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PROJECT SPECIFIC PLAN FOR AREA 4A CERTIFICATION SAMPLING

FERNALD CLOSURE PROJECT
FERNALD, OHIO

APRIL 2005

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4/1/05
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Safety, Health and Quality

FERNALD CLOSURE PROJECT

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TABLE OF CONTENTS

Page

List of Acronyms and Abbreviations iii
List of Figures ii
List of Tables ii

1.0 Introduction 1-1
1.1 Background and Purpose 1-1
1.2 Scope 1-1
1.3 Key Project Personnel 1-1

2.0 Certification Sampling Program 2-1
2.1 Certification Design 2-1
2.2 Surveying 2-1
2.3 Physical Soil Sample Collection 2-1
2.3.1 Sample Collection 2-1
2.3.2 Equipment Decontamination 2-3
2.3.3 Physical Sample Identification 2-3

3.0 Certification Sample Analysis 3-1

4.0 Quality Assurance/Quality Control Requirements 4-1
4.1 Field Quality Control Samples, Analytical Requirements and Data Validation 4-1
4.2 Project Specific Procedures, Manuals and Documents 4-2
4.3 Independent Assessment 4-2
4.4 Implementation of Changes 4-2

5.0 Health and Safety 5-1

6.0 Disposition of Waste 6-1

7.0 Data Management 7-1

APPENDICES

Appendix A Data Quality Objective SL-052, Rev. 3
Appendix B Area 4A Sample Locations and Identifiers

5891

LIST OF TABLES

Table 1-1	Key Project Personnel
Table 3-1	Sampling and Analytical Requirements
Table 3-2	Target Analyte Lists

LIST OF FIGURES

Figure 1-1	Area 4A Location Map
Figure 1-2	Area 4A Certification Area Boundary
Figure 1-3	Area 4A Historical Features
Figure 2-1	Area 4A CU Boundary Map
Figure 2-2	Area 4A Sub-CU Boundary and Certification Sampling Locations
Figure 2-3	Area 4A UST #14 Footprint Sampling Locations

LIST OF ACRONYMS AND ABBREVIATIONS

ASCOC	area specific constituent of concern
ASL	analytical support level
CDL	Certification Design Letter
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	constituent of concern
CU	certification unit
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
FACTS	Fernald Analytical Computerized Tracking System
FAL	Field Activity Log
FCP	Fernald Closure Project
FPA	Former Production Area
FRL	final remediation level
GC/FID	gas chromatography/flame ionization detector
GC/MS	gas chromatography/mass spectroscopy
HWMU	hazardous waste management unit
IC	ion chromatograph
ICP/MS	inductively couple plasma/mass spectroscopy
LSC	liquid scintillation counting
MDC	Main Drainage Corridor
MDL	minimum detection level
mg/kg	milligrams per kilogram
NAD83	North American Datum of 1983
pCi/g	picoCuries per gram
PSP	project specific plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SED	Sitewide Environmental Database
SEP	Sitewide Excavation Plan
SPL	Sample Processing Laboratory
TAL	Target Analyte List
UST	underground storage tank
V/FCN	Variance/Field Change Notice
VOC	volatile organic compound
VSL	validation support level
WAC	waste acceptance criteria
WAO	Waste Acceptance Organization

1.0 INTRODUCTION

1.1 BACKGROUND AND PURPOSE

This Project Specific Plan (PSP) describes the certification sampling and analysis necessary to certify Area 4A. Certification demonstrates that risk-based, area-specific constituents of concern (ASCOCs) meet final remediation levels (FRLs). As shown on Figure 1-1, Area 4A is located in the southeast quadrant of the Former Production Area (FPA). Due to the location of the Main Drainage Corridor (MDC), the certification boundary of Area 4A has been reduced, as shown on Figure 1-2. Area 4A also includes a high-leachability zone where the total uranium FRL is 20 milligrams per kilogram (mg/kg); underground storage tank (UST) #14; and hazardous waste management unit (HWMU) #36, as shown on Figure 1-3. There are a total of nine certification units (CUs) for Area 4A.

1.2 SCOPE

The scope of this PSP includes details of certification sampling, analysis and validation that will take place in Area 4A. The footprint of UST #14 will also be sampled under this PSP. Field activities will be consistent with the Sitewide Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Quality Assurance Project Plan (SCQ) and Section 3.4 of the Sitewide Excavation Plan (SEP). The certification sampling program, as discussed in Section 2.0 of this PSP, will be consistent with Data Quality Objective (DQO) SL-052, Revision 3, which is included as Appendix A of this PSP.

As discussed in the Certification Design Letter (CDL) for Area 4A, HWMU #36 is not included in the scope of this PSP.

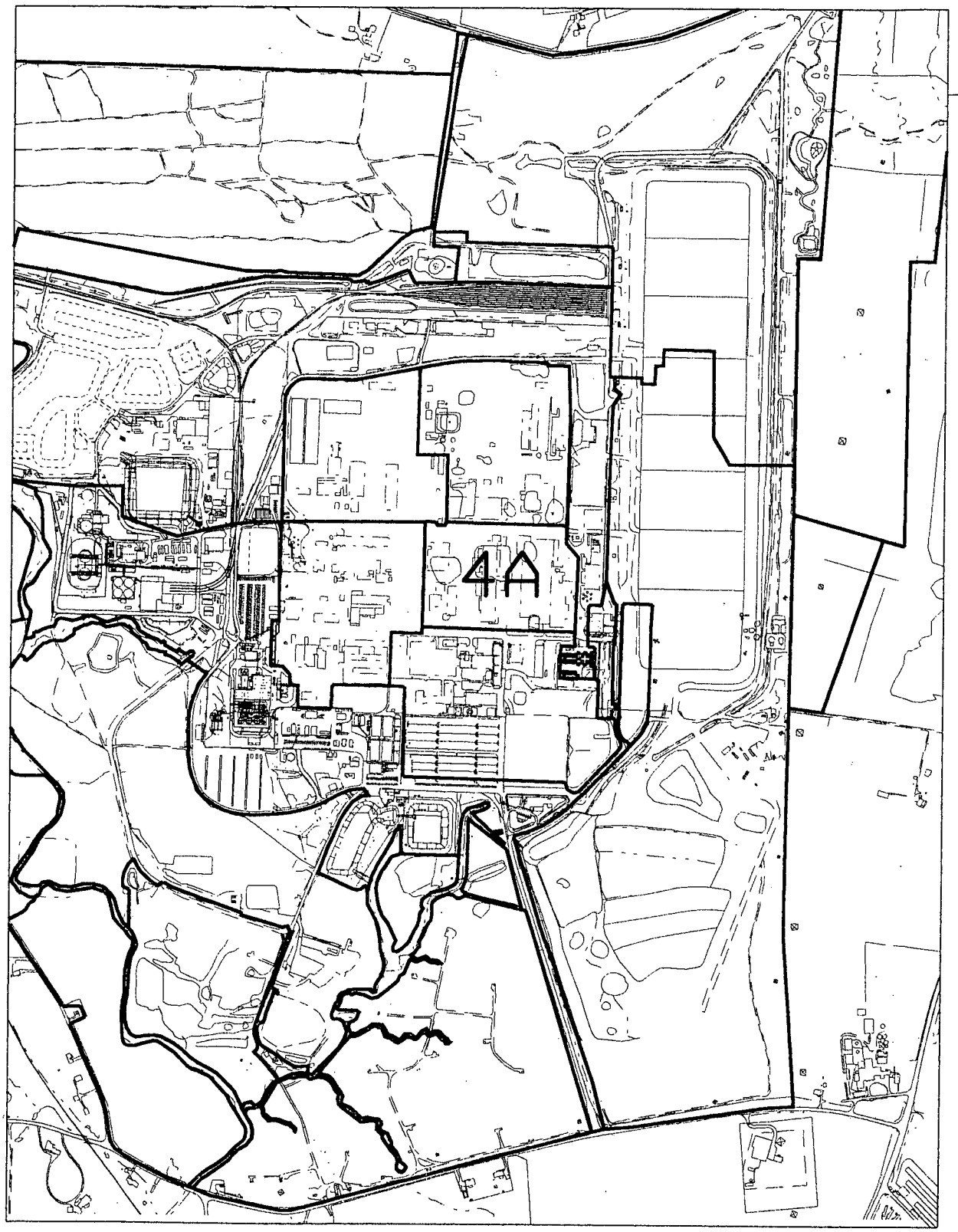
1.3 KEY PROJECT PERSONNEL

Key project personnel responsible for performance of the project are listed in Table 1-1.

TABLE 1-1
KEY PROJECT PERSONNEL

Title	Primary	Alternate
DOE Contact	Johnny Reising	TBD
Project Manager	Jyh-Dong Chiou	Rich Abitz
Characterization Manager	Frank Miller	Denise Arico
Field Sampling Manager	Tom Buhrlage	Jim Hey
Surveying Manager	Jim Schwing	Andy Clinton/Eric Harman
WAO Contact	Christa Walls	Linda Barlow
Laboratory Contact	Heather Medley	Amy Meyer
Area 4A Data Management Contact	Denise Arico	Krista Flaugh
Data Validation Contact	James Chambers	Baohe Chen
Field Data Validation Contact	Dee Dee Early	James Chambers
FACTS/SED Database Contact	Kym Lockard	Susan Marsh
QA/QC Contact	Reinhard Friske	Darren Wessel
Safety and Health Contact	Gregg Johnson	Pete Bolig/Jeff Middaugh

DOE – U.S. Department of Energy
FACTS – Fernald Analytical Computerized Tracking System
QA/QC – Quality Assurance/Quality Control
SED – Sitewide Environmental Database
WAO – Waste Acceptance Organization



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SCALE

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FIGURE 1-1. AREA 4A LOCATION MAP

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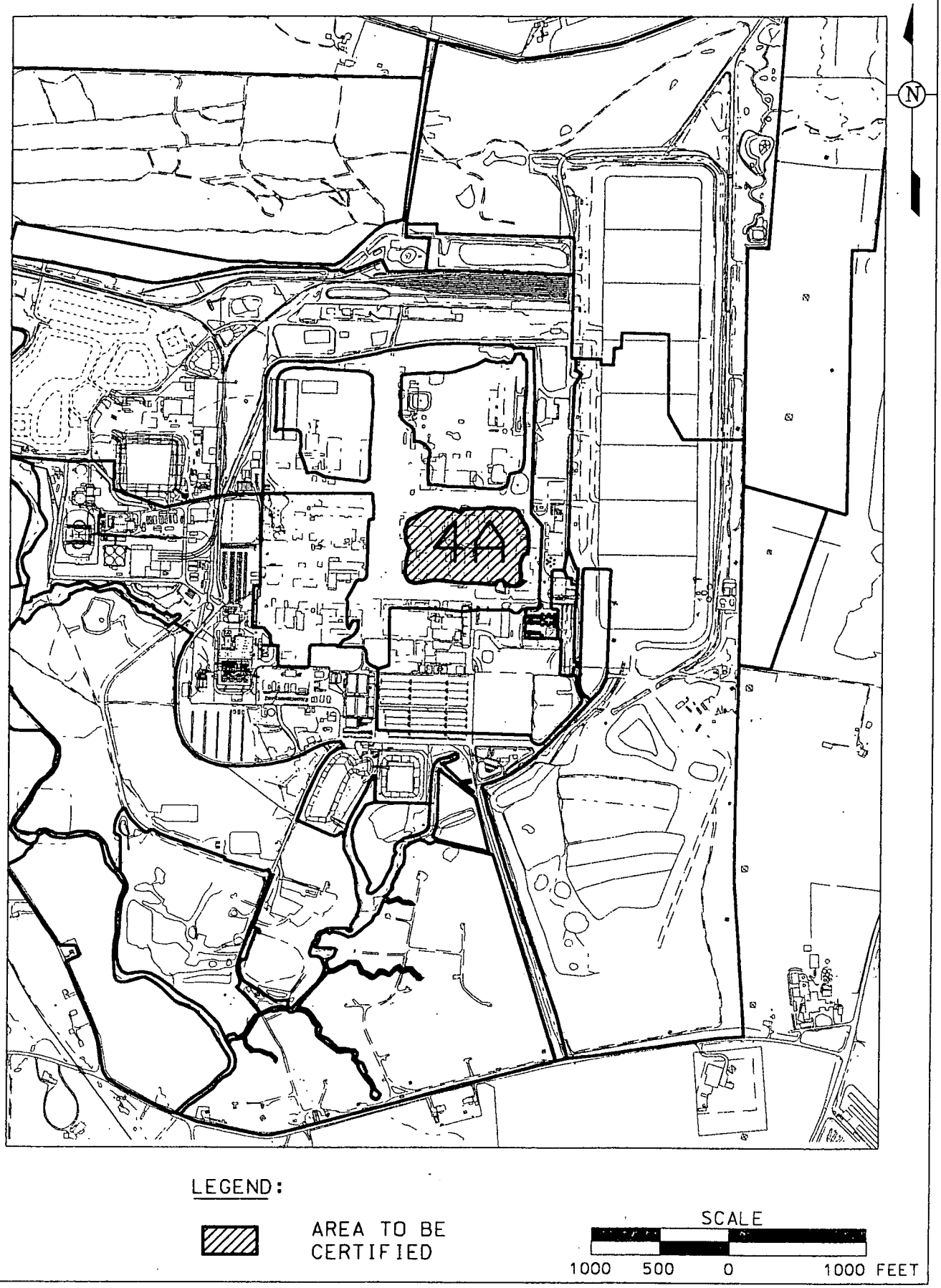

FIGURE 1-2. AREA 4A CERTIFICATION AREA BOUNDARY

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STATE PLANAR COORDINATE SYSTEM 1983

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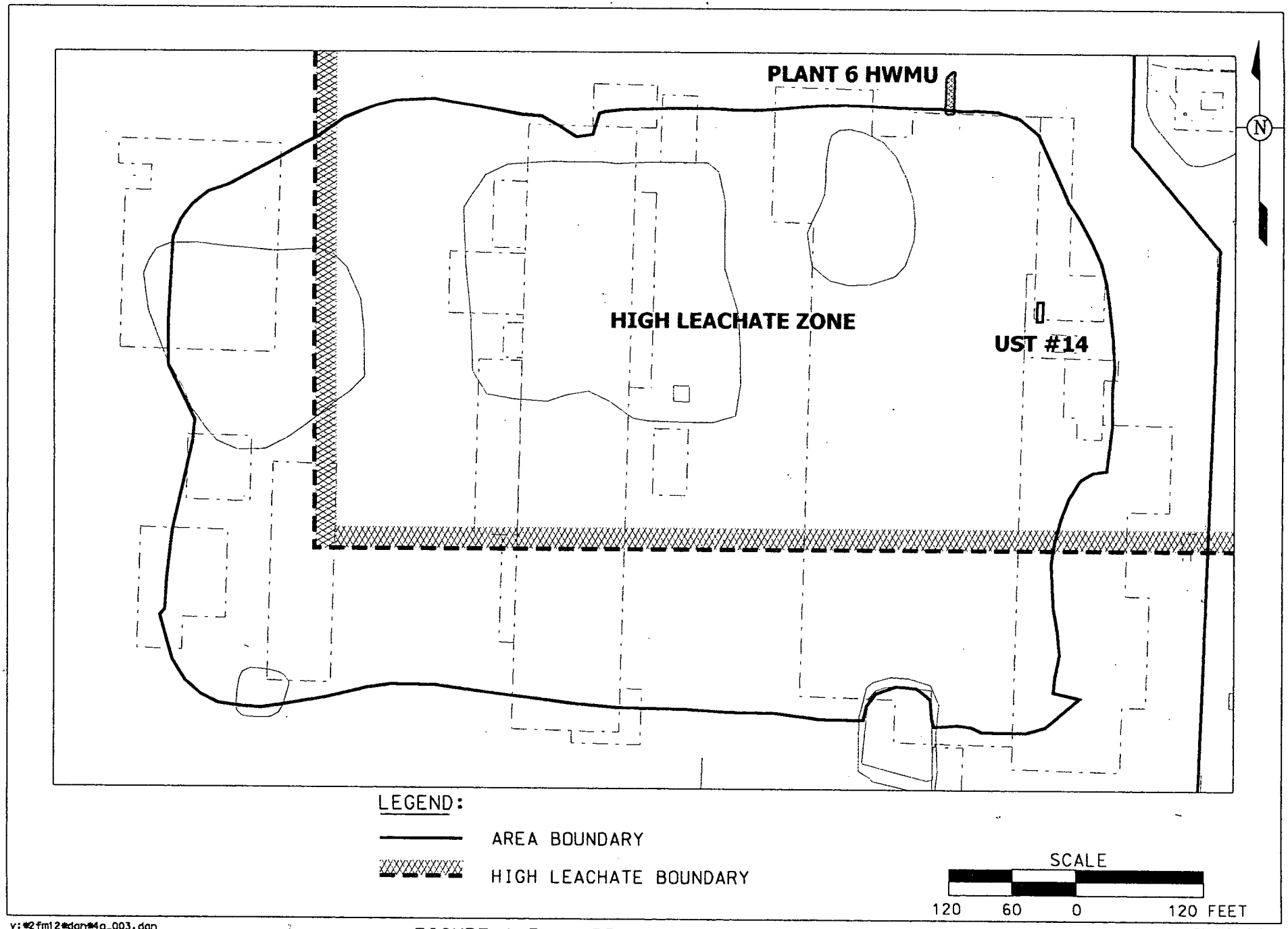

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FIGURE 1-3. AREA 4A HISTORICAL FEATURES

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2.0 CERTIFICATION SAMPLING PROGRAM

2.1 CERTIFICATION DESIGN

Details and logic of the certification design are described in the CDL for Area 4A. Within Area 4A, nine Group 1 CUs have been established. Eight of the CUs have each been divided into 16 sub-CUs. Within each sub-CU, one random certification sample location has been identified. The sample locations in each CU were tested against the minimum distance criterion as defined in the SEP. Certification sampling will consist of sample collection at 12 of the 16 selected locations, plus one field duplicate sample within the CU. The four archive locations will only be sampled if results from the initial 12 locations indicate that additional data are necessary.

In addition to the eight Group 1 CUs described above, another CU has been established for the footprint of UST #14. Within the footprint of UST #14, eight sample locations have been identified. Certification samples will be collected at all eight locations.

The sample locations, field duplicate samples, and archive samples are identified in Appendix B.

2.2 SURVEYING

Before certification sampling activities begin, the North American Datum of 1983 (NAD83) State Planar coordinates for each selected sampling location will be surveyed and identified in the field with a flag. All locations will be field verified to ensure no surface obstacles will prevent collection at the planned location. The Area 4A CU boundary is shown on Figure 2-1, and the tentative certification sampling locations are shown on Figure 2-2 and Appendix B. The tentative sample locations for the UST footprint, CU A4A-C9-UST14, are shown on Figure 2-3 and Appendix B. All certification sample locations meet the minimum distance criterion.

2.3 PHYSICAL SOIL SAMPLE COLLECTION

2.3.1 Sample Collection

Soil samples will be collected in accordance with procedure SMPL-01, Solids Sampling. Surface samples will be collected using 3-inch diameter, 6-inch long, plastic liners, or an alternate method as identified in SMPL-01, as long as sufficient volume is collected from the appropriate depth to perform the prescribed analyses. Ultimately, the method of sample collection will be left to the discretion of the Field Sampling Lead. Following sample collection, each soil core shall be divided, if necessary, and placed into the proper

sample containers. Upon completion of sample collection, the boreholes will be collapsed and no additional abandonment is necessary.

Quality control sample requirements will include a duplicate field sample, a trip blank, and a container blank and/or rinsate, and will be collected per procedure SMPL-21, Collection of Field Quality Control Samples. For the duplicate field sample, twice the soil volume (a second core) will be collected at one location in the CU, and will not be homogenized with the original sample. The location that requires the collection of a duplicate sample is identified in Appendix B. A trip blank will be collected each day that volatile organic compound (VOC) samples are collected, or one per 20 VOC samples that are collected, or one per cooler that will be shipped, whichever is more frequent. Depending on the sample collection method used, container blanks or rinsates will be collected, one before sample collection begins and one at the conclusion of sample collection for the entire Area 4A. All samples will be assigned unique sample identification numbers. Additional information regarding quality control requirements can be found in Section 4.1.

If a subsurface obstacle prevents sample collection at the specified location, it can be moved according to the following guidelines:

- The distance moved must be as small as possible (less than 3 feet);
- It must remain within the boundary of the same CU and sub-CU, and must still meet the minimum distance criterion;
- If the distance moved is greater than 3 feet, the move must be documented in a Variance/Field Change Notice (V/FCN), considered as significant, which will be approved by the agencies prior to collection.

Anytime a location is moved, the appropriate figure should be used to determine the best direction to move the point to adhere to the above guidelines. The Characterization Manager or designee should be contacted when a sample location is moved. All final sampling locations will be documented in the Area 4A Certification Report.

Customer sample numbers and FACTS identification numbers will be assigned to all samples collected. The sample labels will be completed with sample collection information, and technicians will complete a Field Activity Log (FAL), a Sample Collection Log, and a Chain of Custody/Request for Analysis form in the field prior to submittal of the samples.

All soil samples from the CU with like analyses (including the field duplicate) will be batched and submitted to the Sample Processing Laboratory (SPL) under one set of Chain of Custody/Request for Analysis forms which will represent one analytical release. The container blank and/or rinsate will be listed on a separate Chain of Custody/Request for Analysis form. No alpha/beta screens will be required, as historical information can be used for shipping purposes.

2.3.2 Equipment Decontamination

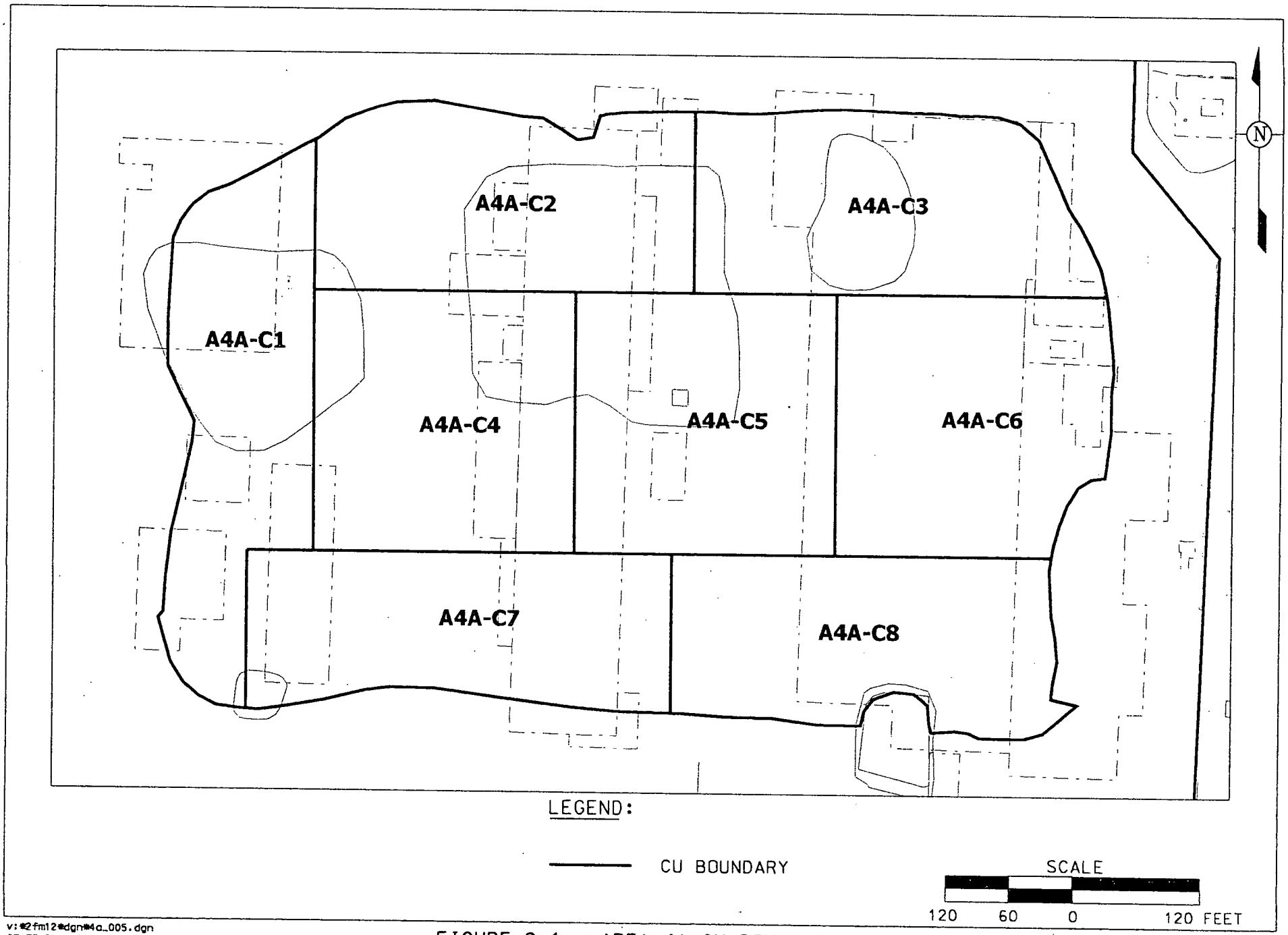
Decontamination is performed to prevent the introduction of contaminants from sampling equipment to subsequent soil samples. Field Technicians will ensure that sampling equipment (core tubes and caps) has been decontaminated prior to transport to the field. As described in SMPL-01, all sampling equipment will have been decontaminated before it is transported to the field site, and the 6-inch core liners will be decontaminated using the Level II (Section K.11 of the SCQ) procedure upon receipt from the manufacturer. Decontamination is also necessary in the field if sampling equipment is reused. If an alternate sampling method is used, equipment will be decontaminated between collection of sample intervals, and again after the sampling performed under this PSP is completed. Following decontamination, clean disposable wipes may be used to replace air-drying of the equipment.

2.3.3 Physical Sample Identification

Each soil certification sample will be assigned a unique sample identification number as *Remediation Area-C#-Location^Analysis-QC,* where:

A4A	=	Sample collected from Remediation Area 4A
C#	=	Certification unit from which sample was collected
UST14	=	Samples collected from UST #14
Location	=	Sample location number within the CU (1 through 16)
Analysis	=	"R" indicates radiological analysis; "F" indicates fluoride analysis; "M" indicates metals analysis; "L" indicates VOC analysis; and "MTH" indicates methanol analysis.
QC	=	Quality control sample, if applicable. A "D" indicates a field duplicate sample; "Y" indicates a container blank sample; "X" indicates a rinsate; "TB1" indicates the first trip blank collected, and each additional trip blank collected will be consecutively numbered.

For example, a field duplicate sample taken from the 1st sample location from Area 4A CU 1 for radiological and fluoride analyses would be identified as A4A-C1-1^RF-D. The rinsate sample will be identified as A4A-C1-X, and the analysis code will also be added. For example, the rinsate will be identified as A4A-C1-R-X. The container blank will be identified as A4A-C1-Y, and the analysis code will also be added. For example, the container blank will be identified as A4A-C1-R-Y. A trip blank will be identified as A4A-C6-TB#, and the analysis code will be added. The first trip blank will be identified as A4A-C6-L-TB1.



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STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 2-1. AREA 4A CU BOUNDARY MAP

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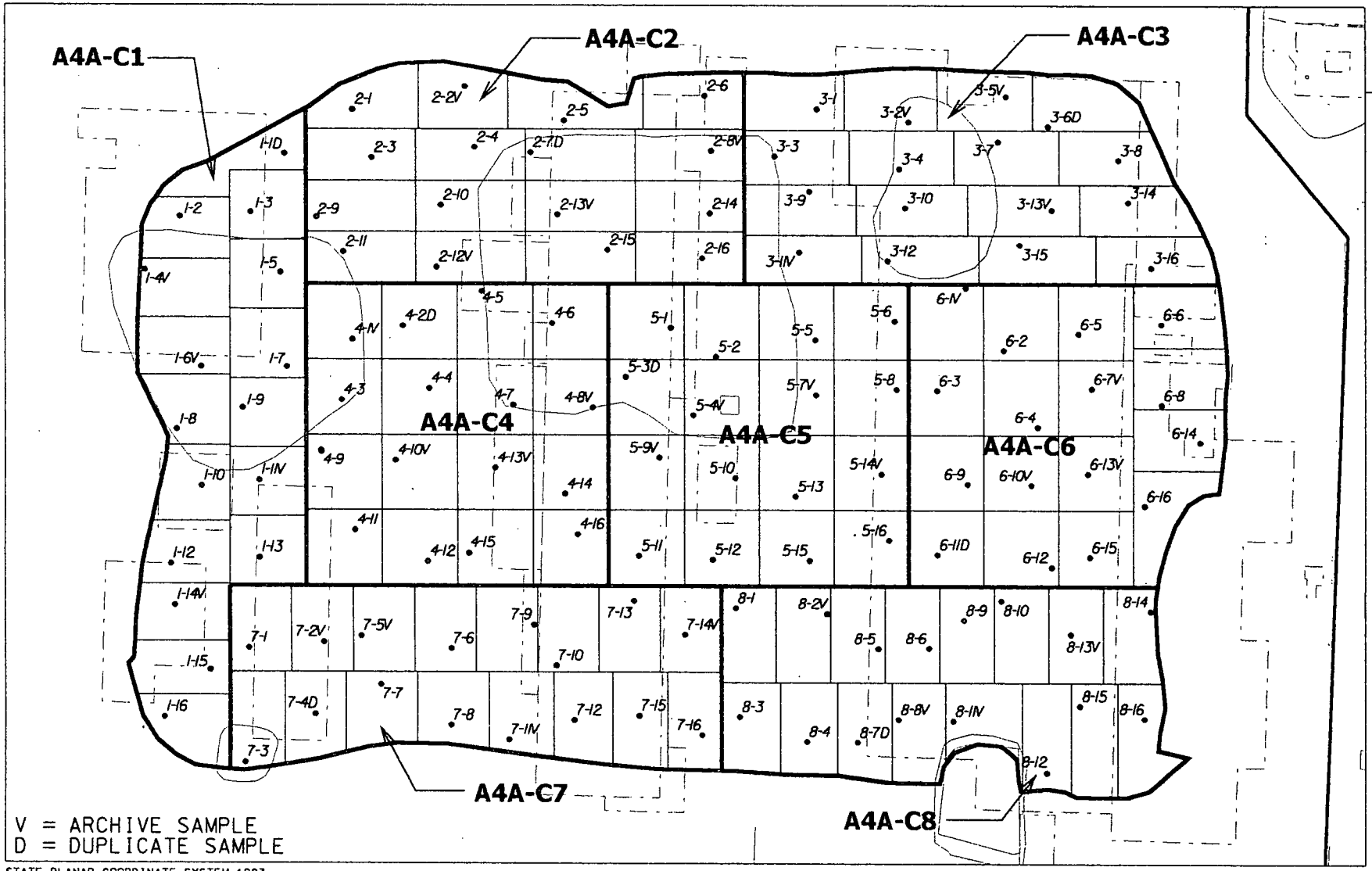

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FIGURE 2-2. AREA 4A SUB-CU BOUNDARY AND CERTIFICATION SAMPLING LOCATIONS

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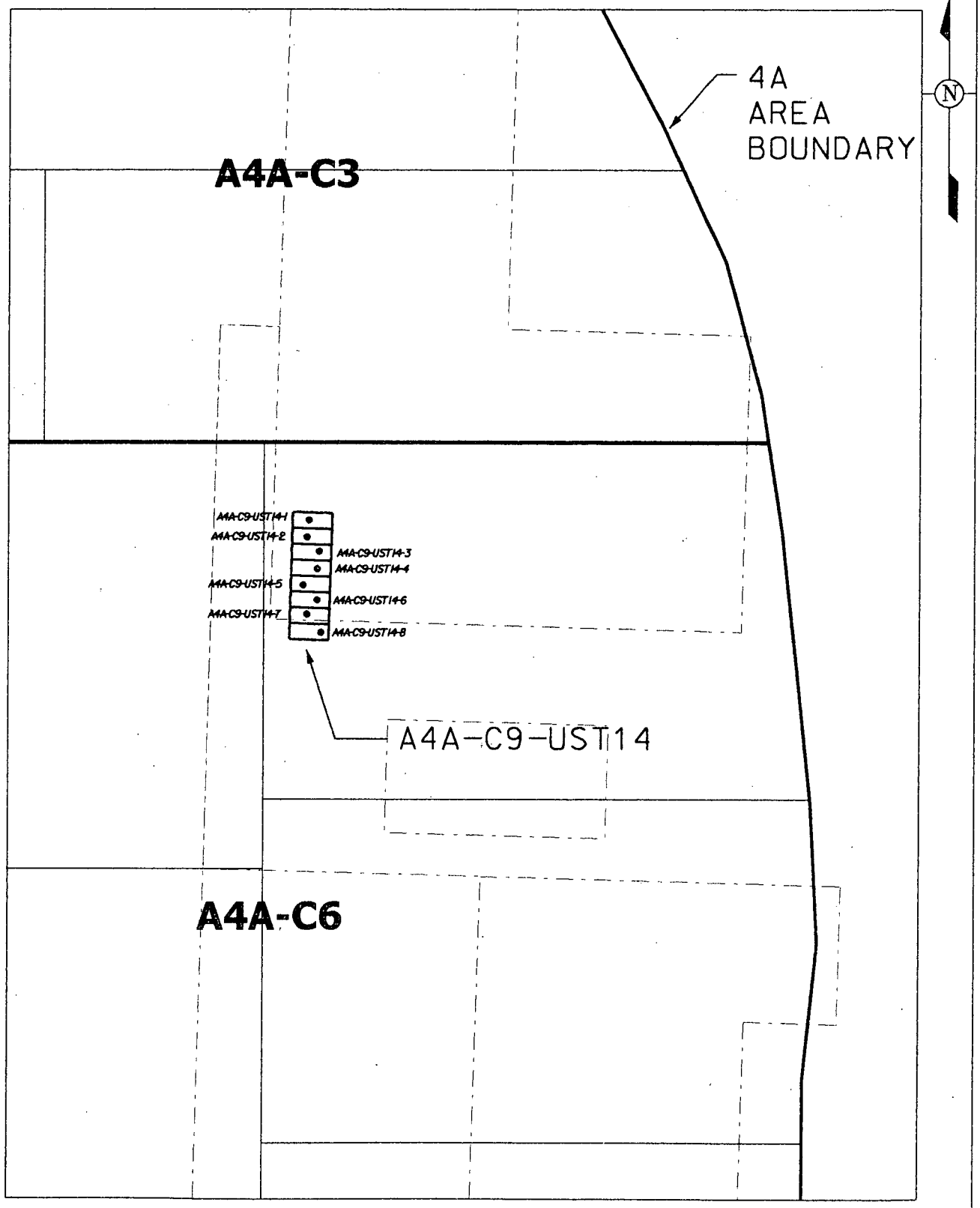

FIGURE 2-3. AREA 4A UST #14 FOOTPRINT SAMPLING LOCATIONS

3.0 CERTIFICATION SAMPLE ANALYSIS

All soil samples from the CU with like analyses (including the field duplicate) will be batched and submitted to the SPL under one set of Chain of Custody/Request for Analysis forms which will represent one analytical release. Container blanks will be listed on a separate Chain of Custody/Request for Analysis form but may be batched together in one analytical release.

All samples will be prepared for shipment to off-site laboratories per procedure 9501, Shipping Samples to Off-site Laboratories. Samples will only be shipped to off-site laboratories that are listed on the Fluor Fernald Approved Laboratories List. Historical data from the area will be used to ship the samples off-site. The highest post-excavation total uranium result from Area 4A is 14.5 mg/kg from boring 4A-P6-C5.

Samples collected for VOC analysis should be shipped to an off-site laboratory within 24 hours of sample collection. As soon as the samples arrive at the laboratory where the analysis will take place, all samples should be prepared for analysis (including homogenization for non-VOC samples), and radiological samples should be sealed to begin the in-growth period for radium analysis. A 30-day turnaround time will be required for sample analysis.

The sampling and analytical requirements are listed in Table 3-1 and the Target Analyte Lists (TAL) are shown in Table 3-2.

TABLE 3-1
SAMPLING AND ANALYTICAL REQUIREMENTS

Analyte[a]	Method[a]	Matrix	Preserve	Hold Time	Container[b]	Minimum Mass/Volume
Radiological (TAL A)	Gamma Spec and LSC	Solid	None	12 months	Plastic or stainless steel core liner or glass or polyethylene sample container	300 g (900 g)[c]
Radiological and Fluoride (TALs AB)	Gamma Spec and LSC IC	Solid	Cool, 4° C	12 months 28 days	Glass with Teflon-lined lid	400 g (1200 g)[c]
Rads/Fluoride/Metals (TALs ABC or ABD)	Gamma Spec and LSC IC ICP/MS	Solid	Cool, 4° C	12 months 28 days 6 months	Glass with Teflon-lined lid	500 g (1500 g)[c]
VOCs (TAL E)	GC/MS	Solid	Cool, 4° C	48 hours	3 x 1-Encore Sampler[c] plus 1 x 2-oz jar for % moisture	Each full Encore Sampler[c] will hold approx. 5 g
Methanol (TAL F)	GC/FID	Solid	Cool, 4° C	14 days	Amber Glass with Teflon-lined lid	60 g (no headspace)
Radiological (TAL A)	Gamma Spec and LSC	Liquid (rinsate[d])	HNO_3 pH<2	6 months	Polyethylene	4 liters
Metals (TALs C or D)	ICP/MS	Liquid (rinsate[d])	HNO_3 pH<2	6 months	Polyethylene	500 milliliter
VOCs (TAL E)	GC/MS	Liquid (trip blank)	H_2SO_4 pH<2 Cool, 4° C	14 days	3 x 40-ml glass with teflon-lined septa	120 ml (no headspace)
Methanol (TAL F)	GC/FID	Liquid (trip blank)	H_2SO_4 pH<2 Cool, 4° C	14 days	3 x 40-ml glass with Teflon-lined septa	120 ml (no headspace)

[a] Samples will be analyzed according to Analytical Support Level (ASL) D requirements but the minimum detection level may cause some analyses to be considered ASL E.

[b] Sample container types may be changed at the direction of the Field Sampling Lead, as long as the volume requirements, container compatibility requirements, and SCQ requirements are met.

[c] At the direction of the Field Sampling Lead, triple the specified volume must be collected for all samples at one location in the CU in order for the contract laboratory to perform the required quality control analysis. The samples shall be identified on the Chain of Custody/Request for Analysis forms as "designated for laboratory QC".

[d] If "push tubes" are used for sampling, the off-site laboratories will be sent container blanks. If an alternative sample method is used, a rinsate will be collected by the Field Technicians.

GC/FID – gas chromatography/flame ionization detector
GC/MS – gas chromatography mass spectroscopy
IC – ion chromatograph
ICP/MS – inductively coupled plasma/mass spectroscopy
LSC – liquid scintillation counting

TABLE 3-2
TARGET ANALYTE LISTS

20803-PSP-0003-A
(Radiological - ASL D/E*)

Analyte	On-Property FRL/*WAC* [b]	MDL
Total Uranium [a]	82 mg/kg 20 mg/kg [a]	8.2 mg/kg 2.0 mg/kg [a]
Radium-226	1.7 pCi/g	0.17 pCi/g
Radium-228	1.8 pCi/g	0.18 pCi/g
Thorium-228	1.7 pCi/g	0.17 pCi/g
Thorium-232	1.5 pCi/g	0.15 pCi/g
Technetium-99 [b]	30.0 pCi/g *(29.1 pCi/g)*	2.91 pCi/g [b]

[a]The total uranium FRL is lower in the defined high leachability zones, which are the following CUs: 2, 3, 4, 5, 6, and 9-UST14.

[b]The minimum detection level (MDL) for technetium-99 is 10 percent of the waste acceptance criteria (WAC) limit, which is lower than the FRL.

pCi/g – picoCuries per gram

20803-PSP-0003-B
(Fluoride - ASL D/E*)

Analyte	On-Property FRL	MDL
Fluoride	78,000 mg/kg	7800 mg/kg

20803-PSP-0003-C
(Metals - ASL D/E*)

Analyte	On-Property FRL	MDL
Arsenic	12.0 mg/kg	1.2 mg/kg

20803-PSP-0003-D
(Metals - ASL D/E*)

Analyte	On-Property FRL	MDL
Beryllium	1.5 mg/kg	0.15 mg/kg

20803-PSP-0003-E
(VOCs - ASL D/E*)

Analyte	On-Property FRL	MDL
1,1-dichloroethene	0.41 mg/kg	0.041 mg/kg
1,2-dichloroethene	0.16 mg/kg	0.016 mg/kg
Tetrachloroethene	3.6 mg/kg	0.36 mg/kg

20803-PSP-0003-F
(Methanol - ASL D/E*)

Analyte	Residential Generic Cleanup Number[c]	MDL
Methanol	31.3 mg/kg	3.13 mg/kg

[c] Listed on Table 1 of the June 2004 Closure Plan Review Guidance for RCRA Facilities, written by the Ohio Environmental Protection Agency Division of Hazardous Waste Management.

RCRA – Resource Conservation and Recovery Act

4.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

4.1 FIELD QUALITY CONTROL SAMPLES, ANALYTICAL REQUIREMENTS AND DATA VALIDATION

Per requirements of the SEP and DQO SL-052, Revision 3, the field quality control, analytical and data validation requirements are as follows:

- Field QC requirements include one field duplicate for the CU, as noted in Section 2.3 and identified in Appendix B. The field duplicate sample will be analyzed for the same constituents of concern (COCs) as the other samples in the CU from which the field duplicate has been collected.

  If "push tubes" are used for sample collection, one container blank will be collected before sample collection begins and one will be collected at the conclusion of sample collection for the entire Area 4A. The container blank sample will be analyzed for the same radiological and metals COCs as other samples in the CU from which the container blank is being collected. If an alternate sample collection method is used, one rinsate will be collected at a minimum frequency of one per 20 pieces of equipment reused in the field.

  A trip blank is required if VOC and/or methanol samples are being collected. The frequency for a trip blank is one per day, or one per batch of 20 VOC samples collected, or one per cooler to be shipped, whichever is more frequent.

- All analyses will be performed at ASL D or E, where E meets the minimum detection level of 10 percent of the FRL and is above the SCQ ASL D detection level, but the analyses meet all other SCQ ASL D criteria. An ASL D data package will be provided for all of the data.

- All field data will be validated. A minimum of 10 percent of the laboratory data will be validated to Validation Support Level (VSL) D with the remainder validated to VSL B. The following CUs will be validated to VSL D: A4A-C5, A4A-C6, A4A-C7, and A4A-C9-UST14. If any result is rejected during validation, the sample will be re-analyzed or an archive location will be sampled and analyzed in its place. If necessary, this change will be documented in a V/FCN.

Once all data are validated as required, results will be entered into the SED and a statistical analysis will be performed to evaluate the pass/fail criteria for the each CU. The statistical approach is discussed in Section 3.4.3 and Appendix G of the SEP.

If any sample collection or analytical 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 certification decision making. If the data will be beneficial, the Project Manager and Characterization Manager will ensure that:

- A variance to the PSP will be written to document references confirming that the new method supports data needs,

- variations from the SCQ methodology are documented in a variance to 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.

4.2 PROJECT SPECIFIC PROCEDURES, MANUALS AND DOCUMENTS

Programs supporting this work are responsible for ensuring team members work to and are trained to applicable documents. Additionally, programs supporting this work are responsible for ensuring team members in their organizations are qualified and maintain qualification for site access requirements. The Project Manager will be responsible for ensuring any project-specific training required to perform work per this PSP is conducted.

To ensure consistency and data integrity, field activities in support of the PSP will follow the requirements and responsibilities outlined in the procedures and guidance documents referenced below.

- 20100-HS-0002, Soil and Disposal Facility Project Integrated Health and Safety Plan
- Certification Design Letter for Area 4A
- Sitewide Excavation Plan (SEP)
- Sitewide CERCLA Quality Assurance Project Plan (SCQ)
- SH-1006, Event Investigation and Reporting
- ADM-02, Field Project Prerequisites
- EQT-06, Geoprobe® Model 5400 and Model 6600
- SMPL-01, Solids Sampling
- SMPL-21, Collection of Field Quality Control Samples
- 9501, Shipping Samples to Off-site Laboratories
- Trimble Pathfinder Pro-XL GPS Operation Manual

4.3 INDEPENDENT ASSESSMENT

An independent assessment may be performed by the Fernald Closure Project (FCP) QA/QC organization by conducting a surveillance, consisting of monitoring/observing on-going project activities and work areas to verify conformance to specified requirements. The surveillance will be planned and documented in accordance with Section 12.3 of the SCQ.

4.4 IMPLEMENTATION OF CHANGES

Before the implementation of changes, the Field Sampling Lead will be informed of the proposed changes. Once the Field Sampling Lead has obtained written or verbal approval (electronic mail is acceptable) from the Characterization Manager and QA/QC for the changes to the PSP, the changes may be implemented. Changes to the PSP will be noted in the applicable FALs and on a V/FCN. QA/QC must receive the completed V/FCN, which includes the signatures of the Characterization and Sampling Managers,

Project Director, and QA/QC within seven days of implementation of the change. The U.S. Environmental Protection Agency and Ohio Environmental Protection Agency will be given a 15-day review period prior to implementing the change(s) for any V/FCNs identified as "significant" per project guidelines.

5.0 HEALTH AND SAFETY

Technicians will schedule a project walkdown with Health and Safety (Radiological Control, Industrial Hygiene, and Safety) and any other groups that may be working in the same or an adjacent area before the start of the project. Any hazards identified during the project walkdown must be corrected/controlled prior to the start of work. Weekly walkdowns will be conducted throughout the course of the project in accordance with SPR 1-10, Safety Walk-Throughs. All work on this project will be performed according to applicable Environmental Monitoring procedures, the documents identified in Section 3.4, Fluor Fernald work permit, Radiological Work Permit, and other applicable permits as determined by project management. Concurrence with applicable safety permits is required by each technician in the performance of their assigned duties.

A job/safety briefing will be conducted before field activities begin each day. The project lead or designee will document the briefing on form FS-F-2955, Training Attendance Roster. Personnel will also be briefed on any health and safety documents (such as Travelers) that may apply to the project work scope. During the course of this project, no operating heavy-duty equipment within a 50-foot buffer zone will be permitted. Additional safety information can be found in 20100-HS-0002, Soil and Disposal Facility Project Integrated Health and Safety Plan. All personnel have stop-work authority for imminent safety hazards or other hazards resulting from noncompliance with the applicable safety and health practices.

Technicians will be provided with cellular phones for all sampling activities, and **all emergencies will be reported by dialing 648-6511 and asking for "CONTROL".** Announcements for severe weather will be provided on the Emergency Message System and by alphanumeric page. Pagers and cellular phones are provided to the Technicians by FCP.

6.0 DISPOSITION OF WASTE

During sampling activities, field personnel may generate small amounts of soil, water, and contact waste. Excess soil generated during sample collection will be replaced in the borehole. Contact waste generation will be minimized by limiting contact with sample media, and by only using disposable materials that are necessary. Contact waste will be bagged and brought back to site for disposal in an uncontrolled area dumpster. Generation of decontamination waters will be minimized in the field. Decontamination water that is generated will be contained in a plastic bucket with a lid and returned to site for disposal. A wastewater discharge form must be completed for disposal. On-site decontamination of equipment will take place at a facility that discharges to the Advanced Wastewater Treatment Facility, either directly or indirectly, through the storm water collection system.

Following analysis, any remaining soil and/or sample residuals will remain at the off-site laboratories for a specified period of time as defined in their contracts with Fluor Fernald. Prior authorization must be obtained from the Characterization Manager, or designee, to disposition samples collected under this PSP.

7.0 DATA MANAGEMENT

A data management process will be implemented so information collected during the investigation will be properly managed to satisfy data end use requirements after completion of field activities. As specified in Section 5.1 of the SCQ, sampling teams will describe daily activities on a FAL, which should be sufficiently detailed for accurate reconstruction of the events without reliance on memory. Sample Collection Logs will be completed according to protocols specified in Appendix B of the SCQ and in applicable procedures. These forms will be maintained in loose-leaf form and uniquely numbered following the sampling event.

All field measurements, observations, and sample collection information associated with physical sample collection will be recorded, as applicable, on the Sample Collection Log, the FAL, the Chain of Custody/Request for Analysis form, the Lithologic Log, and Borehole Abandonment Record. The PSP number will be on all documentation associated with these sampling activities.

Samples will be assigned a unique sample number as explained in Section 2.3 and listed in Appendix B. This unique sample identifier will appear on the Sample Collection Log and Chain of Custody/Request for Analysis form and will be used to identify the samples during analysis, data entry, and data management.

Technicians will review all field data for completeness and accuracy then forward the field data package to the Field Data Validation Contact for final QA/QC review. Analytical data will be entered into the SED by Sample Data Management personnel. Analytical data that is designated for data validation will be forwarded to the Data Validation Group. The PSP requirements for analytical data validation are outlined in Section 4.1. Analytical data will be reviewed by the Data Management Lead upon receipt from the off-site laboratories.

Following field and analytical data validation, the Sample Data Management organization will perform data entry into the SED. The original field data packages, original analytical data packages, and original documents generated during the validation process will be maintained as project records by the Sample Data Management organization.

To ensure that correct coordinates and survey information are tied to the final sample locations in the database, the following process will take place. Upon surveying all locations identified in the PSP, the

Surveying Manager will provide the Data Management Lead (i.e., Characterization) with an electronic file of all surveyed coordinates and surface elevations. The Sampling Manager will provide the Data Management Lead with a list of any locations that must be moved during penetration permitting or sample collection, and the Data Management Lead will update the electronic file with this information. After sample collection is complete, the Data Management Lead will provide this electronic file to the Database Contact for uploading to SED.

APPENDIX A

DATA QUALITY OBJECTIVES SL-052, REV. 3

5891

Control Number _____

Fernald Environmental Management Project

Data Quality Objectives

Title: Sitewide Certification Sampling and Analysis

Number: SL-052

Revision: 3

Effective Date: March 13, 2000

Contact Name: Mike Rolfes

Approval: _____ Date: 3/13/00
James Chambers
DQO Coordinator

Approval: _____ Date: 3/13/00
J.D. Chiou
SCEP Project Director

Rev. #	0	1	2	3			
Effective Date:	4/28/99	6/10/99	2/3/00	3/13/00			

DATA QUALITY OBJECTIVES
Sitewide Certification Sampling and Analysis

Members of Data Quality Objectives (DQO) Scoping Team

The members of the scoping team included individuals with expertise in QA, analytical methods, field sampling, statistics, laboratory analytical methods and data management.

Conceptual Model of the Site

Soil sampling was conducted at the Fernald Environmental Management Project (FEMP) during the Operable Unit 5 (OU5) Remedial Investigation/Feasibility Study (RI/FS). Final Remediation Levels (FRLs) for constituents of concern (COCs), along with the extent of soil contaminated above the FRLs, were identified in the OU5 Record of Decision (ROD). Actual soil remediation activities now fall under the guidance of the final Sitewide Excavation Plan (SEP).

As outlined in the SEP, the FEMP has been divided into individual Remediation Areas (or phased areas within a Remediation Area) to sequentially carry out soil remedial activities. Under the strategy identified in the SEP, pre-design investigations are first conducted to better define the limits of soil excavation requirements. Following any necessary excavation, pre-certification real-time scanning activities are conducted to evaluate residual patterns of soil contamination. Pre-certification scan data should provide a level of assurance that the FRLs will be achieved. When pre-certification data indicate that remediation goals are likely to be met, they are used to define certification units (CUs) within the Remediation Area of interest. Table 2-9 of the final SEP identifies a list of area-specific COCs (ASCOCs) for each Remediation Area at the FEMP. Based on existing data and production knowledge, a subset of these ASCOCs are conservatively identified within each CU as potentially present in the CU. This suite of CU-specific COCs is the subset of the ASCOCs to be evaluated against the FRLs within that CU. At a minimum, the five primary radiological COCs (total uranium, radium-226, radium-228, thorium-228, thorium-232) will be retained as CU-specific COCs for certification of each CU.

Delineation and justification for the final CU boundaries, along with each corresponding suite of CU-specific ASCOCs is documented in a Certification Design Letter. Upon approval of the Certification Design Letter by the EPA, certification activities can begin. Section 3.4 of the final SEP presents the general certification strategy.

1.0 Statement of Problem

FEMP soil and potentially impacted adjacent off-property soil must be certified on a CU by CU basis for compliance with the FRLs of all CU-specific ASCOCs. The appropriate sampling, analytical and information management criteria must be developed to provide the required qualified data necessary to demonstrate attainment of certification statistical criteria. For every area undergoing certification, a sampling plan must be in place that will direct soil samples to be collected which are representative of the CU-specific COC concentrations within the framework of the certification approach identified in the final SEP. The appropriate analytical methodologies must be selected to provide the required data.

Exposure to Soil

The cleanup standards, or FRLs, were developed for a final site land use as an undeveloped park. Under this exposure scenario, receptors could be directly exposed to contaminated soil through dermal contact, external radiation, incidental ingestion, and/or inhalation of fugitive dust while visiting the park. Exposure to contaminated soil by the modeled receptor is expected to occur at random locations within the boundaries of the FEMP and would not be limited to any single area. Some soil FRLs were developed based on the modeled cross-media impact potential of soil contamination to the underlying aquifer. In these instances, potential exposure to contaminants would be indirect through the groundwater pathway, and not directly linked to soil exposure. Off-site soil FRLs were established at more conservative levels than the on-property soil FRLs, based on an agricultural receptor. Benchmark Toxicity Values (BTVs) are also being considered in the cleanup process by assessing habitat impact of individual BTVs under post-remedial conditions.

Available Resources

Time: Certification sampling will be accomplished by the field sampling team prior to interim or final regrading or release of soil for construction activities. The certification sampling schedule must allow sufficient time, in the event additional remediation is required, to demonstrate certification of FRLs prior to permanent construction or regrading. Certification sampling will have to be completed and analytical results validated and statistical analysis completed prior to submission of a Certification Report to the regulatory agencies.

Project Constraints: Certification sampling and analytical testing must be performed with existing manpower, materials and equipment to support the certification effort. Remediation areas are prioritized for certification sampling and analysis according to the date required for initiation of sequential construction activities in those areas. Fluor Daniel Fernald (FDF) and DOE must demonstrate post-remedial compliance with the CU-specific COC FRLs to release the designated Remediation Area for

planned interim grading, eventual restoration under the Natural Resources Restoration Plan (NRRP), and other final land use activities.

2.0 Identify the Decision

Decision

Demonstrate within each CU if all CU-specific COCs pass the certification criteria. These criteria are as follows: 1) The average concentration of each CU-specific COC is below the FRL and within the agreed upon confidence limits (95% for primary ASCOCs and 90% for secondary ASCOCs); and 2) the hot-spot criteria, that no result for any CU-specific COC is more than two times the associated soil FRL. The certification criteria are discussed in greater detail in Section 3.4.4 of the final SEP.

Possible Results

1. The average concentration of each CU-specific COC is demonstrated to be below the FRLs within the confidence level, with no single result for any CU-specific COC greater than two times the associated FRL. The CU can then be certified as attaining remediation goals.

2. The average concentration of at least one CU-specific COC is demonstrated to be above the FRL at the given confidence level. The CU will fail certification and require additional remedial action, per Section 3.4.5 of the final SEP.

3. If a result(s) of one or more CU-specific COC is demonstrated to be at or above two times the FRL, the CU will fail certification. The CU will fail certification and require additional remedial action per Section 3.4.5 of the final SEP. A combination of results 2 and 3 also constitutes certification failure.

3.0 Inputs That Affect the Decision

Required Information

Certification data will be obtained through physical soil sampling. Based on the certification analytical results, the average concentrations of each CU-specific COC with specified confidence levels will be calculated using the statistical methods identified in Appendix G of the final SEP.

Source of Information

Per the SEP, analysis of certification samples for each CU-specific COC will be conducted at analytical support level (ASL) D in accordance with methods and QA/QC standards in the FEMP Sitewide CERCLA Quality Assurance Project Plan [SCQ].

Contaminant-Specific Action Levels
The cleanup levels are the soil FRLs published in the OU5 and OU2 RODs. BTVs being considered in the remediation process are discussed for consideration during certification in Appendix C of the NRRP.

Methods of Sampling and Analysis
Physical soil samples will be collected in accordance with the applicable site sampling procedures. Per the SEP, laboratory analysis will be conducted at ASL D using QA/QC protocols specified in the SCQ. Full raw data deliverables will be required from the laboratory to allow for appropriate data validation. For FEMP-approved on- and off-site laboratories, the analytical method used will meet the required precision, accuracy and detection capabilities necessary to achieve FRL analyte ranges.

4.0 The Boundaries of the Situation

Spatial Boundaries
Domain of the Decision: The boundaries of this certification DQO extend to all surface, stockpile and fill soil in areas that are undergoing certification as part of FEMP remediation.

Population of Soil: Soil includes all excavated surfaces, undisturbed relatively unimpacted native soil, and sub-surface intervals (stockpile or fill areas only) in areas undergoing certification sampling and analysis.

Scale of Decision Making
Based on considerations of the final certification units and the COC evaluation process, the CU-specific COCs are determined. The area undergoing certification will be evaluated on a CU basis, based on physical sample results, as to whether it has passed or failed the criteria for attainment of certification (final SEP Section 3.4.4).

Temporal Boundaries
Time frame: Certification sampling must be performed in time to sequentially release certified areas for scheduled interim grading, restoration, and other final land use activities. Certification sampling data received from the laboratory will be validated and statistically evaluated. Certification results and findings will be documented in Certification Reports, which must be submitted to and approved by the regulatory agencies prior to release of the areas for scheduled interim grading, restoration, and other final land use activities.

Practical Considerations: Some areas undergoing remediation will not be accessible for certification sampling until decontamination/demolition and remedial excavation activities are complete. Other areas, such as wood lots, that are relatively uncontaminated and not planned for excavation, may require preparation, such as cutting of grass or removal of undergrowth prior to certification sampling, thus requiring coordination with FEMP Maintenance personnel.

5.0 Decision Rule

Successful certification of soil within the boundaries of a certification unit (CU) demonstrates that the certified soil (surface or subsurface) has concentrations of CU-specific COC(s) that meet the established criteria for attainment of Certification.

Parameters of Interest

The parameters of interest are the individual and average surface soil concentrations of CU-specific COCs and confidence limits on the calculated average within a CU. OU2 and OU5 ROD identify all applicable soil FRLs. The SEP identifies the ASCOCs, a subset of which will be used to establish CU-specific COCs within each Remediation Area undergoing certification sampling and analysis.

Action Levels

The applicable action levels are the on- and off-property soil FRLs published in the OU5 or OU2 ROD for each ASCOC.

Decision Rules

If the average concentration for each CU-specific COC is demonstrated to be below the FRLs within the agreed upon confidence level (95% for primary COCs; 90% for secondary COCs), and no analytical result exceeds two times the soil FRL, then the CU can be certified as complying with the cleanup criteria. If a CU does not meet the FRLs within the agreed upon confidence level for one or more CU-specific COCs, or one or more analytical results for one or more CU-specific COCs is greater than two times the associated soil FRL, then the CU fails certification and requires further assessment as per the SEP.

6.0 Limits on Decision Errors

Types of Decision Errors and Consequences

Definition

Decision Error 1: This decision error occurs when the decision maker decides that a CU has met the certification criteria, when in reality, the certification criteria have not been met. This situation could result in an increased risk to human health and the environment. In addition, this type of error could result in regulatory fees and penalties.

Decision Error 2: This decision error occurs when the decision maker decides a CU does not met the certification criteria, when actually, the certification criteria have been met. This error would result in unnecessary added costs due to the excavation of soil containing COC concentrations below their FRLs, and an increased volume of soil assigned to the OSDF. In addition, unnecessary delays in the remediation schedule may result.

True State of Nature for the Decision Errors

The true state of nature for Decision Error 1 is that the certification criteria are not met (average CU-specific COC concentrations not below the FRL within the specified confidence limits; or a single sample result above two times the FRL). The true state of nature for Decision Error 2 is that certification criteria are met (average CU-specific COC concentrations are below the FRL within the specified confidence limits, and no result is above two times the FRL). Decision Error 1 is the more severe error due to the potential threat this poses to human health and the environment.

Null Hypothesis

H_o: The average concentration of at least one CU-specific COC within a CU is equal to or greater than the associated FRL.

H_1: The average concentration of all CU-specific COCs within a CU is less than the action levels.

False Positive and False Negative Errors

A false positive is Decision Error 1: less than or equal to five percent ($p = .05$) is considered the acceptable decision error in determination of compliance with FRLs for primary ASCOCs, while ten percent ($p = .10$) is acceptable for secondary ASCOCs.

A false negative is Decision Error 2: less than or equal to 20 percent is considered the acceptable decision error. This decision error is controlled through the determination of sample sizes (see Section G.1.4.1 of the final SEP).

7.0 Design for Obtaining Quality Data

Section 3.4.2 of the final SEP presents the specifics of the certification sampling design. The following text describes the general certification sampling design.

Soil Sample Locations

In order to select certification sampling locations, each CU is divided into 16 approximately equal sub-CUs. Certification sample locations are then generated by randomly selecting an easting and northing coordinate within the boundaries of each cell. Additional alternative sample locations are also generated in case the original random sample location fails the minimum distance criterion. The minimum distance criterion is defined as the minimum distance allowed between random sample locations in order to eliminate the chance of random sample points clustering within a small area. This clustering would tend to over emphasize a small area and, conversely, under represent a large area in certification determination. By not allowing sample locations to be too closely arranged, the sample locations are spread out and provide a more uniform coverage, thus reducing the possibility of large unsampled areas. The equation for determining minimum distance criterion is presented in Section 3.4.2.1 of the SEP.

In the event that the original random sample location failed the minimum distance criterion, the first alternate location was selected and all the locations were retested. This process continued until all 16 random locations passed the minimum distance criteria.

Each CU is also divided into four quadrants, each of which contains 4 sub-CUs and 4 sample locations. Three of the four locations per quadrant (12 per CU) are then selected for sample collection and analysis. The other one per quadrant (4 per CU) are designated as "archives", and samples will not be collected and analyzed unless need arises due to analytical or validation problems warrant. Per Section 3.4.2 of the SEP, as few as 8 samples may be collected from Group 2 CUs for analysis of secondary COCs.

Physical Samples

Physical soil certification samples will be collected from the surface according to SMPL-01 at locations identified in the PSP (generally 12 of the 16 locations per CU).

If stockpiled soil is to be certified, two CUs will be established, on for the stockpile and one for the underlying soil (i.e., the "footprint"). To certify the stockpile, samples will be collected from predetermined random intervals from within the stockpiled soil at each certification sampling location identified in the PSP. To certify the footprint, the first 6-inches of native soil present at each sampling location will also be collected for certification. If fill soil is to be certified, the strategy (surface or sampling at depth) will be based on results from the precertification scan of the fill area(s), as discussed in the Certification Design Letter and the certification PSP.

Laboratory Analysis

As defined in the PSP, a minimum of 8 to 12 samples per CU will be submitted to the on-site laboratory or a FDF approved off-site laboratory for analysis. All certification analyses will meet ASL D requirements per the SCQ except for the HAMDC. Samples will be analyzed for all CU-specific ASCOCs, with minimum detection levels set according to the SCQ and applicable project guidelines.

Validation

All field data will be validated. Also, a minimum of 10 percent of the analytical data from each laboratory will be subject to analytical validation to ASL D requirements in the SCQ, and will require an ASL D package. The remaining analytical data will be validated to a minimum of ASL B, and will require an ASL B package.

8.0 Use of Data to Test Null Hypothesis

Appendix G of the final SEP discusses in detail, the statistical evaluations of certification data used to determine attainment of certification criteria.

Data Quality Objectives
Sitewide Certification Sampling and Analysis

1A. Task Description:

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

RI☐ FS☐ RD☐ RA☒ RvA☐ Other (specify) _____

1C. DQO No.: SL-052, Rev. 2 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 Ananlytical 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☐

4A. Drivers: Remediation Area Remedial Action Work Plans, Applicable or Relevant and Appropriate Requirements (ARARs) and Operable Unit 2 and Operable Unit 5 Records of Decision (ROD), Sitewide Excavation Plan (SEP).

4B. Objective: Confirmation that remediation areas at the FEMP, or adjacent off-property areas, have met certification criteria on a CU by CU basis.

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5. Site Information (Description):

The OU2 and OU5 RODs have identified areas at the FEMP that require soil remediation activities. The RODs specify that the soil in these areas will be demonstrated to be below the FRLs. Certification is necessary for all FEMP soil and some adjacent off-property soil to demonstrate that the residual soil does not contain COC contamination exceeding the FRL at a specified confidence level.

6A. 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	☐	2. Uranium	☒*	3. BTX	☐
Temperature	☐	Full Radiological	☒*	TPH	☐
Specific Conductance	☐	Metals	☒*	Oil/Grease	☐
Dissolved Oxygen	☐	Cyanide	☐		
Technetium-99	☒*	Silica	☐		
4. Cations	☐	5. VOA	☒*	6. Other (specify)	
Anions	☐	BNA	☐		
TOC	☐	PEST	☒*		
TCLP	☐	PCB	☒*		
CEC	☐	COD	☐		

* As identified in the area certification PSP

6.B. Equipment Selection and SCQ Reference:

Equipment Selection		Refer to SCQ Section	
ASL A	_____	SCQ Section	_____
ASL B	_____	SCQ Section	_____
ASL C	_____	SCQ Section	_____
ASL D	Per SCQ and PSP	SCQ Section	Appendix G, Tbls. 1&3
ASL E	Per PSP	SCQ Section	Appendix H (final)

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

Biased☐ Composite☐ Grab☒ Environmental☐ Grid☐
Intrusive☒ Non-Intrusive☐ Phased☐ Source☐ Random☒*
*Systematic random samples, selected one per cell and meeting the minimum distance criterion

7B. Sample Work Plan Reference: Project Specific Plan for the associated Remediation area Remedial Action Work Plan

Background samples: OU5 RI

7C. Sample Collection Reference: Associated PSP(s), SMPL-01

8. Quality Control Samples: (Put an X in the appropriate selection.)

8A. Field Quality Control Samples:

Trip Blanks	☒[1]	Container Blanks	☒
Field Blanks	☒[2]	Duplicate Samples	☒
Equipment Rinsate Blanks	☒	Split Samples	☒[3]
Preservative Blanks	☐	Performance Evaluation Samples	☐

Other (specify) _____

1) Collected for volatile organic sampling
2) As noted in the PSP
3) Split samples will be taken where required by the EPA

8B. Laboratory Quality Control Samples:

Method Blank	☒	Matrix Duplicate/Replicate	☒
Matrix Spike	☒	Surrogate Spikes	☒
Tracer Spike	☒	Other (specify) _____	

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

Sample density will be dependent upon the CU size (Group 1 [250'x250'] or Group 2 [500'x500']), as determined by historical and pre-certification scan data.

APPENDIX B

AREA 4A SAMPLE LOCATION AND IDENTIFIERS

5891

APPENDIX B
AREA 4A SAMPLE LOCATIONS AND IDENTIFIERS

CU	Location	Sample ID	Analysis	Northing	Easting
1	1-1D	A4A-C1-1^RF	TAL AB	480624.08	1349512.12
		A4A-C1-1^RF-D	TAL AB		
	1-2	A4A-C1-2^RF	TAL AB	480573.96	1349426.72
	1-3	A4A-C1-3^RF	TAL AB	480577.48	1349484.28
	1-4V	A4A-C1-4V	Archive	480531.62	1349397.9
	1-5	A4A-C1-5^RF	TAL AB	480529.71	1349508.66
	1-6V	A4A-C1-6V	Archive	480454.37	1349443.77
	1-7	A4A-C1-7^RF	TAL AB	480454.25	1349513.84
	1-8	A4A-C1-8^RF	TAL AB	480404.3	1349423.71
	1-9	A4A-C1-9^RF	TAL AB	480421.63	1349477.6
	1-10	A4A-C1-10^RF	TAL AB	480358.76	1349444.27
	1-11V	A4A-C1-11V	Archive	480363.42	1349491.25
	1-12	A4A-C1-12^RF	TAL AB	480296.82	1349419.38
	1-13	A4A-C1-13^RF	TAL AB	480301.75	1349491.44
	1-14V	A4A-C1-14V	Archive	480263.64	1349422.55
	1-15	A4A-C1-15^RF	TAL AB	480212.03	1349451.02
	1-16	A4A-C1-16^RF	TAL AB	480174.55	1349413.68
2	2-1	A4A-C2-1^RF	TAL AB	480659.3	1349567.46
	2-2V	A4A-C2-2V	Archive	480677.68	1349659.05
	2-3	A4A-C2-3^RF	TAL AB	480620.91	1349583.01
	2-4	A4A-C2-4^RF	TAL AB	480629.26	1349666.81
	2-5	A4A-C2-5^RF	TAL AB	480650.74	1349739.82
	2-6	A4A-C2-6^RF	TAL AB	480670.31	1349854.43
	2-7D	A4A-C2-7^RF	TAL AB	480625.1	1349712.43
		A4A-C2-7^RF-D	TAL AB		
	2-8V	A4A-C2-8V	Archive	480626.38	1349859.61
	2-9	A4A-C2-9^RF	TAL AB	480573.73	1349538.02
	2-10	A4A-C2-10^RF	TAL AB	480583.29	1349639.34
	2-11	A4A-C2-11^RF	TAL AB	480545.89	1349559.27
	2-12V	A4A-C2-12V	Archive	480533.91	1349635.74
	2-13V	A4A-C2-13V	Archive	480575.64	1349734.15
	2-14	A4A-C2-14^RF	TAL AB	480576.56	1349858.4
	2-15	A4A-C2-15^RF	TAL AB	480547.46	1349774.79
	2-16	A4A-C2-16^RF	TAL AB	480540.78	1349852.12

APPENDIX B
AREA 4A SAMPLE LOCATIONS AND IDENTIFIERS

CU	Location	Sample ID	Analysis	Northing	Easting
3	3-1	A4A-C3-1^RF	TAL AB	480659.83	1349946.41
	3-2V	A4A-C3-2V	Archive	480649.64	1350021.7
	3-3	A4A-C3-3^RF	TAL AB	480622.03	1349911.56
	3-4	A4A-C3-4^RF	TAL AB	480612.04	1350013.94
	3-5V	A4A-C3-5V	Archive	480669.73	1350101.54
	3-6D	A4A-C3-6^RF	TAL AB	480646.24	1350136.05
		A4A-C3-6^RF-D	TAL AB		
	3-7	A4A-C3-7^RF	TAL AB	480633.64	1350094.95
	3-8	A4A-C3-8^RF	TAL AB	480619.11	1350193.58
	3-9	A4A-C3-9^RF	TAL AB	480594.29	1349940.24
	3-10	A4A-C3-10^RF	TAL AB	480581.12	1350018.67
	3-11V	A4A-C3-11V	Archive	480545.45	1349931.8
	3-12	A4A-C3-12^RF	TAL AB	480538.95	1350004.37
	3-13V	A4A-C3-13V	Archive	480579.31	1350138.86
	3-14	A4A-C3-14^RF	TAL AB	480585.62	1350201.6
	3-15	A4A-C3-15^RF	TAL AB	480551.51	1350112.6
	3-16	A4A-C3-16^RF	TAL AB	480533.68	1350220.43
4	4-1V	A4A-C4-1V	Archive	480476.02	1349567.32
	4-2D	A4A-C4-2^RF	TAL AB	480486.75	1349608.3
		A4A-C4-2^RF-D	TAL AB		
	4-3	A4A-C4-3^RF	TAL AB	480427.92	1349558.45
	4-4	A4A-C4-4^RF	TAL AB	480437.12	1349629.76
	4-5	A4A-C4-5^RF	TAL AB	480514.41	1349672.65
	4-6	A4A-C4-6^RF	TAL AB	480489.01	1349729.54
	4-7	A4A-C4-7^RF	TAL AB	480423.83	1349698.06
	4-8V	A4A-C4-8V	Archive	480421.86	1349762.62
	4-9	A4A-C4-9^RF	TAL AB	480387.47	1349541.64
	4-10V	A4A-C4-10V	Archive	480379.31	1349602.21
	4-11	A4A-C4-11^RF	TAL AB	480323.66	1349569.21
	4-12	A4A-C4-12^RF	TAL AB	480298.81	1349628.27
	4-13V	A4A-C4-13V	Archive	480373.29	1349683.39
	4-14	A4A-C4-14^RF	TAL AB	480352.49	1349739.9
	4-15	A4A-C4-15^RF	TAL AB	480305.37	1349661.27
	4-16	A4A-C4-16^RF	TAL AB	480320.33	1349750.18

APPENDIX B
AREA 4A SAMPLE LOCATIONS AND IDENTIFIERS

CU	Location	Sample ID	Analysis	Northing	Easting
7	7-1	A4A-C7-1^RFM	TAL ABD	480229.82	1349482.47
	7-2V	A4A-C7-2V	Archive	480234.53	1349543.68
	7-3	A4A-C7-3^RFM	TAL ABD	480138.34	1349479.42
	7-4D	A4A-C7-4^RFM	TAL ABD	480177.05	1349536.55
		A4A-C7-4^RFM-D	TAL ABD		
	7-5V	A4A-C7-5V	Archive	480239.42	1349573.99
	7-6	A4A-C7-6^RFM	TAL ABD	480229.42	1349647.45
	7-7	A4A-C7-7^RFM	TAL ABD	480200.54	1349589.82
	7-8	A4A-C7-8^RFM	TAL ABD	480168.31	1349647.15
	7-9	A4A-C7-9^RFM	TAL ABD	480248.32	1349714.58
	7-10	A4A-C7-10^RFM	TAL ABD	480215.67	1349732.75
	7-11V	A4A-C7-11V	Archive	480156.59	1349694.25
	7-12	A4A-C7-12^RFM	TAL ABD	480172.38	1349747.38
	7-13	A4A-C7-13^RFM	TAL ABD	480267.36	1349795.99
	7-14V	A4A-C7-14V	Archive	480240.55	1349837.7
	7-15	A4A-C7-15^RFM	TAL ABD	480175.87	1349800.3
	7-16	A4A-C7-16^RFM	TAL ABD	480160.36	1349851.77
8	8-1	A4A-C8-1^RF	TAL AB	480261.65	1349879.16
	8-2V	A4A-C8-2V	Archive	480257.16	1349954.26
	8-3	A4A-C8-3^RF	TAL AB	480175.1	1349882.54
	8-4	A4A-C8-4^RF	TAL AB	480155.23	1349937.79
	8-5	A4A-C8-5^RF	TAL AB	480229.49	1349996.41
	8-6	A4A-C8-6^RF	TAL AB	480229.86	1350038.14
	8-7D	A4A-C8-7^RF	TAL AB	480154.71	1349979.35
		A4A-C8-7^RF-D	TAL AB		
	8-8V	A4A-C8-8V	Archive	480173.1	1350013
	8-9	A4A-C8-9^RF	TAL AB	480252.19	1350066.72
	8-10	A4A-C8-10^RF	TAL AB	480267.64	1350097.44
	8-11V	A4A-C8-11V	Archive	480172.04	1350058.06
	8-12	A4A-C8-12^RF	TAL AB	480130.52	1350134.78
	8-13V	A4A-C8-13V	Archive	480241.16	1350154.58
	8-14	A4A-C8-14^RF	TAL AB	480259.43	1350220.04
	8-15	A4A-C8-15^RF	TAL AB	480184.05	1350161.79
	8-16	A4A-C8-16^RF	TAL AB	480173.89	1350214.9

APPENDIX B
AREA 4A SAMPLE LOCATIONS AND IDENTIFIERS

CU	Location	Sample ID	Analysis	Northing	Easting
5	5-1	A4A-C5-1^RFM	TAL ABC	480485.2	1349826.28
	5-2	A4A-C5-2^RFM	TAL ABC	480462.49	1349863.27
	5-3D	A4A-C5-3^RFM	TAL ABC	480446.35	1349789.51
		A4A-C5-3^RFM-D	TAL ABC		
	5-4V	A4A-C5-4V	Archive	480415.62	1349844.66
	5-5	A4A-C5-5^RFM	TAL ABC	480475.78	1349944.97
	5-6	A4A-C5-6^RFM	TAL ABC	480490.75	1350009.9
	5-7V	A4A-C5-7V	Archive	480432.02	1349945.27
	5-8	A4A-C5-8^RFM	TAL ABC	480436.41	1350011.42
	5-9V	A4A-C5-9V	Archive	480381.48	1349816.88
	5-10	A4A-C5-10^RFM	TAL ABC	480365.33	1349879.06
	5-11	A4A-C5-11^RFM	TAL ABC	480303.32	1349800.16
	5-12	A4A-C5-12^RFM	TAL ABC	480300.38	1349860.37
	5-13	A4A-C5-13^RFM	TAL ABC	480350.66	1349928.48
	5-14V	A4A-C5-14V	Archive	480368.6	1349998.99
	5-15	A4A-C5-15^RFM	TAL ABC	480299.66	1349940.03
	5-16	A4A-C5-16^RFM	TAL ABC	480315.67	1350005.28
6	6-1V	A4A-C6-1V	Archive	480517.02	1350068.44
	6-2	A4A-C6-2^RF	TAL AB	480467.66	1350099.53
		A4A-C6-2^L	TAL E		
	6-3	A4A-C6-3^RF	TAL AB	480435.59	1350044.76
		A4A-C6-3^L	TAL E		
	6-4	A4A-C6-4^RF	TAL AB	480406.3	1350127.32
		A4A-C6-4^L	TAL E		
	6-5	A4A-C6-5^RF	TAL AB	480480.7	1350160.73
		A4A-C6-5^L	TAL E		
	6-6	A4A-C6-6^RF	TAL AB	480488.42	1350228.64
		A4A-C6-6^L	TAL E		
	6-7V	A4A-C6-7V	Archive	480437.18	1350171.55
	6-8	A4A-C6-8^RF	TAL AB	480424.25	1350228.96
		A4A-C6-8^L	TAL E		
	6-9	A4A-C6-9^RF	TAL AB	480360.51	1350069.8
		A4A-C6-9^L	TAL E		
	6-10V	A4A-C6-10V	Archive	480359.77	1350122.13
	6-11D	A4A-C6-11^RF	TAL AB	480304.38	1350045.09
		A4A-C6-11^L	TAL E		
		A4A-C6-11^RF-D	TAL AB		
		A4A-C6-11^L-D	TAL E		
	6-12	A4A-C6-12^RF	TAL AB	480294.58	1350138.87
		A4A-C6-12^L	TAL E		
	6-13V	A4A-C6-13V	Archive	480368.92	1350168.48
	6-14	A4A-C6-14^RF	TAL AB	480394.15	1350260.39
		A4A-C6-14^L	TAL E		
	6-15	A4A-C6-15^RF	TAL AB	480302.66	1350170.11
		A4A-C6-15^L	TAL E		
	6-16	A4A-C6-16^RF	TAL AB	480343.43	1350215.04
		A4A-C6-16^L	TAL E		

5891

APPENDIX B
AREA 4A SAMPLE LOCATIONS AND IDENTIFIERS

CU	Location	Sample ID	Analysis	Northing	Easting
9-UST14	9-UST14-1	A4A-C9-UST14-1^R	TAL A	480509.59	1350212.82
		A4A-C9-UST14-1^MTH	TAL F		
	9-UST14-2	A4A-C9-UST14-2^R	TAL A	480507.2	1350212.53
		A4A-C9-UST14-2^MTH	TAL F		
	9-UST14-3	A4A-C9-UST14-3^R	TAL A	480505.19	1350214.25
		A4A-C9-UST14-4^MTH	TAL F		
	9-UST14-4	A4A-C9-UST14-4^R	TAL A	480502.7	1350213.96
		A4A-C9-UST14-4^MTH	TAL F		
	9-UST14-5	A4A-C9-UST14-5^R	TAL A	480500.4	1350212
		A4A-C9-UST14-5^MTH	TAL F		
	9-UST14-6	A4A-C9-UST14-6^R	TAL A	480498.29	1350213.96
		A4A-C9-UST14-6^MTH	TAL F		
	9-UST14-7	A4A-C9-UST14-7^R	TAL A	480496.26	1350212.54
		A4A-C9-UST14-7^MTH	TAL F		
	9-UST14-8	A4A-C9-UST14-8^R	TAL A	480493.7	1350214.49
		A4A-C9-UST14-8^MTH	TAL F		