., hand augers, split spoons, coring devices, scoops, spoons, etc.). Boreholes for subsurface soil samples may be advanced by hand boring devices (hand augers), portable powered augers, drilling rig, Geoprobe®, or hammering equipment. This procedure primarily references hand augers but is applicable to other soil sampling equipment.

5.3.1 Sample Collection

1) For surface soil samples (i.e., 0-15 cm, 0-100 cm):
   a) Using a stainless steel hand auger or other soil sampling device (which has been decontaminated), auger, push, or core into the material that is being sampled, to the depth specified in the FSP, and retrieve the sample.
2) For subsurface soil samples:
   a) Using a hand auger or other boring or drilling, or sampling device (which has been decontaminated), advance the borehole or sample device to the appropriate sampling depth. Use a decontaminated hand auger or sampling device, such as a thin walled tube or split spoon sampler, to collect the sample. Prior to collecting the sample, remove and/or minimize cuttings/cavings from the borehole to avoid collection of material that is not from the sampling interval. After retrieving the sampler, trim the upper portion of the sample to remove any cuttings or cavings that may be present with the sample. OR
   b) Using a cone penetrometer, or Geoprobe® rig with a split-spoon sampler, push to above the desired depth using a dummy one. Retract the rod and replace the dummy cone with the sampler. Push to below the desired depth to collect the sample. Retract the rod and sampler. Open the two halves of the split spoon and remove the sample. Trim the upper portion to remove any carvings that might be present. OR
   c) Using a backhoe to remove soil from the excavation, use a stainless steel trowel to collect soil not in contact with the bucket surface and place it in the pan (or sample container if VOC analyses are to be conducted on the sample).

3) Samples for VOC analysis should be collected first, without mixing, and placed directly into the appropriate (septa lid) sample container leaving no head space. Care should be taken when filling the container to disturb the sample as little as possible.
   a) These samples shall be collected in a manner that minimizes loss of VOCs.
   b) The VOC sample may be collected directly from the sampling device or immediately after the soil is emptied into the pan.
   c) VOC samples should be containerized immediately upon retrieval.
4) Mix the remaining soil in the bowl or pan by quartering the sample, mixing each quarter, and mixing all quarters together. With the exception of VOC samples, it is important that soil samples be mixed as thoroughly as possible to ensure that the sample is representative of the sample interval. A common method of mixing is referred to as quartering:
   a) The soil in the sample pan is divided into quarters.
   b) Each quarter is mixed, and then all quarters are mixed into the center of the pan.
   c) This procedure is followed several times until the sample is adequately mixed.
   d) If round bowls are used for sample mixing, adequate mixing is achieved by stirring the material in a circular fashion and occasionally turning the material

Note:
If samples are predominantly moist and clayey (i.e., cohesive), extra effort may be necessary to produce a homogenous mixture.

5) Fill and cap the remaining sample containers, leaving about 10% head space, and wipe the exteriors of the containers to remove any potential residue.
6) Label or tag the containers as appropriate and custody seal the closure. Place the containers in plastic bags and chill the samples on ice in a sample cooler (or equivalent) as soon as practical for storage and/or transport. It is not necessary to chill samples only for inorganic radionuclides.
7) Document sampling activities, including sample depth and interval, in the field logbook and CO form.

5.4 Quality Assurance/Quality Control Requirements

All provisions of the applicable Quality Assurance Project Plan shall be followed during sampling activities, including collection of appropriate number and types of QC samples. Verify that all equipment has been properly decontaminated prior to sampling. After sampling verify that samples are properly labeled and preserved, and the chain-of-custody forms are completed.

5.4.1 Quality Control Samples

This section describes various additional samples that are required for field sampling quality control. The quality control samples shall be collected and handled taken at the same time and in the same manner as the other samples.

5.4.1.1 Field Duplicate Sample

The time and location of the field duplicate samples will be designated by the sampling team lead. The duplicate sample will be taken at a frequency of at least five percent (one for every 20 samples taken) and be analyzed for the same analyte as the original sample.

A field duplicate will be collected by taking half of the soil sampled from the selected sampling interval after homogenization as described above in Section 5.3.1, 4. This duplicate will be collected in the same manner as the original sample.

5.4.1.2 Matrix Spike

A matrix spike will be collected when samples are collected for chemical parameter analyses and consist of a triple volume from one sample location. Regulatory authority or project-specific requirements will determine whether radiological analyses require matrix spikes. See project specific FSP or other work controlling document for project-specific QC requirements.

Note:
The triple volume shall be separated into three individual containers. The three individual containers enable the laboratory to perform the analysis on the original sample and on two samples that the lab "spikes." These are the "matrix spike" and "matrix spike duplicate."

A matrix spike/matrix spike duplicate shall be collected from at least one sampling location for every 20 locations sampled.

5.4.1.3 Trip Blanks – FOR CHEMICAL (VOLATILE ORGANIC ANALYSES) ONLY

Trip blanks will meet the following requirements:

1) Prepared and used whenever collecting samples for **volatile organic analyses** (not required for other analyses),
2) Prepared using analyte-free water prior to the sampling event and are kept with the investigative samples throughout the sampling event,
3) Be sealed in 40 ml glass vials with Teflon lined septum caps,
4) Completely filled vials with no headspace, and
5) Shall be sent to the laboratory for analysis at a frequency of one per day and must be shipped to the analytical subcontractor with all samples associated to the trip blank. It does not matter in which cooler it is shipped.

Note:
One trip blank consists of two 40 ml vials of analyte-free water. Rinse and trip blanks do not require separate matrix spike analyses.

5.4.1.4 Rinse Blanks

A rinse blank shall meet the following requirements:

1) Rinse blanks are not required for radiological soil samples except for tritium.
2) A rinse blank should be obtained by collecting demonstrated analyte-free water that has been poured into, over, and/or pumped through decontaminated sampling equipment that will be used to sample,
3) Be analyzed for all analyte of interest (determined prior to the sampling event by the characterization lead or designee),
4) Be required for non-dedicated pumps and tubing,
5) Be required for filtration devices (excluding the filter),
6) It is permissible to use the same aliquot of water on all equipment associated with a particular sample matrix and analysis,
7) If tritium is being measured, a tritium blank, made of the water used for rinse blanks, should be submitted along with the rinse blank to quantify the amount of tritium in the blank, and
8) A minimum of one rinse blank will be required for every 20 samples or approximately 5% of the total number of samples at a minimum of one per matrix (i.e., soil).

Note:
Rinse and trip blanks do not require separate matrix spike analyses.

5.5 Waste Disposal

Waste generated from sampling operations will be managed as required by the FSP, WMP, or other work-controlling document.

6.0 APPENDICES

6.1 Appendix A: Recommended Containers, Holding Times, and Preservation

Appendix A

Recommended Containers, Holding Times, and Preservation[1]

ANALYSIS	SOIL/SEDIMENT		
	Container	**Preservative**	**Holding Time**
Radionuclides (except H-3/C-14)	8G or naglene	N/A	180
Tritium/C-14	8G	N/A	45

Pre-Cleaned Containers:
8G - 8 oz. wide mouth glass (Teflon lid). Nalgene bottles up to 1000 ml or larger may be used.

Holding Times: in days

APPENDIX D

Laboratory Requests and Chain of Custody

1.0 PURPOSE

This document is designed to provide guidance for the identification and documentation of the possession history of a sample from collection through analysis by using the appropriate laboratories' Request and Chain of Custody Forms.

2.0 SCOPE

This procedure applies to all samples that are collected for laboratory analysis in support of SEC Field Projects.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- Title 10, *Energy*, Code of Federal Regulations (CFR), Part 830, *Nuclear Safety Management*, Section 120, *Quality Assurance Requirements*
- Department of Energy (DOE) Order 414.1D, *Quality Assurance*
- American Society of Mechanical Engineers (ASME), Nuclear Quality Assurance (NQA)-1, *Quality Assurance Program Requirements for Nuclear Facilities*

3.2 Definitions

- Custody: a sample that is in a particular individual's custody if it is in that person's physical possession, in view of the person who takes possession, secured by that person so that no one can tamper with it, or secured by that person in an area to which access is restricted to authorized personnel.
- Chain of Custody: an unbroken trail of accountability that ensures the physical security of samples, data, and records
- Laboratory Request Form: a record that identifies requested sample analysis.

4.0 GENERAL

4.1 Discussion

The laboratories analyzing the field samples should provide Laboratory Request Forms and Chain of Custody Forms. This procedure provides guidance on handling and completing these forms. Each time the samples are transferred to another custodian, signatures of the persons relinquishing the sample and receiving the sample, the reason for relinquishing the sample, the time, and date shall be documented.

Records for sampling activities shall be maintained in project records' management files. These records shall be retained as part of the project record. Logbook and other documents, if used for sampling activities, shall also be maintained as project records' management files.

4.2 Responsibilities

The individual who collects and packages the samples or the appropriate group leader is responsible for completing the Chain of Custody section of the Request for Analytical Services Request form.

Any individual who takes custody of the samples is responsible for completing the appropriate area(s) of the form.

The Sampling Team Lead is responsible for reviewing all field activities to ensure that prescribed custody procedures were followed.

5.0 PROCEDURE

5.1 Completing the Request for Analytical Services Form

The Laboratory Request Form, SEC-EM-308-F01, is included with this plan as an example. The forms provided by the actual laboratories performing the analyses should look similar. Each area of these forms needs to be completed. If one of these laboratory forms has not provided, use the form attached to this procedure (Form SEC-EM-308-F01).

Complete the Request for Analytical Services Form as follows

1)	Date:	The date the laboratory request is completed.
2)	Shipped To:	The address of the vendor laboratory
3)	Priority:	Select the turn-around required on the sample analysis. This should be cleared through the project cost manager before completing the form.
4)	Special Instructions:	Provide the vendor any special instructions.
5)	Sample ID:	The site-specific sample identification numbering system.
6)	Location ID:	This may be used to further specify the sample location data. This can be a building number, room number, coordinate, or any other designator that is useful to the site.
7)	Sample Date:	The sample collection date.
8)	Analysis:	The analysis requested from the vendor. Often, the analysis requested may be pre-selected.
9)	Matrix:	The media from which the sample is collected (i.e., soil, water, paint scrapings, swipes, air samples, oil, sediment, etc.).
10)	Comments:	Used to provide additional sample parameters. This could be information on quality control, (i.e., duplicate, trip sample, blank, spike, rinsate, etc.).
11)	Sampled By:	The person who collected the samples or who oversaw the collection of samples.
12)	Date:	The date of the sample collection.
13)	Signature:	Signature of the person who collected the sample.
14)	Project Manager:	Person who has the authority to authorize the expenditure of funds to pay for the analysis.
15)	Project Group Leader	Signature verifies that the technical attributes of the request have been correctly completed.

5.2 Completing the Chain of Custody Section

16)	Signatures:	The signatures of the person transferring custody and the person receiving custody are required on the Chain of Custody. The time and date of the signatures is also required.
17)	Comments:	The lower comments box may be used to specify analysis specifics or other shipping requirements.
18)	Package Dose Rate:	Documents that the package containing the sample meets the requirements for a limited-quantity shipment.
19)	Instrument:	The technician completing the form should enter the instrument model and serial number.
20)	Technician:	The technician completing the dose rate.

6.0 APPENDICE

6.1 Appendix A - Laboratory Request and Chain of Custody, Form EM-308-01

Appendix A

Revision 1 | **LABORATORY REQUEST AND CHAIN OF CUSTODY FORM** | October 25, 2002

FORM EM-308-01

Date:	**Turn Around Time (days):** ☐ 2 ☐ 4 ☐ 7 ☐ 14 ☐ 21 ☐ 30
Shipped To:	
Special Instructions:	

Sample ID Number	Location	Sample Collection Date	Analysis Requested	Matrix	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sampled by (print):	**Project Manager** **Date:**
Date:	**Project Group Leader:** **Date:**
Signature:	

Relinquished by (signature)	Received by (signature)		Comments
		Date Time	
		Date Time	
		Date Time	
Package Dose Rate	**Instrument**	**Technician**	

***Add additional chain of custody forms as needed.**

APPENDIX E

Cooler Receipt Checklist

UNCONTROLLED DOCUMENT

Cooler Receipt Checklist

Instructions: Please complete this form when a cooler containing samples is received from the Safety and Ecology Corporation (SEC) West Valley Demonstration Project (WVDP) Environmental Characterization Services (ECS) Contract. Please do the following:

1. Note the date cooler receipt checklist and chain of custody were completed by SEC.
2. Note that the date shown on the checklist matches the date shown on the chain of custody form.
3. Enter the date the samples were received at the lab for analysis.
4. Enter the date the Cooler Receipt Checklist was completed.
5. Make a check indicating the condition of the cooler upon receipt.
6. Check whether the samples specified on the chain of custody were received in the cooler.
7. List the sample containers that were damaged, or check none damaged.
8. If samples were damaged, telephone Steve Green at 509.737.7047 within 24 hours of completing the checklist.
9. Scan the checklist and email to sgreen@perma-fix.com.
10. Transmit the original cooler receipt checklist along with the hard copies of the sample results.

Item Number	Item	Make a check mark if satisfactory, otherwise leave blank
1	Date cooler and chain of custody was shipped.	<completed by SEC>
2	Date shown for item 1 matches chain of custody.	
3	Date samples received at lab.	
4	Date Cooler Receipt Checklist was completed.	
5	Cooler received in good condition.	
6	All samples listed on chain of custody were received in the cooler.	
7	List sample containers by identification number that were damaged, or enter a check if none were damaged.	

APPENDIX F

Submitting Data to the WVDP Data Management System (DMS)

Appendix F

Submitting Data to the West Valley Data Management System (DMS)

Overview

The purpose of this document is to identify the sequential steps that are necessary to produce an error free electronic data deliverable (EDD) for the West Valley Data Management System (DMS). It is important that items be completed and errors corrected before moving on to the next step of the EDD preparation process. The tables below list the sequential steps in the process, a description of each task, and the person or group that is responsible for completing the task. The requirements for a gamma walkover data EDD are described in a separate section that follows the section for an analytical data EDD.

EDD Requirements for the West Valley DMS

1. An EDD for analytical data must be an EQuIS version 3 Excel spreadsheet file. The parts of the EDD can be sent as separate tabs in the same Excel file, or as individual Excel files.

2. An EDD must conform to the current data requirements for a New York State Department of Environmental Conservation (NYSDEC) EQuIS EDD.

3. The EQuIS valid values used in an EDD must conform to the West Valley EQuIS valid value list. The valid value list for West Valley is the NYSDEC list with additions for West Valley. The West Valley list can be requested from the Environmental Database Administrator (EDBA).

4. An EDD for analytical data must include the EQuIS tabs for **Location_v1, Sample_v3, TestResultQC_v3, and Batch_v3**.

5. Each EDD set for analytical data shall contain the data from a single sample delivery group (SDG).

6. The EDD for GWS data must be an Excel spreadsheet file in the EQuIS version 1 format and include tabs for **Location_v1** and **LocationParameter_v1**.

7. Each EDD for a GWS shall contain the data for a single survey area and measurement method.

Steps to Prepare an EDD for Analytical Data

A. Before samples are collected

Step	Who	Task	Done
1	SEC	Request a study area abbreviation code from the Environmental Database Administrator (EDBA) for the area of the current sampling event.	☐
2	SEC	Submit a list of analytes to the EDBA for the current sample plan.	☐
3	EDBA	Send an updated EQuIS reference value file to the laboratory if the sample plan includes new analytes.	☐
4	SEC	Create a DMS location code for each sample location in the sample plan. The format for a DMS location code (sys_loc_code) is: **<task order>-<study area>-<sequential location number>** See Attachment 1, *Sample Location Codes for the WVDP DMS*, for more information on creating location codes for the DMS. **DMS location codes from previous sampling events must not be repeated for new sample locations.**	☐
5	SEC	Review the list of sample location codes to be sure that they conform to DMS location code requirements.	☐
6	SEC	Send the list of DMS location codes for the current sampling event to the EDBA. Complete this step <u>BEFORE</u> sending samples to the laboratory.	☐
7	EDBA	Review the list of sample location codes to be sure that they conform to the DMS location code requirements.	☐
8	SEC	Create a DMS Sample ID for each potential sample in the sample plan. The format for a DMS sample ID (sys_sample_code) is: **<study area>-<sequential location number>-<sample date>-<matrix code>-<start depth>-<end depth>** See Attachment 2, *Sample Identification for the WVDP DMS*, for more information on creating sample IDs for the DMS.	☐

B. Collect samples / prepare sample chain of custody (COC)

Step	Who	Task	Done
9	SEC	Prepare the sample chain of custody (COC). Include DMS location codes in "comments" field of COC.	☐
10	SEC	Review the COC to confirm that sample IDs and location codes conform to DMS requirements.	☐
11	SEC	Notify the lab that the location codes on the COC must be used to populate the 'sys_loc_code' field in the 'Sample_V3' tab of the EQuIS EDD.	☐
12	SEC	The 'COC Number' on the COC must be fifteen (15) characters or less in length.	☐
13	SEC	Sample IDs for normal field samples must have six sections that are separated by a dash (-).	☐
14	SEC	The date part of the sample ID must **<u>NOT</u>** have any dashes (-) between the month, day, or year.	☐

C. Send samples to laboratory

D. Prepare the 'Location_v1' part of EDD

Step	Who	Task	Done
15	SEC	Obtain coordinates for sample locations.	☐
16	SEC	Complete the **blue** cells in the 'Location_v1' EQuIS EDD template. The 'Location_v1' template can be obtained from the EDBA.	☐
17	SEC	E-mail the completed 'Location_v1' template to the **EDBA**.	☐

E. Check EDD from the laboratory

> **IMPORTANT!**
>
> **Return the EDD to the laboratory for corrections when the 'EDP Error Summary' report shows errors or when the sample IDs or location codes are not correct.**
>
> **Consult with the EDBA for guidance on resolving errors in the EDD.**
>
> Note: The 'EDP Error Summary' report file is included with the EDD from the laboratory.

Step	Who	Task	Done
18	SEC	Confirm that the 'EDP Error Summary' report that comes with the EDD from the laboratory does not list any errors.	☐
19	SEC	Inspect the EDD for incorrect location codes (sys_loc_code)s.	☐
20	SEC	Inspect the EDD for incorrect sample IDs (sys_sample_code)s.	☐

F. Send EDD to validator

IMPORTANT!

Do not send an EDD to the validator before all laboratory data problems in the EDD have been resolved.

Consult with the EDBA for guidance on resolving laboratory data errors in the EDD.

G. Check EDD after validation

Item	Who	Task	Done
21	SEC	Check to make sure that valid NYSDEC data qualifier codes are used by the validator in 'validator_qualifiers' and 'interpreted_qualifiers' in the 'TestResultQC_v3' tab. See Attachment 3, *NYSDEC Data Qualifier Codes*, for more information.	☐
22	SEC	Data that are not validated must have 'N' in the 'validated_yn' column in the 'TestResultQC_v3' tab.	☐
23	SEC	Data that are not validated ('validated_yn' = 'N') must have a copy of the 'lab_qualifiers' in the 'interpreted_qualifiers' column in the 'TestResultQC_v3' tab.	☐
24	SEC	Make sure that chemical names have not been changed. (The validator changed the descriptions in the past.)	☐
25	SEC	A description of each 'result_comment' code that is used by the validator must be provided to the EDBA.	☐

H. Complete the 'Sample_V3' (cells not completed by laboratory)

Item	Who	Task	Done
26	SEC	Enter the sampler's name or initials in the 'Sampler' column of the 'Sample_v3' tab.	☐
27	SEC	Enter the date the samples were sent to the laboratory in the 'sent_to_lab_date' column of the 'Sample_v3' tab.	☐
28	SEC	Field QC samples: Populate the 'sample_type_code' in the 'Sample_v3' tab. <u>Sample Type</u> 'sample_type_code' Field Duplicate = FD Field Blank = FB Trip Blank = TB Equipment Blank = EB	☐
29	SEC	Populate the 'sample_class' in the 'Sample_v3' tab. <u>Sample Type</u> 'sample_class' Field QC = FQ Lab QC = LQ Normal Field Samples = NF	☐
30	SEC	Field Duplicates: Enter the 'parent_sample_code' in the 'Sample_v3' tab.	☐
31	SEC	Enter 'Y' in the 'detect_flag' in the 'Sample_v3' tab for all radiological results.	☐
32	SEC	For composite samples, enter 'Y' in 'composite_yn'.	☐
33	SEC	If 'composite_yn' is 'Y', enter the description of the composite in 'composite_desc'. When the composite is made up of other samples, enter the list of sample IDs in the 'composite_desc'.	☐

I. Check the EDD (Sample_v3, TestResultsQC_v3, and Batch_v3) using the EQuIS Data Processor (EDP)

Item	Who	Task	Done
34	EDBA	Check the completed EQuIS EDD using the standalone EQuIS Data Processor (EDP).	☐
35	EDBA	Resolve errors reported by EDP with SEC support.	☐

J. E-mail the final EDD, Lab Report file, and Validation Report file to the Environmental Database Administrator

Item	Who	Task	Done
36	SEC	Send the final EQuIS EDD as an e-mail attachment to the EDBA at mark.harris@wv.doe.gov. Include the SDG in the e-mail subject. Send a description for each code that is used by the validator in the 'result_comment' column of the 'TestResultQC_v3' tab.	☐
37	EDBA	Obtain the laboratory report (PDF) from laboratory web site. The EDBA will retrieve large files directly from a laboratory's website when login information is provided.	☐
38	SEC	Send the validation report (PDF) file as an e-mail attachment to the EDBA at mark.harris@wv.doe.gov. Include the SDG in the e-mail subject.	☐

Steps to Prepare an EDD for Gamma Survey Data

Step	Who	Task	Done
1	SEC	Request a location code (sys_loc_code) from the Environmental Database Administrator (EDBA) for the current GWS area. Provide the coordinates for the centroid of the survey area to the EDBA.	☐
2	SEC	Complete the **blue** cells in the 'Location_v1' EQuIS EDD template. The 'Location_v1' template can be obtained from the EDBA.	☐
3	SEC	Insert a row in the 'LocationParameter_v1' tab for each gamma survey value measured. Complete each row in the 'LocationParameter_v1' tab as described in step 4 through step 10 below.	☐
4	SEC	'sys_loc_code' in 'LocationParameter_v1' must be the same for all records in the same survey area. 'sys_loc_code' is the location code that is obtained from the EDBA in step 1.	☐
5	SEC	Populate the 'parameter_code' in the 'LocationParameter_v1' tab using a different code for each different detector that is used in a specific gamma survey area. Detector Type — 'parameter code' FIDLER = FID-1, FID-2, FID-3, etc. Shielded FIDLER = Sh-FID-1, Sh-FID-2, etc. NaI = NaI-1, NaI-2, NaI-3, etc. Shielded NaI = Sh-NaI-1, Sh-NaI-2, etc. SES NaI = NaI-1-SES, NaI-2-SES, etc.	☐
6	SEC	Populate the 'parameter_value' in counts per minute and 'parameter_unit' as 'CPM' in the 'LocationParameter_v1' tab.	☐
7	SEC	Enter the 'measurement_date' down to the **second** in the 'LocationParameter_v1' tab. Format: mm/dd/yy hh:mm:ss	☐
8	SEC	Populate 'measurement_method' in 'LocationParameter_v1'. Detector Type — 'measurement_method' FIDLER = FIDLER Shielded FIDLER = Shielded_FIDLER NaI = NaI Shielded NaI = Shielded_NaI SES NaI = SES_NaI	☐
9	SEC	Populate the 'Remark' in 'LocationParameter_v1' with the northing and easting of the coordinate of the 'parameter_value'. Separate the northing and easting with a comma (,).	☐

Step	Who	Task	Done
10	SEC	Enter the West Valley task order in 'task_code' in LocationParameter_v1'. Task Order 'task code' Task Order 4 = TO4 Task Order 5 = TO5 Task Order 9 = TO9 etc. = etc.	☐
11	SEC	Send the final EQuIS EDD as an e-mail attachment to the EDBA at mark.harris@wv.doe.gov. Include the gamma survey location in the e-mail subject.	☐

Attachment 1

Sample Location Codes for the WVDP DMS

UNCONTROLLED DOCUMENT

Attachment 1

Sample Location Codes for the WVDP DMS

Location codes for new sampling events must not duplicate location codes that have already been used for a different place at the WVDP Site. Location codes (sys_loc_code)s must be unique over the entire DMS database, including legacy ELIMS data, previously completed site characterization sampling, and future sampling events. To ensure that location codes are not repeated, the following location naming scheme is being proposed:

<task order>-<study>-<sequential location number>

The 'study' abbreviation is assigned by the DMS Environmental Database Administrator (EDBA). A proper DMS location code for analytical data has three (3) sections that are separated by a dash (-).

For example, the first location code for the Task Order 9 Canister Storage Pad Excavation study is as follows:

TO9-CSPE-01

The sequential location number part of the location code should include sufficient leading '0's so that all location sequence numbers for the study are the same length. For example:

TO9-CSPE-001
TO9-CSPE-010
TO9-CSPE-100

In certain special cases the sequential location number may be preceded by one or two characters to group locations within the study. Do not include an extra dash (-) between the location number and the prefix. For example:

TO4-CSPA-SS01 - Task order 4, canister storage pad area, exposed surface soils

Prior to sample collection, location codes must be reviewed by the EDBA.

The following 'study' abbreviations have been named.

Task Order	Study Abbreviation	Description
TO5	OWP	Old Warehouse Pad, BOSF
TO5	PSA	Product Storage Area, BOSF
TO5	MT	Maintenance Triangle, BOSF
TO4	CSPA	Canister Storage Pad Area
TO9	CSPE	Canister Storage Pad Excavation and Approach Apron
TO9	CSPS	Canister Storage Pad Excavation – Spoils Pile

Task Order	Study Abbreviation	Description
TO5	VTC	Vit Hill Trailer Complex, BOSF
TO5	VFS	Vit Fabrication Shop, BOSF
TO5	VTF	Vit Test Facility Waste Storage Area, BOSF
TO5	CT	Cooling Tower, BOSF
TO5	OWCL	Old Warehouse Count Lab, BOSF East side of warehouse foundation / Rad Counting room and ramp area leading up to old pad
TO5	VDG	Vit Diesel Generator / Vit Diesel Fuel Oil Pit, BOSF
TO5	WTFTT	WTT Test Tower, BOSF
TO5	ELAB	Environmental Laboratory, BOSF
TO5	REFSG	Background Reference Area 1 / Sand and Gravel
TO5	REFLT	Background Reference Area 2 / Lavery Till

Gamma Survey Data

The following location codes (sys_loc_code)s have been named for GWSs. These special location codes are used to populate the 'sys_loc_code' in the 'LocationParameter_v1' table for the corresponding gamma survey.

Task Order	Location Code	Location Description
TO5	TO5-OWP-GWS	Old Warehouse Pad Gamma Walkover Data
TO5	TO5-PSA-GWS	Product Storage Area Gamma Walkover Data
TO5	TO5-MT-GWS	Maintenance Triangle Gamma Walkover Data
TO4	TO4-CSPA-SS-GWS	Canister Storage Pad Area Gamma Walkover Data Surface Soils
TO4	TO4-CSPA-DS-GWS	Canister Storage Pad Area Gamma Walkover Data Drainage Soils
TO4	TO4-CSPA-H-GWS	Canister Storage Pad Area Gamma Walkover Data Hardstand
TO9	TO9-CSPE-GWS	Canister Storage Pad Excavation and Approach Apron Gamma Walkover Data
TO9	TO9-CSPS-01-GWS	Canister Storage Pad Excavation – Spoils Pile – Lift 1 Gamma Walkover Data
TO9	TO9-CSPS-02-GWS	Canister Storage Pad Excavation – Spoils Pile – Lift 2 Gamma Walkover Data
TO9	TO9-CSPS-03-GWS	Canister Storage Pad Excavation – Spoils Pile – Lift 3 Gamma Walkover Data

Task Order	Location Code	Location Description
TO9	TO9-CSPS-04-GWS	Canister Storage Pad Excavation – Spoils Pile – Lift 4 Gamma Walkover Data
TO9	TO9-CSPS-05-GWS	Canister Storage Pad Excavation – Spoils Pile – Lift 5 Gamma Walkover Data
TO9	TO9-CSPS-06-GWS	Canister Storage Pad Excavation – Spoils Pile – Lift 6 Gamma Walkover Data
TO5	TO5-VTC-GWS	Vit Hill Trailer Complex Gamma Walkover Data
TO5	TO5-VFS-GWS	Vit Fabrication Shop Gamma Walkover Data
TO5	TO5-VTF-GWS	Vit Test Facility Waste Storage Area Gamma Walkover Data
TO5	TO5-CT-GWS	Cooling Tower Gamma Walkover Data
TO5	TO5-OWCL-GWS	Old Warehouse Count Lab Gamma Walkover Data East Side of Warehouse Foundation / Rad Counting Room and Ramp Area leading up to Old Pad
TO5	TO5-VDG-GWS	Vit Diesel Generator / Vit Diesel Fuel Oil Pit Gamma Walkover Data
TO5	TO5-WTFTT-GWS	WTF Test Tower Gamma Walkover Data
TO5	TO5-ELAB-GWS	Environmental Laboratory Gamma Walkover Data
TO5	TO5-REFSG-GWS	Background Reference Area 1 / Sand and Gravel Gamma Walkover Data
TO5	TO5-REFLT-GWS	Background Reference Area 2 / Lavery Till Gamma Walkover Data
TO9	TO9-WMA09-GWS	WMA 9 Gamma Walkover Data
TO9	TO9-WMA10N-GWS	WMA 10 Gamma Walkover Data - (North section)
TO9	TO9-WMA10S-GWS	WMA 10 Gamma Walkover Data - (South section)

Attachment 2

Sample Identification for the WVDP DMS

Attachment 2

Sample Identification for the WVDP DMS

Sample IDs for new sampling events must not duplicate sample IDs that have already been used in other sampling events. Sample IDs must be unique over the entire DMS database, including legacy ELIMS data, previously completed site characterization sampling, and future sampling events. To ensure that sample IDs are not repeated, the following naming scheme is being proposed.

DMS sample ID (sys_sample_code) format for a normal field sample:

<study area code>-< sequential location number>-<sample date>-<matrix code>-<start depth>-<end depth>

- The **<study area code>** for the sampling event is requested from the West Valley Environmental Database Administrator (EDBA).
- The **<sequential location number>** is the same **<sequential location number>** that is part of the of DMS location code for the sample. See 'Sample Location Codes for the DMS' for more information.
- The **<sample date>** is the sample collection date in MMDDYY format. **No** dashes(-) between month, day and year.
- The **<matrix code>** is the NYSDEC (West Valley) EQuIS valid value for the sample matrix.
- The **<start depth>** is the top of the sample depth interval.
- The **<end depth>** is the bottom of the sample depth interval.

An example of a sample ID for a surface soil sample collected in study area CSPA on 11/14/2012, at location TO4-CSPA-01, at depth interval 0 to 15 would be **CSPA-01-111412-SS-0-15**.

Field Quality Control Samples

The table below identifies the parts of the sample ID (sys_sample_code) for QC samples. The other parts of the sample ID are the same as for a normal field sample.

Sample Type	Sequential Location Number	Depth Interval	Matrix Code	Example
Field Duplicate	Same as Parent Sample	Same as Parent Sample	Append 'D' to Matrix	CSPA-01-111412-SS**D**-0-15
Field Blank	FB1, 2, etc.	none	NYSDEC List Soil = SQ	CSPA-FB1-111412-SQ

Sample Type	Sequential Location Number	Depth Interval	Matrix Code	Example
Trip Blank	TB1, 2, etc.	none	NYSDEC List Soil = SQ	CSPA-TB1-111412-SQ
Equipment Blank	EB2, 2, etc.	none	NYSDEC List Water = WQ	CSPA-EB1-111412-WQ

Laboratory Quality Control Samples

The laboratory must format the samples IDs (sys_sample_code)s in the EDD as specified in the following table.

Sample Type	Sample ID in EDD
Matrix Spike	Append -MS to the original parent sample ID
Matrix Spike Duplicate	Append -MSD to the original parent sample ID
Lab Replicate	Append -LR to the original parent sample ID
Other Lab QC	Laboratories should use their own identifier in the EDD

Attachment 3

NYSDEC Data Qualifier Codes – (NYSDEC_Valid_Values, rt_Qualifier)

QUALIFIER	ORGANIC_DESC	INORGANIC_DESC
B	Indicates the analyte is detected in the associated blank as well as in the sample.	Indicates the analyte is detected in the associated blank as well as in the sample.
H	Sample result is estimated and biased high.	Sample result is estimated and biased high.
J	The reported value is estimated. For tentatively identified compounds (TICs), concentrations are estimated assuming a 1:1 response ratio. For target analytes, certain identification criteria were met for a compound, but the calculated concentration falls between zero and the adjusted CRQL.	The reported value was obtained from a reading that was less than the CRQL but greater than or equal to the MDL.
R	Indicates the reported result is unusable. (Note: the analyte may or may not be present.)	Indicates the reported result is unusable. (Note: the analyte may or may not be present.)
U	The compound was analyzed for, but not detected above the PQL/CRQL. The sample specific quantitation limit reported has been corrected for dilution and percent moisture.	The compound was analyzed for, but not detected above the MDL.
E	Identifies compounds whose concentration exceed the calibration range of the instrument for that specific analysis.	Identifies compounds whose concentration exceed the calibration range of the instrument for that specific analysis.
L	Sample result is estimated and biased low.	Sample result is estimated and biased low.
K	Reported concentration value is proportional to dilution factor and may be exaggerated.	Reported concentration value is proportional to dilution factor and may be exaggerated.
JL	Estimated biased low based on use of analytical method 5035 or 5035A.	Not applicable.
J-	Estimated biased low.	Estimated biased low.
J+	Estimated on the high side.	Estimated on the high side.
Q	For radiological results, the associated sample results combined standard uncertainty exceeds the project required uncertainty.	For radiological results, the associated sample results combined standard uncertainty exceeds the project required uncertainty.
+		Correlation coefficient the for MS < 0.995.
>		

QUALIFIER	ORGANIC_DESC	INORGANIC_DESC
A	Indicates TICs that are suspected to be Aldol condensation products.	Indicates TICs that are suspected to be Aldol condensation products.
C	Indicates pesticide results have been confirmed by GC/MS. Also C with a number indicates a coeluting congener peak.	Indicates pesticide results have been confirmed by GC/MS.
F	The result is faulty due to problems outside the realm of typical validation rules/flags. This qualifier may be affixed to a result when the data validator has reason to consider the result suspect, warranting notification of the end user.	The result is faulty due to problems outside the realm of typical validation rules/flags. This qualifier may be affixed to a result when the data validator has reason to consider the result suspect, warranting notification of the end user.
G	Indicates the Toxicity Characteristic Leaching Procedure (TCLP) MS recovery was greater than the upper limit of the analytical method.	Indicates the TCLP MS recovery was greater than the upper limit of the analytical method.
I	Matrix interference.	Matrix interference.
S	Indicates that the reported values were determined by the method of standard additions.	Indicates that the reported values were determined by the method of standard additions.
W	Post-digestion spike out of control limits, etc.	Post-digestion spike out of control limits, etc.
X	Recovered amount of spike is less than the project reporting limit.	Recovered amount of spike is less than the project reporting limit.
KK	True bacterial concentration is assumed to be less than the reported value.	True bacterial concentration is assumed to be less than the reported value.
LL	True bacterial concentration is assumed to be greater than the reported value.	True bacterial concentration is assumed to be greater than the reported value.
D	Indicates an identified compound in an analysis that has been diluted. This flag alerts the data user to any differences between the concentrations reported in the two analyses.	The result is faulty due to problems outside the realm of typical validation rules/flags. This qualifier may be affixed to a result when the data validator has reason to consider the result suspect, warranting notification of the end user of a dilution.
M	Indicates that the duplicate injection precision was not met.	Indicates that the duplicate injection precision was not met.

QUALIFIER	ORGANIC_DESC	INORGANIC_DESC
N	Indicates presumptive evidence of a compound. This flag is usually used for a TIC, where the identification is based on a mass spectral library search.	Sample result is estimated and biased low.
P	Indicates a pesticide/aroclor target analyte had a percent difference greater than 25% between the two GC columns. The lower of the two results is reported.	Not applicable.

UNCONTROLLED DOCUMENT

<u>*DWMEP Procedure for Posting NRC Meeting at least 10 Calendar Days before Meeting 03/05/14*</u>
For NRC Closed (Non-Public) Meetings, only put publicly-available information in a Meeting Notice.

STEP	**ACTION**	**RESPONSIBLITY**
1.	Identify that NRC Public or NRC Closed (Non-Public) Meeting is needed	***Project Manager***
2.	Determine Date(s), Time(s), Location, and Bridgeline Information *(if appropriate)*	***Project Manager*** *(who may request help from a DWMEP Administrative Assistant (AA))*
3.	Determine other information needed for Meeting Notice *(see Step #4)*	***Project Manager***
4.	Provide to a DWMEP Administrative Assistant the following information:	***Project Manager***

- *Is Bridgeline Information (phone number/passcode) to be in meeting notice?* ***Yes, or No***
- Title
- Date(s) and Time(s)
- Location *(address, including room number, if applicable)*
- Category *(Category 1, 2, or 3, including special conditions, such as whether:)*
  - public is invited
  - public will be given an opportunity to speak *(if so, then when and how often)*
  - teleconference, videoconference, webinar, or combination of those choices and in-person
- Purpose
- Contact *(name, phone number, and e-mail address)*
- Participants *("NRC" – full name of NRC Offices/Regions; and "Other" – entity NRC is meeting with)*
- Docket Number *(if applicable)* and Name of entity NRC is meeting with
- Comments *(see teleconference example below)*
  Interested members of the public can participate this meeting via teleconference. For additional details, please call the NRC meeting contact(s) listed on the NRC Meeting Schedule or call the NRC's toll-free number, 1-800-368-5642, and ask the operator to be connected to the meeting contact *FIRSTNAME LASTNAME* or the DWMEP Administrative Assistant at 301-415-7319.
- Agenda (see example below)

1:00 pm – 1:05 pm	Introductions, Opening Remarks, and Statement of Purpose
1:05 pm – 2:30 pm	*APPLICANT'SNAME* discuss with NRC *TOPIC*
2:30 pm – 3:00 pm	Public discuss regulatory issues with NRC
3:00 pm	Adjourn

5. Enter Step #4 information into NRC Meeting Notices System — ***DWMEP AA***

6. **NRC Meeting Notices System will process the request, which may take up to a day**.

7. Enter NRC Meeting Notices System to see that *.PDF* meeting notice has been created — ***DWMEP AA***

8. if **YES**, then send copy of *.PDF* meeting notice to the Project Manager for review — ***DWMEP AA***
   *(If **NO**, then contact system support to fix System or re-enter information by going to Step #5.)*

9. Review *.PDF* meeting notice for accuracy and respond to DWMEP AA with confirmation or changes to the *.PDF* meeting notice — ***Project Manager***

10. Enter NRC Meeting Notices System, make any changes, and confirm in System — ***DWMEP AA***

11. **Project Manager to check Public Meeting Notice section of NRC Public Website to confirm posting**