

2212

**CERTIFICATION REPORT
FOR AREA 1, PHASE II SECTOR 2B**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO**



**INFORMATION
ONLY**

MAY 1999

**U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE**

**20710-RP-0010
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LIST OF ACRONYMS AND ABBREVIATIONS

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A1PI	Area 1, Phase I
A1PII-2B	Area 1, Phase II Sector 2B
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
EIS	East Impacted Stockpile
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FRL	final remediation level
HAMDC	highest allowable minimum detectable concentration
HPGe	high purity germanium detector
LCS	laboratory control sample
MDC	minimum detectable concentration
mg/kg	milligrams per kilogram
NAR	North Access Road
OEPA	Ohio Environmental Protection Agency
OU	Operable Unit
OSDF	On-Site Disposal Facility
pCi/g	picocuries per gram
PSP	Project Specific Plan
QA/QC	Quality Assurance/Quality Control
RAWP	Remedial Action Work Plan
RTRAK	Radiation Tracking System
ROD	Record of Decision
SED	Sitewide Environmental Database
SEP	Sitewide Excavation Plan
SCQ	Sitewide CERCLA Quality Assurance Project Plan
TPU	total propagated uncertainty
µg/kg	micrograms per kilogram
UCL	upper confidence level
V&V	verification and validation
WAC	waste acceptance criteria

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EXECUTIVE SUMMARY

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This certification report presents the information and data used by the U.S. Department of Energy (DOE) to determine that existing soil concentrations do not exceed the final remediation levels (FRLs) in Area 1, Phase II Sector 2B (A1PII-2B) at the Fernald Environmental Management Project (FEMP). On the basis of this reported information and supporting project files, DOE has determined that no remedial actions are required in this area of the site; therefore, this area can be considered "certified." Upon approval from the regulatory agencies, DOE intends to proceed with construction of the On-Site Disposal Facility (OSDF) Cell 3.

As discussed in the A1PII-S2B Certification Design Letter (CDL) (DOE 1999a), A1PII-S2B is an approximately 1.5-acre parcel of land located in the northern portion of A1PII. A1PII-S2B includes the former East Impacted Stockpile (EIS) footprint and the adjacent portion of the North Access Road (NAR) and ditches, which consist of four certification units (CUs). Certification sampling was conducted in each CU to verify that the certification criteria were achieved. These criteria state that: 1) the mean concentrations or activities of the primary area-specific constituents of concern (ASCOCs) within a CU are less than the FRLs at the 95 percent upper confidence level (UCL) (90 percent for secondary ASCOCs); and 2) no certification result can exceed two-times the FRL (i.e., the "hot spot" criterion). If either of these criteria is not met, then further investigation and possible excavation is required. If both of these criteria are met for a CU, than it can be released for final land use. A1PII-S2B has passed both of these criteria and will be considered certified when the U.S. Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (OEPA) agree that the certification criteria have been met within all four CUs.

As discussed in the CDL, the only remedial action which has occurred in A1PII-S2B was the removal of the EIS and 6 inches below original grade. The certification samples were analyzed at FEMP-approved laboratories per the Sitewide CERCLA Quality Assurance Project Plan (SCQ). All these samples were analyzed and reported at the required analytical support level (ASL). Analytical data packages included sample results with associated Quality Assurance/Quality Control (QA/QC) data and all applicable raw data. The data were also subjected to the required validation and verification process, which did not identify any significant quality concerns.

All CUs achieved the certification criteria. The determination of passing or failing certification was based on a review of certification sample analytical results from each CU against the certification criteria. Statistical analysis was not necessary to determine if a ASCOC passed certification for a particular CU in most cases, since only one result (including all ASCOCs, all CUs) exceeded the associated FRL. When the statistical analyses were run, all CUs passed final certification relative to the average constituent of concern concentration and the "hot spot" determination on the first round of certification, and no additional corrective actions were necessary.

DOE has restricted access to certified areas in order to maintain their integrity prior to final land use development. A FEMP procedure (EP-0008) has been developed to implement a process to protect certified areas from becoming recontaminated. Upon approval of this report by EPA and OEPA, OSDF Cell 3 construction will begin.

1.0 INTRODUCTION

1.1 PURPOSE

This certification report presents the information and data used by the DOE to determine that existing soil contamination does not exceed FRLs within A1P11-S2B. As identified in the A1P11-S2B CDL (DOE 1999a), this soil is being certified in order to proceed with future land use activities. On the basis of this reported information, DOE considers remedial goals achieved.

1.2 BACKGROUND

In the Operable Unit (OU) 5 Record of Decision (ROD) (DOE 1996a), DOE committed to excavating contaminated soil that exceeds health-based FRLs, with final disposition of the excavated material in the OSDF or at an off-site disposal facility if OSDF waste acceptance criteria (WAC) are exceeded. The OU5 Remedial Investigation Report (DOE 1995) defined the extent of above-FRL soil contamination and, in general, indicated widespread contamination in approximately 430 acres of the 1,050-acre FEMP. Approximately 1.8 million cubic yards of contaminated soil are anticipated to be excavated and placed within the OSDF.

In the OU5 Remedial Action Work Plan (RAWP) (DOE 1996b), DOE committed to preparing a Sitewide Excavation Plan (SEP) to define the overall approach to implementing the soil and at- and below-grade debris cleanup obligations identified in the OU2, OU3, and OU5 RODs. Subsequently, the FEMP has been divided into distinct remedial areas and phases for soil remediation, based on the OU remediation schedule. As discussed in the Area 1, Phase II Supplemental Characterization Package (DOE 1999b), the certification strategy for Area 1, Phase II will proceed in an iterative manner. The next CDL submitted to the regulatory agencies will address the certification of the utility trenches in Sector 3. The final CDL will address the certification of Sector 1B, Sectors 2C and 2D, and Sector 3.

1.3 AREA DESCRIPTION

As shown on Figure 1-1, A1P11-S2B includes the footprint of the former EIS and the adjacent portion of the former NAR. The A1P11-S2B CUs consist of:

- **CU A1P2-S2B-NAR1** - established to cover the soil beneath the paved portion of the North Access Road in the northern portion of A1P11-S2B.

- **CU A1P2-S2B-NAR2** - established to cover the soil beneath the paved portion of the North Access Road in southern portion of A1PII-S2B. 1
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- **CU A1P2-S2B-NAR3** - established to cover the ditch along the west side of the North Access Road to the southern part of the certified area, and the ditch on the east side of the NAR in northern portion of A1PII-S2B. 3
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- **CU A1P2-S2B-EIS** - established to contain the footprint of the EIS. 7

1.4 OBJECTIVES 8

The objectives of this Certification Report are: 9

- Describe the precertification activities 10
- Describe the analytical methods, data validation processes, data reduction and statistical processes used to support the certification process 11
12
- Present certification sampling results for the four CUs being certified 13
- Present the statistical analysis showing that all four CUs have passed the certification criteria, including FRL attainment and hot spot criteria, as discussed in Section 2.0 14
15
- Describe access controls implemented to prevent recontamination. 16

1.5 REPORT FORMAT 17

This certification report is presented in five sections with supporting documentation and data in the appendices. These sections are as follows: 18
19

- Section 1.0 Introduction: Purpose, background, area description, and objectives of the report 20
- Section 2.0 Certification Approach: The approach to sampling and analysis used for certification 21
- Section 3.0 Overview of Field Activities: Area preparation, excavation, and changes to work scope 22
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- Section 4.0 Analytical Methodologies, Data Validation Processes, and Data Reduction 24
- Section 5.0 Certification Evaluation and Conclusions 25
- Section 6.0 Protection of Certified Areas 26
- Appendix A CU Maps and Statistics Tables 27

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1.6 FEMP CERTIFICATION MASTER MAP

In order to track certification and characterization for reuse areas at the FEMP, DOE will include a controlled map showing the status of the soil remediation areas and phased areas with all Certification Reports and CDLs. This map is included in this Certification Report as Figure 1-2, and has been updated to reflect the status of the recent approvals of Area 1 Phase I, Area 8 Phase I, and Area 1 Phase II Sector 1, 2a and the Conveyance Ditch.

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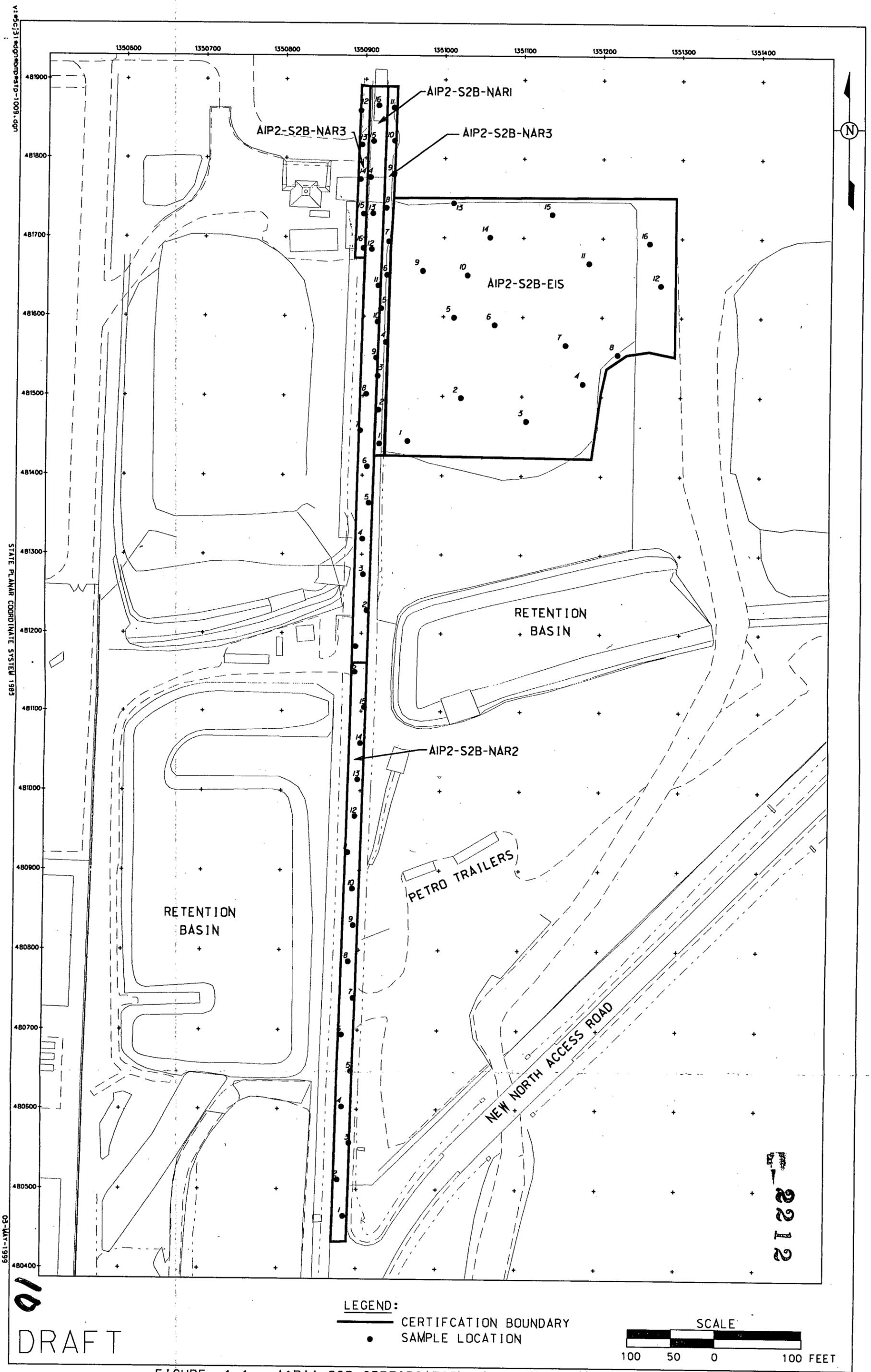
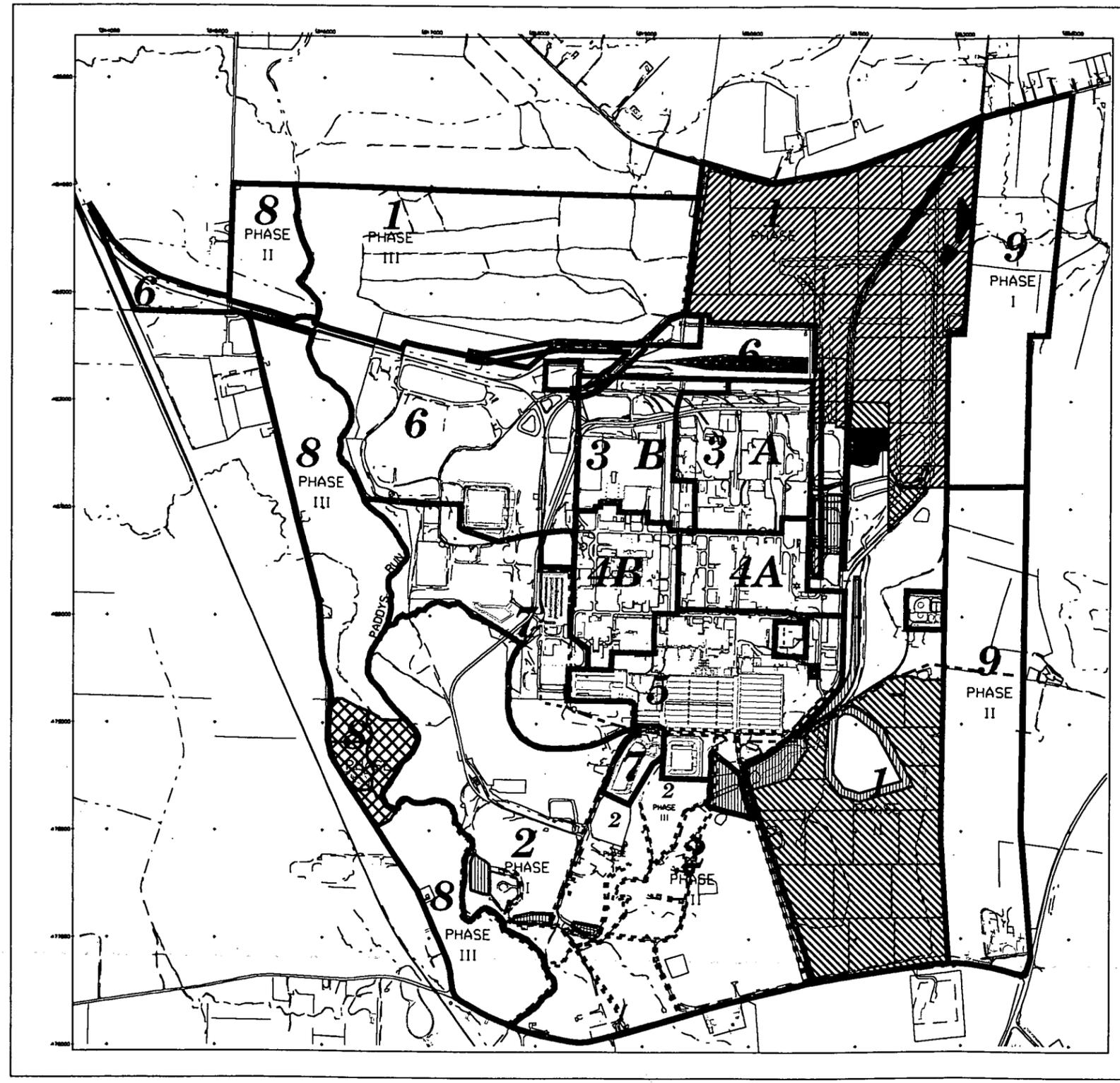


FIGURE 1-1. A1PII-S2B CERTIFICATION UNITS AND SAMPLE LOCATIONS



- LEGEND:**
- A1P11 CERTIFIED AREAS (AGENCY APPROVED) 80.1 ACRES
 - CHARACTERIZATION FOR REUSE AREAS 20.2 ACRES
 - AREAS EXCLUDED FROM A1P1
 - A1P1 CERTIFIED AREAS (AGENCY APPROVED) 120.5 ACRES
 - ABP1 CERTIFIED AREAS (AGENCY APPROVED) 12.5 ACRES
 - A1P1 SEDIMENT TRAPS 2 AND (AGENCY APPROVED) 1.4 ACRES
 - A1P2-S2B (PENDING) 1.5 ACRES

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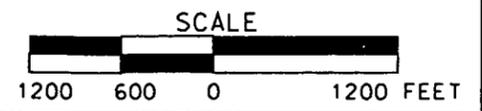


FIGURE 1-2. FEMP CONTROLLED CERTIFICATION MASTER MAP

2.0 CERTIFICATION APPROACH

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2.1 CERTIFICATION STRATEGY

This section summarizes the ASCOCs selection process and the certification approach, including CU establishment, sampling design, and statistical analysis. The general purpose of certification sampling is to verify that the mean concentrations or activities of primary ASCOCs remaining in the soil of a CU following remedial activities are less than the FRLs at the 95 percent UCL, and at the 90 percent UCL for secondary ASCOCs. The certification process also includes the hot spot criterion, which states that if any of the certification samples exceeds two-times the FRL, further action is required as discussed in Section 2.2.5 of the CDL (DOE 1999a). If the mean residual ASCOC concentrations or activities are below the FRLs within the respective confidence bounds, and the hot spot criterion is met, then the remedial objectives have been achieved for the CU. It can then be released for regrading, reseeding and final land use. The general certification strategy is described in Section 3.4 of the SEP (DOE 1998a), and the A1PII-2B specific strategy is described in the CDL for A1PII-2B (DOE 1999a).

2.1.1 A1PII-S2B Area-Specific Constituents of Concern

The ASCOC selection process for A1PII-S2B was the same as the Area 1 Phase I (A1PI) certified area, and ASCOCs are the same except for thorium-230, cesium-137, and aroclor 1260.

TABLE 2-1
 ASCOC LIST FOR A1PII-S2B

Primary ASCOCs	FRL	Secondary ASCOCs	FRL
Total Uranium	82 mg/kg	Arsenic	12.0 mg/kg
Thorium-228	1.7 pCi/g		
Thorium-232	1.5 pCi/g		
Radium-226	1.7 pCi/g		
Radium-228	1.8 pCi/g		

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2.2 CERTIFICATION APPROACH

2.2.1 Certification Design

The certification design for A1P2-S2B follows the general approach outlined in Section 3.4 of the SEP (DOE 1998a). Because A1P2-S2B included shallow excavation of impacted soil, Approach A from the SEP was used as a basis for certification design, as described in Section 4.1 of the SEP. Three Group 1 CUs, which can be as large as 62,500 square feet, and one Group 2 CU, which can be as large as 250,000 square feet, were located within A1P2-S2B as follows:

- **CU A1P2-S2B-NAR1** - established to cover the soil beneath the paved portion of the North Access Road in the northern portion of A1P2-S2B.
- **CU A1P2-S2B-NAR2** - established to cover the soil beneath the paved portion of the North Access Road in southern portion of A1P2-S2B.
- **CU A1P2-S2B-NAR3** - established to cover the ditch along the west side of the North Access Road to the southern part of the certified area, and the ditch on the east side of the NAR in northern portion of A1P2-S2B. Since the NAR ditches receive run-off from the NAR and uncertified areas, this CU consists only of areas which receive run-off from certified areas. Also, since this CU is not contiguous all 16 samples were collected and analyzed.
- **CU A1P2-S2B-EIS** - established to contain the footprint of the EIS.

The sample location selection process was described in the CDL for A1P2-S2B, and was consistent with the approach in Section 3.4.2 of the SEP, with the exception of CU A1P2-S2B-NAR3 since the CU is not contiguous. The 16 samples locations were allocated between the ditches (east of the NAR and west of the NAR) based on the respective lengths, with the west ditch receiving 5 sample locations and the east 11. The selection process is described in the CDL.

As discussed in the Project Specific Plan (PSP) for Certification Sampling of Area 1, Phase II Sector 2B (DOE 1999c), discrete soil samples were collected from each of the 16 random sampling locations. Each sample was collected from the 0 to 6-inch (surface) soil interval at the designated and surveyed sample point. Samples collected from A1P2-S2B-NAR1 and A1P2-S2B-NAR2 consisted of native soil from beneath the NAR pavement. These samples were collected by drilling through the pavement until the surface of the native soil is reached. Of the 16 certification samples, a total of 12 will be submitted for analysis, with the exception of CU A1P2-S2B-NAR3 where all the samples will be analyzed. In the other three CUs, the 12 samples to be analyzed were selected by dividing each CU into

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quadrants with each quadrant containing four sample locations. Three of the four samples from each quadrant were then randomly selected for analysis, resulting in a total of 12 samples analyzed per CU. The other four samples from each CU were archived. Additional samples were collected on the NAR in CUs A1P2-S2B-NAR1 and A1P2-S2B-NAR2.

2.2.2 Statistical Analysis

The statistical analysis of certification samples is discussed in Appendix G of the SEP (DOE 1998a). Statistical analysis of certification results is not necessary to determine if an ASCOC passed certification in a CU if all of the results for that ASCOC in that CU were below the FRL. If any sample result does exceed the associated FRL, then statistical analyses will be performed and two criteria must be met for the CU to pass certification. If the data distribution is normal or lognormal, the first criterion is to compare the 95 percent UCL on the mean of each primary ASCOC to its FRL, resulting in the pass/fail decision on each individual CU. If the data distribution was not normal or lognormal, the appropriate nonparametric approach, discussed in Appendix G of the SEP, was used to evaluate the 95 percent UCL on the mean. The second criterion is related to the hot spot criterion, which states that if a certification sample for a primary radiological ASCOC exceeds two-times the FRL, then further action is necessary as shown on Figure 3-11 of the SEP (DOE 1998a). Specifically, if the contamination is not widespread in the CU and is limited to an individual sample location, the high purity germanium detector (HPGe) will be used to delineate the area as described in Section 3.3.3 of the Real-Time User's Manual (DOE 1998b). If the area is less than 10 square meters (m^2) then the acceptable concentration is three times the FRL. If the area is larger than 10 m^2 , then the acceptable concentration is two times the FRL. When the given UCL on the mean for each constituent of concern (COC) is less than its FRL, and the hot spot criterion is met, the CU has met both criteria and will be considered certified.

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3.0 OVERVIEW OF FIELD ACTIVITIES

3.1 AREA PREPARATION

The only area preparation that occurred in A1P11-S2B was in the EIS area. Once the EIS was excavated to the original grade, it was scanned using the Radiation Tracking System (RTRAK). The RTRAK scan did not show any contamination approaching the WAC, and an additional 6 inches was excavated. The highest pre-excitation RTRAK total uranium reading using a two point average was 108 mg/kg. Once the six inches was excavated, a real-time precertification scan of the area was planned on the post-excitation footprint. However, field conditions have been too wet to allow any additional real-time monitoring. Since the pre-excitation scan showed limited contamination approaching the FRL prior to the excavation, and this certification effort is a critical path activity to the OSDF schedule, certification sampling proceeded without the precertification real-time scan. However, the scan was performed once the area sufficiently dried, and the results confirmed that the area was below FRL. The highest post-excitation RTRAK total uranium reading using a two-point average was 64 mg/kg.

3.2 CHANGES TO SCOPE OF WORK

The scope of work for A1P11-S2B certification sampling was documented in the CDL (DOE 1999a), and there were no major changes during field implementation. Final certification sampling locations and CU boundaries remained as identified, and all analyses were carried out as planned. For the WAC sampling of the compacted fill material on the NAR, a WAC sample was planned at every location. However, at locations 14, 15, and 16 in CU A1P2-S2B-NAR1 and at locations 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, and 14 in CU A1P2-S2B-NAR2, fill material was not encountered and a WAC sample was not collected.

4.0 ANALYTICAL METHODOLOGIES, DATA VALIDATION
PROCESSES AND DATA REDUCTION

4.1 ANALYTICAL METHODOLOGIES

A1PII samples were analyzed at the FEMP on site laboratory, which is on the FEMP Approved Laboratories List, per the Sitewide CERCLA Quality Assurance Project Plan (SCQ). To be on the FEMP Approved Laboratories List, a laboratory must comply with SCQ requirements and be audited within one year of sample analysis. The SCQ is also the source for analytical methodologies (Appendix G), data validation and verification, and analytical and field QA/QC requirements.

For all the certification data, ASL D analytical requirements were selected per Appendix G of the SCQ. The laboratory reported an ASL D data package, which includes all the raw data. For the total uranium data, the detection limit was set at 10 percent of the FRL (8.2 µg/kg), which is higher than the detection limit documented in Appendix G. Similarly, the detection limit was set at approximately 10 percent of the FRL (1.5 pCi/g) for thorium-228 and thorium-232, which is also higher than the detection limit documented in Appendix G. Therefore, by definition, the ASL detection limit for uranium, thorium-228 and thorium-232 is ASL E, although all other ASL D requirements are met for these analyses. The analytical data packages provided by the contract laboratory included sample results with associated QA/QC data and all applicable raw data.

4.1.1 Radiochemical Methods

The radiochemical analytical methods depended on the specific nuclides of interest. Performance-based specification criteria included highest allowable minimum detectable concentration (HAMDC), percent overall tracer/chemical recovery, percent matrix spike recovery, method blank concentration, percent recovery of laboratory control sample, and percent recovery for duplicate samples for each analyte. Laboratories were required to meet these specifications using the methodologies described below.

Total Uranium

Samples were analyzed for uranium-238 using gamma spectrometry, and the results were used to calculate the total uranium value. The calculation used was as follows:

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Total uranium (mg/kg) = (2.998544) x uranium-238 gamma spectrometry result (pCi/g)

The validation qualifier assigned to the total uranium value was the same as the uranium-238 qualifier.

Radium-226

Samples were analyzed by gamma spectrometry, and radium-226 was quantified by measuring gamma rays emitted by members of its decay chain. This method does not require chemical separation, but the samples must be allowed a 20-day progeny ingrowth period before counting. The laboratory used the same gamma ray emission lines and error weighted average methodology to calculate all certification results.

Radium-228

Following gamma spectrometry analysis, radium-228 was also quantified by measuring gamma rays emitted by members of its decay chain. The off-site laboratory used the same gamma ray emission lines and error weighted average methodology to calculate all certification results.

Isotopic Thorium

Isotopic thorium was also quantified by gamma spectrometry. The off-site laboratory used the same gamma ray emission lines and error weighted average methodology to calculate all certification results.

4.2 DATA VERIFICATION AND VALIDATION

This section discusses the data verification and validation (V&V) process used to examine the quality of field and laboratory results. Data were qualified to indicate the level of data usability, or level of confidence in the reported analytical results. The EPA's National Functional Guidelines for Data Review (Inorganic Data) (EPA 1994), as adapted and approved by EPA Region V, was used for this process.

Specific parameters associated with the data were evaluated during V&V to determine whether the data quality objectives were met. Five principal quality assurance parameters (i.e., precision, accuracy, completeness, comparability, and representativeness) were addressed during V&V. Field sampling and handling, laboratory analysis and reporting, and nonconformances and discrepancies in the data were examined to ensure compliance with appropriate and applicable procedures.

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The V&V process evaluated the following parameters:

- Specific Field Forms for sample collection and handling
- Chain of Custody forms
- Completeness of Laboratory Data Deliverable

The data validation process examined the analytical data to determine the level of confidence of the results. General areas examined that apply to all the chemical data include the following:

- Holding Times
- Instrument calibrations
- Calculation of results
- Matrix spike/matrix spike duplicate recoveries
- Laboratory/field duplicate precision
- Field/Laboratory Blank contamination
- Dry weight correction for solid samples
- Correct detection limits reported
- Laboratory control sample (LCS) recoveries and compliance with established limits

Parameters unique to the evaluation of radiochemical analyses include:

- Calibration data for specific energies
- Background checks
- Relative Error ratios
- Tracer yields
- Detector efficiencies
- Background count correction

For this project, all the radiological data were reviewed and validated for all criteria noted above. Per project requirements, a minimum of ten percent of the certification data were validated to validation Level D. This validation included the same review process as for ASL B, but included a systematic review of the raw data and recalculations.

Following V&V, qualifier codes were applied to specific data points, reflecting the level of confidence assigned to the particular datum. These codes included:

- No qualification; the positive result or detection limit is confident as reported

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- J Positive result is estimated or imprecise; data point is usable for decision-making purposes. Positive results less than the contract required reporting limit are also qualified in this manner 1-3
- R Positive result or detection limit is considered unreliable - data point should NOT be used for decision-making purposes 4-5
- U Undetected result at the stated limit of detection 6
- UJ Undetected result; detection limit is considered estimated or imprecise; the data point is usable for decision-making purposes 7-8
- N Positive result is tentatively identified - that is, there is some question regarding the actual identification and quantification of the result. Compound reported is best professional judgement of the interpretation of the supporting data, such as mass spectra. Caution must be exercised with the use of this data 9-12
- NV Not Validated. The results for this sample were not validated 13
- Z This result, or detection limit in this analysis is not the best one to use; another analysis (e.g., the dilution or re-analysis) contains a more confident and usable result. 14-15

The V&V of this data set did not identify any significant problems with the data set. 16

4.3 DATA REDUCTION 17

Each sample used to support the certification decision was entered in the FEMP Sitewide Environmental Database (SED) with the following information. 18-19

Field Information 20

- Sample Identification Number - A unique number assigned to each discrete sample point 21-22
- Coordinate Information - Northing and Easting locations 23
- Certification Unit - Each sample is assigned to a CU based on location. 24

Laboratory Information 25

For each sample result the following information is entered: 26

- Laboratory Result - The reported analytical value from the laboratory 27

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- Laboratory Qualifier - The qualifier reported from the lab. For radiological parameters non-detect values are assigned a U qualifier 1 2
- Total Propagated Uncertainty (TPU) - This value represents the uncertainty associated with the reported result. TPU includes the counting error, as well as uncertainty from other laboratory measurements and data reduction. (Applicable to radiological parameters only) 3 4 5 6
- Units - The units in which the Laboratory Result is reported. 7

Validation Information 8

- Validation Result - The result based on the validation process. During the validation process, sample results may be adjusted. If the laboratory result is less than the associated minimum detectable concentration (MDC), the validation result becomes the MDC value 9 10 11 12
- Validation TPU - The TPU based on the validation process 13
- Validation Qualifier - The qualifier assigned as a result of the data validation process 14
- Validation Units - The units in which the Validation Result is reported. 15

Using the information as summarized above, the following actions were taken for data reduction of each CU data set. 16 17

1. All the data for each CU were queried from the SED. All the data were used even if the CU had more than the minimum required data points 18 19
2. The data from the validation fields were used for statistical calculations 20
3. Data with a qualifier of R or Z was not used in the statistical calculations 21
4. The highest of the two duplicate results was used in the statistical calculations 22
5. One half of the non-detect (U or UJ) values was used in the statistical calculations. 23

5.0 CERTIFICATION EVALUATION AND CONCLUSIONS

5.1 CERTIFICATION RESULTS AND EVALUATION

All CUs for A1PII-2SB passed the certification criteria. Certification success or failure was based on a review of certification sample data from each CU against criteria discussed in Section 2.2.5 of the CDL (DOE 1999a). All CUs passed final certification relative to the average COC concentration and the two-times FRL "hot spot" criterion. All CUs passed on the first round of certification, and no additional corrective actions were necessary. Final certification data are presented in Appendix A. A review of the certification results reveals that no sample result exceeded the FRL.

Presented in Appendix A are the results of the WAC samples taken in CUs A1PII-S2B-NAR1 and A1P2-S2B-NAR2. As discussed in Section 3.2, compacted fill material was not encountered at every location. All results are below the FRL (82 mg/kg) and the WAC (1,080 mg/kg) for total uranium.

5.2 A1PII-S2B CERTIFICATION CONCLUSIONS

All of the CUs have passed certification statistical analyses relative to the determination of average residual soil concentrations within applicable confidence bounds of all the ASCOCs, and relative to the two-times FRL "hot spot" criterion. Based on these results, DOE has determined that the remedial objectives in the OU5 ROD (DOE 1996a) have been achieved in A1PII, and no remedial actions are required. The subject areas will be released for final land use.

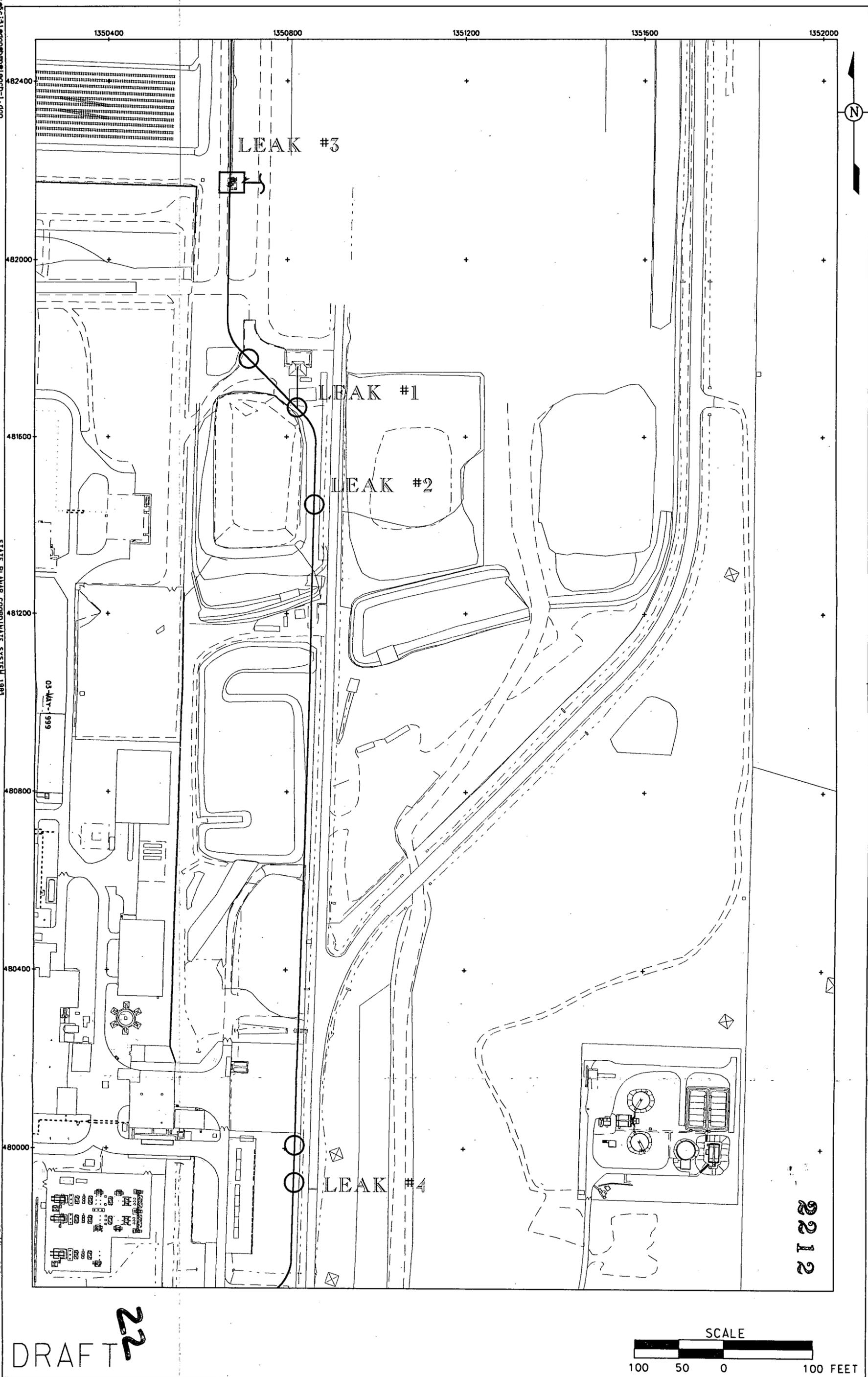
5.3 LEACHATE LINE INVESTIGATION RESULTS

As part of the Leachate Line investigation, samples were taken from the open excavations at the four locations shown in Figure 5-1. The results from these samples are presented in Appendix A. All results were below the respective FRLs. While these data do not affect the certification of A1PII-S2B, they are presented here for informational purposes.

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FIGURE 5-1. LEACHATE LINE SAMPLE LOCATIONS

6.0 PROTECTION OF CERTIFIED AREAS

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DOE has restricted access to certified areas in order to maintain their integrity prior to transferral for final land use. FEMP procedure EP-0008 has been developed to implement a process to protect certified areas from becoming recontaminated.

The procedure is summarized as follows:

- At the initiation of certification sampling activities for a remediation area, temporary fencing will be installed to delineate the perimeter of the "certified" area
- Signs will be posted upon the temporary perimeter fencing to require access approval for entry into the "certified" area
- To gain access to the "certified" area, the individual(s) or project desiring admittance will submit a written request to the responsible project manager
- Any equipment to be used within the "certified" area must have been clean in accordance with FEMP certified area access procedure subsequent to any use in a uncertified areas; or for any work, before entry into a "certified" area
- FEMP management team representatives must instruct general employees/operators on the entry and exit requirements for a "certified" area.

After DOE certifies the remediated area, it will be transferred for final land use. At that time, best management practices and administrative controls will be used to protect the area from contamination, and other controls will be implemented as needed.

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APPENDIX A

**CERTIFICATION SAMPLES, RESULTS
AND STATISTICS TABLES**

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Area 1 Phase II Sector 2B Certification Statistics

Station Number	RADIONUCLIDES					METALS
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic
A1P2S2B-NAR1-01	1.52 -	1.22 -	1.19 -	1.22 -	4.47 J	4.63 -
A1P2S2B-NAR1-03	1.31 -	1.12 -	1.13 -	1.12 -	4.41 U	7.15 -
A1P2S2B-NAR1-03-D	1.20 -	1.12 -	1.09 -	1.12 -	4.83 J	6.28 -
A1P2S2B-NAR1-04	1.29 -	1.23 -	1.23 -	1.23 -	4.48 U	10.50 -
A1P2S2B-NAR1-05	1.55 -	1.18 -	1.19 -	1.18 -	4.33 U	5.50 -
A1P2S2B-NAR1-06	1.46 -	1.09 -	1.09 -	1.09 -	4.59 U	6.40 -
A1P2S2B-NAR1-07	1.69 -	1.12 -	1.13 -	1.12 -	4.43 U	4.90 -
A1P2S2B-NAR1-09	1.34 -	1.15 -	1.17 -	1.15 -	4.45 U	2.98 -
A1P2S2B-NAR1-11	1.07 -	0.80 -	0.81 -	0.80 -	3.63 J	3.82 -
A1P2S2B-NAR1-12	0.80 -	0.67 -	0.65 -	0.67 -	3.97 U	3.77 -
A1P2S2B-NAR1-13	0.80 -	0.67 -	0.69 -	0.67 -	3.92 U	3.78 -
A1P2S2B-NAR1-14	1.00 -	0.70 -	0.73 -	0.70 -	4.03 U	3.84 -
A1P2S2B-NAR1-15	1.59 -	0.84 -	0.85 -	0.84 -	3.50 J	4.73 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	mg/kg
Conf. Level	95%	95%	95%	95%	95%	90%
W-statistic Prob. #	30.7% (N)	2.3% (N)	2.7% (N)	2.3% (N)	not tested	35.2% (LN)
Test Procedure	t-Test (N)	Wilcoxon	Wilcoxon	Wilcoxon	Proportions	t-Test (LN)
Sample Size	12	12	12	12	12	12
Est. Mean*	1.28	1.11	1.11	1.11	2.22	5.17
UCL	--	--	--	--	--	--
Prob.	--	--	--	--	--	--
Pass / Fail	--	--	--	--	--	--
Max Result	1.69 -	1.23 -	1.23 -	1.23 -	4.83 J	10.50 -
2x Rule P/F	Pass	Pass	Pass	Pass	Pass	--

Definition of Qualifiers
"J" = estimated result
"UJ" = not detected, estimated
"U" = not detected
"-" = no data qualifier
"NV" = not validated
"UNV" = not detected, not validated

a posteriori Sample Size calculation	5	3	3	3	3	2
	Pass	Pass	Pass	Pass	Pass	Pass

Note: Est. Mean = Estimated measure of central tendency(Normal: Mean; LogNormal: Est. Mean; Non-Parametric: Median)
 The maximum value of the two duplicates was used in all statistical equations.
 #: This is the highest reported probability of the Shapiro-Wilk W-statistic for tests for the validity of the normality assumption.
 The test is performed on the raw data (untransformed) data (N) and the log-transformed data (LN) to test for lognormality.

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Area 1 Phase II Sector 2B Certification Statistics

Station Number	RADIONUCLIDES					METALS
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic
A1P2S2B-NAR2-01	1.43 -	1.28 -	1.30 -	1.28 -	4.97 J	8.95 -
A1P2S2B-NAR2-02	1.45 -	1.17 -	1.13 -	1.17 -	3.16 U	5.30 -
A1P2S2B-NAR2-03	1.37 -	1.00 -	0.98 -	1.00 -	4.16 J	8.16 -
A1P2S2B-NAR2-05	1.48 -	1.24 -	1.21 -	1.24 -	3.89 U	3.89 -
A1P2S2B-NAR2-07	1.47 -	1.06 -	1.02 -	1.06 -	3.80 U	6.80 -
A1P2S2B-NAR2-08	1.12 -	0.96 -	0.95 -	0.96 -	6.03 J	5.29 -
A1P2S2B-NAR2-10	0.98 -	0.83 -	0.84 -	0.83 -	4.97 J	6.78 -
A1P2S2B-NAR2-10-D	1.01 -	0.91 -	0.90 -	0.91 -	3.30 U	8.14 -
A1P2S2B-NAR2-11	0.90 -	0.72 -	0.73 -	0.72 -	3.30 U	6.27 -
A1P2S2B-NAR2-12	1.34 -	0.94 -	0.91 -	0.94 -	3.61 J	7.94 -
A1P2S2B-NAR2-14	1.24 -	1.18 -	1.17 -	1.18 -	3.88 U	3.27 -
A1P2S2B-NAR2-15	0.99 -	0.76 -	0.75 -	0.76 -	7.40 U	4.84 -
A1P2S2B-NAR2-16	1.04 -	0.83 -	0.80 -	0.83 -	3.60 U	6.68 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	mg/kg
Conf. Level	95%	95%	95%	95%	95%	90%
W-statistic Prob. #	11.4% (N)	57.2% (N)	78.3% (LN)	57.2% (N)	not tested	91.0% (N)
Test Procedure	t-Test (N)	t-Test (N)	t-Test (LN)	t-Test (N)	Proportions	t-Test (N)
Sample Size	12	12	12	12	12	12
Est. Mean*	1.23	1.00	0.98	1.00	2.78	6.18
UCL	--	--	--	--	--	--
Prob.	--	--	--	--	--	--
Pass / Fail	--	--	--	--	--	--
Max Result	1.48 -	1.28 -	1.30 -	1.28 -	6.03 J*	8.95 -
2x Rule P/F	Pass	Pass	Pass	Pass	Pass	--

Definition of Qualifiers
"J" = estimated result
"UJ" = not detected, estimated
"U" = not detected
" - " = no data qualifier
"NV" = not validated
"UNV" = not detected, not validated

a posteriori Sample Size calculation	3	2	3	3	3	2
	Pass	Pass	Pass	Pass	Pass	Pass

Note: Est. Mean = Estimated measure of central tendency(Normal: Mean; LogNormal: Est. Mean; Non-Parametric: Median)

The maximum value of the two duplicates was used in all statistical equations.

#: This is the highest reported probability of the Shapiro-Wilk W-statistic for tests for the validity of the normality assumption.

The test is performed on the raw data (untransformed) data (N) and the log-transformed data (LN) to test for lognormality.

* "6.03 J" is reported as the maximum value because "7.40 U" is assumed to be "3.70" (½ the Detection Limit).

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Area 1 Phase II Sector 2B Certification Statistics

Station Number	RADIONUCLIDES					METALS
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic
A1P2S2B-NAR3-01	0.51 -	0.33 J	0.30 -	0.33 J	3.38 U	1.99 -
A1P2S2B-NAR3-01-D	0.41 -	0.28 J	0.26 -	0.28 J	3.43 U	1.62 -
A1P2S2B-NAR3-02	0.55 -	0.25 J	0.25 -	0.25 J	3.42 U	1.38 -
A1P2S2B-NAR3-03	0.52 -	0.27 J	0.27 -	0.27 J	3.22 U	2.27 -
A1P2S2B-NAR3-04	0.44 -	0.20 J	0.20 -	0.20 J	3.35 U	2.23 -
A1P2S2B-NAR3-05	0.94 -	1.13 J	1.13 -	1.13 J	21.56 -	8.14 -
A1P2S2B-NAR3-06	0.98 -	0.85 J	0.82 -	0.85 J	19.79 -	2.76 -
A1P2S2B-NAR3-07	1.08 -	1.00 J	0.98 -	1.00 J	37.79 -	2.82 -
A1P2S2B-NAR3-08	1.17 -	0.91 J	0.90 -	0.91 J	11.27 -	7.35 -
A1P2S2B-NAR3-09	1.03 -	0.84 J	0.85 -	0.84 J	17.52 -	5.99 -
A1P2S2B-NAR3-10	1.36 -	1.18 J	1.14 -	1.18 J	10.46 -	5.59 -
A1P2S2B-NAR3-11	1.28 -	1.05 J	1.08 -	1.05 J	26.66 -	3.08 -
A1P2S2B-NAR3-12	1.17 -	0.88 J	0.88 -	0.88 J	11.33 -	4.27 -
A1P2S2B-NAR3-13	1.10 -	0.71 J	0.65 -	0.71 J	9.03 -	3.00 -
A1P2S2B-NAR3-14	1.03 -	0.80 J	0.75 -	0.80 J	14.52 J	4.65 -
A1P2S2B-NAR3-15	1.05 -	0.63 J	0.61 -	0.63 J	5.58 -	2.31 -
A1P2S2B-NAR3-16	1.24 -	1.28 J	1.26 -	1.28 J	17.75 -	3.43 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	mg/kg
Conf. Level	95%	95%	95%	95%	95%	90%
W-statistic Prob. #	2.9% (N)	18.9% (N)	19.1% (N)	18.9% (N)	16.7% (N)	75.7% (LN)
Test Procedure	Wilcoxon	t-Test (N)	t-Test (N)	t-Test (N)	t-Test (N)	t-Test (LN)
Sample Size	16	16	16	16	16	16
Est. Mean*	1.04	0.77	0.75	0.77	13.12	3.85
UCL	--	--	--	--	--	--
Prob.	--	--	--	--	--	--
Pass / Fail	--	--	--	--	--	--
Max Result	1.36 -	1.28 J	1.26 -	1.28 J	37.79 -	8.14 -
2x Rule P/F	Pass	Pass	Pass	Pass	Pass	--

Definition of Qualifiers
"J" = estimated result
"UJ" = not detected, estimated
"U" = not detected
"-" = no data qualifier
"NV" = not validated
"UNV" = not detected, not validated

a posteriori Sample Size calculation	3	3	3	3	2	2
	Pass	Pass	Pass	Pass	Pass	Pass

Note: Est. Mean = Estimated measure of central tendency(Normal: Mean; LogNormal: Est. Mean; Non-Parametric: Median)

The maximum value of the two duplicates was used in all statistical equations.

#: This is the highest reported probability of the Shapiro-Wilk W-statistic for tests for the validity of the normality assumption.

The test is performed on the raw data (untransformed) data (N) and the log-transformed data (LN) to test for lognormality.

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Area 1 Phase II Sector 2B Certification Statistics

Station Number	RADIONUCLIDES					METALS
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic
A1P2S2B-EIS-01	1.32 -	1.14 -	1.12 -	1.14 -	10.04 -	3.41 -
A1P2S2B-EIS-02	1.09 -	1.08 -	1.06 -	1.08 -	16.82 -	2.05 -
A1P2S2B-EIS-03	1.14 -	1.16 -	1.14 -	1.16 -	19.33 -	0.63 -
A1P2S2B-EIS-06	1.14 -	1.10 -	1.09 -	1.10 -	12.40 -	3.36 -
A1P2S2B-EIS-06-D	1.01 -	1.08 -	1.06 -	1.08 -	11.12 -	3.60 -
A1P2S2B-EIS-07	1.10 -	1.07 -	1.05 -	1.07 -	9.15 -	3.15 -
A1P2S2B-EIS-08	0.95 J	1.12 -	1.12 -	1.12 -	14.69 -	3.11 -
A1P2S2B-EIS-09	1.37 -	1.13 -	1.10 -	1.13 -	16.12 -	4.37 -
A1P2S2B-EIS-10	1.51 -	1.15 -	1.11 -	1.15 -	17.05 -	3.48 -
A1P2S2B-EIS-11	1.50 -	1.18 -	1.19 -	1.18 -	18.05 -	4.56 -
A1P2S2B-EIS-13	1.27 -	1.11 -	1.10 -	1.11 -	18.80 -	3.19 -
A1P2S2B-EIS-15	1.26 -	1.10 -	1.05 -	1.10 -	17.86 -	3.28 -
A1P2S2B-EIS-16	1.29 -	1.19 -	1.20 -	1.19 -	17.04 -	3.76 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	mg/kg
Conf. Level	95%	95%	95%	95%	95%	90%
W-statistic Prob. #	75.0% (N)	86.1% (LN)	36.3% (LN)	86.1% (LN)	6.2% (N)	3.4% (N)
Test Procedure	t-Test (N)	t-Test (LN)	t-Test (LN)	t-Test (LN)	t-Test (N)	Wilcoxon
Sample Size	12	12	12	12	12	12
Est. Mean*	1.24	1.13	1.11	1.13	15.61	3.32
UCL	--	--	--	--	--	--
Prob.	--	--	--	--	--	--
Pass / Fail	--	--	--	--	--	--
Max Result	1.51 -	1.19 -	1.20 -	1.19 -	19.33 -	4.56 -
2x Rule P/F	Pass	Pass	Pass	Pass	Pass	--

Definition of Qualifiers
"J" = estimated result
"UJ" = not detected, estimated
"U" = not detected
" - " = no data qualifier
"NV" = not validated
"UNV" = not detected, not validated

a posteriori Sample Size calculation	3 Pass	2 Pass	2 Pass	2 Pass	2 Pass	2 Pass
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Note: Est. Mean = Estimated measure of central tendency(Normal: Mean; LogNormal: Est. Mean; Non-Parametric: Median)

The maximum value of the two duplicates was used in all statistical equations.

#: This is the highest reported probability of the Shapiro-Wilk W-statistic for tests for the validity of the normality assumption.

The test is performed on the raw data (untransformed) data (N) and the log-transformed data (LN) to test for lognormality.

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Appendix A
WAC Sample Results

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SAMPLE ID	Parameter	Result	Units
A1P2S2B-NAR1-01W	URANIUM	1.81	ug/g
A1P2S2B-NAR1-02W	URANIUM	1.57	ug/g
A1P2S2B-NAR1-03W	URANIUM	1.59	ug/g
A1P2S2B-NAR1-04W	URANIUM	1.29	ug/g
A1P2S2B-NAR1-05W	URANIUM	1.59	ug/g
A1P2S2B-NAR1-06W	URANIUM	1.58	ug/g
A1P2S2B-NAR1-07W	URANIUM	1.27	ug/g
A1P2S2B-NAR1-08W	URANIUM	2.09	ug/g
A1P2S2B-NAR1-09W	URANIUM	2.02	ug/g
A1P2S2B-NAR1-10W	URANIUM	1.91	ug/g
A1P2S2B-NAR1-11W	URANIUM	1.69	ug/g
A1P2S2B-NAR1-12W	URANIUM	1.4	ug/g
A1P2S2B-NAR1-13W	URANIUM	1.47	ug/g
A1P2S2B-NAR1-14W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR1-15W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR1-16W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-01W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-02W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-03W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-04W	URANIUM	1.82	ug/g
A1P2S2B-NAR2-05W	URANIUM	1.79	ug/g
A1P2S2B-NAR2-06W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-07W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-08W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-09W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-10W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-11W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-12W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-13W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-14W	Sample Not Collected	N/A	N/A
A1P2S2B-NAR2-15W	URANIUM	1.07	ug/g
A1P2S2B-NAR2-16W	URANIUM	1.6	ug/g

Appendix A
Leachate Line Results

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Sample ID	Parameter	Result	Qualifier	Unit
LCS LEAK #1	1,1-Dichloroethene	10	U	ug/kg
LCS LEAK #1	Bromodichloromethane	10	U	ug/kg
LCS LEAK #1	Tetrachloroethene	10	U	ug/kg
LCS LEAK #1	Trichloroethene	10	U	ug/kg
LCS LEAK #1	Vinyl chloride	10	U	ug/kg
LCS LEAK #1	cis-1,2-Dichloroethene	10	U	ug/kg
LCS LEAK #1	trans-1,2-Dichloroethene	10	U	ug/kg
LCS LEAK #1	Boron	3	-	mg/kg
LCS LEAK #1	Mercury	0	B	mg/kg
LCS LEAK #1	Moisture Content	15	-	PERCENT
LCS LEAK #1	Technetium-99	1	U	pCi/g dry
LCS LEAK #1	Uranium, Total	6	-	ug/g dry
LCS LEAK #1	4-Nitroaniline	840	U	ug/kg
LCS LEAK #1	Carbazole	330	U	ug/kg
LCS LEAK #1	alpha-Chlordane	2	U	ug/kg
LCS LEAK #1	bis(2-Chloroisopropyl) ether	330	U	ug/kg
LCS LEAK #1	Extractable Organic Halogen	20	U	mg/kg
LCS LEAK #1	Total Organic Carbon	5550	-	mg/kg
LCS LEAK #2	1,1-Dichloroethene	10	U	ug/kg
LCS LEAK #2	Bromodichloromethane	10	U	ug/kg
LCS LEAK #2	Tetrachloroethene	10	U	ug/kg
LCS LEAK #2	Trichloroethene	10	U	ug/kg
LCS LEAK #2	Vinyl chloride	10	U	ug/kg
LCS LEAK #2	cis-1,2-Dichloroethene	10	U	ug/kg
LCS LEAK #2	trans-1,2-Dichloroethene	10	U	ug/kg
LCS LEAK #2	Boron	3	-	mg/kg
LCS LEAK #2	Mercury	0	B	mg/kg
LCS LEAK #2	Moisture Content	16	-	PERCENT
LCS LEAK #2	Technetium-99	1	U	pCi/g dry
LCS LEAK #2	Uranium, Total	2	-	ug/g dry
LCS LEAK #2	4-Nitroaniline	840	U	ug/kg
LCS LEAK #2	Carbazole	330	U	ug/kg
LCS LEAK #2	alpha-Chlordane	2	U	ug/kg
LCS LEAK #2	bis(2-Chloroisopropyl) ether	330	U	ug/kg
LCS LEAK #2	Extractable Organic Halogen	20	U	mg/kg
LCS LEAK #2	Total Organic Carbon	11800	-	mg/kg
LCS LEAK #3	1,1-Dichloroethene	10	U	ug/kg
LCS LEAK #3	Bromodichloromethane	10	U	ug/kg
LCS LEAK #3	Tetrachloroethene	10	U	ug/kg
LCS LEAK #3	Trichloroethene	10	U	ug/kg
LCS LEAK #3	Vinyl chloride	10	U	ug/kg

Appendix A
Leachate Line Results

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Sample ID	Parameter	Result	Qualifier	Unit
LCS LEAK #3	cis-1,2-Dichloroethene	10	U	ug/kg
LCS LEAK #3	trans-1,2-Dichloroethene	10	U	ug/kg
LCS LEAK #3	Boron	2	-	mg/kg
LCS LEAK #3	Mercury	0	U	mg/kg
LCS LEAK #3	Moisture Content	24	-	PERCENT
LCS LEAK #3	Technetium-99	1	U	pCi/g dry
LCS LEAK #3	Uranium, Total	2	-	ug/g dry
LCS LEAK #3	4-Nitroaniline	840	U	ug/kg
LCS LEAK #3	Carbazole	330	U	ug/kg
LCS LEAK #3	alpha-Chlordane	2	U	ug/kg
LCS LEAK #3	bis(2-Chloroisopropyl) ether	330	U	ug/kg
LCS LEAK #3	Extractable Organic Halogen	20	U	mg/kg
LCS LEAK #3	Total Organic Carbon	2210	-	mg/kg
LCS LEAK #4	1,1-Dichloroethene	9	U	ug/kg
LCS LEAK #4	Bromodichloromethane	9	U	ug/kg
LCS LEAK #4	Tetrachloroethene	9	U	ug/kg
LCS LEAK #4	Trichloroethene	9	U	ug/kg
LCS LEAK #4	Vinyl chloride	9	U	ug/kg
LCS LEAK #4	cis-1,2-Dichloroethene	9	U	ug/kg
LCS LEAK #4	trans-1,2-Dichloroethene	9	U	ug/kg
LCS LEAK #4	Boron	3	-	mg/kg
LCS LEAK #4	Mercury	0	U	mg/kg
LCS LEAK #4	Moisture Content	16	-	PERCENT
LCS LEAK #4	Technetium-99	1	U	pCi/g dry
LCS LEAK #4	Uranium, Total	1	-	ug/g dry
LCS LEAK #4	4-Nitroaniline	840	U	ug/kg
LCS LEAK #4	Carbazole	330	U	ug/kg
LCS LEAK #4	alpha-Chlordane	2	U	ug/kg
LCS LEAK #4	bis(2-Chloroisopropyl) ether	330	U	ug/kg
LCS LEAK #4	Extractable Organic Halogen	20	U	mg/kg
LCS LEAK #4	Total Organic Carbon	14500	-	mg/kg