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PROJECT SPECIFIC PLAN FOR PREDESIGN SAMPLING IN THE SOLID WASTE LANDFILL AND THE FIRE TRAINING FACILITY

SOIL AND DISPOSAL FACILITY PROJECT

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

OCTOBER 17, 2001

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

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LIST OF ACRONYMS AND ABBREVIATIONS

ASCOC	area-specific constituent of concern
ASL	analytical support level
ccpm	corrected counts per minute
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	constituent of concern
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
ECDC	Engineering/Construction Document Control
FACTS	Fernald Analytical Computerized Tracking System
FAL	Field Activity Log
FEMP	Fernald Environmental Management Project
FRL	final remediation level
FTF	Fire Training Facility
GC/MS	gas chromatograph/mass spectrograph
GFAA	graphite-furnace atomic absorption spectrometry
GPS	global positioning system
HPGe	high-purity germanium detector
HPLC	high-performance liquid chromatography
HRMS	high-resolution mass spectrometry
HWMU	hazardous waste management unit
IC	ion chromatrography
ICP/AES	inductively coupled plasma/atomic electron spectrometry
ICP/MS	inductively coupled plasma/mass spectrometry
LAN	Local Area Network
MDC	minimum detection concentration
mg/kg	milligrams per kilogram
OSDF	On-Site Disposal Facility
PCBs	polychlorinated biphenyls
pCi/g	picoCuries per gram
PID	photoionization detector
ppm	parts per million
PSP	Project Specific Plan
QA	Quality Assurance
RA28	Removal Action No. 28
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RMS	Radiation Measurement System
RSS	Radiation Scanning System
RTIMP	Real-Time Instrumentation Measurement Program
RTRAK	Real-Time Radiation Tracking System
SDFP	Soil and Disposal Facility Project
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SED	Sitewide Environmental Database
SEP	Sitewide Excavation Plan
SWL	Solid Waste Landfill
TAL	Target Analyte List

LIST OF ACRONYMS AND ABBREVIATIONS

TBD	to be determined
V/FCN	Variance/Field Change Notice
VOA	volatile organic analysis
VOC	volatile organic compound
WAC	waste acceptance criteria
WAO	Waste Acceptance Organization

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this project specific plan (PSP) is to provide details of the predesign sampling and real-time data collection activities to be conducted in the Solid Waste Landfill (SWL) and the Fire Training Facility (FTF). These areas are located in remediation Area 6 of the Fernald Environmental Management Project (FEMP). The SWL is located in the northeastern corner of the Waste Pit Area, northwest of the Former Production Area (see Figure 1-1). The FTF is located along the northeastern fence line of the Former Production Area. There will be approximately 2 acres under investigation during this PSP. Sampling data collection activities of the SWL are necessary to help determine the depth of remediation that is needed. The data collected will also be used to determine the appropriate disposition and extent of the material.

Sampling activities carried out under this PSP will be performed in accordance with the Sitewide Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Quality Assurance Project Plan (SCQ), the Sitewide Excavation Plan (SEP), the Waste Acceptance Criteria (WAC) Attainment Plan for the On-Site Disposal Facility (OSDF), and Data Quality Objectives (DQO) SL-048, Revision 5 and SL-056, Revision 0 (Appendix A).

1.2 KEY PERSONNEL

The team members responsible for coordination of work in accordance with this PSP are listed in Table 1-1.

TABLE 1-1
KEY PERSONNEL

Title	Primary	Alternate
DOE Contact	Robert Janke	Kathi Nickel
Project Manager	Jyh-Dong Chiou	Frank Miller
Characterization Lead	Frank Miller	TBD
RTIMP Lead	Dale Seiller	TBD
Field Sampling Lead	Tom Buhrlage	Jim Hey
Surveying Lead	Jim Schwing	Andy Clinton
WAO Contact	Linda Barlow	TBD
Laboratory Contact	Denise Arico	Brenda Collier
Data Validation Contact	Jim Chambers	Jim Cross
Field Data Validation Contact	Andy Sandfoss	Jim Chambers
Data Management Lead	Frank Miller	TBD
Radiological Control Contact	Corey Fabricante	TBD
FACTS/SED Database Contact	Anna Russell	Krista Blades
Quality Assurance Contact	Reinhard Friske	Frank Thompson
Safety and Health Contact	Debra Grant	Jeff Middaugh

FACTS - Fernald Analytical Computerized Tracking System
RTIMP - Real-Time Instrumentation Measurement Program
SED - Sitewide Environmental Database
TBD - to be determined
WAO - Waste Acceptance Organization

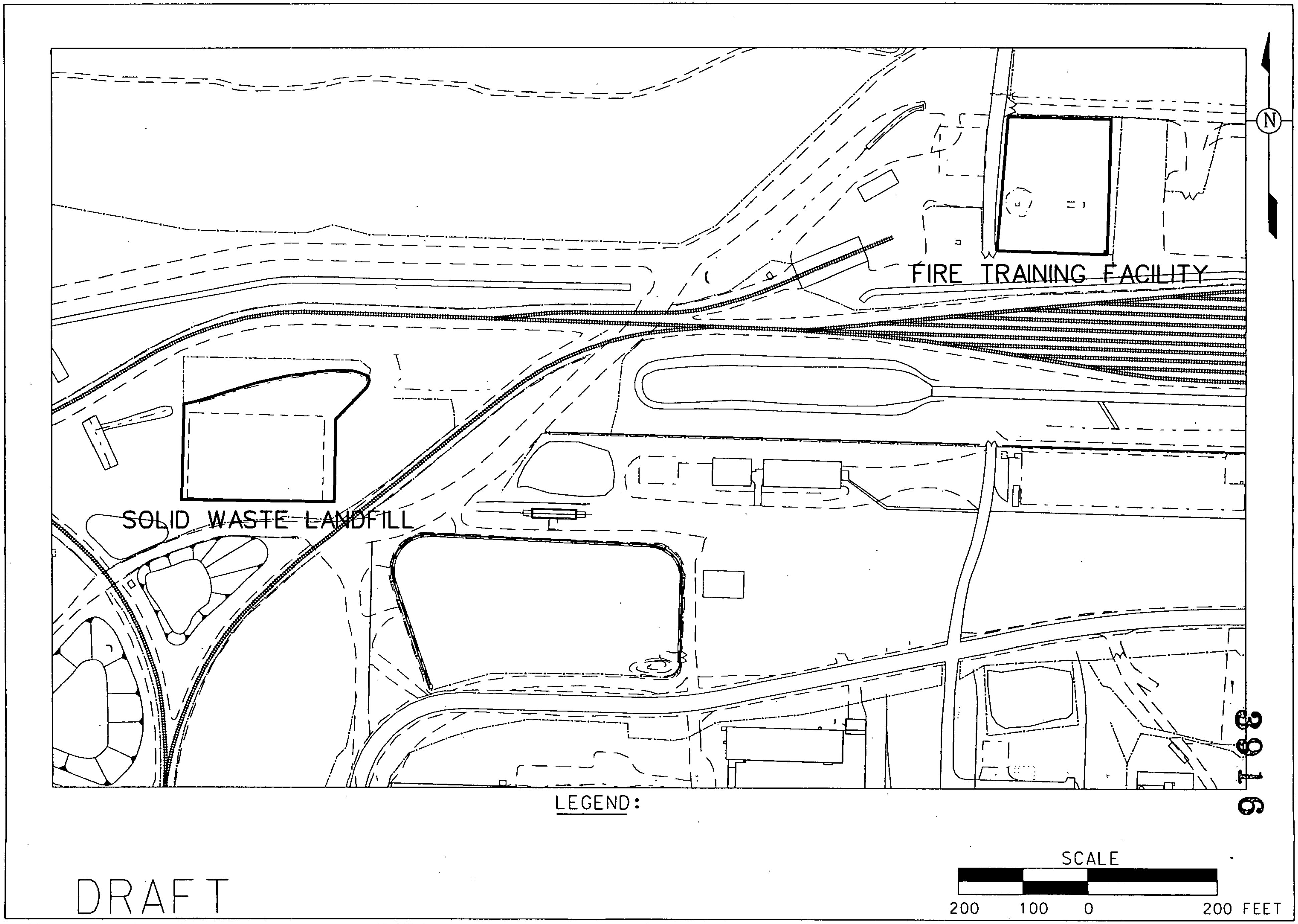

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FIGURE 1-1. LOCATION MAP FOR THE SOLID WASTE LANDFILL AND THE FIRE TRAINING FACILITY

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2.0 PREDESIGN SAMPLING IN THE SOLID WASTE LANDFILL

2.1 HISTORY

The SWL covers a flat, rectangular area of approximately 1-acre and has been inactive since 1986. Although its operational history is not well documented, limited operational records indicate that dumping commenced in mid-1974. The facility was planned as a sanitary landfill for non-burnable trash. Materials reportedly buried include non-burnable and non-radioactive solid wastes (cafeteria waste, rubbish, etc.), non-radioactive construction-related rubble, and double-bagged and bulk quantities of non-radioactive asbestos. A trenching investigation conducted in 1992 encountered burnable wastes (bagged trash and wood), possible burnable trash (respirator cartridges, asphalt roofing materials, medical wastes, fire hoses, and rubber hoses/belts), and non-burnable wastes (unidentified high activity radioactive waste, medicine vials, bagged asbestos, ceramic tiles, possible magnesium fluoride, glass acid bottles, steel cables/cans, paint cans, and copper tubing). Remedial Investigation/Feasibility Study (RI/FS) borings (Figure 2-1) indicated the depth of waste material over most of the landfill to be 10 feet or less below current ground level, although a few borings detected waste material at depths up to 20 feet deep in the southeastern corner. The total volume of waste material is calculated to be approximately 14,425 cubic yards.

2.2 SCOPE

This PSP covers all data collection activities associated with predesign in the SWL, including physical sampling and real-time measurements. This PSP supplements previous investigations and does not cover any certification sampling. Nineteen boring locations have initially been selected within this investigation area for physical sampling.

All data collection activities will be consistent with the SCQ and Section 3.1 of the SEP. Physical samples will be collected in accordance with DQO SL-048, Revision 5 and SL-056, Revision 0 (Appendix A). The data will be utilized to assess whether constituent of concern (COC) concentrations in these areas are lower than the final remediation levels (FRLs) outlined in the Operable Unit 2 Record of Decision. The data collected under this plan will also be utilized to determine whether soil and soil-like material from the area meet the OSDF WAC, as defined in the SEP, the OSDF WAC Attainment Plan, and the Impacted Materials Placement Plan. All sampling activities and characterization data collection activities will conform to the requirements of the documents listed in Section 7.0.

2.3 DETERMINATION OF FRL COCs AND WAC COCs

2.3.1 WAC COCs

A search of the Sitewide Environmental Database (SED) for data from all borings in the SWL was performed to identify all constituents present at concentrations that meet or exceed the OSDF WAC. Total uranium was the only analyte that exceeded the OSDF WAC. These above-WAC locations were further investigated per PSP for Sampling of Miscellaneous Area for OSDF WAC Attainment. Therefore, the sample intervals that will be collected to determine WAC status will be in areas lacking data and will be analyzed for total uranium. Technetium-99 will also be analyzed on the WAC sample intervals due to the variety of the material that was disposed into the SWL and due to the high concentrations of technetium-99 across the site. All other WAC COCs will not be retained based on the low historical data in the area.

2.3.2 FRL COCs

The base intervals, which are at the anticipated excavation design elevation, will be analyzed for the FRL COCs. Due to the variety of material disposed into the SWL, all primary and secondary COCs for Area 6, as specified in the SEP, will be analyzed during this investigation.

2.4 SAMPLING STRATEGY

Nineteen boring locations will be sampled in the SWL. Samples are being collected to fill in data gaps from historical data and bound known above-FRL locations. All historical locations are shown on Figure 2-1.

2.4.1 WAC Sampling Strategy

Boring locations were designed to determine if there is any additional above-WAC locations within the SWL. These boring locations were placed to fill in gaps within the historical data set. Samples throughout the boring will be submitted and analyzed for Target Analyte List (TAL) A, which is only looking to determine if the soil is below WAC.

2.4.2 FRL Sampling Strategy

The approximate depth of the SWL is 12 feet. Above-FRL contamination has been found at the 22-foot interval in the middle section of the SWL. Borings will be collected to support the anticipated excavation design. A small portion of the SWL will be excavated to 25 feet to capture the SWL material and all above-FRL soil contamination. The remaining portion of the SWL will be excavated to 15 feet to capture the SWL material and all above-FRL soil contamination. Borings will be advanced to 16 feet in the 15-foot excavation area and to 26 feet in the 25-foot excavation area. Samples will be collected at the base interval and analyzed to TAL B through TAL J (Appendix B) to determine whether the soil is below FRL.

The on-site laboratory has developed a more efficient method for thorium-230. For comparability purposes, five samples at location A6-SWL-14 will be collected and analyzed for thorium-230 by both available methods.

2.5 SELECTION OF SAMPLE LOCATIONS

Two historical locations, 11041 and 11039, are above-FRL for thorium-228 and thorium-232. Two historical locations, 1035 and 1722, are above-FRL for total uranium. One historical location, 1721, is above-FRL for arsenic. These locations are shown on Figure 2-2. Five of the 19 locations, A6-SWL-1 through A6-SWL-5 as shown on Figure 2-3, were chosen to further investigate these historical samples with above-FRL concentrations. These borings will be advanced to a depth of 26 feet and a sample interval will be collected at 23.0 to 24.0 feet and 25.0 to 26.0 feet. These borings will be analyzed for the constituent which is above-FRL along with the primary radionuclides. The sample identification and locations are listed in Table C-1.

Fourteen of the 19 boring locations, A6-SWL-6 through A6-SWL-19, were chosen to investigate WAC status in areas lacking data. These samples will include a base interval to assess FRL status as well. These borings will be advanced to a depth of either 16 or 26 feet, depending on location (Table C-1), for investigation. Samples will be collected at the following intervals, 0.0 to 1.0 feet, 5.0 to 6.0 feet, 10.0 to 11.0 feet, 15.0 to 16.0 feet, 20.0 to 21.0 feet and 25.0 to 26.0 feet for the samples that will be advanced to 26 feet.

Additional boring and sample locations may be identified by the Characterization Manager or designee based on results of real-time field measurements and analytical data as specified in Sections 4.0 and 5.0. All field modifications and/or additional samples will be documented in a Variance/Field Change Notice (V/FCN).

2.6 SAMPLE IDENTIFICATION

All physical samples and real-time measurements will be assigned a unique alpha-numeric identification for data tracking purposes and will contain one or more of the following designators:

1. Area Designator:	Denotes physical sampling area or real-time measurement area: A6-SWL = Area 6 Solid Waste Landfill
2. Location Designator:	Location designates the sequential number of physical samples. An alpha character (A, B, C, or D) is also included for the bounding samples. **OR** Batch number designates the sequential numbering of batch runs that are unique to each of the RMS systems **OR** Location designates the sequential number of HPGe measurements. The first measurement taken is 1 and any subsequent measurements are numbered sequentially (2, 3, 4, etc.).
3. Depth Interval (if applicable):	Denotes depth interval in 12-inch increments, 2 (0 to 1 feet), 4 (1 to 2 feet), etc.
4. Measurement Designator:	G = HPGe gamma measurement and associated moisture measurement R = Radiological analyses M = Metals analyses S = Semi-volatiles L= Volatiles P = Pesticides and PCBs H = PAHs D = Dioxins/furans V = Archived sample
5. Quality Control Designators (if necessary):	D = duplicate measurement TB = trip blank

Using these guidelines, the unique identification scheme for a physical sample being analyzed for radionuclides and metals at a depth interval of 2.0 to 3.0 feet is as follows:

A6-SWL-1-6-RM

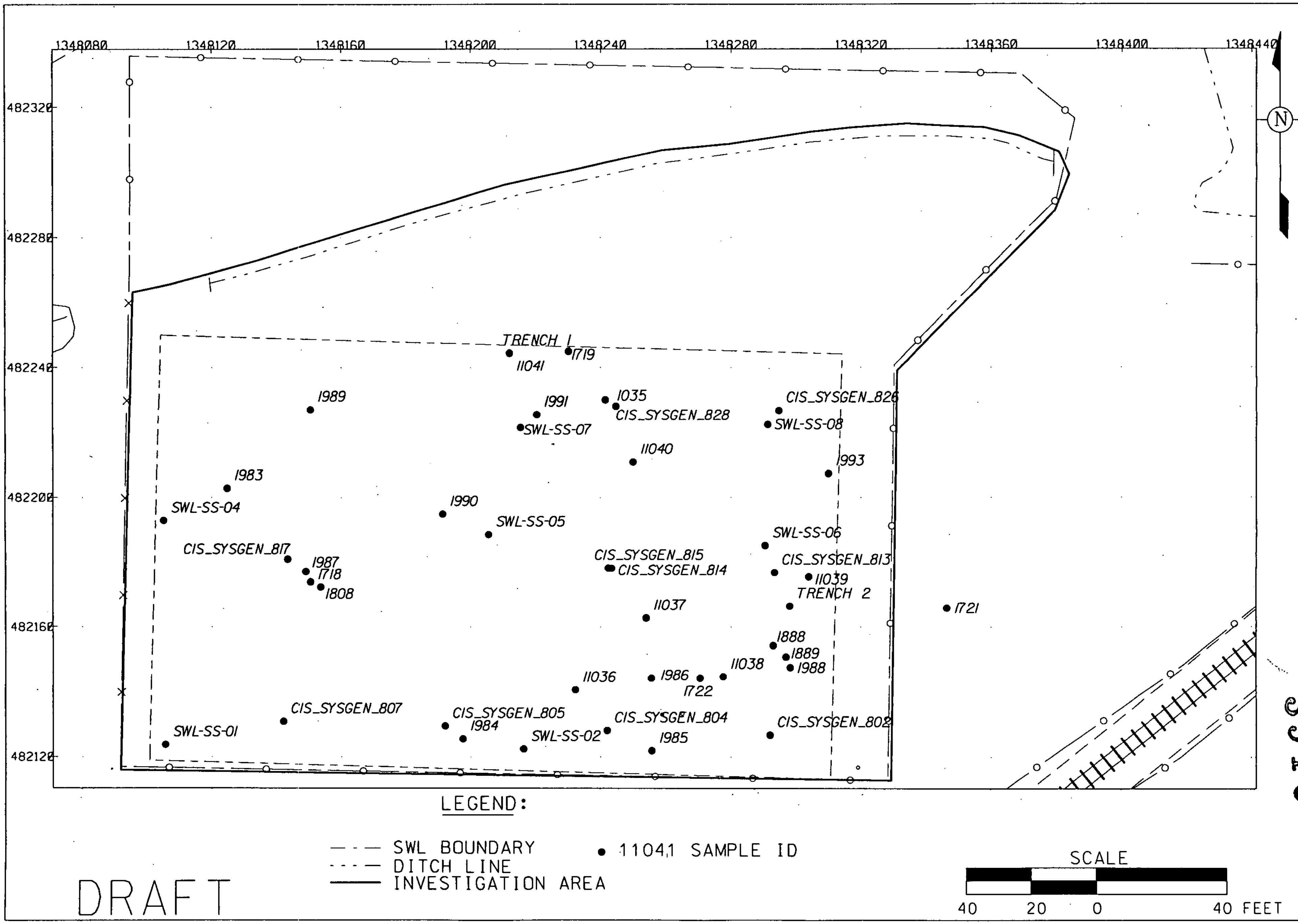

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FIGURE 2-1. ALL HISTORICAL SAMPLE LOCATIONS IN THE SWL

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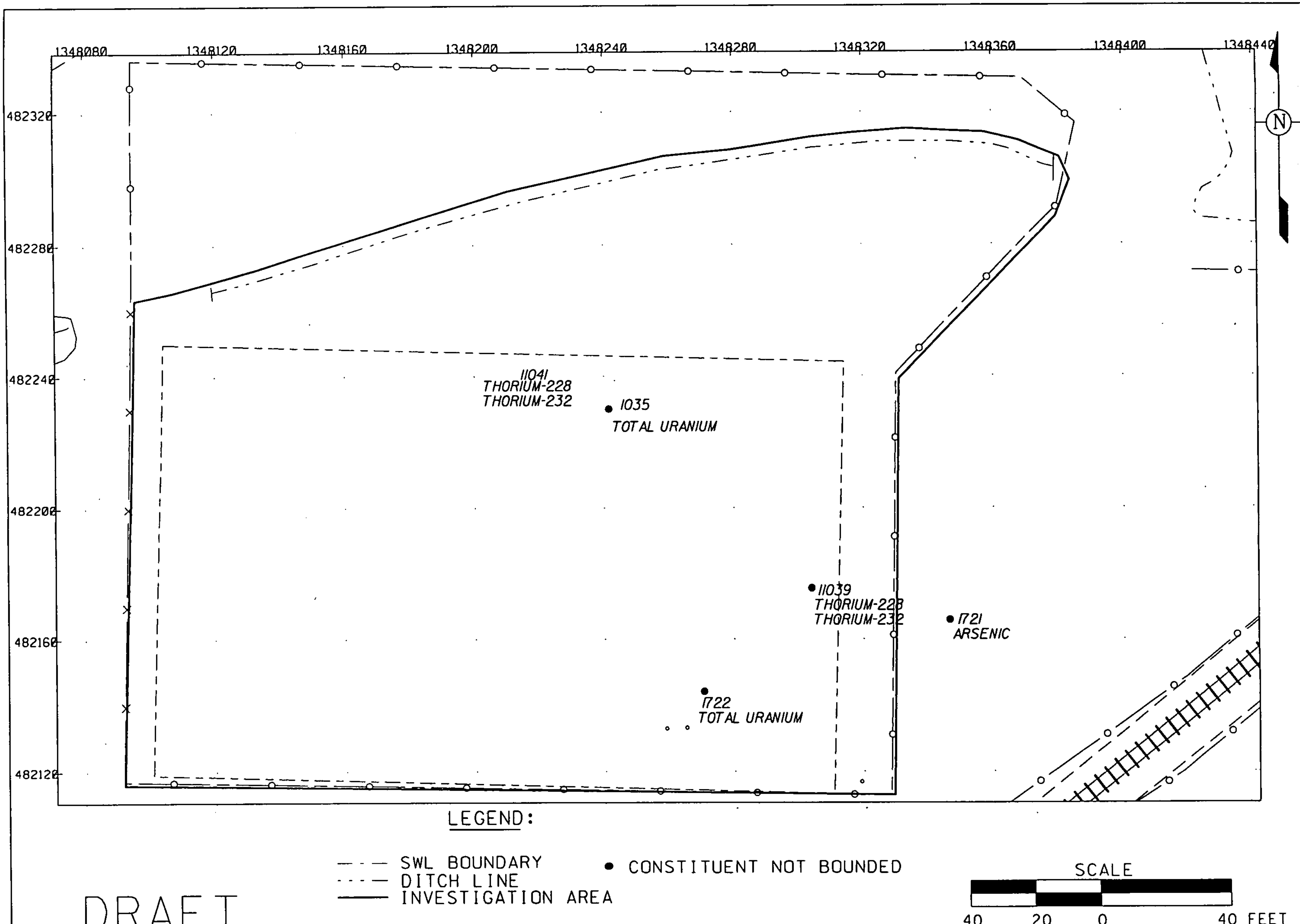

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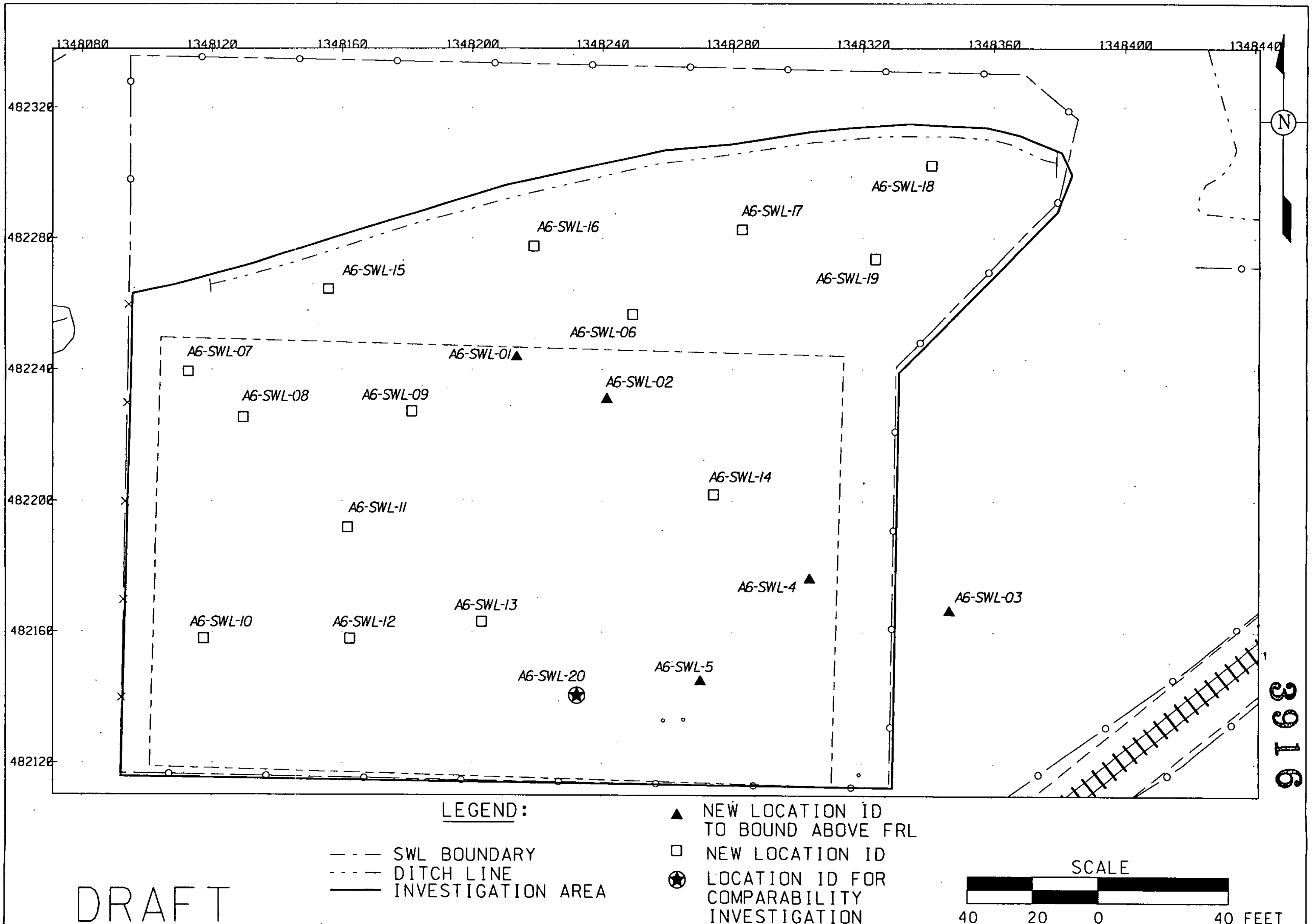

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STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 2-3. NEW SAMPLE LOCATIONS

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3.0 PREDESIGN SAMPLING IN THE FIRE TRAINING FACILITY

3.1 HISTORY

The Fire Training Facility (FTF) is located in Area 6 along the northern fence-line of the Former Production Area, just north of the railyard. The FTF was constructed in 1966 as a training facility for the Fernald Site Fire Department and the surrounding community fire departments. It operated from 1966 to 1990 and contained a block building, skid tank, open top tank, horizontal pressure vessel, metal burn areas, and a former drum storage area. The flammable and combustible substances used to start the fires at the FTF were determined to have contained hazardous and radiological materials. As a result, the FTF site and components became contaminated with hazardous materials, low level radioactive materials, and low levels of polychlorinated biphenyls (PCBs).

In August 1991, the FTF was declared a Hazardous Waste Management Unit (HWMU) 1 under Resource Conservation and Recovery Act (RCRA). The FTF was also identified as requiring a removal action subject to the regulations associated with CERCLA. Removal Action No. 28 (RA28) was initiated in July 1994 and concluded in April 1995. The removal action included: removing each structure in the FTF; excavating each area of contamination in the FTF; collecting pre- and post-excavation samples of each area; and back-filling each area. Sampling results were used to determine requirements for containerization and disposition of the resulting waste. The excavated soil was containerized or stockpiled. The containers are stored in a designated on-site storage facility pending final disposition. The stockpiles are currently still located at the FTF. These stockpiles will be sampled under the PSP for Sampling of Miscellaneous Areas for OSDF WAC Attainment. The stockpiles should be removed prior to sampling under this PSP.

Prior to determining the scope of this PSP, all historical data from the FTF were reviewed from both before and after the removal action. A summary of the data follows.

A review of the data from before the removal action indicates that above-FRL, and above-WAC values at one sample location for COCs exist in the soil. Most of these concentrations exist at a depth of 0 to 0.5 feet and 2.0 to 2.5 feet. Excavation during the removal action in the majority of the area did not exceed 6 inches. Therefore, these COCs at the above-FRL and WAC concentrations may still be present in the soil. The RA28 excavation took place before the establishment of the FRL values, which were not established until the RI/FS (completed in 1996). Therefore, the excavation was only to remove the highly and visibly contaminated soils. The above-WAC concentrations were at one location for total uranium in a part of the FTF east field area that was not excavated.

A review of the verification data from after RA28 indicated that there are still above-FRL concentrations present for the following COCs: aroclor-1260, aroclor-1254, total uranium, arsenic, beryllium, tetrachloroethene, and thorium-232. One above-FRL result for radium-226 was obtained from an area south of the asphalt pad, perhaps near the magnesium burn area. These locations are indicated on Figure 3-1, where the above FRL locations are identified with "M" for metals, "O" for organics, and "R" for radionuclides.

3.2 SCOPE

Under this PSP, soil samples will be collected to determine the boundaries of the above-FRL and WAC contamination in the FTF. The majority of above-FRL contamination is located in the east field of the FTF at a depth of 2 to 2.5 feet, within the RA28 excavation footprint. The majority of the FTF east field area was excavated, however, mostly only to a depth of 0.5 feet. Above-FRL concentrations were also present along the western edge of the former asphalt pad at the surface, prior to removal of the pad. Although verification samples were collected, those same exact locations were not re-evaluated following removal of the pad. In addition, the verification sampling, following removal of the pad, did not include all of the area-specific constituents of concern (ASCOCs) that need to be addressed under this PSP. Therefore, samples will be collected around the perimeter of the asphalt pad.

Samples will be collected at a pre-RA28 sample location, Zone 3-456 (Figure 3-2), south of the former open-top tank in the east field, to determine if above-WAC concentrations are present for total uranium. This particular sample location was not excavated during RA28.

3.3 DETERMINATION OF FRL COCs and WAC COCs

3.3.1 WAC COCs

One pre-RA28 sample location, Zone 3-456, had above-WAC concentrations of total uranium at the surface. The WAC level for total uranium is 1030 milligrams per kilogram (mg/kg). The sample analysis result at this location was 1044.6 mg/kg.

3.3.2 FRL COCs

The FTF is located within Area 6. The FRL COCs include the ASCOCs for Area 6 as listed in the SEP. Additional COCs were added based on historical sample results. Samples collected before and after RA28 indicated above-FRL concentrations of aroclor-1260, aroclor-1254, total uranium, arsenic, beryllium, tetrachloroethene, and thorium-232. All COCs for the FTF predesign project are listed in the TALs in Appendix B.

Only sample locations A6-FTF-21, A6-FTF-22, A6-FTF-29 through A6-FTF-32, and A6-FTF-41 through A6-FTF-43 will have radiological analysis for all primary radiological COCs. At all remaining locations, radiological analysis will be conducted for total uranium and total thorium as all other primary radiological COCs have been bounded based on historical sample results.

It is the intent of the PSP to bound non-total uranium/thorium contamination that is above FRL that will drive remediation beyond the extent of total uranium/thorium contamination.

A search of the SED was performed to identify constituents present at concentrations that exceed the Area 6 FRLs. These results were compared to the total uranium and total thorium concentrations to identify areas where non-total uranium/thorium FRL exceedances are located outside the soil volume that is currently planned to be excavated due to total uranium/thorium contamination. In the east-field area as well as the asphalt pad area (former block building) the total uranium/thorium contamination was deeper than non-total uranium/thorium contamination in all areas except for two locations, Zone 3-435. At these locations radium and thorium will be included in the analytical list.

3.4 SAMPLING STRATEGY

Fifty-eight boring locations will be sampled in the FTF. The boring locations are shown in Figure 3-2 and listed with identification numbers in Table C-2. Boring locations were designed to determine if there is any additional above-WAC locations and the extent of impacted above-FRL material. Above-FRL contamination has been found at the surface, the 2.0 to 2.5-foot interval, the 6.0 to 6.5-foot interval, and the 10.0 to 10.5-foot interval. Predesign sampling will be conducted to a depth of 4, 6, 9, and 14 feet, depending on the location, with samples collected in 12-inch intervals as indicated on Table C-2.

Several locations were chosen to further investigate historical sample locations from both before and after RA28 with above-FRL concentrations. The area in the east field of the FTF where the open-top tank was located (eastern side of field) contains above-FRL concentrations of organic and inorganic COCs. The area in the east field where the skid tank and pond were located (western side of field) contains above-FRL concentrations primarily of organic and radiological COCs. In both of these areas, the majority of above-FRL levels are present primarily at a depth of 2.0 to 2.5 feet. The majority of the east field area was excavated, but only to depth of 0.5 feet, leaving the soil containing the above-FRL constituents in place.

One pre-RA28 sample location Zone 3-456 south of the open-top tank had above-WAC concentrations of uranium at the surface. This location was outside of the RA28 excavated area. The sample location will be investigated again for above-WAC and above-FRL radiological constituents. These samples will be collected to a depth of 6 feet.

Pre-RA28 samples collected on the west perimeter of the asphalt pad indicate above-FRL concentrations of organics and radiological COCs. Only two of the post-RA28 sample locations were analyzed for radiological constituents. Those two locations RA28-SP-1CP and RA28-SP-2CP are situated where the concrete building was standing in the center of the pad. The verification samples for the remainder of the pad area were analyzed only for organic and inorganic COCs. Samples will be collected from the perimeter of the former asphalt pad. All ASCOCs were not analyzed for during the verification sampling following the removal action. In addition, the area of the former asphalt pad will be quartered. One sample will be collected from the center of each quarter and will be analyzed for the primary radiological COCs to a depth of 4 feet. The sample location in the northeast quadrant will be analyzed for all ASCOCs.

One post-RA28 sample location 044703-009 south of the former asphalt pad had above-FRL concentrations for radium-226 at the surface. This sample location area will be re-investigated for radiological constituents to a depth of 4 feet. Sample locations were selected in these areas to re-sample the original location and to bound it by a distance of 10 feet in four directions: northwest, northeast, southwest, and southeast.

One pre-RA28 sample location south of the southern boundary fence, SS-15, had above-FRL concentrations for N-Nitroso-di-n-propylamine at a depth of 2 to 2.5 feet. This sample location area will be re-investigated for radiological constituents to a depth of 6 feet. Sample locations were selected in these areas to re-sample the original location and to bound it by a distance of 10 feet in four directions: northwest, northeast, southwest, and southeast.

3.5 SELECTION OF SAMPLE LOCATIONS

3.5.1 WAC ATTAINMENT SAMPLE LOCATIONS

WAC levels at historical sample location Zone 3-456 will be reinvestigated. The original sample location will be re-sampled to a depth of 6 feet (sample location 15). Four sample locations (A6-FTF-13, A6-FTF-14, A6-FTF-16, and A6-FTF-17) will be placed a distance of 5 feet from the original sample location, one in each of the following directions: northwest, northeast, southwest, and southeast (Figure 3-2).

3.5.2 SELECTION OF FRL ATTAINMENT SAMPLE LOCATIONS

General East Field Area

FRL attainment sample locations are identified on Figure 3-2. Four sample locations (A6-FTF-1 through A6-FTF-4) in the northern portion of the east field were chosen because there is currently no data from that area. The majority of the locations identified in the east field (A6-FTF-5 through A6-FTF-12, A6-FTF-18 through A6-FTF-23, A6-FTF-45, and A6-FTF-48 through A6-FTF-58) were selected primarily to bound areas historically identified as having above-FRL concentrations of radiological, organic or inorganic COCs.

Former Asphalt Pad Area

The sample locations identified around the perimeter of the former asphalt pad area (Figure 3-2) were selected to bound areas historically identified as having above-FRL concentrations of radiological or organic COCs (A6-FTF-34 through A6-FTF-40), and to provide supplemental data to the verification data collected following RA28 (A6-FTF-46 and A6-FTF-47). Not all ASCOCs were included in the verification sampling following the removal action. Four sample locations are located within the boundaries of the former asphalt pad (A6-FTF-41 through A6-FTF-44), one in each quadrant, to re-investigate the presence of radiological constituents in the soil. Only two historical samples were analyzed for radiological COCs from within the pad area (from beneath where the concrete building was located) following RA28. All results were below their respective FRLs. The northeast quadrant sample point will also be analyzed for organic and inorganic constituents to supplement RA28 verification samples and to bound the northeast corner for those constituents.

One isolated historical sample (at a location distant from the majority of all sample locations), SS-15, was identified as having an above-FRL concentration for N-Nitroso-di-n-propylamine and another isolated (at a distant location) historical sample (044703-009) was identified as having an above-FRL concentration for radium-226. Sample locations were selected in these areas to re-sample the original location and to bound it by a distance of 10 feet in four directions: northwest, northeast, southwest, and southeast. (Sample locations are A6-FTF-24 through A6-FTF-27 and A6-FTF-29 through A6-FTF-33 respectively.)

3.6 SAMPLE IDENTIFICATION

All physical samples and real-time measurements will be assigned a unique alpha-numeric identification for data tracking purposes and will contain one or more of the following designators:

1. Area Designator:	Denotes physical sampling area or real-time measurement area: A6-FTF = Area 6 Fire Training Facility
2. Location Designator:	Location designates the sequential number of physical samples. The first sample taken is 1 and any subsequent samples are numbered sequentially (2, 3, 4, etc.). An alpha character (A, B, C, or D) is also included for the bounding samples. **OR** Batch number designates the sequential numbering of batch runs that are unique to each of the RMS systems **OR** Location designates the sequential number of HPGe measurements. The first measurement taken is 1 and any subsequent measurements are numbered sequentially (2, 3, 4, etc.).
3. Depth Interval (if applicable):	Denotes depth interval in 12-inch increments, 2 (0 to 1 feet), 4 (1 to 2 feet), etc.

4. Measurement Designator:
   G = HPGe gamma measurement and associated moisture measurement
   R = Radiological analyses
   M = Metals analyses
   S = Semi-volatiles
   L= Volatiles
   P = Pesticides and PCBs
   H = PAHs
   D = Dioxins/furans
   V = Archived sample

5. Quality Control Designators (if necessary):
   D = duplicate measurement
   TB = trip blank

Using these guidelines, the unique identification scheme for a physical sample being analyzed for radionuclides and metals at a depth interval of 0 to 1.0 feet is as follows:

A6-FTF-1-2-RM

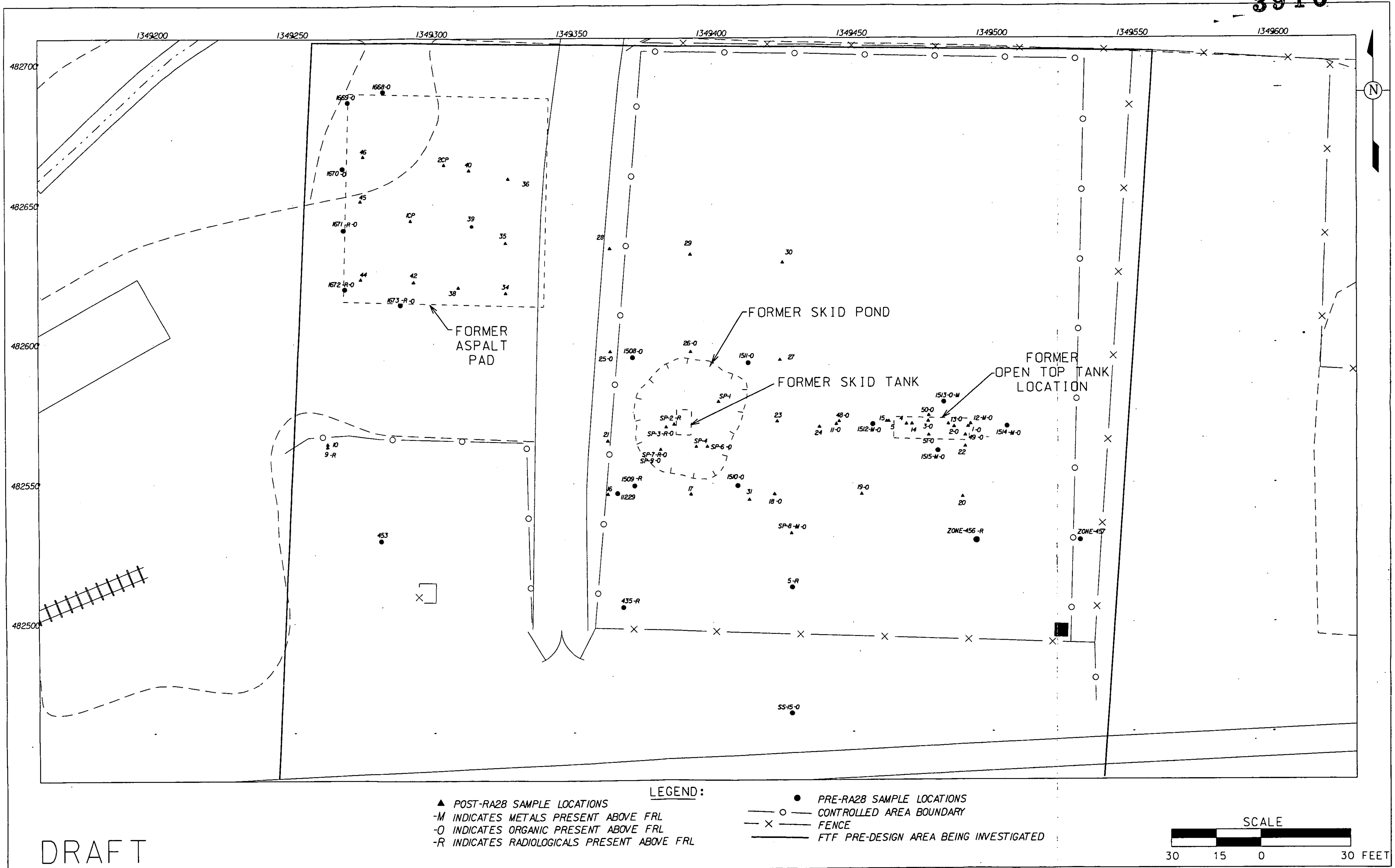

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FIGURE 3-1. -FIRE TRAINING FACILITY HISTORICAL SAMPLE LOCATIONS

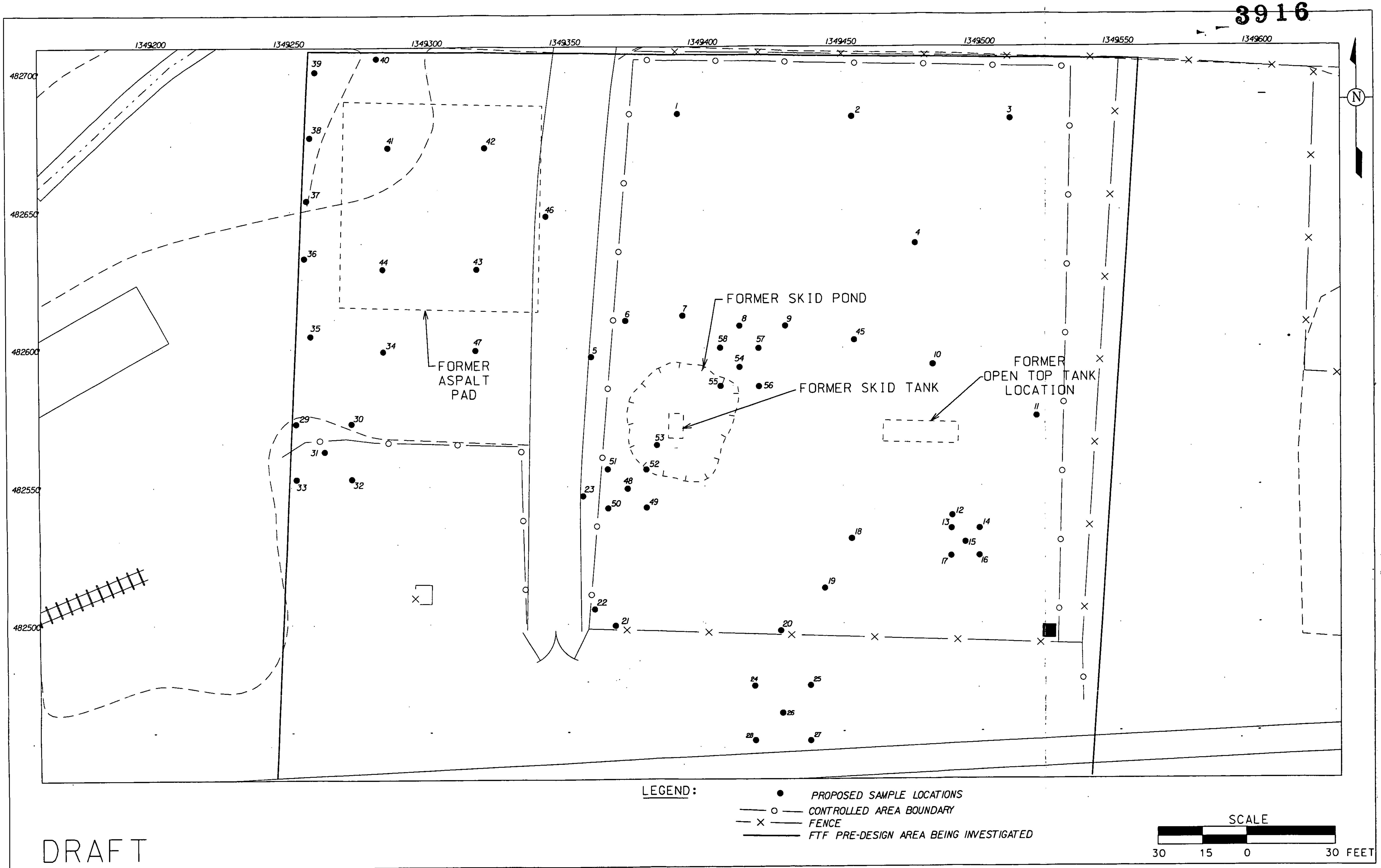

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FIGURE 3-2. -FIRE TRAINING FACILITY PRE-DESIGN SAMPLE LOCATIONS

4.0 REAL-TIME MEASUREMENTS

Real-time data will be used to assess the need for additional physical sample locations or to adjust existing sample locations if necessary in the SWL and FTF. Real-time surface measurements will be collected at Analytical Support Level (ASL) A and will require no data validation (refer to the SCQ for a definition of ASLs).

The Real-Time Radiation Tracking System (RTRAK) is utilized for larger flat areas that are readily accessible. The Radiation Scanning System (RSS) is utilized for smaller areas, gradual slopes, or areas not accessible by the RTRAK. The high-purity germanium detector (HPGe) is utilized for areas that are inaccessible to both the RTRAK and the RSS. A walkdown of the area by Characterization and/or RTIMP representatives may be required to determine the appropriate type of *in situ* gamma spectroscopy equipment needed. The decision to use any of these evaluation techniques will be made by the Characterization Manager and RTIMP Field Manager or their designees.

4.1 RMS DATA ACQUISITION

The Radiation Measurement System (RMS) will be used to conduct a surface scan covering as close to 100 percent coverage as possible of the accessible area. The spectral acquisition time will be 4 seconds with data collected at a detector speed of 1 mile per hour [as determined by the on-board global positioning system (GPS)]. The RTRAK or RSS passes will typically be in a back and forth pattern after two perimeter passes have been completed. Alternatively, a circular pattern may be more appropriate. The RTRAK overlapping passes are achieved by placing the innermost tire track in the former outermost tire track from the previous passes, achieving an approximate 0.4-meter scanning overlap. Stakes or other markers may be used to keep the RSS on track. The RTRAK or RSS measurements will be accompanied by GPS northing and easting coordinates. GPS operations are described in Section 5.8 of the User Guidelines, Measurement Strategies, and Operational Factors for Deployment of In-Situ Gamma Spectroscopy at the Fernald Site (User's Manual) and manufacturer's technical manuals.

The RTRAK or RSS will use a two-point running average (2 spectra average) to determine the trigger level of one times (1x) the FRL for the following COCs: total uranium [1x FRL = 82 parts per million (ppm)], thorium-232 [1x FRL = 1.5 picoCuries per gram (pCi/g)], radium-226 (1x FRL = 1.7 pCi/g).

If RTRAK or RSS scans indicate measurement results greater than 1x FRL for total uranium, thorium-232, or radium-226, the location of the above-trigger level measurements may be further investigated with HPGe measurements or physical sampling. This determination will be at the discretion of the Characterization Manager or designee. If confirmation and/or delineation measurements are collected, the data will be collected at ASL B and 10 percent will be validated.

4.2 HPGe DATA ACQUISITION

If the HPGe detectors are used to conduct a surface scan, the data acquisition parameters will be a detector height of 1 meter and a spectral acquisition time of 15 minutes. If more than one HPGe measurement is required, the center of the measurements should be located nominally 11 meters (approximately 36 feet) apart to achieve 99.1 percent coverage (see User's Manual). The HPGe trigger level for characterization with 1-meter detector heights is 1x the FRL for the following COCs: total uranium (1x FRL = 82 ppm), thorium-232 (1x FRL = 1.5 pCi/g), radium-226 (1x FRL = 1.7 pCi/g). If the HPGe scans indicate measurement results greater than 1x FRL for total uranium, thorium-232 or radium-226, then the location of the above-trigger level measurements may be further investigated with physical sampling. This determination will be at the discretion of the Characterization Manager or designee.

HPGe measurements will be accompanied by GPS northing and easting coordinates. One duplicate HPGe measurement will be collected for every 20 HPGe measurements performed. The duplicate will be collected immediately after the initial measurement at the same acquisition time and detector height.

4.3 CONFIRMATION AND DELINEATION

Confirmation (Phase II) can be performed with HPGe detectors to confirm any areas above 1xFRL with RMS for the appropriate COC and 1x FRL for HPGe (at 1 meter). A HPGe scan will be collected at both 1 meter and 31 centimeters (cm) for a RMS confirmation. Either measurement over 2x FRL at 1 meter or 31 cm will be considered a confirmation. A HPGe scan will be collected at both 31 cm and 15 cm for a HPGe confirmation.

Delineation can be performed to determine the horizontal migration of contamination for the COC at 15-cm height and an acquisition time of 15 minutes. The area will be considered a "hot spot" if data is

3x FRL for the COC. This area will the be grided in a triangular grid with a 2-meter distance between each detector location.

4.4 SURFACE MOISTURE MEASUREMENTS

Surface moisture measurements are used to correct *in situ* RTIMP equipment gamma spectroscopy measurement data in order to report data on a dry weight basis prior to mapping. Surface moisture measurements will be collected with an *in situ* moisture measurement instrument (i.e., Troxler® moisture gauge or Zeltex® Infrared Moisture Meter) within 8 hours of the collection of gamma spectroscopy measurement data. Moisture measurements may be taken more frequently if ambient weather or soil moisture conditions change or are expected to change, including watering for dust control. Field conditions, such as weather, will be noted on the applicable electronic field worksheet.

At least one surface moisture measurement will be collected for each area that is approximately 0.5 acre (100 feet by 200 feet) in size or smaller. More than one moisture measurement can be collected for each area if the surface moisture appears visibly different over the area. If a large difference in measurements is noted by the RTIMP Lead or designee, the data will be re-evaluated. One surface moisture measurement will be collected at each HPGe measurement location.

If conditions prevent the use of a field moisture instrument, a default moisture value of 20 percent (which will overcorrect data in dry conditions and undercorrect in wet conditions) may be used. Field moisture measurements and moisture-corrected data are discussed in detail in Sections 3.8 and 5.2 of the User's Manual.

4.5 REAL-TIME DATA MAPPING

As the RTIMP measurements are acquired, the data will be electronically loaded into mapping software through manual file transfer or Ethernet. A set of maps and/or data summaries will be given to the Characterization Lead or designee. Maps will be generated indicating radionuclide concentrations at geographic locations (northing and easting). The maps will depict the following:

- COC concentration maps - depicts total uranium, radium-226, thorium-232 concentrations (2 point running average) at 0.5x FRL, 1x FRL, 2x FRL, and 3x FRL. The total uranium concentration maps will also depict above-WAC concentrations (721 ppm for RTRAK/RSS and 928 ppm for HPGe), if present.

- HPGe location map - shows field of view circles that are color coded for COC concentrations and denotes identification number for each HPGe measurement, including a data summary printout for each HPGe measurement.

5.0 SAMPLE COLLECTION AND METHODS

Samples will be collected using the Geoprobe® Model 5400 in accordance with Procedure EQT-06, Geoprobe® Model 5400 - Operation and Maintenance, where locations support the safe operation of the Geoprobe® vehicle. Hand augering or direct-push liner sampling will be conducted in accordance with Procedure SMPL-01, Solids Sampling, when the Geoprobe® cannot be used. At each sampling location, the surface vegetation within a 6-inch radius of the sample point will be removed using a stainless steel trowel or by hand with clean nitrile gloves while taking care to minimize the removal of any soil.

Soil samples will be collected from the sample intervals identified in Appendix C. If additional volume is necessary, samples will be collected from adjacent intervals and recorded on the appropriate field documentation.

All borings will be completed to at least 1 feet below the estimated depth identified in Appendix C, for field screening purposes. If refusal is encountered during the soil borings, additional borings within a 3-foot radius of the original point may be conducted. Borings will require plugging with bentonite pellets, bentonite grout slurry, or manaually collapsed immediately after sampling is completed.

If pellets are used, they will be placed in the borehole in 2-foot intervals, then hydrated with potable water.

5.1 <u>SURVEYING SAMPLE POINTS</u>

The sampling locations will be marked by the Fluor Fernald Surveying and Mapping group. Northing (Y) and easting (X) coordinate values (NAD83, Ohio South Zone, #3402) will be determined using standard survey practices and standard positioning instrumentation (electronic total stations and GPS receivers). All field personnel using survey stakes or flags will mark field locations in a manner easily identifiable. Survey information (coordinate data) will be downloaded at the completion of each survey job or at the end of each day and transferred electronically to the Survey Lead. This information will be forwarded to the Data Management Lead and/or designees.

5.2 GEOPROBE METHODS

When the Geoprobe® is used, a Geoprobe® Model 5400 with the dual-tube or macro-core sampling system will be utilized to collect the target depth intervals for the soil samples specified in Appendix C. Multiple cores may be collected at each sampling location (not to exceed a 3-foot radius of the identified sample location) to obtain sufficient sample volume for analysis if complete sample recovery is not obtained.

5.3 MANUAL SAMPLING METHODS

If Geoprobe® accessibility is not possible, soil samples will be collected using a hand auger (typically 3-inch diameter) or other methods specified in Procedure SMPL-01. The hand auger will be advanced in approximately 6-inch increments. As with core sampling, multiple holes at one sampling location (not to exceed 3 feet apart) may have to be augered to obtain sufficient volume for laboratory analysis. The same hand auger may be used through the entire depth of a single boring but will be wiped visually clean. The hand auger will be decontaminated to Level II for each interval. Borehole collapse will be monitored during core sampling to ensure sidewall slough is accounted for during augering and sample collection.

5.4 BIASED SAMPLE SELECTION

At a minimum, the sample locations summarized in Appendix C will be collected. The soil from each boring will be radiologically screened using a beta/gamma (Geiger-Mueller) survey meter and all results will be recorded on the Field Activity Log (FAL). The entire length of the soil core (or cuttings in the case of hand augering) will be surveyed to determine any intervals with beta/gamma readings above 400 corrected counts per minute (ccpm), as established in Appendix D of the Area 2, Phase I Integrated Remedial Design Package. A biased sample will be collected from any interval exceeding 400 ccpm and analyzed for total uranium only (Appendix B, TAL P). If the entire soil core is found to be less than 400 ccpm, then no biased sample will be collected from that boring. Samples will be collected from the 6-inch intervals above and below any sample intervals that are above 400 ccpm. If the interval above or below is already designated for sampling, then no additional sample will be collected in that direction. All biased samples and associated analysis will be documented in a V/FCN.

The entire length of each boring will also be screened using a photoionization detector (PID). For Geoprobe® cores, the core liners will be opened for PID screening. Any sample interval with sustained

5-ppm above-background reading on the PID will be subjected to a headspace analysis, in accordance with Procedure EQT-04, Photoionization Detector. Headspace analysis involves placing a small amount of soil into a sample container, covering the container opening with aluminum foil, placing the lid on the container, and placing it in an area where the temperature is greater than 60°F for 5 to 10 minutes. The container lid is then removed, the PID tip inserted through the aluminum foil, and a PID measurement collected for 10 seconds. The sample measurement will be recorded on the FAL. If the result of the headspace analysis is above 10 ppm, the sample interval will be submitted for VOC analysis (Appendix B, TAL Q) and documented on a V/FCN.

5.5 SOIL SAMPLE PROCESSING AND ANALYSIS

The Geoprobe® soil cores or hand-augered soil cuttings will be laid out on clean plastic and the appropriate sample intervals (as defined in Appendix C) will be separated to obtain the necessary samples following radiological and PID field screening. Any debris (e.g., wood, concrete, metal) contained in a sample interval will be removed from the sample in the field and described on the FAL. Sampling and analytical requirements are summarized in Tables 5-1 and 5-2. Radiological and inorganic analyses will be performed at the on-site laboratory with the exception of fluoride, which will be analyzed off-site. At the discretion of the laboratory manager, the listed method may be changed if the required detection limit is still met. Organics analyses will be sent to the Sample Processing Laboratory, where they will be prepared for shipment to an approved off-site laboratory in accordance with Procedure 9501, Shipping Samples to Offsite Laboratories. One alpha/beta screening sample from depth interval 2 (0 to 1.0 feet) will be collected and analyzed or the interval with the highest activity on site for samples being sent for off-site analysis.

5.6 EQUIPMENT DECONTAMINATION

Sampling equipment will be decontaminated before transporting to the sampling site. Additionally, equipment will be decontaminated, including the core sampler cutting shoe, hand auger buckets, and other sample collection tools between boring locations. All decontamination will be Level II decontamination as specified in Procedure SMPL-01. If used, the core barrel portion of the core sampler will be wiped down between sample intervals and locations to remove visible soil or material. Decontamination of the core barrel will not be necessary when using a liner insert because the core barrel will not come into contact with the sample.

5.7 SAMPLE HANDLING AND SHIPPING

Samples will be processed in accordance with Procedure SMPL-01 to ensure they are documented properly and chain of custody and sample integrity are maintained. All samples will be transported from the field to the on-site Sample Processing Laboratory for analyses.

5.8 DISPOSITION OF WASTES

During completion of physical sampling activities, field personnel may generate small amounts of soil, sediment, water, contact waste, or construction rubble that was segregated from soil samples (e.g. bolts, nails, concrete, metal). Excess soil can be placed next to the boring location. Management of these waste streams will be coordinated with WAO. WAO will evaluate the sample material (including soil archive samples) and determine the disposition based on analytical data, material type, and location. If sample material is below-WAC, the material may be placed near the sample location. Any Category 2 material may be placed in an existing Category 2 pile for OSDF placement. Above-WAC sample material will be placed in Stockpile (SP-7) (or other designated above-WAC location).

Generation of decontamination waters will be minimized in the field. This water will be disposed of in a storm water collection basin that discharges to the Advanced Wastewater Treatment Facility after approval of the FEMP Wastewater Discharge Request. Contact waste generation will be minimized by limiting contact with sample media and by only using disposable materials that are necessary.

TABLE 5-1
SAMPLING AND ANALYTICAL REQUIREMENTS FOR THE ON-SITE LABORATORY

Analyte	Method	Sample Matrix	ASL	Preserve	Holding Time	Container	Sample Mass	TAL
Total Uranium, Radium-226, Radium-228, Thorium-228, Thorium-230, Thorium-232, Cesium-137, Technetium-99	Alpha or Gamma Spectroscopy or ICP/MS	Solid	B	None	12 months	Plastic or stainless steel core liner or glass or polyethylene sample container	300 grams	A,B,C,P
Total Uranium, Radium-226, Radium-228, Thorium-228, Thorium-230, Thorium-232, Cesium-137, Technetium-99	Alpha or Gamma Spectroscopy or ICP/MS	Liquid	B	HNO_3, pH <2 cool 4°C	6 months	Plastic sample container	2 liters	A,B,C,P
Total Uranium, Total Thorium	ICP/MS	Solid	B	None	12 months	Plastic or stainless steel core liner or glass or polyethylene sample container	50 grams	K
Total Uranium, Total Thorium	ICP/MS	Liquid	B	HNO_3, pH <2 cool 4°C	6 months	Plastic sample container	250 ml	K
Arsenic, Beryllium, Silver, Antimony, Cadmium	ICP/AES, ICP/MS, or GFAA	Solid	B	Cool, 4°C	6 months	Collect in same core liner as rad sample	100 grams	D,L
Arsenic, Beryllium, Silver, Antimony, Cadmium	ICP/AES, ICP/MS, or GFAA	Liquid	B	HNO_3, pH <2 cool 4°C	6 months	Plastic	1 liter	D,L

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GFAA – gas chromatograph/mass spectrograph
ICP/AES – inductively coupled plasma/atomic electron spectrometry
ICP/MS – inductively coupled plasma/mass spectrometry

TABLE 5-2
SAMPLING AND ANALYTICAL REQUIREMENTS FOR THE OFF-SITE LABORATORY

Analyte	Method	Sample Matrix	ASL	Preserve	Holding Time	Container	Sample Mass
PAHs – Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	HPLC	Solid	B	Cool, 4°C	14 Days	Glass with teflon lined cap	100 grams
PAHs – Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	HPLC	Liquid (rinsate)	B	Cool, 4°C	7 Days	Amber glass with teflon-lined cap	1 liter
SEMI-VOLATILES – 3,3 Dichlorobenzidine N-nitroso-di-n-propylamine Pentachlorophenol	GC/MS	Solid	B	Cool, 4°C	14 Days	Glass with teflon lined cap	100 grams
SEMI-VOLATILES – 3,3 Dichlorobenzidine N-nitroso-di-n-propylamine Pentachlorophenol	GC/MS	Liquid (rinsate)	B	Cool, 4°C	7 Days	Amber glass with teflon-lined cap	1 liter
VOAs- Bromodichloromethane 1,1-dichloroethene Tetrachloroethene	GC/MS	Solid	B	Cool, 4°C	14 Days	60 ml glass with teflon lined septa	50 grams (no headspace)
VOAs- Bromodichloromethane 1,1-dichloroethene Tetracholorethene	GC/MS	Liquid (Rinsate and trip blank)	B	Cool, 4°C H_2SO_4 to pH<2	14 Days	Three 40-ml glass with teflon lined septa	NA
PCBs- Aroclor-1254 Aroclor-1260	GC	Solid	B	Cool, 4°C	14 Days	Glass with teflon lined cap	100 grams

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TABLE 5-2
SAMPLING AND ANALYTICAL REQUIREMENTS FOR THE OFF-SITE LABORATORY

Analyte	Method	Sample Matrix	ASL	Preserve	Holding Time	Container	Sample Mass
PCBs- Aroclor-1254 Aroclor-1260	GC	Liquid (rinsate)	B	Cool, 4°C	7 Days	Amber glass with teflon lined cap	1 liter
PESTICIDES – Dieldrin Alpha-chlordane Gamma-chlordane	GC	Solid	B	Cool, 4°C	14 Days	Glass with teflon lined cap	100 grams
PESTICIDES – Dieldrin Alpha-chlordane Gamma-chlordane	GC	Liquid (rinsate)	B	Cool, 4°C	7 Days	Amber glass with teflon lined cap	1 liter
DIOXINS – Heptachlorodibenzo-p-dioxins Heptachlorodibenzofurans Octachlorodibenzo-p-dioxins	HRMS	Solid	B	Cool, 4°C	14 Days	Glass with teflon lined cap	100 grams
DIOXINS – Heptachlorodibenzo-p-dioxins Heptachlorodibenzofurans Octachlorodibenzo-p-dioxins	HRMS	Liquid	B	Cool, 4°C	7 Days	Amber glass with teflon lined cap	2 1-liter bottles
Fluoride	IC	Solid	B	Cool, 4°C	28 days	Polyethelene with teflon lined cap	20 grams
Fluoride	IC	Liquid	B	Cool, 4°C	28 days	Plastic	500 ml

GC/MS – gas chromatography/mass spectrograph
HPLC – high-performance liquid chromatography
HRMS – high-resolution mass spectrometry
IC – ion chromatrography
VOAs – volatile organic compounds

6.0 QUALITY ASSURANCE REQUIREMENTS

6.1 FIELD QUALITY CONTROL SAMPLES, ANALYTICAL REQUIREMENTS AND DATA VALIDATION

In accordance with the requirements of DQO SL-048, Revision 5 and SL-056, Revision 0 (Appendix A), the field quality control, analytical, and data validation requirements are as follows:

- All laboratory analyses will be performed at ASL B

- All analytical data will require a certificate of analysis and 10 percent of the analytical data will also require the associated quality assurance/quality control results. A minimum of 10 percent of the analytical data from each laboratory will be validated to ASL B. All field data forms will be validated

- One trip blank will be taken each day that volatile organic compound (VOC) samples are collected or one per 20 VOC samples that are collected, whichever is more frequent. In addition, a lab matrix spike duplicate will be designated on the Chain of Custody form for each organic release sent for off-site analysis.

If any sample collection or analysis methods are used that are not in accordance with the SCQ, the Project Manager and Characterization Manager must determine if the qualitative data from the samples will be beneficial to WAC attainment decision making. If the data will be beneficial, the Project Manager and Characterization Manager will ensure that:

- The PSP is revised through a V/FCN to include references confirming that the new method is sufficient to support data needs,

- Variations from the SCQ methodology are documented in the PSP, or

- Data validation of the affected samples is requested or qualifier codes of J (estimated) and R (rejected) be attached to detected and non-detected results, respectively.

6.2 APPLICABLE PROCEDURES, MANUALS AND DOCUMENTS

To assure consistency and data integrity, field activities in support of this PSP will follow the requirements and responsibilities outlined in controlled procedures and manufacturer operational manuals. Applicable procedures and manuals include the following:

- 9501, Shipping Samples to Offsite Labs
- ADM-02, Field Project Prerequisites
- ADM-16, In-Situ Gamma Spectrometry Quality Control Measurement
- ADM-17, In-Situ Gamma Spectrometry Data Management

- ADM-19, In-Situ Gamma Spectrometry Field Prerequisites
- EP-0003, Unexpected Discovery of Cultural Resources
- EQT-04, Photoionization Detector
- EQT-05, Geodimeter® 4000 Surveying System
- EQT-06, Geoprobe® Model 5400 Operation and Maintenance Manual
- EQT-22, High Purity Germanium Detector In-Situ Efficiency Calibration
- EQT-23, High Purity Germanium Detectors
- EQT-32, Troxler® 3440 Series Surface Moisture/Density Gauge
- EQT-33, Real-Time Differential Global Positioning System Operation
- EQT-39, Zeltex® Infrared Moisture Meter
- EQT-41, Radiation Measuring Systems
- RM-0021, Safety Performance Requirements Manual
- SMPL-01, Solids Sampling
- SMPL-21, Collection of Field Quality Control Samples
- Sitewide Excavation Plan (SEP)
- Area 2, Phase I Integrated Remedial Design Package
- OSDF Impacted Materials Placement Plan
- OSDF WAC Attainment Plan
- User Guidelines, Measurement Strategies, and Operational Factors for Deployment of In-Situ Gamma Spectroscopy at the Fernald Site (User's Manual)
- Sitewide CERCLA Quality (SCQ) Assurance Project Plan
- In-Situ Gamma Spectroscopy Addendum to the SCQ Assurance Project Plan
- RTRAK Applicability Study
- RTIMP Quality Assurance Plan
- PSP for RTIMP WAC Attainment Scanning in Miscellaneous Areas
- PSP for Sampling of Miscellaneous Area for OSDF WAC Attainment.

6.3 PROJECT REQUIREMENTS FOR INDEPENDENT ASSESSMENTS

Project management has ultimate responsibility for the quality of the work processes and the results of the sampling activities covered by this PSP. The Quality Assurance (QA) organization may conduct independent assessments of the work process and operations to assure the quality of performance. Assessment will encompass technical and procedural requirements of this PSP and the SCQ. Independent assessments will be performed by conducting a surveillance. Surveillances will be planned and documented according to Section 12.3 of the SCQ.

6.4 IMPLEMENTATION OF FIELD CHANGES

Changes to the PSP will be noted in the applicable FALs and on a V/FCN. QA must receive the completed V/FCN, which includes the signatures of the Characterization Manager, Sampling Lead, Project Manager, WAO, QA, and Real-Time Lead, if applicable, within seven working days of implementation of the change.

7.0 SAFETY AND HEALTH

The Health and Safety Lead, Field Sampling Leads, and team members will assess the safety of performing sampling activities on the surfaces of the areas to be sampled. This will include vehicle positioning limitations, fall hazards, and vehicle stability of the Geoprobe®.

Technicians will conform to precautionary surveys performed by personnel representing the Radiological Control, Safety, and Industrial Hygiene organizations. All work on this project will be performed in accordance with applicable Environmental Monitoring procedures, RM-0021 (Safety Performance Requirements Manual), Fluor Fernald work permits, penetration permits, and other applicable permits. Concurrence with applicable safety permits (indicated by the signature of each field team member assigned to this project) is required by each team member in the performance of their assigned duties.

The Field Sampling Lead will ensure that each technician performing sampling related to this project has been trained to the relevant sampling procedures, including safety precautions. Technicians who do not sign project safety and technical briefing forms will not participate in the execution of sampling activities related to the completion of assigned project responsibilities. A copy of applicable safety permits/surveys issued for worker safety and health will be posted at the sampling area during sampling activities. A safety briefing will be conducted before initiating field activities. Sample team members and lab analytical personnel should be aware of the possible presence of asbestos in material collected from the SWL. Additionally, broken glass, needles, and sharp metals may be present in the work area. Appropriate safety precautions should be taken regarding these potential hazards.

All emergencies shall be reported immediately on extension 911, or to the Site Communications Center at 648-6511 (if using a cellular phone), or using a radio and contacting "CONTROL" on Channel 11.

8.0 DATA MANAGEMENT

The RTIMP group will provide hard copy maps and/or summary reports to the Characterization Lead and Data Management Lead or designees. All real-time data will be collected and reported at a minimum ASL A and require no data validation. All physical samples measurements will be collected and reported at ASL B and will require 10 percent data validation. All electronically recorded field data will have the RMS or HPGe Data Verification Checklist (Section 5.4 of the User's Manual), which will be completed after each data collection event. Field documentation, such as the Nuclear Field Density/Moisture Worksheet, will undergo an internal review by the RTIMP.

Electronically recorded data from the GPS, HPGe, and RMS systems will be downloaded on a daily basis to disks, or to the Local Area Network (LAN) using the Ethernet connection. The Characterization Lead or designee will be informed by the RTIMP Lead or designee when RTIMP measurements do not meet data quality control checklist criteria. The Characterization Lead or designee will determine whether additional scanning, confirmation, or delineation measurements are required.

Once the electronic data have been placed on the LAN and SED, the Data Management Lead will perform an evaluation prior to placement on the Soil and Disposal Facility Project (SDFP) web site. The evaluation may involve a comparison check between the electronic data, hard copy maps and summary reports for accuracy and completeness. The evaluation will be documented on the Real-Time Electronic Data Quality Control checklist (Figure 8-1), dated and signed.

Technicians and the field sampling data coordinator will review all field data for completeness and accuracy and then forward the data package to the Data Validation Contact for final review. The field data package will be filed in the records of the Environmental Management Project.

The Sample and Data Management organization will perform data entry into the SED for physical sampling and analytical results. After the sample data are in the SED, the Data Group Form (FS-F-5157) will be completed by the Characterization Lead with concurrence from a WAO representative.

Copies of field documentation shall be generated and provided to the Characterization Lead or Data Management Lead upon request and maintained in SDFP project files until dispositioned to Engineering/Construction Document Control (ECDC). RTIMP will maintain all the real-time files and survey data will be maintained by the Survey Lead or designee. All records associated with this PSP will reference the PSP number and eventually be forwarded to ECDC to be placed in the project file.

PSP/Project #:________________

Batch Numbers:________________

HPGe file Numbers:________________

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FIGURE 8-1
EXCAVATION MONITORING REAL-TIME ELECTRONIC DATA QUALITY CONTROL CHECKLIST

#	ITEM TO BE CHECKED	✔ or No	Modification/Correction with explanation	Date Corrected
1	Receive the Characterization Request form, Excavation Monitoring Form (EMF), coverage maps, real-time verification checklist, and/or HPGe parameter summary report from the Characterization field personnel			
2	Verify the signatures and all blanks on the EMF are complete through Section 6 and complete on the Real-Time Verification Checklist			
3	Check loader to ensure the data transferred from the LAN to the SED (if the data files are in the SED, the loader is working properly)			
4	Check to ensure data transferred into the correct fields by looking at the data on the LAN in comparison with the data transferred to the SED (to verify this, all data fields for a few runs in each file will be reviewed)			
5	Check that the project number is correct and is consistent on the EMF, the LAN, and the SED in both the worksheet files and the results/data files			
6	Check that the EMF, the LAN, and the SED have the correct location identifier in both the worksheet files and the results/data files			
7	Check that worksheet on the LAN and in the SED have the correct elevation documented from the surveying group			
8	Verify northing and easting coordinates, look at the plotted map and the coordinates in the SED and verify the coordinates are within the boundary on the plotted map			
9	Check data files to ensure all files are received			
10	Attach this checklist and documentation for modifications to the EMF, initial and date all forms and documentation		X	X
11	Insert USE into the "QC Field" on the SED after all this has been checked and verified correct		X	X

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Sign and Date________________

PSP/Project #:____________________

Batch Numbers:____________________

HPGe file Numbers:____________________

1. If no, check with the Characterization Lead or designee to get needed forms.

2. If no, contact Characterization Lead and return EMF to be completed and/or signed.

3. If no, check with SED Database Manager (ext. 7544) to find out why.

4. If no, check with the Real-Time Field Lead to see if any additional fields were added. If so, call SED Database Manager (ext. 7544) to have the field added into the SED tables. If not, check with SED Database Manager (ext. 7544) to see why the fields loaded incorrectly.

5. If no, verify the correct project number with the Characterization Lead and insert the project number into the worksheet on the LAN and the worksheet in the SED; attach the documentation to the form.

6. If no, verify with the Characterization Lead the correct identifier and correct the identifier both in the worksheet on the LAN and in the SED; attach the documentation to the form.

7. If no, check with the Surveying group to verify the elevation; If incorrect, change the elevation in the worksheet on the LAN and in the SED and attach the documentation to the form.

8. If no, check with Characterization Lead or designee to resolve the problem.

9. Run query in SED. The number of RTRAK/RSS files can be checked with the number of records (files) listed in the SRDIG directory under Real-Time Lab View files. No sequential gaps are anticipated; if gaps are found, check with the Real-Time Field Lead. The Real-Time Field Lead will verify gaps or will investigate to find out why the files are missing. For HPGe shots, an HPGe Data Verification Checklist is attached to the EMF listing all the files. This Checklist can be used to ensure all the files were received in the SED.

Sign and Date____________________

APPENDIX A

DATA QUALITY OBJECTIVES
SL-048, REVISION 5 AND
SL-056, REVISION 0

Control Number 3916

Fernald Environmental Management Project

Data Quality Objectives

Title: Delineating the Extent of Constituents of Concern During Remediation Sampling

Number: SL-048

Revision: 5

Effective Date: February 26, 1999

Contact Name: Eric Kroger

Approval: (signature on file) Date: 2/25/99
James E. Chambers
DQO Coordinator

Approval: (signature on file) Date: 2/26/99
J.D. Chiou
SCEP Project Director

Rev. #	0	1	2	3	4	5	6
Effective Date:	9/19/97	10/3/97	4/15/98	6/17/98	7/14/98	2/26/99	

DATA QUALITY OBJECTIVES
Delineating the Extent of Constituents of Concern During Remediation Sampling

Members of Data Quality Objectives (DQO) Scoping Team
The members of the DQO team include a project lead, a project engineer, a field lead, a statistician, a lead chemist, a sampling supervisor, and a data management lead.

Conceptual Model of the Site
Media is considered contaminated if the concentration of a constituent of concern (COC) exceeds the final remediation levels (FRLs). The extent of specific media contamination was estimated and published in the Operable Unit 5 Feasibility Study (FS). These estimates were based on kriging analysis of available data for media collected during the Remedial Investigation (RI) effort and other FEMP environmental characterization studies. Maps outlining contaminated media boundaries were generated for the Operable Unit 5 FS by overlaying the results of the kriging analysis data with isoconcentration maps of the other constituents of concern (COCs), as presented in the Operable Unit 5 RI report, and further modified by spatial analysis of maps reflecting the most current media characterization data. A sequential remediation plan has been presented that subdivides the FEMP into seven construction areas. During the course of remediation, areas of specific media may require additional characterization so remediation can be carried out as thoroughly and efficiently as possible. As a result, additional sampling may be necessary to accurately delineate a volume of specific media as exceeding a target level, such as the FRL or the Waste Attainment Criterion (WAC). Each individual Project-Specific Plan (PSP) will identify and describe the particular media to be sampled. This DQO covers all physical sampling activities associated with Pre-design Investigations, precertification sampling, WAC attainment sampling or regulatory monitoring that is required during site remediation.

1.0 Statement of Problem

If the extent (depth and/or area) of the media COC contamination is unknown, then it must be defined with respect to the appropriate target level (FRL, WAC, or other specified media concentration).

2.0 Identify the Decision

Delineate the horizontal and/or vertical extent of media COC contamination in an area with respect to the appropriate target level.

3.0 Inputs That Affect the Decision

Informational Inputs - Historical data, process history knowledge, the modeled extent of COC contamination, and the origins of contamination will be required to establish a sampling plan to delineate the extent of COC contamination. The desired precision of the delineation must be weighed against the cost of collecting and analyzing additional samples in order to determine the optimal sampling density. The project-specific plan will identify the optimal sampling density.

Action Levels - COCs must be delineated with respect to a specific action level, such as FRLs and On-Site Disposal Facility (OSDF) WAC concentrations. Specific media FRLs are established in the OU2 and OU5 RODs, and the WAC concentrations are published in the OU5 ROD. Media COCs may also require delineation with respect to other action levels that act as remediation drivers, such as Benchmark Toxicity Values (BTVs).

4.0 The Boundaries of the Situation

Temporal Boundaries - Sampling must be completed within a time frame sufficient to meet the remediation schedule. Time frames must allow for the scheduling of sampling and analytical activities, the collection of samples, analysis of samples and the processing of analytical data when received.

Scale of Decision Making - The decision made based upon the data collected in this investigation will be the extent of COC contamination at or above the appropriate action level. This delineation will result in media contaminant concentration information being incorporated into engineering design, and the attainment of established remediation goals.

Parameters of Interest - The parameters of interest are the COCs that have been determined to require additional delineation before remediation design can be finalized with the optimal degree of accuracy.

5.0 Decision Rule

If existing data provide an unacceptable level of uncertainty in the COC delineation model, then additional sampling will take place to decrease the model uncertainty. When deciding what additional data is needed, the costs of additional sampling and analysis must be weighed against the benefit of reduced uncertainty in the delineation model, which will eventually be used for assigning excavation, or for other purposes.

6.0 Limits on Decision Errors

In order to be useful, data must be collected with sufficient areal and depth coverage, and at sufficient density to ensure an accurate delineation of COC concentrations. Analytical sensitivity and reproducibility must be sufficient to differentiate the COC concentrations below their respective target levels.

Types of Decision Errors and Consequences

Decision Error 1 - This decision error occurs when the decision maker determines that the extent of media contaminated with COCs above action levels is not as extensive as it actually is. This error can result in a remediation design that fails to incorporate media contaminated with COC(s) above the action level(s). This could result in the re-mobilization of excavation equipment and delays in the remediation schedule. Also, this could result in media contaminated above action levels remaining after remediation is considered complete, posing a potential threat to human health and the environment.

Decision Error 2 - This decision error occurs when the decision maker determines that the extent of media contaminated above COC action levels is more extensive than it actually is. This error could result in more excavation than necessary, and this excess volume of materials being transferred to the OSDF, or an off-site disposal facility if contamination levels exceed the OSDF WAC.

True State of Nature for the Decision Errors - The true state of nature for Decision Error 1 is that the maximum extent of contamination above the FRL is more extensive than was determined. The true state of nature for Decision Error 2 is that the maximum extent of contamination above the FRL is not as extensive as was determined. Decision Error 1 is the more severe error.

7.0 Optimizing Design for Useable Data

7.1 Sample Collection

A sampling and analytical testing program will delineate the extent of COC contamination in a given area with respect to the action level of interest. Existing data, process knowledge, modeled concentration data, and the origins of contamination will be considered when determining the lateral and vertical extent of sample collection. The cost of collecting and analyzing additional samples will be weighed against the benefit of reduced uncertainty in the delineation model. This will determine the sampling density. Individual PSPs will identify the locations and depths to be sampled, the sampling density necessary to obtain the desired accuracy of the delineation, and if samples will be analyzed by the on-site or off-site laboratory. The PSP will also identify the sampling increments to be selectively analyzed for concentrations of the COC(s) of interest, along with field work requirements. Analytical requirements will be listed in the PSP. The chosen analytical methodologies are able to achieve a detection limit capable of resolving the COC action level. Sampling of groundwater monitoring wells may require different purge requirements than those stated in the SCQ (i.e., dry well definitions or small purge volumes). In order to accommodate sampling of wells that go dry prior to completing the purge of the necessary well volume, attempts to sample the monitoring wells will be made 24 hours after purging the well dry. If, after the 24 hour period, the well does not yield the required volume, the analytes will be collected in the order stated in the applicable PSP until the well goes dry. Any remaining analytes will not be collected. In some instances, after the 24 hour wait the well may not yield any water. For these cases, the well will be considered dry and will not be sampled.

7.2 COC Delineation

The media COC delineation will use all data collected under the PSP, and if deemed appropriate by the Project Lead, may also include existing data obtained from physical samples, and if applicable, information obtained through real-time screening. The delineation may be accomplished through modeling (e.g. kriging) of the COC concentration data with a confidence limit specific to project needs that will reduce the potential for Decision Error 1. A very conservative approach to delineation may also be utilized where the boundaries of the contaminated media are extended to the first known vertical and horizontal sample locations that reveal concentrations below the desired action level.

7.3 QC Considerations

Laboratory work will follow the requirements specified in the SCQ. If analysis is to be carried out by an off-site laboratory, it will be a Fluor Daniel Fernald approved full service laboratory. Laboratory quality control measures include a media prep blank, a laboratory control sample (LCS), matrix duplicates and matrix spike. Typical Field QC samples are not required for ASL B analysis. However the PSPs may specify appropriate field QC samples for the media type with respect to the ASL in accordance with the SCQ, such as field blanks, trip blanks, and container blanks. All field QC samples will be analyzed at the associated field sample ASL. Data will be validated per project requirements, which must meet the requirements specified in the SCQ. Project-specific validation requirements will be listed in the PSP.

Per the Sitewide Excavation Plan, the following ASL and data validation requirements apply to all **soil and soil field QC samples** collected in association with this DQO:

- If samples are analyzed for Pre-design Investigations and/or Precertification, 100% of the data will be analyzed per ASL B requirements. For each laboratory used for a project, 90% of the data will require only a Certificate of Analysis, the other 10% will require the Certificate of Analysis and all associated QA/QC results, and will be validated to ASL B. Per Appendix H of the SEP, the minimum detection level (MDL) for these analyses will be established at approximately 10% of the action level (the action level for precertification is the

FRL; the action level for pre-design investigations can be several different action levels, including the FRL, the WAC, RCRA levels, ALARA levels, etc.). If this MDL is different from the SCQ-specified MDL, the ASL will default to ASL E, though other analytical requirements will remain as specified for ASL B.

- If samples are analyzed for WAC Attainment and/or RCRA Characteristic Areas Delineation, 100% of the data will be analyzed and reported to ASL B with 10% validated. The ASL B package will include a Certificate of Analysis along with all associated QA/QC results. Total uranium analyses using a higher detection limit than is required for ASL B (10 mg/kg) may be appropriate for WAC attainment purposes since the WAC limit for total uranium is 1,030 mg/kg. In this case, an ASL E designation will apply to the analysis and reporting to be performed under the following conditions:

  - all of the ASL B laboratory QA/QC methods and reporting criteria will apply with the exception of the total uranium detection limit

  - the detection limit will be ≤10% of the WAC limit (e.g., ≤103 mg/kg for total uranium).

- If delineation data are also to be used for certification, the data must meet the data quality objectives specified in the Certification DQO (SL-043).

- Validation will include field validation of field packages for ASL B or ASL D data.

All data will undergo an evaluation by the Project Team, including a comparison for consistency with historical data. Deviations from QC considerations resulting from evaluating inputs to the decision from Section 3, must be justified in the PSP such that the objectives of the decision rule in Section 5 are met.

7.4 Independent Assessment

Independent assessment shall be performed by the FEMP QA organization by conducting surveillances. Surveillances will be planned and documented in accordance with Section 12.3 of the SCQ.

7.5 Data Management

Upon receipt from the laboratory, all results will be entered into the SED as qualified data using standard data entry protocol. The required ASL B, D or E data will undergo analytical validation by the FEMP validation team, as required (see Section 7.3). The Project Manager will be responsible to determine data usability as it pertains to supporting the DQO decision of determining delineation of media

COC's.

7.6 Applicable Procedures

Sample collection will be described in the PSP with a listing of applicable procedures. Typical related plans and procedures are the following:

- Sitewide Excavation Plan (SEP)
- Sitewide CERCLA Quality Assurance Project Plan (SCQ).
- SMPL-01, *Solids Sampling*
- SMPL-02, *Liquids and Sludge Sampling*
- SMPL-21, *Collection of Field Quality Control Samples*
- EQT-06, *Geoprobe® Model 5400 Operation and Maintenance*
- EQT-23, *Operation of High Purity Germanium Detectors*
- EQT-30, *Operation of Radiation Tracking Vehicle Sodium Iodide Detection System*

Data Quality Objectives
Delineating the Extent of Constituents of Concern During Remediation Sampling

1A. Task/Description: Delineating the extent of contamination above the FRLs

1.B. Project Phase: (Put an X in the appropriate selection.)

RI ☐ FS ☐ RD ☒ RA ☐ R_vA ☐ OTHER ☐

1.C. DQO No.: SL-048, Rev. 5 DQO Reference No.:____________

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2. Media Characterization: (Put an X in the appropriate selection.)

Air ☐ Biological ☐ Groundwater ☒ Sediment ☒ Soil ☒

Waste ☒ Wastewater ☐ Surface water ☐ Other (specify) _____

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3. Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization
A ☐ B ☒ C ☐ D ☒ E ☒

Risk Assessment
A ☐ B ☐ C ☐ D ☐ E ☐

Evaluation of Alternatives
A ☐ B ☐ C ☐ D ☐ E ☐

Engineering Design
A ☐ B ☒ C ☐ D ☒ E ☒

Monitoring during remediation
A ☒ B ☒ C ☐ D ☒ E ☒

Other
A ☐ B ☐ C ☐ D ☐ E ☐

4.A. Drivers: Remedial Action Work Plans, Applicable or Relevant and Appropriate Requirements (ARARs) and the OU2 and/or OU5 Record of Decision (ROD).

4.B. Objective: Delineate the extent of media contaminated with a COC (or COCs) with respect to the action level(s) of interest.

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5. Site Information (Description):

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1. pH	[X] *	2. Uranium	[X] *	3. BTX	[ ]
Temperature	[X] *	Full Radiological	[X] *	TPH	[ ]
Specific Conductance	[X] *	Metals	[X] *	Oil/Grease	[ ]
Dissolved Oxygen	[X] *	Cyanide	[ ]		
Technetium-99	[X] *	Silica	[ ]		

4. Cations	[ ]	5. VOA	[X] *	6. Other (specify)
Anions	[ ]	BNA	[X] *	
TOC	[ ]	Pesticides	[X] *	
TCLP	[X] *	PCB	[X] *	
CEC	[ ]	COD	[ ]	

*If constituent is identified for delineation in the individual PSP.

6.B. Equipment Selection and SCQ Reference:

Equipment Selection		Refer to SCQ Section
ASL A	______	SCQ Section: ______
ASL B	X	SCQ Section: App. G Tables G-1&G-3
ASL C	______	SCQ Section: ______
ASL D	X	SCQ Section: App. G Tables G-1&G-3
ASL E	X (See sect. 7.3, pg. 6)	SCQ Section: App. G Tables G-1&G-3

7.A. Sampling Methods: (Put an X in the appropriate selection.)

Biased	[X]	Composite	[ ]	Environmental	[X]	Grab	[X]	Grid	[X]
Intrusive	[X]	Non-Intrusive	[ ]	Phased	[ ]	Source	[ ]		

DQO Number: SL-048, Rev. 5

7.B. Sample Work Plan Reference: This DQO is being written prior to the PSPs.

Background samples: OU5 RI

7.C. Sample Collection Reference:

Sample Collection Reference: SMPL-01, SMPL-02, EQT-06

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8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

8.A. Field Quality Control Samples:

Trip Blanks	[X]*	Container Blanks	[X]++
Field Blanks	[X]+	Duplicate Samples	[X]***
Equipment Rinsate Samples	[X]***	Split Samples	[X]**
Preservative Blanks	[ ]	Performance Evaluation Samples	[ ]
Other (specify)			

- * For volatile organics only
- ** Split samples will be collected where required by EPA or OEPA.
- *** If specified in PSP.
- \+ Collected at the discretion of the Project Manager (if *warranted by field* conditions)
- \+ + One per Area and Phase Area per container type (i.e. stainless steel core liner/plastic core liner/Geoprobe tube).

8.B. Laboratory Quality Control Samples:

Method Blank	[X]	Matrix Duplicate/Replicate	[X]
Matrix Spike	[X]	Surrogate Spikes	[ ]
Tracer Spike	[ ]		

Other (specify) Per SCQ

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

3916

Control Number ________

Fernald Environmental Management Project

Data Quality Objectives

Title: Real Time Final Remediation Level (FRL) Monitoring

Number: SL-056

Revision: 0

Effective Date: 9/01/99

Contact Name: Joan White

Approval: J. E. Chambers Date: 9/1/99
James Chambers
DQO Coordinator

Approval: Joan White Date: 9/1/99
Joan White
Real-Time Instrumentation Measurement
Program Manager

Rev. #	0						
Effective Date:	9/01/99						

Data Quality Objectives
Real Time Final Remediation Level (FRL) Monitoring

1.0 Statement of Problem

Conceptual Model of the Site

The general soil remediation process at the Fernald Environmental Management Project (FEMP) includes real-time *in-situ* gamma spectrometry (real-time) measurements and physical sampling during different phases of the remediation process. Initially, pre-design investigations define excavation boundaries. During excavation, real-time measurements and/or sampling for waste disposition issues occurs. After planned excavations are complete, real-time measurements and/or physical sampling precertification activities are carried out to verify that residual contamination is below final remediation levels (FRLs).

This DQO describes the real-time in-situ gamma spectrometry methods used for gamma resolvable Area Specific Contaminants of Concern (ASCOC) FRL monitoring to support remedial design and precertification. Any physical soil samples collected to support remedial design will be collected under a separate DQO. Real-time FRL measurements involve field surveys of the surface soil using mobile and stationary gamma-discernable real-time equipment. Real-time FRL measurements are collected within an area when above-FRL radiological contamination is anticipated to be minimal based on process knowledge or previous investigations.

FRL scanning activities must follow the guidelines established in the *Sitewide Excavation Plan* (SEP) and the most current version of the document *User Guidelines, Measurement Strategies, and Operational Factors for Deployment of In-Situ Gamma Spectrometry at the Fernald Site* (hereinafter referred to as the Real Time Users Manual). As discussed in these documents, FRL measurements are conducted in two separate activities:

- FRL Phase I includes a mobile sodium iodide (NaI) detector scan of as much of the area as accessible at a 31 cm detection height at 1 mile per hour. If parts of the area of interest are inaccessible to the mobile NaI detectors, then the stationary High Purity Germanium (HPGe) detector will be used to obtain measurements in those areas. Target parameters for FRL Phase I NaI measurements are gross gamma activity and 3-times the FRL (3x FRL) values of total uranium, radium-226 and/or thorium-232, as calculated by a moving two-point average of consecutive measurements, or as indicated by 2x FRL in single measurements using the HPGe detectors at a 1 meter detector height.

- FRL Phase II includes stationary HPGe "hot spot evaluation" measurements at Phase I locations where the two-point average of total uranium, radium-226 and/or thorium-232 has identified resolvable ASCOC concentrations greater than 3-times the FRL (3x FRL) using the RMS systems, or where single HPGe measurement from Phase I are greater than 2x FRL. Target parameters for FRL Phase II are all gamma resolvable radiological ASCOCs.

Available Resources

Time: FRL investigation of remediation areas or phased areas must be accomplished by the field team of real-time instrumentation operators (and samplers if necessary), to provide required information in time to support the design effort.

Project Constraints: FEMP remediation activities are being performed in support of the Accelerated Remediation Plan, and soil remediation activities must be consistent with the SEP. FRL scanning, and if necessary, sampling and analytical testing, must be performed with existing manpower and instrumentation, considering instrument availability, to support the remediation and certification schedule. The results of FRL Phase I will determine Phase II HPGe measurement location and if necessary, will determine physical sample location. Design and execution of potential remediation is dependent on successful completion of this work.

Instrumentation: Real-time monitoring includes mobile sodium iodide (NaI) systems referred to as the Radiation Measurement Systems (RMS). In addition, stationary germanium detectors mounted on a tripod (the HPGe), are also used. These instruments can significantly accelerate the pace of necessary characterization by detecting soil contaminated with gamma resolvable radiological ASCOCs in a rapid and non-intrusive manner.

2.0 Identify the Decision

Decision

Delineate the horizontal extent of above-FRL (hot spot criteria) radiological contamination in the area soil. In addition, determine the need for Phase II real-time measurements to further assist in the above-FRL delineation.

3.0 Identify Inputs That Affect the Decision

Required Informational Input

Real-time FRL measurements will be used to estimate the surface soil contamination and the variation in surface soil contamination in areas scheduled for design, modeling, precertification, or certification activities. In addition, RTIMP data may be used to determine physical sampling collection location and/or a review of existing physical sample data, process knowledge, or visible observation.

Sources of Informational Input

FRL measurements for gamma discernible radiological COCs will involve measurements from mobile and stationary in-situ gamma spectrometry equipment. Physical samples may be collected to verify real-time measurements, or to investigate non-gamma resolvable ASCOCs.

Action Levels

FRLs established in the OU2 and OU5 Records of Decision are specific for radiological COC, and in some cases, vary between remediation areas. The FRLs were developed to account for health risks, cross media impact, background concentrations, and applicable or relevant and appropriate requirements (ARARs) and represent not-to-exceed contaminant-specific average soil concentrations. Real-time HPGe measurements may also be taken to support excavation to ALARA requirements. Physical samples may be used to verify HPGe readings and to precertify for non-gamma resolvable ASCOCs.

The 3x FRL concentrations/activities obtained through two-point averaging of mobile NaI measurements have been developed based on the ability of the instrumentation to resolve these levels. Refer to the Real-Time User's Manual for additional details.

Methods of Data Collection

FRL Phase I measurements will be utilized to obtain as close to complete coverage of the areas of concern. Hot spot confirmation and delineation measurements will be obtained during FRL Phase II by strategically placed stationary HPGe measurements. Analysis and data management for FRL Phase I data will be conducted at ASL A. FRL Phase II data may be conducted at either ASL A or ASL B, at the discretion of the Project. The decision to collect Phase II data at ASL A, or ASL B will depend on the Project's need for validated data. Only ASL B data is subject to validation, at project request. Real-time data collection for Phase II ASL A and ASL B measurements are identical. All measurements will be performed in compliance with operating procedures, the Real-Time User's Manual, the SEP, and the SCQ.

The FRL Phase I data will be utilized to establish general radiological concentration patterns and detect areas of elevated total gamma activity, as well as provide isotopic information for resolvable ASCOCs. The FRL Phase II HPGe gamma detectors will be used to confirm and delineate Phase I potential hot spot measurements, as needed. All real-time Phase I and Phase II measurements will be collected in accordance with the procedures identified in Section 7.0 of this DQO.

Surface physical samples may be collected to verify HPGe measurements for non-gamma resolvable ASCOCs. If physical sampling is needed, it will be identified in PSPs. The data quality of these samples will be consistent with the latest sampling DQO.

4.0 The Boundaries of the Situation

Spatial Boundaries

Domain of the Decision: Boundaries are limited to surface soils of areas planned for certification, and adjacent areas, as defined in the individual work plans.

Population of Soils: The soils affected are surface soils (to a nominal depth of 6 inches), which include recently excavated surfaces and undisturbed soils associated with excavation areas as designated in the individual work plans.

Temporal Boundaries

Time Constraints on Real-Time Measurements: The scheduling of FRL scanning is closely associated with the design process and excavation schedule. FRL real-time scanning must be conducted prior to design, excavation, if any, and before certification activities begin. The scanning data must be returned and processed into useable format in time for the information to be useful within the current remediation schedule.

Practical Considerations: In-situ gamma spectrometry measurements cannot be made during snow coverage or standing water conditions or during precipitation. Field analytical methods should also be limited to unsaturated soils. Most areas undergoing scanning are flat, open terrain, and are readily accessible to the equipment. Some areas may require preparation, such as cutting of grass or removal of undergrowth, fencing and other obstacles. In situ measurements will require coordination with appropriate maintenance personnel for site preparation. Physical and environmental parameters will be recorded and assessed during data collection. Refer to the Real-Time User's Manual for additional details.

5.0 Develop a Logic Statement

Parameters of Interest

For FRL Phase I, parameters of interest are gross gamma activity and 3-times the FRL values of total uranium, radium-226 and thorium-232, as calculated by a moving two-point average of consecutive readings. For FRL Phase II, parameters of interest are all HPGe-discernable radiological ASCOCs.

FRL Target Levels

For FRL Phase I, target levels are the highest gross gamma activity readings, 3x FRL for total uranium, radium-226 and thorium-232, and WAC trigger levels for total uranium. For FRL Phase II, target levels are the FRLs of all gamma discernable radiological ASCOCs including the WAC trigger level for total uranium.

Decision Rules

Following FRL Phase I, any Phase I NaI scanned areas exhibiting patterns of high gross gamma activity will be measured with the HPGe. Also, any Phase I HPGe measurements greater than 3x FRL will be scanned with the HPGe for hot spot evaluation per section 3.3 of the Real-Time User's Manual.

Following FRL Phase II, if HPGe results indicate an area could fail FRLs, the soil may be evaluated further with additional HPGe measurements or physical samples, or undergo remedial excavations. If remedial excavations are performed, the excavated area will be measured with post-excavation HPGe measurements to ensure removal of the contamination. Once the remediation is complete, FRL attainment is confirmed by the HPGe.

6.0 Establish Constraints on the Uncertainty of the Decision

Range of Parameter Limits

The range of surface soil concentrations anticipated will be from background (natural concentrations) to greater than 3X FRL.

Types of Decision Errors and Consequences

Decision Error 1: This decision error occurs when the decision maker decides an area meets FRLs when the average soil concentration in an area is above the FRL, or the soil contains ASCOC concentrations above the hot spot criteria (3x FRL for hot spots $\leq 10\ m^2$, or 2x FRL for hot spots $> 10\ m^2$). This decision error would lead to the area failing certification for average radiological COC concentrations above the FRL or for hot spot criteria. If an area fails certification sampling and analytical testing, remobilization and further excavation, precertification, and certification sampling would be necessary.

Decision Error 2: This decision error occurs when the decision maker decides that additional HPGe and/or physical samples are necessary based on FRL Phase II results; or the decision maker directs the excavation (or additional excavation) of soils, when they actually have average radiological COC concentrations below the FRLs and no ASCOC hot spots (3x FRL for hot spots $\leq 10\ m^2$, or 2x FRL for hot spots $> 10\ m^2$). This would result in added sampling and analytical costs and/or added costs due to the excavation of clean soils and an increased volume in the OSDF. This is not as severe as Decision Error 1. The addition of clean soil to the

OSDF would result in further reduction, although minimally, to human health risk in the remediated areas.

True State of Nature for the Decision Errors

The true state of nature for Decision Error 1 is that the actual concentrations of radiological ASCOCs are greater than their FRLs and/or the hot spot criteria. The true state of nature for Decision Error 2 is that the true concentrations of COCs are below their FRLs and/or hot spot criteria. Decision Error 1 would be the more severe error.

7.0 Optimize a Design for Obtaining Quality Data

As discussed in Section 3.3.3 of the SEP, FRL scanning consists of two separate activities. Refer to Section 1.0 of this DQO for a general overview of FRL Phase I and FRL Phase II activities.

Real-time measurements are generated by two methods: 1) the mobile sodium iodide (NaI) detection systems which provide semi-quantitative radiological data, and 2) the stationary high purity germanium (HPGe) system that provides quantitative measurements of radiological COCs. If necessary, physical samples may also be collected for HPGe data verification, and to precertify for non-gamma resolvable ASCOCs.

Surface moisture readings are obtained in conjunction with Phase I and Phase II the NaI and HPGe system measurements using the Troxler nuclear moisture and density gauge or the Zeltex moisture meter. If conditions do not permit the use of the moisture meters, a soil moisture sample may be collected and submitted to the on-site laboratory for percent moisture analysis, or a default moisture value of 20% may be used. The soil moisture data will be used as is discussed in Sections 3.8, 4.11 and 5.2 of the Real-Time User's Manual. The gamma data will be corrected to a dry weight equivalent.

Background radon monitoring will also occur in conjunction with Phase I and Phase II NaI and HPGe system measurements, as specified in the PSP. Refer to the Section 5.3 of the Real-Time User's Manual for a discussion on radium-226 corrections.

Sodium Iodide (NaI) System

The mobile NaI detector systems are collectively called the Radiation Measurement Systems (RMS). They are used to achieve as close to complete coverage of the area as possible, taking into consideration the topographic and vegetative constraints which limit access. The NaI systems currently are used to obtain measurements over an area specified in a PSP to detect radiological total activity patterns and elevated radiological activity. The NaI detector systems are used at a 31 cm detector height at 1 mph for a 4 second acquisition with a 0.4 meter overlap, and are consistent with the Real-time User's Manual. If the total uranium FRL is 20 ppm or lower, the NaI systems should not be used for FRL attainment, the HPGe system should be used.

The mobile NaI systems are electronically coupled with a global positioning system (GPS) rover and base unit to record each measurement location. Counting and positioning information is recorded continuously on a field personal computer (PC) and stored on disk or hard drive for future downloading on the site soil database and Graphical Information System (GIS) system, or transferred directly to the Local Area Network (LAN) by Ethernet.

Information from the NaI/GPS system is recorded on the PC and transferred to the Unix system through the local area network on a regular (at least daily) basis. The information is plotted on the FEMP GIS system, or in the field using Surfer software. With the output, patterns of elevated total activity, and locations of elevated concentrations can be identified.

Data reduction is an important aspect of NaI system data use. Individual total uranium, radium-226 and thorium-232 concentrations will undergo two-point averaging. The two-point averaged values will be mapped and evaluated with respect to 3x FRL.

NaI measurements may be used for design, excavation during remediation, and precertification decision making if the measurements clearly indicate below FRL criteria have been met. They may also be used to determine the location and number of FRL Phase II HPGe measurements, if required.

In-Situ HPGe Detectors

The HPGe detector is used during FRL Phase I or FRL Phase II, as follows:

- During FRL Phase I, the HPGe is used in areas where topographic or vegetative constraints prevent mobile NaI detector access or if the NaI systems are out of service. The HPGe is used in a 99.1% coverage grid over the accessible area. Detector height is 1 meter with a count time of 15 minutes.

- During FRL Phase II, the HPGe detector is used at strategic locations established thorough the FRL Phase I screening. These locations are where the highest readings of gross gamma activity were identified and/or where individual ASCOC concentrations were identified as hot spots. The HPGe is used to identify radiological COC levels, which in turn provide information concerning the ability to pass FRLs. The number of Phase II HPGe measurements to delineate the hot spot boundary varies based on the size of extent of contamination. If the area potentially exceeding the 2x FRL or 3x FRL exhibits a visible contamination boundary, the Project may determine that Phase II measurements may not need to be collected.

Physical Soil Sampling

Physical samples may be collected and analyzed for target radiological COCs to verify the HPGe measurements and/or to precertify for non-gamma discernable ASCOCs. If physical samples are required, they will be collected in compliance with the applicable sampling DQO. Criteria for obtaining physical samples, such as sample density, will be specified in the PSP, if necessary. The minimum data quality acceptable for this purpose will be identified in the applicable sampling DQO. Field QC, ASL and Validation requirements will be consistent with the SCQ and SEP requirements.

Data Quality Objectives
Real Time FRL Measurements

1A. Task/Description: FRL real-time measurements.
1B. Project Phase: (Put an X in the appropriate selection.)

RI ☐ FS ☐ RD ☐ RA ☒ R_vA ☐ OTHER ☐

1.C. DQO No.: SL-056, Rev. 0 DQO Reference No.: Current Sampling DQO

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2. Media Characterization: (Put an X in the appropriate selection.)

Air ☐ Biological ☐ Groundwater ☐ Sediment ☒ Soil ☒

Waste ☐ Wastewater ☐ Surface water ☐ Other (specify) ____________

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3. Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization
A ☒ B ☒ C ☐ D ☐ E ☐

Risk Assessment
A ☐ B ☐ C ☐ D ☐ E ☐

Evaluation of Alternatives
A ☐ B ☐ C ☐ D ☐ E ☐

Engineering Design
A ☒ B ☒ C ☐ D ☐ E ☐

Monitoring during remediation activities
A ☒ B ☒ C ☐ D ☐ E ☐

Other: Precertfication
A ☒ B ☒ C ☐ D ☐ E ☐

4.A. Drivers: Applicable or Relevant and Appropriate Requirements (ARARs), Operable Unit 5 Record of Decision (ROD), the Real-Time User's Manual, the Sitewide Excavation Plan and the Project-Specific Plan (PSP).

4.B. Objective: To determine if the area of interest is likely to pass FRLs for all HPGe discernable radiological COCs

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5. Site Information (Description): The OU2 and OU5 RODs have identified areas at the FEMP that require remediation activities. The RODs specify that the soils in these areas will be clean and demonstrated to be below the FRLs.

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1. pH ☐ Temperature ☐ Spec.Conductance ☐ Dissolved Oxygen ☐ Technetium-99 ☐

2. Uranium ☒* Full Rad. ☒* Metals ☐ Cyanide ☐ Silica ☐

3. BTX ☐ TPH ☐ Oil/Grease ☐

4. Cations ☐ Anions ☐ TOC ☐ TCLP ☐ CEC ☐ COD ☐

5. VOA ☐ ABN ☐ Pesticides ☐ PCB ☐

6. Other (specify) Percent Moisture

* If specified in the PSP for NaI and HPGe detectable rad's.

6.B. Equipment Selection and SCQ Reference:

Equipment Selection	Refer to SCQ Section
ASL A Mobile NaI, HPGe and HPGe*	SCQ Section: Not Applicable
ASL B HPGe*	SCQ Section: App. G, Table 1
ASL C	SCQ Section:
ASL D	SCQ Section:
ASL E	SCQ Section:

* Choosing the ASL level for Phase II FRL HPGe measurements is at the discretion of the project considering the project need for validated data.

7.A. Sampling Methods: (Put an X in the appropriate selection.)

Biased [X] Composite [ ] Environmental [ ] Grab [X] Grid [X]

Intrusive [ ] Non-Intrusive [X] Phased [ ] Source [ ]

7.B. Sample Work Plan Reference: The DQO is being established prior to completion of the Project-Specific Plans.
Background samples: OU5 RI/FS

7.C. Sample Collection Reference:
-EQT-22, *Characterization of Gamma Sensitive Detectors*
-EQT-23, *Operation of High Purity Germanium Detectors*
-EQT-32, *Troxler 3440 Series Surface Moisture Gauge*
-EQT-33, *Real Time Differential Global Positioning System*
-EQT-39, *Zeltex Infrared Moisture Meter*
-EQT-40, *Satloc Real-time Differential Global Positioning System*
-EQT-41, *Radiation Measurement Systems*
-ADM-16, *In-Situ Gamma Spectrometry Quality Control*
-User Guidelines, Measurement Strategies, and Operational Factors for Deployment of In-Situ Gamma Spectrometry at the Fernald Site, 20701-RP-0006

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8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

8.A. Field Quality Control Samples:

Trip Blanks	[ ]	Container Blanks	[ ]
Field Blanks	[ ]	Duplicate Samples	[X]*
Equipment Rinsate Samples	[ ]	Split Samples	[ ]
Preservative Blanks	[ ]	PE Samples	[ ]

Other (specify) Radon Monitoring, moisture *
* If specified in the PSP.

8.B. Laboratory Quality Control Samples:

Method Blank	[ ]	Matrix Duplicate/Replicate	[ ]
Matrix Spike	[ ]	Surrogate Spikes	[ ]

Other (specify) ____________________

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9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

APPENDIX B

TARGET ANALYTE LISTS

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APPENDIX B
TARGET ANALYTE LISTS

TAL 20600-PSP-0002-A
(ASL B)

Analyte	WAC Limit	MDC
Total Uranium	1030 ppm	10 ppm
Technetium-99	29.1 pCi/g	2.9 pCi/g

MDC - minimum detection concentration

TAL 20600-PSP-0002-B
(ASL B)

Analyte	FRL Limit	MDC
Total Uranium	38.6 ppm (SWL) 82 ppm (FTF)	3.8 ppm (SWL) 8.2 ppm (FTF)
Thorium-228	1.8 pCi/g	0.18 pCi/g
Thorium-232	1.5 pCi/g	0.15 pCi/g
Thorium-230	280 pCi/g	28 pCi/g
Radium-226	1.8 pCi/g	0.18 pCi/g
Radium-228	2.0 pCi/g	0.20 pCi/g
Cesium-137	1.4 pCi/g	0.14 pCi/g
Technitium-99	29.1 pCi/g	2.9 pCi/g

TAL 20600-PSP-0002-C
(ASL B)

Analyte	FRL Limit	MDC
Thorium-230	280 pCi/g	28 pCi/g

TAL 20600-PSP-0002-D
(ASL B)

Analyte	FRL Limit	MDC
Arsenic	12 mg/kg	3.5 mg/kg
Beryllium	1.5 mg/kg	0.15 mg/kg

TAL 20600-PSP-0002-E
(ASL B)

Analyte	FRL Limit	MDC
Aroclor-1254	.13 mg/kg	0.033 mg/kg
Aroclor-1260	.13 mg/kg	0.033 mg/kg

TAL 20600-PSP-0002-F
(ASL B)

Analyte	FRL Limit	MDC
Dibenzo(a,h)anthracene	2.0 mg/kg	0.2 mg/kg
Benzo(a)pyrene	2.0 mg/kg	0.33 mg/kg
Indeno(1,2,3-cd)pyrene	20.0 mg/kg	2.0 mg/kg
Benzo(b)fluoranthene	20.0 mg/kg	2.0 mg/kg

TAL 20600-PSP-0002-G
(ASL B)

Analyte	FRL Limit	MDC
Bromodichloromethane	4.0 mg/kg	0.40 mg/kg
1.1-dichloroethene	0.41 mg/kg	0.041 mg/kg
Tetrachloroethene	3.6 mg/kg	0.36 mg/kg

TAL 20600-PSP-0002-H
(ASL B)

Analyte	FRL Limit	MDC
Heptachloradibenzo-p-dioxin	0.0008 mg/kg	0.00008 mg/kg
Octachlorodibenzo-p-dioxin	0.008 mg/kg	0.0008 mg/kg

TAL 20600-PSP-0002-I
(ASL B)

Analyte	FRL Limit	MDC
Dieldrin	0.015 mg/kg	0.0033 mg/kg

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TAL 20600-PSP-0002-J
(ASL B)

Analyte	FRL Limit	MDC
Fluoride	78000.0 mg/kg	1000 mg/kg

TAL 20600-PSP-0002-K
(ASL B)

Analyte	FRL Limit	MDC
Total Uranium	82 mg/kg	8.2 mg/kg
Total Thorium	13.7 mg/kg	1.3 mg/kg

TAL 20600-PSP-0002-L
(ASL B)

Analyte	FRL Limit	MDC
Arsenic	12.0 mg/kg	3.5 mg/kg
Beryllium	1.5 mg/kg	0.15 mg/kg
Silver	29000.0 mg/kg	100 mg/kg
Antimony	9.6 mg/kg	1.2 mg/kg
Cadmium	82.0 mg/kg	8.2 mg/kg

TAL 20600-PSP-0002-M
(ASL B)

Analyte	FRL Limit	MDC
Dieldrin	0.015 mg/kg	0.0033 mg/kg
Alpha-chlordane	0.19 mg/kg	0.019 mg/kg
Gamma-chlordane	0.19 mg/kg	0.019 mg/kg

TAL 20600-PSP-0002-N
(ASL B)

Analyte	FRL Limit	MDC
3,3-Dichlorobenzidine	0.55 mg/kg	0.33 mg/kg
N-Nitroso-di-n-propylamine	0.2 mg/kg	0.33 mg/kg
Pentachlorophenol	2.3 mg/kg	0.830 mg/kg

TAL 20600-PSP-0002-O
(ASL B)

Analyte	FRL Limit	MDC
Heptachloradibenzo-p-dioxin	0.0008 mg/kg	0.00008 mg/kg
Octachlorodibenzo-p-dioxin	0.008 mg/kg	0.0008 mg/kg
Heptachlorodibenzofurans	0.0008 mg/kg	0.00008 mg/kg

TAL 20600-PSP-0002-P
(ASL B)

Analyte	FRL Limit	MDC
Total Uranium	38.6 ppm (SWL) 82 ppm (FTF)	3.8 ppm (SWL) 8.2 ppm (FTF)

Notes: The MDCs for benzo(a)pyrene, aroclor-1254, aroclor-1260, and dieldrin are sufficient although they are higher than 10 percent of the FRL MDC. In addition, dibenzo(a,h)anthracene will be analyzed by SW846 Method 8310 since the Contract Laboratory Program method cannot achieve an MDC less than the FRL.

ppm, µg/g, mg/kg, ng/mg, pg/µg can all be interchanged and ppb, ng/g, µg/kg can all be interchanged.

APPENDIX C

SOIL SAMPLE LOCATIONS

TABLE C-1
SOIL SAMPLE LOCATIONS IN THE NORTHWEST CORNER OF THE FORMER PRODUCTION AREA

Boring ID	Sample ID*	Northing	Easting	Estimated Boring Depth	Sample Depths at Boring Location (feet)	TAL
A6-SWL-1	A6-SWL-1-48	482243.77	1348213.60	26.0	23.0-24.0	B,D,E,F,G,H,I,J
	A6-SWL-1-52				25.0-26.0	
A6-SWL-2	A6-SWL-2-48	482230.84	1348241.36	26.0	23.0-24.0	B,D,E,F,G,H,I,J
	A6-SWL-2-52				25.0-26.0	
A6-SWL-3	A6-SWL-3-28	482166.29	1348346.49	16.0	13.0-14.0	B,D,E,F,G,H,I,J
	A6-SWL-3-32				15.0-16.0	
A6-SWL-4	A6-SWL-4-48	482176.19	1348303.71	26.0	23.0-24.0	B,D,E,F,G,H,I,J
	A6-SWL-4-52				25.0-26.0	
A6-SWL-5	A6-SWL-5-48	482144.88	1348270.20	26.0	23.0-24.0	B,D,E,F,G,H,I,J
	A6-SWL-5-52				25.0-26.0	
A6-SWL-6	A6-SWL-6-2	482256.73	1348249.26	16.0	0.0-1.0	A
	A6-SWL-6-12				5.0-6.0	
	A6-SWL-6-22				10.0-11.0	
	A6-SWL-6-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-7	A6-SWL-7-2	482239.33	1348112.56	16.0	0.0-1.0	A
	A6-SWL-7-12				5.0-6.0	
	A6-SWL-7-22				10.0-11.0	
	A6-SWL-7-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-8	A6-SWL-8-2	482225.43	1348129.41	16.0	0.0-1.0	A
	A6-SWL-8-12				5.0-6.0	
	A6-SWL-8-22				10.0-11.0	
	A6-SWL-8-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-9	A6-SWL-9-2	482227.26	1348181.33	16.0	0.0-1.0	A
	A6-SWL-9-12				5.0-6.0	
	A6-SWL-9-22				10.0-11.0	
	A6-SWL-9-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-10	A6-SWL-10-2	482157.91	1348117.20	16.0	0.0-1.0	A
	A6-SWL-10-12				5.0-6.0	
	A6-SWL-10-22				10.0-11.0	
	A6-SWL-10-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-11	A6-SWL-11-2	482191.96	1348161.61	16.0	0.0-1.0	A
	A6-SWL-11-12				5.0-6.0	
	A6-SWL-11-22				10.0-11.0	
	A6-SWL-11-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-12	A6-SWL-12-2	482157.91	1348162.24	16.0	0.0-1.0	A
	A6-SWL-12-12				5.0-6.0	
	A6-SWL-12-22				10.0-11.0	
	A6-SWL-12-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-13	A6-SWL-13-2	482163.17	1348202.86	16.0	0.0-1.0	A
	A6-SWL-13-12				5.0-6.0	
	A6-SWL-13-22				10.0-11.0	
	A6-SWL-13-32				15.0-16.0	B,D,E,F,G,H,I,J

TABLE C-1
SOIL SAMPLE LOCATIONS IN THE NORTHWEST CORNER OF THE FORMER PRODUCTION AREA

Boring ID	Sample ID*	Northing	Easting	Estimated Boring Depth	Sample Depths at Boring Location (feet)	TAL
A6-SWL-14	A6-SWL-14-2	482201.91	1348274.22	26.0	0.0-1.0	A
	A6-SWL-14-12				5.0-6.0	
	A6-SWL-14-22				10.0-11.0	
	A6-SWL-14-32				15.0-16.0	
	A6-SWL-14-42				20.0-21.0	
	A6-SWL-14-52				25.0-26.0	B,D,E,F,G,H,I,J
A6-SWL-15	A6-SWL-15-2	482264.60	1348155.72	16.0	0.0-1.0	A
	A6-SWL-15-12				5.0-6.0	
	A6-SWL-15-22				10.0-11.0	
	A6-SWL-15-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-16	A6-SWL-16-2	482277.48	1348218.87	16.0	0.0-1.0	A
	A6-SWL-16-12				5.0-6.0	
	A6-SWL-16-22				10.0-11.0	
	A6-SWL-16-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-17	A6-SWL-17-2	482282.50	1348282.85	16.0	0.0-1.0	A
	A6-SWL-17-12				5.0-6.0	
	A6-SWL-17-22				10.0-11.0	
	A6-SWL-17-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-18	A6-SWL-18-2	482302.05	1348341.03	16.0	0.0-1.0	A
	A6-SWL-18-12				5.0-6.0	
	A6-SWL-18-22				10.0-11.0	
	A6-SWL-18-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-19	A6-SWL-19-2	482273.66	1348323.74	16.0	0.0-1.0	A
	A6-SWL-19-12				5.0-6.0	
	A6-SWL-19-22				10.0-11.0	
	A6-SWL-19-32				15.0-16.0	B,D,E,F,G,H,I,J
A6-SWL-20	A6-SWL-20-2	482140.57	1348232.20	5.0	0.0-1.0	C
	A6-SWL-20-4				1.0-2.0	
	A6-SWL-20-6				2.0-3.0	
	A6-SWL-20-8				3.0-4.0	
	A6-SWL-20-10				4.0-5.0	

* The identifier specified in the PSP will be added to the end of the sample id for the constituent being analyzed

TABLE C-2
SOIL SAMPLE LOCATIONS FOR THE FIRE TRAINING FACILITY

Sample ID	Northing	Easting	Sample Interval (feet)	TAL
A6-FTF-1-2	482684.85	1349390.6	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-1-6	482684.85	1349390.6	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-1-12	482684.85	1349390.6	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-2-2	482683.77	1349453.47	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-2-6	482683.77	1349453.47	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-2-12	482683.77	1349453.47	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-3-2	482682.93	1349510.66	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-3-6	482682.93	1349510.66	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-3-12	482682.93	1349510.66	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-4-2	482637.26	1349476.2	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-4-6	482637.26	1349476.2	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-4-12	482637.26	1349476.2	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-5-2	482596.78	1349358.64	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-5-6	482596.78	1349358.64	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-5-12	482596.78	1349358.64	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-5-18	482596.78	1349358.64	8 – 9	K,L,J,E,M,F,N,G,O
A6-FTF-6-2	482609.96	1349371.07	0 – 1	E,M,F,N,G,O
A6-FTF-6-6	482609.96	1349371.07	2 – 3	E,M,F,N,G,O
A6-FTF-6-12	482609.96	1349371.07	5 - 6	E,M,F,N,G,O
A6-FTF-6-18	482609.96	1349371.07	8 – 9	E,M,F,N,G,O
A6-FTF-7-2	482611.76	1349392.09	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-7-6	482611.76	1349392.09	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-7-12	482611.76	1349392.09	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-7-18	482611.76	1349392.09	8 – 9	K,L,J,E,M,F,N,G,O
A6-FTF-8-2	482607.98	1349412.73	0 – 1	E,M,F,N,G,O
A6-FTF-8-6	482607.98	1349412.73	2 – 3	E,M,F,N,G,O
A6-FTF-8-12	482607.98	1349412.73	5 – 6	E,M,F,N,G,O
A6-FTF-9-2	482607.26	1349429.32	0 – 1	L,J,E,M,F,N,G,O
A6-FTF-9-6	482607.26	1349429.32	2 – 3	L,J,E,M,F,N,G,O
A6-FTF-9-12	482607.26	1349429.32	5 – 6	L,J,E,M,F,N,G,O
A6-FTF-10-2	482593.88	1349482.42	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-10-6	482593.88	1349482.42	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-10-12	482593.88	1349482.42	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-11-2	482575.00	1349519.84	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-11-6	482575.00	1349519.84	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-11-12	482575.00	1349519.84	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-12-2	482539.10	1349489.27	0 – 1	L,J,E,M,F,N,G,O
A6-FTF-12-6	482539.10	1349489.27	2 – 3	L,J,E,M,F,N,G,O
A6-FTF-12-12	482539.10	1349489.27	5 – 6	L,J,E,M,F,N,G,O
A6-FTF-13-2	482534.39	1349488.98	0 – 1	K
A6-FTF-13-6	482534.39	1349488.98	2 – 3	K
A6-FTF-13-12	482534.39	1349488.98	5 – 6	K
A6-FTF-14-2	482534.41	1349499.11	0 – 1	K
A6-FTF-14-6	482534.41	1349499.11	2 – 3	K
A6-FTF-14-12	482534.41	1349499.11	5 – 6	K
A6-FTF-15-2	482529.41	1349493.96	0 – 1	K
A6-FTF-15-6	482529.41	1349493.96	2 – 3	K
A6-FTF-15-12	482529.41	1349493.96	5 – 6	K
A6-FTF-16-2	482524.48	1349499.03	0 – 1	K
A6-FTF-16-6	482524.48	1349499.03	2 – 3	K
A6-FTF-16-12	482524.48	1349499.03	5 – 6	K
A6-FTF-17-2	482524.38	1349488.84	0 – 1	K

TABLE C-2
SOIL SAMPLE LOCATIONS FOR THE FIRE TRAINING FACILITY

Sample ID	Northing	Easting	Sample Interval (feet)	TAL
A6-FTF-17-6	482524.38	1349488.84	2 – 3	K
A6-FTF-17-12	482524.38	1349488.84	5 – 6	K
A6-FTF-18-2	482530.78	1349452.94	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-18-6	482530.78	1349452.94	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-18-12	482530.78	1349452.94	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-19-2	482512.72	1349443.22	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-19-6	482512.72	1349443.22	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-19-12	482512.72	1349443.22	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-20-2	482497.24	1349427.28	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-20-6	482497.24	1349427.28	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-20-12	482497.24	1349427.28	5 – 6	K,L,J,E,M,F,N,G,O
A6-FTF-21-2	482499.21	1349367.08	0 – 1	A,L,J,E,M,F,N,G,O
A6-FTF-21-6	482499.21	1349367.08	2 – 3	A,L,J,E,M,F,N,G,O
A6-FTF-21-12	482499.21	1349367.08	5 – 6	A,L,J,E,M,F,N,G,O
A6-FTF-22-2	482505.22	1349359.54	0 – 1	A,L,J,E,M,F,N,G,O
A6-FTF-22-6	482505.22	1349359.54	2 – 3	A,L,J,E,M,F,N,G,O
A6-FTF-22-12	482505.22	1349359.54	5 – 6	A,L,J,E,M,F,N,G,O
A6-FTF-23-2	482546.39	1349355.52	0 – 1	L,J,E,M,F,N,G,O
A6-FTF-23-6	482546.39	1349355.52	2 – 3	L,J,E,M,F,N,G,O
A6-FTF-23-12	482546.39	1349355.52	5 – 6	L,J,E,M,F,N,G,O
A6-FTF-24-2	482477.17	1349417.75	0 – 1	E,M,F,N,G,O
A6-FTF-24-6	482477.17	1349417.75	2 – 3	E,M,F,N,G,O
A6-FTF-24-12	482477.17	1349417.75	5 – 6	E,M,F,N,G,O
A6-FTF-25-2	482477.27	1349437.97	0 – 1	E,M,F,N,G,O
A6-FTF-25-6	482477.27	1349437.97	2 – 3	E,M,F,N,G,O
A6-FTF-25-12	482477.27	1349437.97	5 – 6	E,M,F,N,G,O
A6-FTF-26-2	482467.24	1349427.93	0 – 1	E,M,F,N,G,O
A6-FTF-26-6	482467.24	1349427.93	2 – 3	E,M,F,N,G,O
A6-FTF-26-12	482467.24	1349427.93	5 – 6	E,M,F,N,G,O
A6-FTF-27-2	482457.26	1349437.97	0 – 1	E,M,F,N,G,O
A6-FTF-27-6	482457.26	1349437.97	2 – 3	E,M,F,N,G,O
A6-FTF-27-12	482457.26	1349437.97	5 – 6	E,M,F,N,G,O
A6-FTF-28-2	482457.37	1349417.96	0 – 1	E,M,F,N,G,O
A6-FTF-28-6	482457.37	1349417.96	2 – 3	E,M,F,N,G,O
A6-FTF-28-12	482457.37	1349417.96	5 – 6	E,M,F,N,G,O
A6-FTF-29-2	482572.70	1349251.77	0 – 1	A
A6-FTF-29-6	482572.70	1349251.77	2 – 3	A
A6-FTF-29-12	482572.70	1349251.77	5 – 6	A
A6-FTF-30-2	482572.70	1349271.78	0 – 1	A
A6-FTF-30-6	482572.70	1349271.78	2 – 3	A
A6-FTF-30-12	482572.70	1349271.78	5 – 6	A
A6-FTF-31-2	482562.65	1349261.98	0 – 1	A
A6-FTF-31-6	482562.65	1349261.98	2 – 3	A
A6-FTF-31-12	482562.65	1349261.98	5 – 6	A
A6-FTF-32-2	482552.68	1349271.87	0 – 1	A
A6-FTF-32-6	482552.68	1349271.87	2 – 3	A
A6-FTF-32-12	482552.68	1349271.87	5 – 6	A
A6-FTF-33-2	482552.68	1349251.87	0 – 1	A
A6-FTF-33-6	482552.68	1349251.87	2 – 3	A
A6-FTF-33-8	482552.68	1349251.87	5 – 6	A
A6-FTF-34-2	482598.83	1349283.38	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-34-6	482598.83	1349283.38	2 – 3	K,L,J,E,M,F,N,G,O

TABLE C-2
SOIL SAMPLE LOCATIONS FOR THE FIRE TRAINING FACILITY

Sample ID	Northing	Easting	Sample Interval (feet)	TAL
A6-FTF-34-8	482598.83	1349283.38	3 – 4	K,L,J,E,M,F,N,G,O
A6-FTF-35-2	482604.49	1349257.07	0 – 1	K,E,M,F,N,G,O
A6-FTF-35-6	482604.49	1349257.07	2 – 3	K,E,M,F,N,G,O
A6-FTF-35-8	482604.49	1349257.07	3 – 4	K,E,M,F,N,G,O
A6-FTF-36-2	482632.81	1349255.05	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-36-6	482632.81	1349255.05	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-36-8	482632.81	1349255.05	3 – 4	K,L,J,E,M,F,N,G,O
A6-FTF-37-2	482653.78	1349255.49	0 – 1	K,E,M,F,N,G,O
A6-FTF-37-6	482653.78	1349255.49	2 – 3	K,E,M,F,N,G,O
A6-FTF-37-8	482653.78	1349255.49	3 – 4	K,E,M,F,N,G,O
A6-FTF-38-2	482676.68	1349257.20	0 – 1	E,M,F,N,G,O
A6-FTF-38-6	482676.68	1349257.20	2 – 3	E,M,F,N,G,O
A6-FTF-38-8	482676.68	1349257.20	3 – 4	E,M,F,N,G,O
A6-FTF-39-2	482700.39	1349259.16	0 – 1	E,M,F,N,G,O
A6-FTF-39-6	482700.39	1349259.16	2 – 3	E,M,F,N,G,O
A6-FTF-39-8	482700.39	1349259.16	3 – 4	E,M,F,N,G,O
A6-FTF-40-2	482705.23	1349281.47	0 – 1	L,J,E,M,F,N,G,O
A6-FTF-40-6	482705.23	1349281.47	2 – 3	L,J,E,M,F,N,G,O
A6-FTF-40-8	482705.23	1349281.47	3 – 4	L,J,E,M,F,N,G,O
A6-FTF-41-2	482672.87	1349258.55	0 – 1	A
A6-FTF-41-6	482672.87	1349258.55	2 – 3	A
A6-FTF-41-8	482672.87	1349258.55	3 – 4	A
A6-FTF-42-2	482672.87	1349320.56	0 – 1	A,L,J,E,M,F,N,G,O
A6-FTF-42-6	482672.87	1349320.56	2 – 3	A,L,J,E,M,F,N,G,O
A6-FTF-42-8	482672.87	1349320.56	3 – 4	A,L,J,E,M,F,N,G,O
A6-FTF-43-2	482628.80	1349317.42	0 – 1	A
A6-FTF-43-6	482628.80	1349317.42	2 – 3	A
A6-FTF-43-8	482628.80	1349317.42	3 – 4	A
A6-FTF-44-2	482628.80	1349283.38	0 – 1	A
A6-FTF-44-6	482628.80	1349283.38	2 – 3	A
A6-FTF-44-8	482628.80	1349283.38	3 – 4	A
A6-FTF-45-2	482602.79	1349454.02	0 – 1	L,J,E,M,F,N,G,O
A6-FTF-45-6	482602.79	1349454.02	2 – 3	L,J,E,M,F,N,G,O
A6-FTF-45-8	482602.79	1349454.02	3 – 4	L,J,E,M,F,N,G,O
A6-FTF-46-2	482647.82	1349342.60	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-46-6	482647.82	1349342.60	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-46-8	482647.82	1349342.60	3 – 4	K,L,J,E,M,F,N,G,O
A6-FTF-47-2	482599.26	1349316.83	0 – 1	K,L,J,E,M,F,N,G,O
A6-FTF-47-6	482599.26	1349316.83	2 – 3	K,L,J,E,M,F,N,G,O
A6-FTF-47-8	482599.26	1349316.83	3 – 4	K,L,J,E,M,F,N,G,O
A6-FTF-48-22	482549.06	1349371.62	10 – 11	K
A6-FTF-48-28	482549.06	1349371.62	13 – 14	K
A6-FTF-49-22	482542.20	1349378.56	10 – 11	K
A6-FTF-49-28	482542.20	1349378.56	13 – 14	K
A6-FTF-50-22	482541.95	1349364.59	10 – 11	K
A6-FTF-50-28	482541.95	1349364.59	13 – 14	K
A6-FTF-51-22	482556.09	1349364.51	10 – 11	K
A6-FTF-51-28	482556.09	1349364.51	13 – 14	K
A6-FTF-52-22	482556.00	1349378.48	10 – 11	K
A6-FTF-52-28	482556.00	1349378.48	13 – 14	K
A6-FTF-53-2	482564.83	1349382.41	0 – 1	A
A6-FTF-53-6	482564.83	1349382.41	2 – 3	A

TABLE C-2
SOIL SAMPLE LOCATIONS FOR THE FIRE TRAINING FACILITY

Sample ID	Northing	Easting	Sample Interval (feet)	TAL
A6-FTF-53-14	482564.83	1349382.41	6 – 7	A
A6-FTF-53-18	482564.83	1349382.41	8 – 9	A
A6-FTF-54-2	482592.98	1349412.70	0 – 1	K
A6-FTF-54-6	482592.98	1349412.70	2 – 3	K
A6-FTF-54-14	482592.98	1349412.70	6 – 7	K
A6-FTF-54-18	482592.98	1349412.70	8 – 9	K
A6-FTF-54-22	482592.98	1349412.70	10 – 11	K
A6-FTF-54-28	482592.98	1349412.70	13 – 14	K
A6-FTF-55-2	482586.12	1349405.84	0 – 1	K
A6-FTF-55-6	482586.12	1349405.84	2 – 3	K
A6-FTF-55-14	482586.12	1349405.84	6 – 7	K
A6-FTF-55-18	482586.12	1349405.84	8 – 9	K
A6-FTF-55-22	482586.12	1349405.84	10 – 11	K
A6-FTF-55-28	482586.12	1349405.84	13 – 14	K
A6-FTF-56-2	482585.96	1349419.67	0 – 1	K
A6-FTF-56-6	482585.96	1349419.67	2 – 3	K
A6-FTF-56-14	482585.96	1349419.67	6 – 7	K
A6-FTF-56-18	482585.96	1349419.67	8 – 9	K
A6-FTF-56-22	482585.96	1349419.67	10 – 11	K
A6-FTF-56-28	482585.96	1349419.67	13 – 14	K
A6-FTF-57-2	482599.84	1349419.56	0 – 1	K
A6-FTF-57-6	482599.84	1349419.56	2 – 3	K
A6-FTF-57-14	482599.84	1349419.56	6 – 7	K
A6-FTF-57-18	482599.84	1349419.56	8 – 9	K
A6-FTF-57-22	482599.84	1349419.56	10 – 11	K
A6-FTF-57-28	482599.84	1349419.56	13 – 14	K
A6-FTF-58-2	482600.00	1349405.73	0 – 1	K
A6-FTF-58-6	482600.00	1349405.73	2 – 3	K
A6-FTF-58-14	482600.00	1349405.73	6 – 7	K
A6-FTF-58-18	482600.00	1349405.73	8 – 9	K
A6-FTF-58-22	482600.00	1349405.73	10 – 11	K
A6-FTF-58-28	482600.00	1349405.73	13 – 14	K