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CERTIFICATION REPORT FOR AREA 1, PHASE II SECTOR 2 CERTIFICATION UNITS WEST OF FORMER NORTH ACCESS ROAD

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

INFORMATION ONLY

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U.S. DEPARTMENT OF ENERGY
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LIST OF ACRONYMS AND ABBREVIATIONS

A1PI	Area 1, Phase I
A1PII	Area 1, Phase II
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
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FRL	final remediation level
HAMDC	highest allowable minimum detectable concentration
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectroscopy
LCS	laboratory control sample
MDC	minimum detectable concentration
mg/kg	milligrams per kilogram
NAR	North Access Road
ug/kg	milligrams per kilogram
OEPA	Ohio Environmental Protection Agency
OU5	Operable Unit 5
OSDF	On-Site Disposal Facility
pCi/g	picoCuries per gram
ppm	parts per million
PSP	Project Specific Plan
QA/QC	quality assurance/quality control
ROD	Record of Decision
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SED	Sitewide Environmental Database
SEP	Sitewide Excavation Plan
STP	Sewage Treatment Plant
TPU	total propagated uncertainty
UCL	upper confidence level
V&V	verification and validation
WAC	waste acceptance criteria

EXECUTIVE SUMMARY

This certification report presents the information and data used by the U.S. Department of Energy (DOE) to determine that remaining soil concentrations do not exceed the final remediation levels (FRLs) in the 13 Certification Units (CUs) in Area 1, Phase II (A1PII) Sector 2 west of the former North Access Road (NAR) and a portion of Remediation Area 5. Based on this reported information and supporting project files, DOE has determined that remedial actions are complete in this area of the site; therefore, this area can now be considered remediated and "certified." Upon approval from the regulatory agencies, DOE intends to proceed with construction activities in the area, including installation of the permanent leachate line starting in March 2000.

The 13 CUs are part of the certification scope discussed in the Certification Design Letter (CDL) for A1PII Certified for Reuse Areas, Trap Range, Sector 2C, and Sector 3 (DOE 1999a) which also summarizes the remedial actions conducted in this area. 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. The 13 CUs have met both criteria and will be considered certified upon concurrence from the U.S. Environmental Protection Agency (EPA) and Ohio Environmental Protection Agencies (OEPA). Four additional samples were collected from predetermined locations as specified in the CDL in CU A1PII-S2SB-01 for metals because, while the CU passed the average UCL and "hot spot" criteria with 12 samples, it failed the *a posteriori* sample size calculation for arsenic. With the additional four samples, the CU passed all certification criteria.

Samples were collected in the fill material within CU A1P2-S2LL-01 to determine if the material meets waste acceptance criteria (WAC) for placement in the OSDF when excavated. The fill material met WAC and FRL and this material will not impact the certification intervals.

The certification samples were analyzed at laboratories on the FEMP Approved Laboratories List 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.

DOE has restricted access to certified areas in order to maintain their integrity prior to final land use development. A FEMP procedure (EP-0008, Revision 2) has been developed to implement a process to protect certified areas from becoming recontaminated.

1.0 INTRODUCTION

1.1 PURPOSE

This certification report presents the information and data used by the U.S. Department of Energy (DOE) to determine that remaining soil contamination does not exceed the final remediation levels (FRLs) within the 13 certification units (CUs) located in Area 1, Phase II (A1PII) Sector 2 west of the former North Access Road (NAR) and a portion of Remediation Area 5. These CUs were identified in the Certification Design Letter (CDL) for A1PII Certified for Reuse Areas, Trap Range, Sector 2C, and Sector 3 (DOE 1999a), and this soil is being certified in order to proceed with OSDF related construction activities. Based on this reported information, DOE considers remedial goals achieved for the subject CUs.

Additionally, samples were collected in the fill material within CU A1P2-S2LL-01 to determine if the material meets waste acceptance criteria (WAC) for placement in the OSDF when excavated. The fill material met WAC and FRL and is presented in Appendix A.

1.2 BACKGROUND

As discussed in the A1PII Supplemental Characterization Package (DOE 1999b), and in the A1PII Certified for Reuse Areas, Trap Range, Sector 2C, and Sector 3 CDL, certification will proceed in an iterative manner. Table 1-1 summarizes the CDLs and Certification Reports that have been submitted and the current status.

The first certification effort covered Sector 1, Sector 2A, and the Conveyance Ditch (DOE 1999c) and consisted of a total of 22 CUs. The second certification effort covered A1PII Sector 2B, (DOE 1999d) which consisted of four CUs in Sector 2. The third CDL covered the Utility Trenches (DOE 1999e) for abandoned underground utilities removed during Sewage Treatment Plant (STP) excavation in Sector 3. The remaining areas in A1PII not covered under the previously described CDLs and the recertification of the designated certified for reuse CUs are within the scope of the A1PII Certified for Reuse Areas, Trap Range, Sector 2C, and Sector 3 CDL, including the 13 CUs within the scope of this certification report. The NAR requires certification to support Permanent Leachate Line installation during the upcoming construction season. For this reason, a separate certification report was prepared for these CUs. The remaining CUs within the scope of the A1PII Certified for Reuse Areas, Trap

Range, Sector 2C, and Sector 3 CDL and a summary of all CUs in A1PII will be submitted in a final certification report by June 15, 2000. In addition, all A1PII construction activities material tracking, and project costs will be summarized in the final certification report.

1.3 AREA DESCRIPTION

The Sector 2 area west of the former NAR consists of 13 CUs as shown in Figure 1-1. Figure 1-2 depicts the sample locations within each CU. The primary features of this area include two sediment basins, three former stockpile footprints, and the On-Site Disposal Facility (OSDF) temporary and interim leachate lines. The following is a brief description of the primary features:

Sediment Basins: Two sediment basins are found in the area - the West Impacted Material Stockpile Basin and the OSDF Sediment Basin (also referred to as the "S-shaped sediment basin").

Stockpile Footprints: Several stockpiles were located in Sector 2, including the OSDF Sediment Basin Pile (OSD-007), the West Impacted Material Stockpile (W800056), and the Area 1, Phase I (A1PI) West Debris Stockpile (W800010).

Leachate Line: Both the Interim and the Temporary Leachate Lines were considered when designing the CUs. The Interim Line was used as the western border of Sector 2, and the original Temporary Leachate Line was considered its own CU.

Two nearby areas were excluded from this certification effort. The Interim Leachate Line area will be certified as part of Remediation Area 6 (see Figure 1-3). An area located north of the West Impacted Material Stockpile footprint is currently being used to support OSDF placement activities, which consists of the Equipment Wash Facility, construction trailers, and the Debris Haul Road. This area will be certified after the 2000, along with the area directly north of, and adjacent to, the Equipment Wash Facility in A1PI, construction season when the Equipment Wash Facility and the construction trailers are relocated.

1.4 OBJECTIVES

The objectives of this Certification Report are:

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

1.5 REPORT FORMAT

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

Section 1.0	Introduction - Purpose, background, area description, and objectives of the report
Section 2.0	Certification Approach - The approach to sampling and analysis used for certification
Section 3.0	Overview of Field Activities - Area preparation, excavation, and changes to work scope
Section 4.0	Analytical Methodologies, Data Validation Processes, and Data Reduction
Section 5.0	Certification Evaluation and Conclusions
Section 6.0	Protection of Certified Areas
Appendix A	Data Results for WAC Samples
Appendix B	Statistics Tables

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 updated and included in this Certification Report as Figure 1-3.

TABLE 1-1
A1PII CERTIFICATION

CDL - Scope	CDL Submittal	Certification Report
Sector 1, Sector 2A, Conveyance Ditch	Complete	Complete
Sector 2B	Complete	Complete
Sector 3 Utility Trenches	Complete	June 2000 (Draft Final)
Certified for Reuse Areas, Trap Range, Sector 2C, and Sector 3	Comment Responses submitted January 26, 2000	Submitted in two parts: 1. 13 CUs in Sector 2 west of former NAR 2. Remainder of CUs and final A1PII Certification Report - June 2000

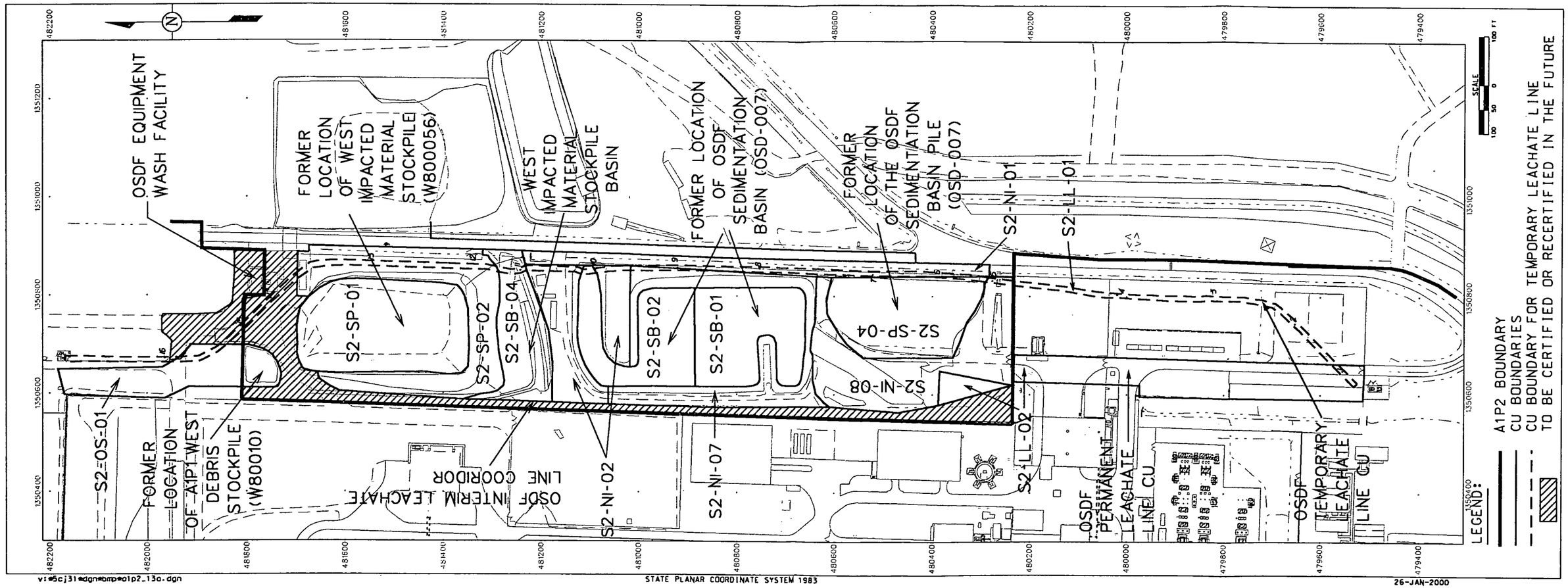

FIGURE 1-1. A1P11 SECTOR 2 BOUNDARIES

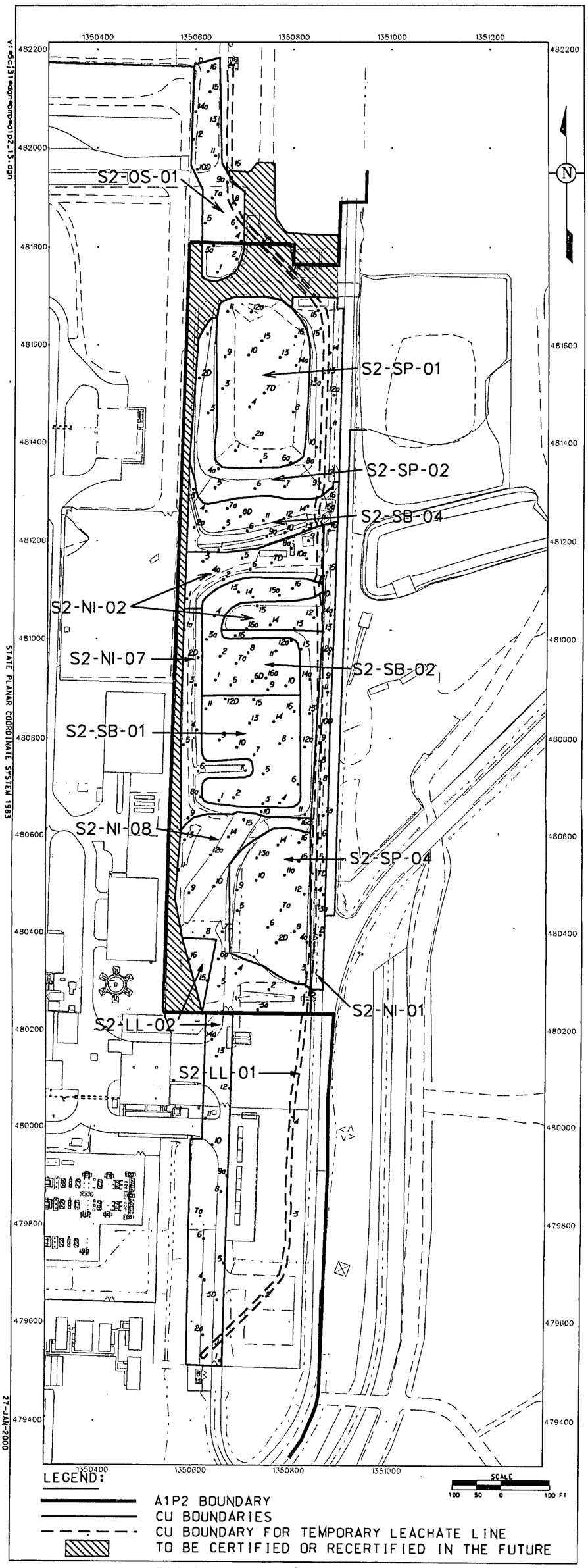

FIGURE 1-2. A1P11 SECTOR 2
BOUNDARIES AND SAMPLE LOCATIONS

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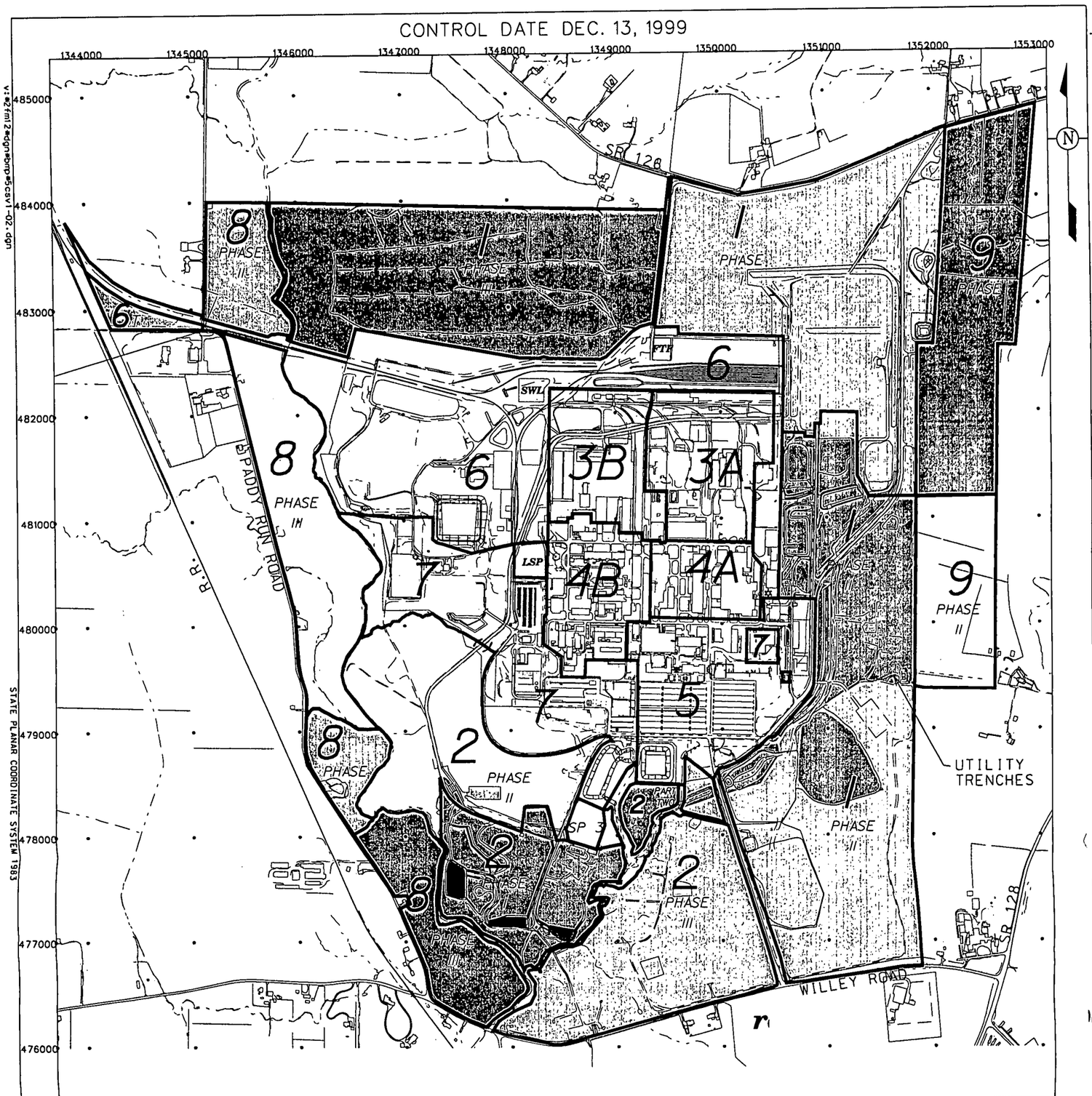

LEGEND:

APPROVED CERTIFIED AREAS (308.1 ACRES TOTAL)

- A1PI APPROVED CERTIFIED AREAS - 120.5 ACRES
- A1PI SEDIMENT TRAPS 2 AND 3 APPROVED CERTIFIED AREAS 1.4 ACRES
- A1PII APPROVED CERTIFIED AREAS - 80.1 ACRES
- A1PII-S2B APPROVED CERTIFIED AREAS 1.5 ACRES
- A8PII/A6TA APPROVED CERTIFIED AREA - 22.1 ACRES
- A8PI APPROVED CERTIFIED AREAS - 12.5 ACRES
- A2PIII APPROVED CERTIFIED AREA - 70 ACRES

CERTIFICATION IN PROGRESS

REMEDIATION IN PROGRESS

CHARACTERIZATION FOR REUSE AREAS - 2.5 ACRES

NON CERTIFIED AREAS

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SCALE

1000 500 0 1000 FEET

FIGURE 1-3. FEMP CONTROLLED CERTIFICATION MAP

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2.0 CERTIFICATION APPROACH

2.1 CERTIFICATION STRATEGY

This section summarizes the area-specific constituents of concern (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 upper confidence level (UCL), and at the 90 percent UCL for secondary ASCOCs. The certification process also includes the hot spot criterion, as discussed in Section 2.2.3. 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 Sitewide Excavation Plan (SEP 1998a).

2.1.1 ASCOC for the 13 CUs in A1PII Sector 2 West of NAR

The ASCOC selection process for the 13 CUs is described in the CDL. These 13 CUs only required the primary ASCOCs listed in Table 2-1.

2.2 CERTIFICATION APPROACH

2.2.1 Certification Design

The certification design for the 13 CUs follows the general approach outlined in Section 3.4 of the SEP. Because most of the CUs included a 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. All the CUs were Group 1 CUs, which can be as large as 62,500 square feet.

As shown on Figure 1-1, the following CUs are located in Sector 2 west of the former NAR:

- A1P2-S2NI-01 – Non-impacted area between certified former NAR and other structures including OSD-007 footprint, and the OSDF Sediment Basin
- A1P2-S2NI-02 – Non-impacted area bordering the Former Production Area fenceline and the Sediment Basin
- A1P2-S2NI-07 – Non-impacted area bordering the Former Production Area fenceline and the Sediment Basin

- A1P2-S2NI-08 – Non-impacted area adjacent to OSD-007 footprint and west side of the A1PII boundary
- A1P2-S2SP-01 – Excavated footprint of West Impacted Material Stockpile
- A1P2-S2SP-02 – Area around the excavated footprint of West Impacted Material Stockpile
- A1P2-S2SP-04 – Excavated footprint of OSD-007 Stockpile
- A1P2-S2SB-01 – Northern portion of the footprint of the OSDF Sediment Basin
- A1P2-S2SB-02 – Southern portion of the footprint of the OSDF Sediment Basin
- A1P2-S2SB-04 – Sediment Basin south of former location of West Impacted Material Stockpile
- A1P2-S2LL-01 – The abandoned temporary Leachate Conveyance System footprint
- A1P2-S2LL-02 – The southern section of the Permanent Leachate Line
- A1P2-S2OS-01 – Excavated footprint of the West Debris Stockpile and surrounding area including a portion of A1PI.

2.2.2 Sample Selection Process

The sample location selection process was described in the CDL, and was consistent with the approach in Section 3.4.2 of the SEP. As discussed in the Project Specific Plan (PSP) for Certification Sampling of A1PII Certified for Reuse Areas, Trap Range, Sector 2C, and Sector 3 (DOE 1999f), discrete soil samples were collected from 12 of the 16 random CU sampling locations. Each sample was collected from the 0 to 6-inch (surface) soil interval at the designated and surveyed sample point. The only exception was for CU A1P2-S2LL-01, where all samples were collected at depth beneath the leachate line bedding in the top 6 inches of undisturbed, native soil. The material above native soil will be removed as impacted material and placed in the OSDF. Samples were collected in the fill material to support the WAC. Six WAC samples were collected from the top 6 inches and ten were collected from the 6-inch interval above the certification sample. The data representing below-WAC results are listed in Appendix A.

2.2.3 Statistical Analysis

The statistical analysis of certification samples is discussed in Appendix G of the SEP. Statistical analysis of certification results is not necessary if all of the results for that ASCOC in that CU were below the FRL. If any sample result(s) exceeds 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 appropriate UCL on the mean of each primary ASCOC to its FRL, resulting in the pass/fail decision on each CU. When the mean of the constituent of concern (COC) concentration is less than FRL, but the UCL of the mean is above the FRL, then the option to analyze the available archived sample will be exercised to better estimate the average contaminant levels within the 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 UCL on the mean. The second criterion is related to the hot spot criterion, which states that if a certification sample for an ASCOC exceeds two-times the FRL (2xFRL), then further action is necessary as shown on Figure 3-11 of the SEP. When the given UCL on the mean for each COC is less than its FRL, and the hot spot criterion is met, the CU has met both criteria and will be considered certified.

TABLE 2-1
ASCOC LIST FOR ALL CUs

ASCOC	FRL	Reason Retained
Total Uranium	82 mg/kg	Retained as a primary ASCOC sitewide
Radium-226	1.7 pCi/g	Retained as a primary ASCOC sitewide
Radium-228	1.8 pCi/g	Retained as a primary ASCOC sitewide
Thorium-228	1.7 pCi/g	Retained as a primary ASCOC sitewide
Thorium-232	1.5 pCi/g	Retained as a primary ASCOC sitewide
Arsenic	12 mg/kg	Retained as a secondary ASCOC
Lead	400 mg/kg	Retained as a secondary and ecological ASCOC

3.0 OVERVIEW OF FIELD ACTIVITIES

3.1 AREA PREPARATION

Excavation activities occurred prior to certification sampling in four areas.

- A1PI West Debris Pile. The stockpile was removed and a precertification scan was completed

- West Impacted Material Stockpile. The stockpile and ramp, which supported the STP excavation operations, were removed and a WAC scan was completed. The top 6 inches were then removed and a precertification scan was completed.

- West Impacted Material Stockpile Sediment Basin. The sediment was dug out under and surrounding the basin and a WAC scan was completed. The top 6 inches were then removed and a precertification scan was completed.

- OSDF Sediment Basin Pile. The pile was removed and a WAC scan was completed over the area. The top 6 inches were removed and a precertification scan was completed.

Presented in Figures 3-1, 3-2, and 3-3 is the updated precertification data for Sector 2 for total uranium, thorium-232, and radium-226, respectively. The additional information includes precertification data for the excavated areas. The precertification scans show a few distinguishable patterns but none with a range of concentrations large enough to warrant separate CU considerations or further remedial actions. As discussed in the CDL, the elevated concentrations were attributed to the thorium storage building and uranium staging nearby the day of scanning. The precertification results confirm below-FRL conditions.

3.2 CHANGES TO SCOPE OF WORK

The scope of work for certification sampling was performed as documented in the CDL and PSP, and there were no major changes during field implementation. Final certification sampling locations and CU boundaries remained as identified, with the exception of three sample locations. Location 4 in CU A1P2-S2SB-04 was moved due to the overflow pipe and surrounding stone at the west end of the West Impacted Material Stockpile Basin. Location 16 in CU A1P2-S2SP-02 was moved because the original sample location fell under a trailer. Location 10 in CU A1P2-S2OS-01 was moved due to fill material from the haul road. All analyses were carried out as planned, except for the collection of archive samples in CU A1PII-S2SB-01 for metals analysis, as a result of the CU failure for arsenic.

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 Comprehensive Environmental Response (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 Quality Assurance/Quality Control (QA/QC) requirements.

For all the certification data, analytical support level (ASL) D analytical requirements were selected per Appendix G of the SCQ. The laboratory reported an ASL D data package, which included all the raw data. For the total uranium data, the detection limit was set at 10 percent of the FRL (8.2 ppm), which is higher than the detection limit documented in the SCQ. 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 the SCQ. 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 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 the 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 as follows:

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 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 laboratory used the same gamma ray emission lines and error weighted average methodology to calculate all certification results.

Lead/Arsenic

Samples were analyzed for arsenic and lead by Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES) in accordance with the SCQ ASL D criteria.

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 U.S. Environmental Protection Agency's (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. The SCQ radiochemical validation guidelines were used for the radiological results.

Specific parameters associated with the data were evaluated during V&V to determine whether the data quality objectives were met. Five principal QA 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.

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
- 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 10 percent of the certification data were validated to validation

Level D. The CUs which were validated to ASL D are A1P2-S2LL-02 and A1P2-S2SB-01, which includes a systematic review of the raw data and recalculations. The other CUs were validated to ASL B only.

Following V&V, qualifier codes were applied to specific data points, reflecting the level of confidence assigned to the particular datum. These codes are presented with the data in Appendix B and include:

-	No qualification; the positive result or detection limit is confident as reported
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
R	Positive result or detection limit is considered unreliable - data point should NOT be used for decision-making purposes
U	Undetected result at the stated limit of detection
UJ	Undetected result; detection limit is considered estimated or imprecise; the data point is usable for decision-making purposes
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
NV	Not Validated. The results for this sample were not validated
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.

The V&V of this data set did not identify any significant problems with the data set. The majority of the results received no qualifier (-) while some results are qualified as estimated (J) and nondetects (U). There were no samples qualified as rejected (R.

4.3 DATA REDUCTION

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

Field Information

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

Laboratory Information

For each sample result the following information is entered:

- Laboratory Result - The reported analytical value from the laboratory
- Laboratory Qualifier - The qualifier reported from the lab. For radiological parameters non-detect values are assigned a U qualifier
- 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).
- Units - The units in which the Laboratory Result is reported.

Validation Information

- 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
- Validation TPU - The TPU based on the validation process
- Validation Qualifier - The qualifier assigned as a result of the data validation process
- Validation Units - The units in which the Validation Result is reported.

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

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

2. The data from the validation fields were used for statistical calculations

3. Data with a qualifier of R or Z was not used in the statistical calculations

4. The highest of the two duplicate results was used in the statistical calculations

5. One half of the non-detect (U or UJ) values was used in the statistical calculations.

5.0 CERTIFICATION EVALUATION AND CONCLUSIONS

5.1 CERTIFICATION RESULTS AND EVALUATION

All 13 CUs 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 2.2.3. All CUs passed final certification relative to the mean COC concentration and the 2xFRL "hot spot" criterion. All CUs passed on the first round of certification, with the exception of CU A1PII-S2SB-01. This CU passed the UCL on the mean and "hot spot" criteria with the original 12 samples, but failed the *a posteriori* sample size calculation for arsenic. The additional four archive samples were collected and submitted for analysis. With the additional four samples the CU passes all certification criteria, and no additional corrective actions were necessary. Final certification data are presented in Appendix B.

5.2 CERTIFICATION CONCLUSIONS

All of the CUs have passed certification statistical analyses relative to the determination of mean residual soil concentrations within applicable confidence bounds of all the ASCOCs, and relative to the 2xFRL "hot spot" criterion. Based on these results, DOE has determined that the remedial objectives in the Operable Unit 5 (OU5) Records of Decision (ROD, DOE 1996) have been achieved in these 13 CUs within A1PII, and remedial actions are complete. The subject areas will be released for OSDF construction activities.

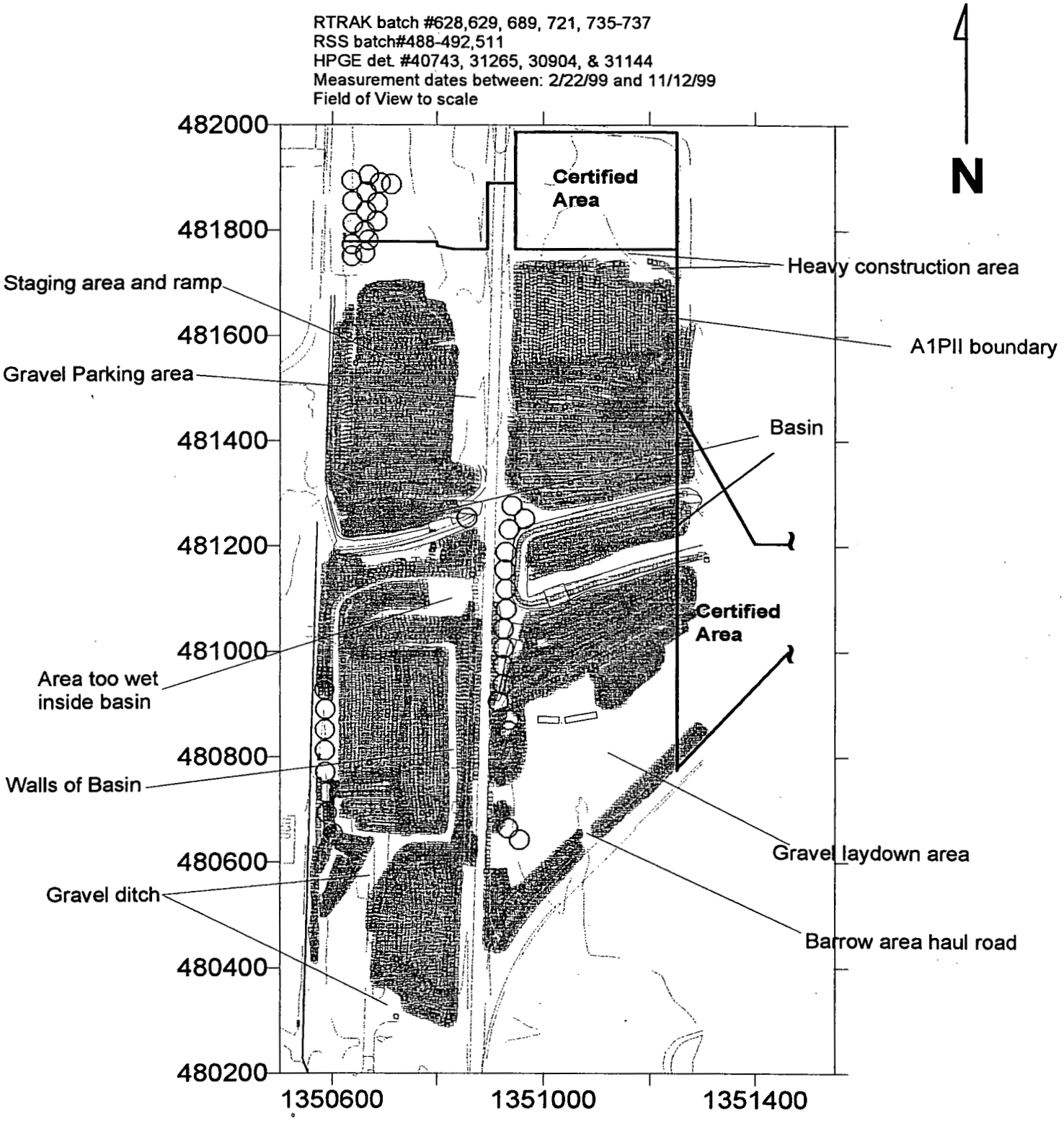
A1P2 SECTOR 2

Figure 3-1

2790

Moisture Corrected Total Uranium

RTRAK batch #628,629, 689, 721, 735-737
RSS batch#488-492,511
HPGE det. #40743, 31265, 30904, & 31144
Measurement dates between: 2/22/99 and 11/12/99
Field of View to scale



ppm Total Uranium

- -95.00 to 82.00
- 82.00 to 164.00
- 164.00 to 246.00
- 246.00 to 10000.00

RTIMP DWG Title: A1P2-PC-NORTH-TU-2PT-MC
Project #: 20710-PSP-0003 V/FCN 9
Project Name: A1PII Pre-Design Invest.
Prepared By: David Allen
File:A1P2_PC_NORTH_TU_2PT_MC.srf
Date Prepared: 11/12/99

27

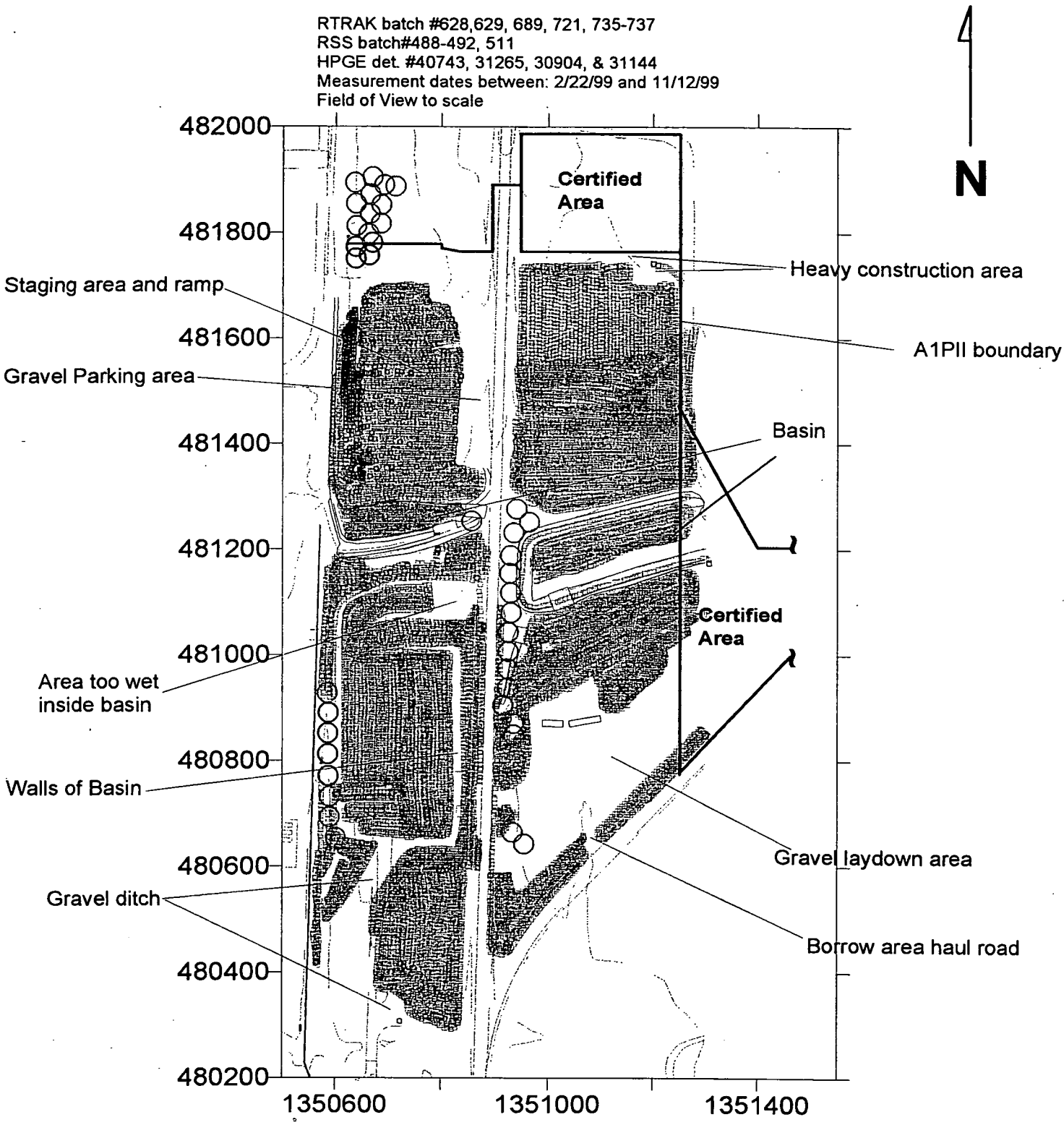
A1P2 SECTOR 2

Figure 3-2

Moisture Corrected Thorium 232

2790

RTRAK batch #628,629, 689, 721, 735-737
RSS batch#488-492, 511
HPGE det. #40743, 31265, 30904, & 31144
Measurement dates between: 2/22/99 and 11/12/99
Field of View to scale



pCi/gm Th-232

- -0.20 to 1.50
- 1.50 to 3.00
- 3.00 to 4.50
- 4.50 to 10000.00

RTIMP DWG Title: A1P2-PC-NORTH-TH-2PT-MC
Project #: 20710-PSP-0003 V/FCN 9
Project Name: A1PII Pre-Design Invest.
Prepared By: David Allen
File:A1P2_PC_NORTH_TH_2PT_MC.srf
Date Prepared: 11/12/99

A1P2 SECTOR 2

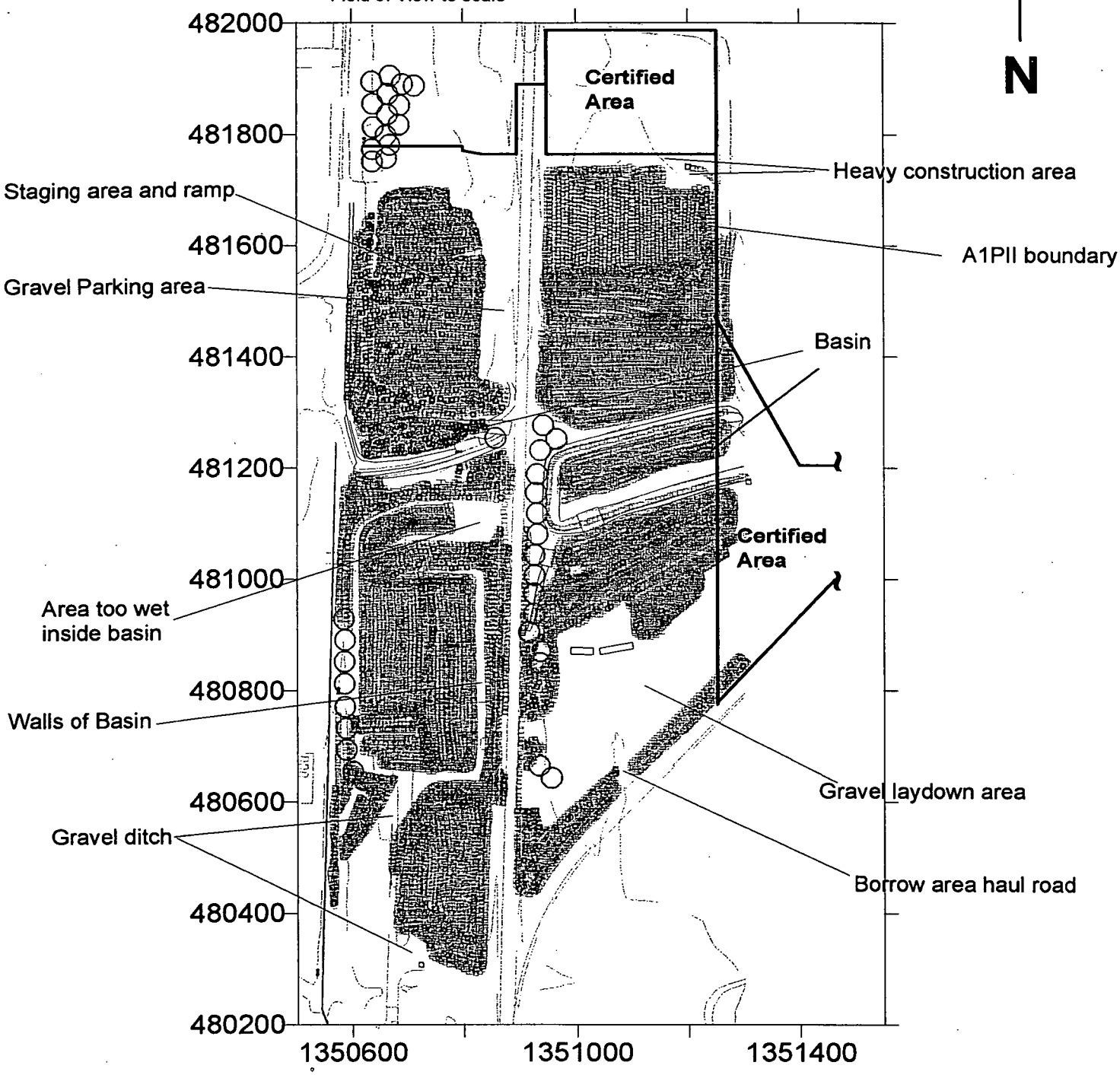
Figure 3-3

Moisture and Radon Corrected Radium 226

RTRAK batch #628,629, 689, 721, 735-737
RSS batch#488-492, 511
HPGE det. #40743, 31265, 30904, & 31144
Measurement dates between: 2/22/99 and 11/12/99
Field of View to scale

2790

N



pCi/gm Ra-226
-0.30 to 1.70
1.70 to 3.40
3.40 to 5.10
5.10 to 10000.00

RTIMP DWG Title: A1P2-PC-NORTH-RA-2PT-MC
Project #: 20710-PSP-0003 V/FCN 9
Project Name: A1PII Pre-Design Invest.
Prepared By: David Allen
File:A1P2_PC_NORTH_RA_2PT_MC.srf
Date Prepared: 11/12/99

6.0 PROTECTION OF CERTIFIED AREAS

DOE has restricted access to certified areas in order to maintain their integrity prior to transferal for final land use. FEMP procedure EP-0008, Revision 2 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.

REFERENCES

U.S. Department of Energy, 1996, "Record of Decision for Remedial Actions at Operable Unit 5," Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

U.S. Department of Energy, 1999a, "Certification Design Letter for Area 1, Phase II Certified for Reuse Areas, Trap Range, Sector 2C, and Sector 3," Draft, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

U.S. Department of Energy, 1999b, "Area 1, Phase II Supplemental Characterization Package," Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

U.S. Department of Energy, 1999c, "Certification Design Letter for Certification Design Letter for Area 1, Phase II Sectors 1, 2A and Conveyance Ditch," Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

U.S. Department of Energy, 1999d, "Certification Design Letter for Certification Design Letter for Area 1, Phase II Sectors 2B," Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

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U.S. Environmental Protection Agency, 1994, "National Functional Guidelines for Data Review," U.S. EPA Office of Solid Waste and Emergency Response, Washington, DC.

APPENDIX A

DATA RESULTS FOR WAC SAMPLES

APPENDIX A
TOTAL URANIUM RESULTS FOR WAC SAMPLING OF CU A1P2-S2LL-01 2790

SAMPLE ID	ANALYTE	RESULTS	UNITS
A1P2-S2LL-01-01W	URANIUM	3.97	mg/kg dry
A1P2-S2LL-01-02W-A	URANIUM	1.11	mg/kg dry
A1P2-S2LL-01-03W	URANIUM	2.7	mg/kg dry
A1P2-S2LL-01-04W	URANIUM	0.851	mg/kg dry
A1P2-S2LL-01-05W	URANIUM	4.5	mg/kg dry
A1P2-S2LL-01-06W	URANIUM	0.995	mg/kg dry
A1P2-S2LL-01-07W	URANIUM	8.82	mg/kg dry
A1P2-S2LL-01-08W	URANIUM	0.896	mg/kg dry
A1P2-S2LL-01-09W	URANIUM	1.01	mg/kg dry
A1P2-S2LL-01-10W	URANIUM	1.29	mg/kg dry
A1P2-S2LL-01-11W	URANIUM	6.06	mg/kg dry
A1P2-S2LL-01-12W	URANIUM	8.44	mg/kg dry
A1P2-S2LL-01-13W	URANIUM	1.63	mg/kg dry
A1P2-S2LL-01-14W	URANIUM	1.18	mg/kg dry
A1P2-S2LL-01-15W	URANIUM	3.24	mg/kg dry
A1P2-S2LL-01-16W	URANIUM	2.24	mg/kg dry

APPENDIX B

CERTIFICATION SAMPLES, ANALYTICAL RESULTS AND STATISTICS TABLES

Appendix B: Certification Statistics for A1P2-S2LL-01

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2LL-01-01B-RM	0.89 -	0.71 -	0.70 -	0.71 -	2.38 MDC	2.83 U	13.50 J
A1P2-S2LL-01-02B-RM	0.92 -	0.76 -	0.75 -	0.76 -	2.93 J	2.73 U	12.30 J
A1P2-S2LL-01-03B-RM	1.17 -	0.88 -	0.88 -	0.88 -	2.29 MDC	6.53 J	20.40 J
A1P2-S2LL-01-04B-RM	0.90 -	0.71 -	0.71 -	0.71 -	2.49 MDC	2.51 U	12.30 J
A1P2-S2LL-01-05B-RM	0.60 -	0.40 -	0.39 -	0.40 -	2.05 MDC	3.06 J	9.69 J
A1P2-S2LL-01-06B-RM	0.88 -	0.70 -	0.69 -	0.70 -	2.90 J	2.79 U	13.00 J
A1P2-S2LL-01-07B-RM	0.85 -	0.65 -	0.65 -	0.65 -	2.47 MDC	2.64 U	11.70 J
A1P2-S2LL-01-07B-RM-D	0.75 -	0.64 -	0.64 -	0.64 -	2.26 MDC	2.52 U	11.50 J
A1P2-S2LL-01-08B-RM	0.85 -	0.69 -	0.67 -	0.69 -	2.63 J	2.48 U	11.90 J
A1P2-S2LL-01-09B-RM	0.80 -	0.66 -	0.65 -	0.66 -	2.25 J	3.36 J	11.60 J
A1P2-S2LL-01-10B-RM	0.94 -	0.72 -	0.71 -	0.72 -	2.66 J	2.58 U	12.60 J
A1P2-S2LL-01-11B-RM	0.75 -	0.71 -	0.70 -	0.71 -	1.77 J	3.52 J	16.60 J
A1P2-S2LL-01-12B-RM	0.82 -	0.75 -	0.73 -	0.75 -	2.60 J	2.65 U	13.30 J
A1P2-S2LL-01-13B-RM	0.82 -	0.55 -	0.50 -	0.55 -	2.63 MDC	4.77 J	11.70 J
A1P2-S2LL-01-14B-RM	0.90 -	0.59 -	0.57 -	0.59 -	6.60 J	2.95 J	11.80 J
A1P2-S2LL-01-15B-RM	0.75 -	0.58 -	0.56 -	0.58 -	2.66 MDC	2.72 U	13.30 J
A1P2-S2LL-01-16B-RM	0.81 -	0.60 -	0.58 -	0.60 -	2.59 MDC	3.60 J	10.30 J
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.17 @	0.88 @	0.88 @	0.88 @	6.60 @	6.53 @	20.40 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	16	16	16	16	16	16	16
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posteriori Sample Size calculation	--	--	--	--	--	--	--

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

NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2LL-02

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2LL-02-01-RM	1.18 -	0.90 -	0.86 -	0.90 -	4.57 -	8.47 -	19.20 -
A1P2-S2LL-02-03-RM	1.13 -	0.96 -	0.94 -	0.96 -	2.80 MDC	6.36 -	15.80 -
A1P2-S2LL-02-04-RM	1.11 -	0.93 -	0.91 -	0.93 -	13.97 -	5.91 -	19.80 -
A1P2-S2LL-02-05-RM	1.26 -	1.06 -	1.04 -	1.06 -	5.59 J	7.33 -	18.00 -
A1P2-S2LL-02-05-RM-D	1.26 -	0.96 -	0.96 -	0.96 -	2.41 MDC	7.52 -	15.90 -
A1P2-S2LL-02-06-RM	1.21 -	0.93 -	0.91 -	0.93 -	16.04 -	6.29 -	18.10 -
A1P2-S2LL-02-08-RM	1.17 -	0.94 -	0.92 -	0.94 -	5.74 -	7.68 -	16.00 -
A1P2-S2LL-02-10-RM	1.22 -	0.92 -	0.91 -	0.92 -	5.73 -	3.06 -	17.70 -
A1P2-S2LL-02-11-RM	1.24 -	1.04 -	1.01 -	1.04 -	7.00 -	6.48 -	18.20 -
A1P2-S2LL-02-12-RM	1.29 -	1.10 -	1.09 -	1.10 -	9.27 -	6.17 -	21.50 -
A1P2-S2LL-02-13-RM	1.34 -	1.09 -	1.07 -	1.09 -	5.85 -	4.83 -	20.70 -
A1P2-S2LL-02-15-RM	1.29 -	1.10 -	1.06 -	1.10 -	25.27 -	7.12 -	71.30 -
A1P2-S2LL-02-16-RM	1.35 -	1.18 -	1.14 -	1.18 -	53.66 -	8.46 -	46.80 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.35 @	1.18 @	1.14 @	1.18 @	53.66 @	8.47 @	71.30 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posterion Sample	--	--	--	--	--	--	--
Size calculation	--	--	--	--	--	--	--

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

NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2NI-01

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2NI-01-01-R	1.18 -	0.93 -	0.91 -	0.93 -	4.86 -	5.72 J	17.20 -
A1P2-S2NI-01-02-R	0.67 -	0.53 -	0.56 -	0.53 -	4.25 -	2.54 U	5.81 -
A1P2-S2NI-01-04-R	0.63 -	0.48 -	0.48 -	0.48 -	2.50 J	2.58 U	14.10 -
A1P2-S2NI-01-05-R	0.70 -	0.67 -	0.65 -	0.67 -	11.07 -	5.63 J	18.00 -
A1P2-S2NI-01-06-R	0.95 -	0.79 -	0.78 -	0.79 -	4.50 -	2.99 J	18.10 -
A1P2-S2NI-01-08-R	1.01 -	0.87 -	0.84 -	0.87 -	6.12 -	2.87 U	15.70 -
A1P2-S2NI-01-09-R	1.04 -	0.82 -	0.80 -	0.82 -	5.18 -	5.04 J	18.50 -
A1P2-S2NI-01-10-R	0.97 -	0.86 -	0.86 -	0.86 -	6.07 MDC	4.19 J	18.20 -
A1P2-S2NI-01-10-R-D	0.99 -	0.83 -	0.82 -	0.83 -	2.95 MDC	2.53 U	18.60 -
A1P2-S2NI-01-11-R	1.01 -	0.87 -	0.86 -	0.87 -	6.43 -	6.70 J	17.10 -
A1P2-S2NI-01-13-R	0.95 -	0.81 -	0.80 -	0.81 -	7.16 -	5.87 J	19.80 -
A1P2-S2NI-01-15-R	1.06 -	0.87 -	0.85 -	0.87 -	12.08 -	5.71 J	23.00 -
A1P2-S2NI-01-16-R	1.05 -	0.85 -	0.84 -	0.85 -	6.53 -	7.72 J	20.00 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.18 @	0.93 @	0.91 @	0.93 @	12.08 @	7.72 @	23.00 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posteriori Sample	--	--	--	--	--	--	--
Size calculation	--	--	--	--	--	--	--

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

NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

-2790

Appendix B: Certification Statistics for A1P2-S2NI-02

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2NI-02-01-R	0.98 -	0.91 -	0.89 -	0.91 -	5.24 -	9.69 -	30.50 -
A1P2-S2NI-02-02-R	1.46 -	1.09 -	1.08 -	1.09 -	13.20 -	9.86 -	19.10 -
A1P2-S2NI-02-03-R	1.00 -	0.83 -	0.82 -	0.83 -	5.97 -	10.70 -	19.40 -
A1P2-S2NI-02-05-R	0.99 -	0.94 -	0.92 -	0.94 -	15.26 -	3.67 -	17.60 -
A1P2-S2NI-02-06-R	1.05 -	1.05 -	1.03 -	1.05 -	7.67 -	4.91 -	15.70 -
A1P2-S2NI-02-07-R	0.99 -	0.88 -	0.85 -	0.88 -	18.42 -	6.96 J	16.00 -
A1P2-S2NI-02-07-R-D	1.03 -	0.91 -	0.90 -	0.91 -	18.96 -	4.58 J	18.00 -
A1P2-S2NI-02-09-R	1.14 -	1.09 -	1.08 -	1.09 -	21.46 -	7.28 -	22.80 -
A1P2-S2NI-02-11-R	0.97 -	0.85 -	0.85 -	0.85 -	8.64 -	7.76 -	17.40 -
A1P2-S2NI-02-12-R	1.05 -	0.85 -	0.85 -	0.85 -	10.31 -	7.38 -	18.40 -
A1P2-S2NI-02-13-R	1.19 -	1.07 -	1.05 -	1.07 -	4.54 -	7.89 -	19.50 -
A1P2-S2NI-02-14-R	1.31 -	1.09 -	1.07 -	1.09 -	10.46 -	8.08 -	31.00 -
A1P2-S2NI-02-15-R	0.73 -	0.70 -	0.69 -	0.70 -	2.63 MDC	2.45 U	11.80 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.46 @	1.09 @	1.08 @	1.09 @	21.46 @	10.70 @	31.00 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posterion Sample Size calculation	--	--	--	--	--	--	--

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

NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2NI-07

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2NI-07-02-R	1.03 -	0.90 -	0.86 -	0.90 -	3.53 J	2.63 UJ	18.90 J
A1P2-S2NI-07-02-R-D	1.05 -	0.89 -	0.86 -	0.89 -	3.44 J	7.18 J	19.70 J
A1P2-S2NI-07-03-R	0.88 -	0.79 -	0.80 -	0.79 -	3.12 J	2.59 UJ	14.80 J
A1P2-S2NI-07-04-R	1.02 -	0.87 -	0.86 -	0.87 -	2.42 J	8.80 J	20.80 J
A1P2-S2NI-07-05-R	0.97 -	0.89 -	0.88 -	0.89 -	4.13 J	9.86 J	21.30 J
A1P2-S2NI-07-06-R	0.89 -	0.76 -	0.73 -	0.76 -	8.64 J	3.08 J	16.30 J
A1P2-S2NI-07-07-R	1.03 -	0.89 -	0.88 -	0.89 -	2.95 J	4.89 J	15.60 J
A1P2-S2NI-07-09-R	0.80 -	0.72 -	0.69 -	0.72 -	5.17 J	5.99 J	15.80 J
A1P2-S2NI-07-10-R	1.04 -	0.90 -	0.89 -	0.90 -	2.63 MDC	3.76 J	15.00 J
A1P2-S2NI-07-11-R	0.94 -	0.81 -	0.77 -	0.81 -	2.20 MDC	4.45 J	17.60 J
A1P2-S2NI-07-13-R	1.25 -	1.10 -	1.08 -	1.10 -	4.00 J	11.00 J	24.80 J
A1P2-S2NI-07-15-R	0.92 -	0.74 -	0.73 -	0.74 -	3.87 J	5.53 J	13.80 J
A1P2-S2NI-07-16-R	0.86 -	0.66 -	0.68 -	0.66 -	2.55 MDC	5.38 J	12.70 J
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.25 @	1.10 @	1.08 @	1.10 @	8.64 @	11.00 @	24.80 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posteriori Sample Size calculation	--	--	--	--	--	--	--

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

NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

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Appendix B: Certification Statistics for A1P2-S2NI-08

Sample ID	RADIONUCLIDES						
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2NI-08-01-RM	0.98 -	0.88 -	0.85 -	0.88 -	6.89 -	7.82 -	33.40 J
A1P2-S2NI-08-02-RM	0.97 -	0.87 -	0.85 -	0.87 -	8.60 -	5.90 -	40.70 J
A1P2-S2NI-08-04-RM	0.13 -	0.10 -	0.09 -	0.10 -	3.97 MDC	2.44 -	4.57 J
A1P2-S2NI-08-05-RM	1.03 -	1.05 -	1.05 -	1.05 -	57.22 -	4.06 -	38.80 J
A1P2-S2NI-08-07-RM	0.97 -	0.76 -	0.75 -	0.76 -	8.03 -	3.75 J	17.50 J
A1P2-S2NI-08-07-RM-D	1.02 -	0.79 -	0.79 -	0.79 -	6.71 -	2.71 U	14.50 J
A1P2-S2NI-08-08-RM	1.19 -	0.90 -	0.89 -	0.90 -	5.96 -	11.40 -	19.00 J
A1P2-S2NI-08-09-RM	0.90 -	0.61 -	0.60 -	0.61 -	6.10 -	6.19 -	15.00 J
A1P2-S2NI-08-10-RM	1.17 -	0.94 -	0.92 -	0.94 -	7.44 MDC	4.79 -	19.70 J
A1P2-S2NI-08-11-RM	0.95 -	0.88 -	0.86 -	0.88 -	35.55 -	6.55 -	29.70 J
A1P2-S2NI-08-13-RM	0.87 -	0.63 -	0.64 -	0.63 -	7.92 -	2.76 U	10.60 J
A1P2-S2NI-08-14-RM	1.62 -	1.15 -	1.12 -	1.15 -	7.54 MDC	4.73 -	24.60 J
A1P2-S2NI-08-15-RM	1.46 -	1.12 -	1.12 -	1.12 -	4.60 -	11.60 -	24.20 J
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.62 @	1.15 @	1.12 @	1.15 @	57.22 @	11.60 @	40.70 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posteriori Sample Size calculation	--	--	--	--	--	--	--

Definition of Qualifiers
"J" = estimated result
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NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2OS-01

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2OS-01-01-RM	1.29 -	1.06 -	1.03 -	1.06 -	9.57 -	3.77 -	24.10 -
A1P2-S2OS-01-02-RM	1.19 -	0.98 -	0.93 -	0.98 -	14.24 -	8.18 -	20.30 -
A1P2-S2OS-01-04-RM	1.07 -	0.77 -	0.76 -	0.77 -	4.35 -	5.71 -	16.00 -
A1P2-S2OS-01-05-RM	1.22 -	0.98 -	0.95 -	0.98 -	13.24 -	10.20 -	18.20 -
A1P2-S2OS-01-06-RM	1.06 -	0.84 -	0.81 -	0.84 -	5.61 -	4.95 -	21.00 -
A1P2-S2OS-01-08-RM	1.32 -	1.07 -	1.04 -	1.07 -	4.97 -	8.11 -	19.00 -
A1P2-S2OS-01-10-RM	0.97 -	0.65 -	0.65 -	0.65 -	7.33 -	2.81 U	8.55 -
A1P2-S2OS-01-10-RM-D	0.94 -	0.70 -	0.69 -	0.70 -	9.80 -	2.91 U	13.40 -
A1P2-S2OS-01-11-RM	1.09 -	0.85 -	0.84 -	0.85 -	6.86 MDC	7.99 -	19.00 -
A1P2-S2OS-01-12-RM	0.96 -	0.72 -	0.71 -	0.72 -	5.28 -	6.08 -	14.40 -
A1P2-S2OS-01-13-RM	1.01 -	0.78 -	0.75 -	0.78 -	2.80 MDC	7.13 -	15.30 -
A1P2-S2OS-01-15-RM	1.02 -	0.74 -	0.71 -	0.74 -	9.39 -	4.08 -	14.10 -
A1P2-S2OS-01-16-RM	1.15 -	0.84 -	0.81 -	0.84 -	4.54 -	5.28 -	18.50 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.32 @	1.07 @	1.04 @	1.07 @	14.24 @	10.20 @	24.10 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posterion Sample Size calculation	--	--	--	--	--	--	--

Definition of Qualifiers
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NOTES:

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

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2SB-01

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2SB-01-01-RM	1.38 J	1.35 J	1.32 J	1.35 J	3.49 J	8.05 J	25.10 -
A1P2-S2SB-01-02-RM	1.40 J	1.20 J	1.18 J	1.20 J	5.88 J	13.60 J	22.40 -
A1P2-S2SB-01-03-M						4.28 J	14.30 -
A1P2-S2SB-01-04-RM	1.21 J	1.08 J	1.05 J	1.08 J	3.95 J	7.92 J	19.20 -
A1P2-S2SB-01-05-RM	1.35 J	1.13 J	1.10 J	1.13 J	2.69 MDC	10.10 J	19.20 -
A1P2-S2SB-01-06-RM	1.05 J	0.86 J	0.84 J	0.86 J	2.48 MDC	11.90 J	22.00 -
A1P2-S2SB-01-07-M						3.86 U	20.90 -
A1P2-S2SB-01-08-RM	1.07 J	0.88 J	0.85 J	0.88 J	4.17 J	14.50 J	22.30 -
A1P2-S2SB-01-09-RM	1.34 J	1.20 J	1.19 J	1.20 J	2.91 J	8.59 J	22.40 -
A1P2-S2SB-01-10-M						3.83 J	12.70 -
A1P2-S2SB-01-11-RM	1.25 J	1.04 J	1.03 J	1.04 J	2.98 MDC	11.00 J	20.30 -
A1P2-S2SB-01-12-RM	1.34 J	1.12 J	1.09 J	1.12 J	3.78 J	5.00 J	16.90 -
A1P2-S2SB-01-12-RM-D	1.39 J	1.11 J	1.11 J	1.11 J	3.80 J	9.61 J	24.70 -
A1P2-S2SB-01-13-RM	1.23 J	1.01 -	0.98 -	1.01 -	2.58 MDC	10.70 J	20.50 -
A1P2-S2SB-01-14-M						9.52 J	22.50 -
A1P2-S2SB-01-15-RM	1.39 J	1.09 -	1.07 -	1.09 -	5.96 -	11.60 J	19.00 -
A1P2-S2SB-01-16-RM	1.02 J	0.82 -	0.80 -	0.82 -	4.18 -	11.80 J	23.90 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.40 @	1.35 @	1.32 @	1.35 @	5.96 @	14.50	25.10 @
Standardized Skewness	--	--	--	--	--	-0.965	--
W-Statistic Probability[1]	--	--	--	--	--	29.4% (N)	--
Test Procedure	--	--	--	--	--	t-Test (N)	--
Sample Size	12	12	12	12	12	16	16
Estimated Mean	--	--	--	--	--	9.31	--
UCL on the Mean[2]	--	--	--	--	--	10.48	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	Pass	--
2x Rule Pass / Fail	--	--	--	--	--	Pass	--
a posterion Sample Size	--	--	--	--	--	9	--
calculation	--	--	--	--	--	Pass	--

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

NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2SB-02

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2SB-02-01-RM	1.09 -	0.98 -	0.96 -	0.98 -	5.11 -	7.02 J	19.60 -
A1P2-S2SB-02-02-RM	1.10 -	0.95 -	0.91 -	0.95 -	4.78 -	3.04 U	16.60 -
A1P2-S2SB-02-04-RM	0.89 -	0.78 -	0.76 -	0.78 -	3.67 -	3.78 J	16.40 -
A1P2-S2SB-02-05-RM	1.34 -	1.07 -	1.05 -	1.07 -	2.74 MDC	4.65 J	16.00 -
A1P2-S2SB-02-06-RM	1.13 -	0.88 -	0.85 -	0.88 -	3.43 -	3.52 J	19.60 -
A1P2-S2SB-02-06-RM-D	1.20 -	0.99 -	0.96 -	0.99 -	4.26 -	4.72 J	17.00 -
A1P2-S2SB-02-08-RM	1.13 -	0.98 -	0.95 -	0.98 -	2.91 MDC	7.12 J	16.00 -
A1P2-S2SB-02-09-RM	1.08 -	0.95 -	0.95 -	0.95 -	3.81 -	4.62 J	15.80 -
A1P2-S2SB-02-10-RM	0.76 -	0.83 -	0.80 -	0.83 -	2.84 MDC	5.35 J	17.30 -
A1P2-S2SB-02-11-RM	0.91 -	0.76 -	0.74 -	0.76 -	2.95 MDC	2.56 J	14.70 -
A1P2-S2SB-02-13-RM	0.91 -	0.74 -	0.74 -	0.74 -	6.64 -	2.71 U	10.20 -
A1P2-S2SB-02-14-RM	0.89 -	0.74 -	0.73 -	0.74 -	3.53 -	4.63 J	18.90 -
A1P2-S2SB-02-16-RM	1.07 -	0.86 -	0.84 -	0.86 -	6.06 -	3.04 U	13.50 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.34 @	1.07 @	1.05 @	1.07 @	6.64 @	7.12 @	19.60 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posteriori Sample Size calculation	--	--	--	--	--	--	--

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

NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2SB-04

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2SB-04-01-RM	0.96 -	0.87 -	0.84 -	0.87 -	4.34 -	2.62 U	15.00 -
A1P2-S2SB-04-03-RM	1.29 -	1.01 -	1.01 -	1.01 -	4.33 -	8.25 J	21.30 -
A1P2-S2SB-04-04-RM	0.81 -	0.60 -	0.57 -	0.60 -	5.09 -	3.86 J	14.60 -
A1P2-S2SB-04-05-RM	1.34 -	1.12 -	1.09 -	1.12 -	2.63 MDC	5.66 J	17.50 -
A1P2-S2SB-04-06-RM	1.07 -	0.82 -	0.78 -	0.82 -	4.64 -	4.90 J	17.60 -
A1P2-S2SB-04-08-RM	1.00 J	0.92 -	0.90 -	0.92 -	2.34 MDC	6.58 J	15.50 -
A1P2-S2SB-04-08-RM-D	0.83 J	0.81 -	0.80 -	0.81 -	2.49 MDC	4.05 J	15.90 -
A1P2-S2SB-04-10-RM	1.48 -	1.16 -	1.08 -	1.16 -	3.46 J	15.70 J	23.50 -
A1P2-S2SB-04-11-RM	1.47 -	1.16 -	1.14 -	1.16 -	2.51 MDC	3.05 U	20.10 -
A1P2-S2SB-04-12-RM	1.42 -	1.24 -	1.22 -	1.24 -	2.80 MDC	14.10 J	27.20 -
A1P2-S2SB-04-13-RM	1.19 -	0.96 -	0.96 -	0.96 -	10.92 -	3.44 J	15.70 -
A1P2-S2SB-04-14-RM	1.22 -	1.08 -	1.05 -	1.08 -	5.26 -	5.95 J	22.00 -
A1P2-S2SB-04-16-RM	1.22 -	1.08 -	1.08 -	1.08 -	2.84 MDC	4.58 J	22.30 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.48 @	1.24 @	1.22 @	1.24 @	10.92 @	15.70	27.20 @
Standardized Skewness	--	--	--	--	--	1.921	--
W-Statistic Probability[1]	--	--	--	--	--	55.3% (LN)	--
Test Procedure	--	--	--	--	--	t-Test (LN)	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	6.61	--
UCL on the Mean[2]	--	--	--	--	--	9.92	--
Non-Parametric Prob..	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	Pass	--
2x Rule Pass / Fail	--	--	--	--	--	Pass	--
a posterior Sample Size calculation	--	--	--	--	--	5	--
	--	--	--	--	--	Pass	--

Definition of Qualifiers
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NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2SP-01

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2SP-01-01-RM	0.99 -	0.92 -	0.89 -	0.92 -	19.14 -	3.41 -	17.10 -
A1P2-S2SP-01-03-RM	1.15 -	1.10 -	1.07 -	1.10 -	24.00 -	6.30 -	22.10 -
A1P2-S2SP-01-04-RM	1.03 -	0.88 -	0.86 -	0.88 -	15.26 -	4.01 -	13.60 -
A1P2-S2SP-01-05-RM	1.14 -	1.13 -	1.10 -	1.13 -	24.25 -	5.59 -	19.90 -
A1P2-S2SP-01-07-RM	1.08 -	0.86 -	0.87 -	0.86 -	15.78 -	6.94 -	21.90 -
A1P2-S2SP-01-07-RM-D	1.11 -	0.98 -	0.96 -	0.98 -	14.84 -	7.06 -	20.60 -
A1P2-S2SP-01-08-RM	1.12 -	1.00 -	0.97 -	1.00 -	12.85 -	8.04 -	23.30 -
A1P2-S2SP-01-09-RM	1.22 -	0.98 -	0.95 -	0.98 -	18.91 -	8.59 -	26.20 -
A1P2-S2SP-01-10-RM	1.05 -	1.00 -	0.99 -	1.00 -	16.21 -	5.09 -	22.20 -
A1P2-S2SP-01-11-RM	0.94 -	0.77 -	0.75 -	0.77 -	12.97 -	2.64 -	18.60 -
A1P2-S2SP-01-13-RM	1.03 -	0.85 -	0.83 -	0.85 -	13.34 -	6.23 -	20.10 -
A1P2-S2SP-01-15-RM	1.15 -	0.95 -	0.93 -	0.95 -	18.47 -	4.94 -	17.50 -
A1P2-S2SP-01-16-RM	1.10 -	0.87 -	0.87 -	0.87 -	16.22 -	6.24 -	20.00 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.22 @	1.13 @	1.10 @	1.13 @	24.25 @	8.59 @	26.20 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posteriori Sample Size calculation	--	--	--	--	--	--	--

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

NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2SP-02

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2SP-02-01-RM	1.39 -	1.18 -	1.14 -	1.18 -	32.53 -	4.70 J	21.70 -
A1P2-S2SP-02-02-RM	1.28 -	0.96 -	0.94 -	0.96 -	10.12 -	2.92 UJ	17.40 -
A1P2-S2SP-02-02-RM-D	1.25 -	1.01 -	0.99 -	1.01 -	8.38 -	8.95 J	19.10 -
A1P2-S2SP-02-03-RM	1.16 -	1.01 -	0.99 -	1.01 -	21.36 -	3.93 J	20.10 -
A1P2-S2SP-02-05-RM	1.25 -	1.09 -	1.07 -	1.09 -	12.56 -	4.62 J	20.80 -
A1P2-S2SP-02-06-RM	1.10 -	0.77 -	0.76 -	0.77 -	5.55 -	3.44 J	10.60 -
A1P2-S2SP-02-07-RM	1.33 -	1.12 -	1.11 -	1.12 -	8.36 -	5.28 J	18.40 -
A1P2-S2SP-02-09-RM	1.20 -	1.02 -	1.02 -	1.02 -	10.39 -	3.91 J	24.50 -
A1P2-S2SP-02-10-RM	1.29 -	0.98 -	0.97 -	0.98 -	6.32 -	6.23 J	18.50 -
A1P2-S2SP-02-11-RM	1.18 -	0.98 -	0.98 -	0.98 -	9.54 -	2.72 U	14.60 -
A1P2-S2SP-02-14-RM	0.95 -	0.78 -	0.77 -	0.78 -	5.99 -	3.28 J	18.40 -
A1P2-S2SP-02-15-RM	1.26 -	0.95 -	0.94 -	0.95 -	4.23 -	7.05 J	17.20 -
A1P2-S2SP-02-16-RM	0.86 -	0.56 -	0.54 -	0.56 -	2.71 J	2.53 U	13.20 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.39 @	1.18 @	1.14 @	1.18 @	32.53 @	8.95 @	24.50 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posterion Sample	--	--	--	--	--	--	--
Size calculation	--	--	--	--	--	--	--

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

NOTES:

@ Maximum result did not exceed the FRL, therefore no statistics were generated and no other tests performed.
The maximum value of the two duplicates was used in all statistical equations.

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.

Appendix B: Certification Statistics for A1P2-S2SP-04

Sample ID	RADIONUCLIDES					METALS	
	Radium-226	Radium-228	Thorium-228	Thorium-232	Uranium, Total	Arsenic	Lead
A1P2-S2SP-04-01-RM	0.87 -	0.67 -	0.65 -	0.67 -	4.18 J	4.19 -	13.40 -
A1P2-S2SP-04-02-RM	1.33 -	1.11 -	1.10 -	1.11 -	14.87 J	2.90 -	20.40 -
A1P2-S2SP-04-02-RM-D	1.29 -	1.05 -	1.04 -	1.05 -	11.80 J	2.78 U	19.70 -
A1P2-S2SP-04-03-RM	1.06 -	0.87 -	0.86 -	0.87 -	5.36 J	2.89 -	15.80 -
A1P2-S2SP-04-05-RM	0.99 -	0.82 -	0.79 -	0.82 -	11.50 J	3.20 -	19.30 -
A1P2-S2SP-04-06-RM	1.41 -	1.22 -	1.20 -	1.22 -	5.56 J	9.04 -	22.50 -
A1P2-S2SP-04-08-RM	1.43 -	1.23 -	1.22 -	1.23 -	4.11 J	10.40 -	31.10 -
A1P2-S2SP-04-09-RM	0.97 -	0.87 -	0.87 -	0.87 -	17.70 J	3.58 -	15.60 -
A1P2-S2SP-04-10-RM	1.22 -	1.01 -	0.99 -	1.01 -	10.39 J	4.08 -	20.30 -
A1P2-S2SP-04-12-RM	1.54 -	1.26 -	1.23 -	1.26 -	3.53 J	8.70 -	41.90 -
A1P2-S2SP-04-14-RM	1.19 -	1.04 -	1.02 -	1.04 -	10.49 J	2.61 U	20.20 -
A1P2-S2SP-04-15-RM	0.91 -	0.80 -	0.79 -	0.80 -	5.69 J	2.57 U	19.20 -
A1P2-S2SP-04-16-RM	0.92 -	0.82 -	0.82 -	0.82 -	3.24 J	2.50 U	17.90 -
FRL	1.70	1.80	1.70	1.50	82.00	12.00	400.00
Units	pCi/g	pCi/g	pCi/g	pCi/g	ug/g	ug/g	ug/g
Confidence Level	95%	95%	95%	95%	95%	90%	90%
Max Result	1.54 @	1.26 @	1.23 @	1.26 @	17.70 @	10.40 @	41.90 @
Standardized Skewness	--	--	--	--	--	--	--
W-Statistic Probability[1]	--	--	--	--	--	--	--
Test Procedure	--	--	--	--	--	--	--
Sample Size	12	12	12	12	12	12	12
Estimated Mean	--	--	--	--	--	--	--
UCL on the Mean[2]	--	--	--	--	--	--	--
Non-Parametric Prob.	--	--	--	--	--	--	--
Est. Mean - Pass / Fail	--	--	--	--	--	--	--
2x Rule Pass / Fail	--	--	--	--	--	--	--
a posteriori Sample Size calculation	--	--	--	--	--	--	--

Definition of Qualifiers
"J" = estimated result
"UJ" = not detected, estimated
"U" = not detected
" - " = no data qualifier
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NOTES:

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

[1] W-Statistic Probability is the highest calculated 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 (Normal) and the log-transformed data (LogNormal) to test for lognormality.

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

MDC The reported non-detect value was below the MDC - one half of the MDC was used in subsequent statistical calculations.