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**LETTER REPORT
FOR PRE-DESIGN INVESTIGATION
OF TOTAL URANIUM IN THE
SEWAGE TREATMENT PLANT (STP) AREA**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO**



NOVEMBER 1997

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

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ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DQO	Data Quality Objective
FACTS	Fernald Analytical Customer Tracking System
FRL	Final Remediation Level
OU5	Operable Unit 5
ppm	parts per million
PSP	Project Specific Plan
QA/QC	Quality Assurance/Quality Control
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SCQ	Sitewide CERCLA Quality Assurance Project Plan
STP	Sewage Treatment Plan
STPI	Sewage Treatment Plant Incinerator
V/FCN	Variance/Field Change Notice
WAC	Waste Acceptance Criteria
WDSS	Waste Disposition Support Services

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EXECUTIVE SUMMARY

This document presents the results of sampling conducted to determine the extent of total uranium contamination in soils in and around the Fernald Environmental Management Project (FEMP) Sewage Treatment Plant (STP). These data were used to support the Area 1, Phase II (A1PII) Integrated Remedial Design Package (IRDP) to determine the quantity of soil to be excavated within the STP. The sampling and analyses were conducted under Project Number 50.03.59.05, in accordance with the *Project-Specific Plan for Pre-Design Investigation for Total Uranium in the Sewage Treatment Plant (STP) Area* (DOE, August 1997).

Based on the Remedial Investigation / Feasibility Study (RI/FS) data the contamination within the STP area was above the Record of Decision (ROD) established Final Remediation Levels (FRLs) for soluble and insoluble forms of total uranium. The RI/FS provided valuable data, but failed to fully define the areal and vertical extent of total uranium contamination at the sewage treatment plant. Additional data was need to prepare accurate estimates of the soil volume which, when removed, would eliminate unacceptable risks, including potential leaching to the underlying Great Miami Aquifer.

The Project Specific Plan for this investigation proposed twenty additional borings, including four borings outside the FEMP boundary. Low total uranium concentrations in samples from borings inside the boundary indicated that no additional outside borings were needed. Fourteen borings were advanced to depths of eight to twenty-five feet at points inside the sewage treatment plant compound and immediately west and north of the plant. No total uranium concentrations in soil samples from the borings exceeded final remediation levels. However, the analytical data filled gaps in the RI/FS data, allowing much more accurate estimates of the required volume of soil to be excavated.

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1.0 INTRODUCTION

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1.1 PURPOSE

This document presents the results of sampling conducted to determine the extent of total uranium contamination in soils in and around the Fernald Environmental Management Project (FEMP) Sewage Treatment Plant (STP). The sample analyses provided information required to more accurately determine the quantity of soil to be excavated during remedial activities at the STP. The sampling and analyses were conducted under Project Number 50.03.59.05, in accordance with the *Project-Specific Plan for Pre-Design Investigation for Total Uranium in the Sewage Treatment Plant (STP) Area* (DOE, August 1997)

The Operable Unit 5 (OU5) Remedial Investigation (RI) documented uranium contamination of soil in and around the Sewage Treatment Plant (STP) (DOE 1994). The OU5 Feasibility Study (FS) examined options for remediating soils near the STP (DOE 1995). A Record of Decision (ROD; DOE 1996) established area-specific constituents of concern (ASCOCs) and the following medium- and contaminant-specific criteria:

- Final Remediation Levels (FRLs) are concentrations found to be protective of human health and the environment. Media exceeding FRLs require treatment, removal, or both. The FRL for inside the STP is 20 ppm, and 82 outside the STP.
- Waste Acceptance Criteria (WAC) are concentrations that must not be exceeded by media placed in the On-Site Disposal Facility (OSDF). The WAC for total uranium is 1030 ppm.

FRLs for OU5 are based on the identification of two forms of uranium in site soils. The more soluble form is more likely to be leached into subsurface soils. The RI presented the results of analyses performed to determine the leachability coefficient, K_L , for uranium and uranium compounds detected in OU5. The K_L values for the two forms of total uranium are the bases for the following FRLs established in the ROD.

TABLE 1-1
LEACHABILITY COEFFICIENTS AND FRLs
FOR TOTAL URANIUM IN OU5

LEACHABILITY COEFFICIENT, K_L (L/kg ²)	FRLs	
	ON FEMP PROPERTY	OFF FEMP PROPERTY
325	82	50
15	20	N/A

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The FS concluded that excavation of soils exceeding FRLs for total uranium would also remove soils and perched groundwater exceeding FRLs for other forms of radiological, organic, and inorganic contamination. This project allowed investigators to better define the boundaries of excavation and calculate the volume of soil requiring remedial action.

The objectives of the PSP were:

- To refine estimated limits of soil excavation by providing additional data for the kriging model
- To determine if soils excavated from the STP would exceed the total uranium WAC.

Drilling, sampling, and analyses were conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Sitewide Quality Assurance Project Plan (SCQ), and Data Quality Objective (DQO) No. SL-036.

1.2 AREA DESCRIPTION

The STP area (Figure 1-1) lies along the eastern FEMP boundary within remediation Area 1, Phase II. The STP, associated facilities, and an abandoned solid waste incinerator are surrounded by a 6-foot-high chain-link fence. STP treatment of the FEMP sanitary wastewater began in 1952. The system was later reconstructed to receive both sanitary and process-related wastewater. The use of the STP to treat process-related wastewater was discontinued with the installation and start-up of the bio-denitrification effluent treatment system. The abandoned-in-place solid waste incinerator is located in the northwest corner of the STP. This incinerator operated from November 1954 through December 1979, when a new solid waste incinerator at Building 39 was put into service. The STP incinerator (STPI) burned uranium- and thorium-contaminated and uncontaminated combustible trash during its operation.

1.3 PREVIOUS INVESTIGATIONS

Two field investigations under the Remedial Investigation/Feasibility Study (RI/FS) and a separate removal action (Removal Action 14) have been conducted in the STP area. The first investigation was the surface soil sampling program conducted in 1988. All samples were collected in the upper 18 inches of soil and were analyzed for radiological parameters only. Surface radiological measurements and limited soil samples collected in the vicinity of the STP facilities indicated the presence of localized elevated concentrations of radionuclides. The soils near the STPI were contaminated with various concentrations

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of uranium. Airborne deposition (surface soil contamination) from the incinerator stack was localized to the northeast of the STP. Subsurface radiological contamination was detected beneath the STP. Available data and process knowledge indicated that all other ASCOCs in soils near the STP were confined to the volume in which total uranium exceeded its FRL. Therefore, the soil samples in this investigation were only analyzed for total uranium.

The second investigation, conducted in 1990 under the RI/FS, was the installation of six monitoring wells under the Production and Additional Suspect Areas Work Plan. This was augmented by borings 1492 and 1493 on the west and north sides of the fenced STP area for the geochemical program (Figure 1-1). Subsurface soil samples from selected intervals were analyzed for full radiological parameters. Analytical results indicated that total uranium concentrations decreased with depth. Current data and process knowledge indicates that the source of subsurface total uranium was the STP. Data from previous RI/FS investigations indicate that perched groundwater under the STP is contaminated. Further investigation of perched water was conducted under Project Number 50.03.59.03. The *Project Specific Plan for Area 1, Phase II Perched Sampling at the Sewage Treatment Plant* presents additional details.

Removal Action 14, "Contaminated Soils Adjacent to the Sewage Treatment Plant Incinerator," was conducted from 1992 through 1994 to remove surface soil contamination in excess of the criteria shown in Table 1-2. Note that the location-specific criteria exceed the more current FRLs established in the ROD (Table 1-1).

**TABLE 1-2
LOCATION-SPECIFIC CRITERIA FOR TOTAL URANIUM IN SOILS**

Location	Location- Specific Criteria (pCi/g)*	Location- Specific Criteria (ppm)**
On-site, within STP	300	446
On-site, outside STP	100	149
Off-site	35	52

* -- picoCuries per gram

** --parts per million

Initial excavations were performed within those areas to remove and containerize radiologically

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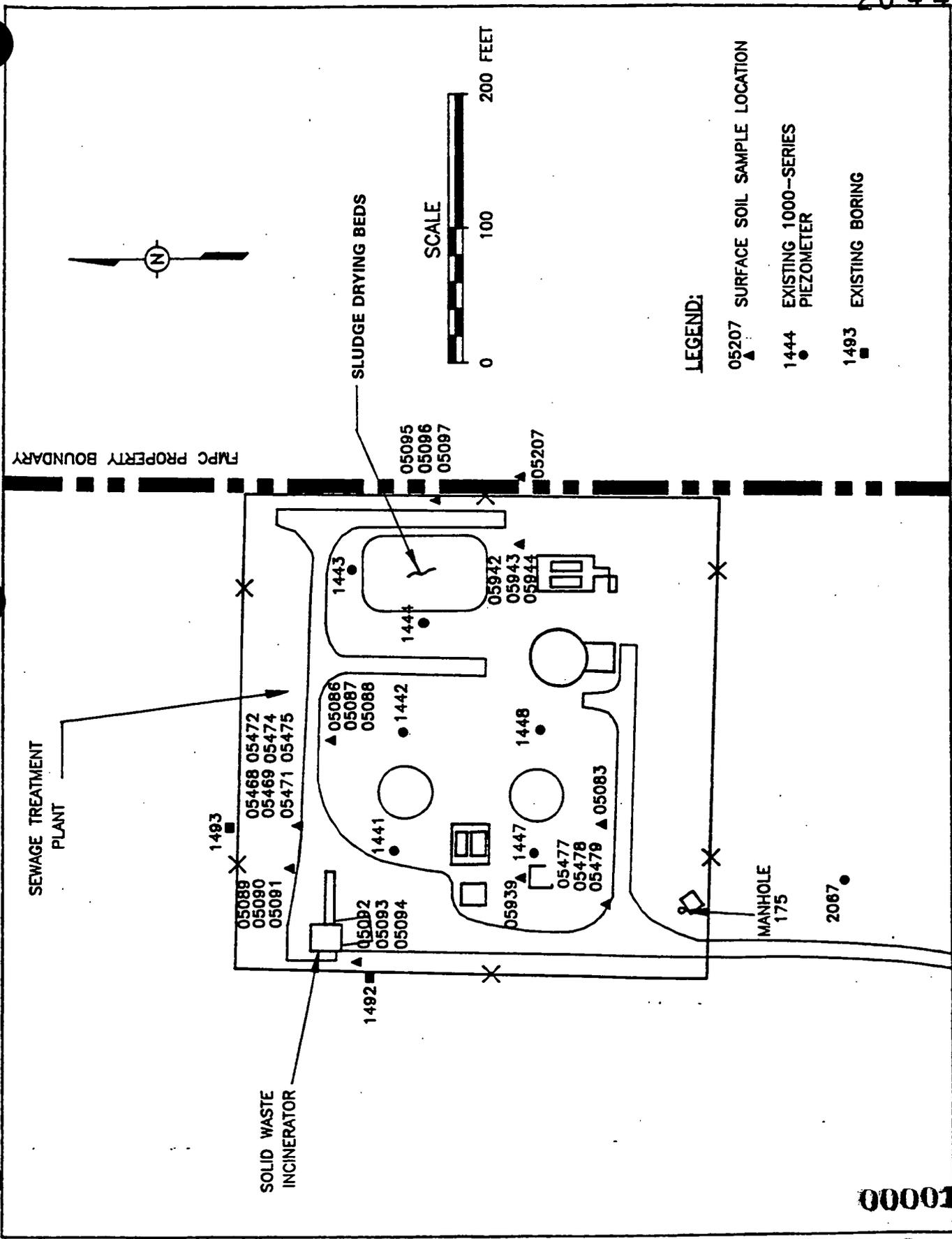
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contaminated soil and verify that excavation had achieved the removal criteria through the collection and analysis of residual soil samples. Verification sampling results indicated that the removal action criteria for total uranium had been met. Fill material was used to regrade the area.

1.4 SCOPE

The scope of this project was limited to investigation of the vertical and lateral extent of subsurface total uranium contamination in soil in the vicinity of the STP. The boundaries for the Project Specific Plan (PSP) included the anticipated deep excavations in the STP area and the air deposition area of contamination from the STPI located north of the STP area. Total uranium was used as the indicator parameter to define the extent of excavation required to remove soil exceeding the FRL and on-site WAC in this PSP. The PSP was implemented in a phased approach for some borings in a line parallel to the eastern property line (Figure 1-2). This allowed investigators to determine if total uranium concentrations exceeded the FRL on-property before determining if off-property investigation were required.

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LEGEND:

- ▲ 05207 SURFACE SOIL SAMPLE LOCATION
- 1444 EXISTING 1000-SERIES PIEZOMETER
- 1493 EXISTING BORING

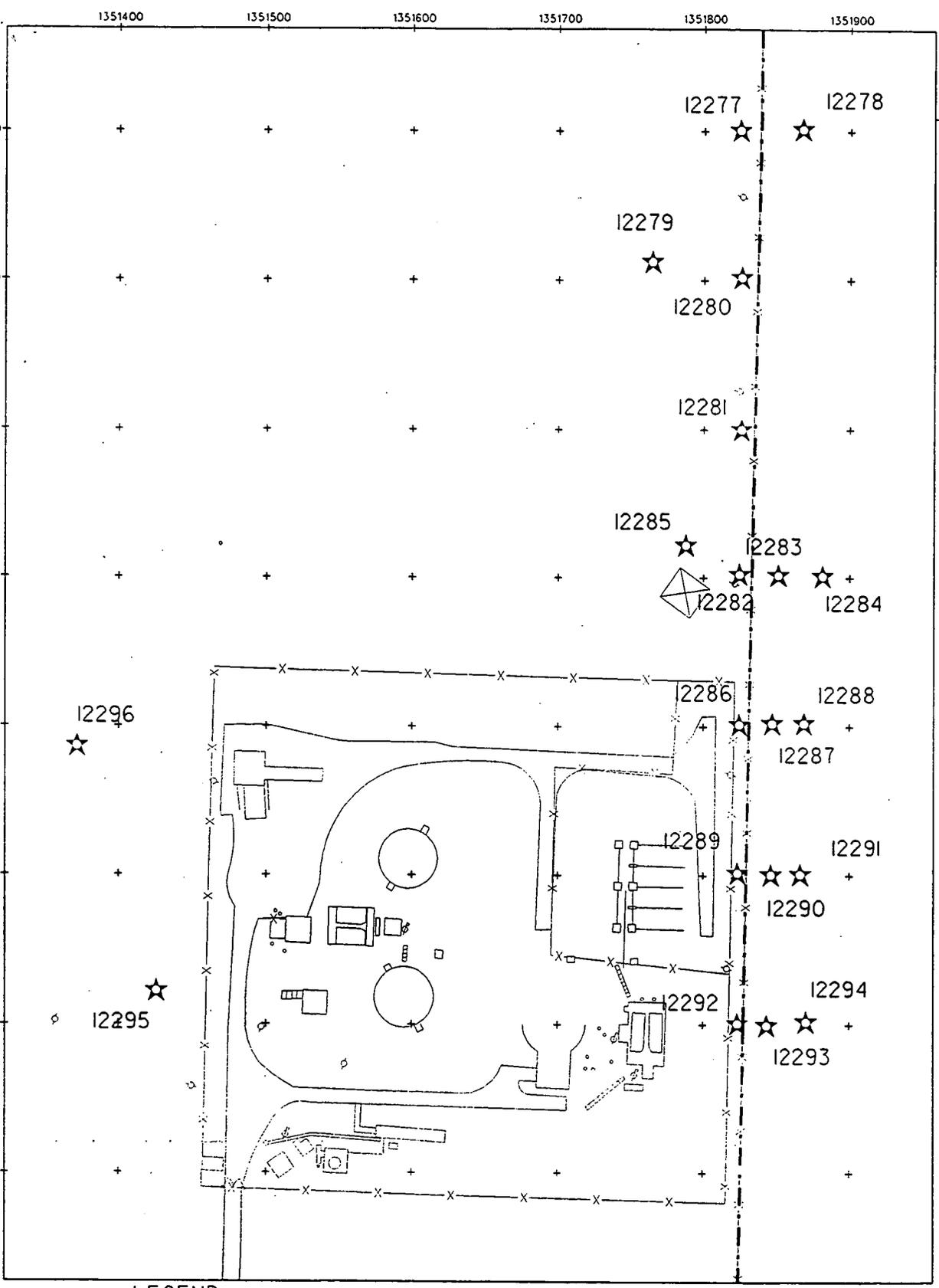
Figure 1-1
Sewage Treatment Plant

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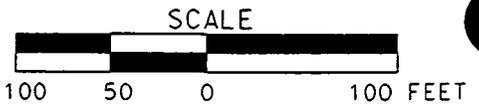
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LEGEND:

- FEMP BOUNDARY
- ☆ PROPOSED BORING LOCATIONS



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FIGURE 1-2. PHASE I AND PHASE II BORING LOCATIONS FOR THE PRE-DESIGN INVESTIGATION AT THE SEWAGE TREATMENT PLANT AREA

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2.0 PRE-DESIGN INVESTIGATION PROGRAM

2.1 SOIL BORING LOCATION AND DEPTH STRATEGY

Soil excavation will be required in the STP area to meet the OU5 FRLs. Investigators prepared excavation contour maps showing the lateral and vertical extent of soil contaminated above the total uranium FRL using RI data and a kriging model. As anticipated, excavation volumes generated by the kriging model were observed to increase significantly in areas where data gaps (uncertainties) are present.

The sampling locations and depths for this project were based on those kriged excavation limits. Boring depths were advanced 3 feet below the modeled depths. The 25-foot deep borings were sampled at 4- to 5-foot intervals, which were based on known kriging model sensitivity. The rationale for selecting the soil boring locations included the following additional considerations:

- Soil borings were advanced in two phases. Phase 1 included 15 on-property locations. Five additional off-property locations were to be advanced in Phase 2 only if analyses from the Phase 1 borings fail to bound total uranium above the FRL in the STP and adjacent areas (see Figure 1-2). The Area Project Manager reviewed Phase 1 analytical results and determined that the Phase 2 borings were unnecessary.
- Phase 1 borings 12277, 12280, and 12281 and Phase 2 boring 12278 were proposed to bound the extent of on-property/off-property airborne-deposited contamination assumed to originate from the STPI (incinerator). These borings were 8 feet deep, with samples taken at regular 2 foot intervals. RI data gaps near the 8 foot borings required a smaller sampling interval for model input.
- Boring 12279 was advanced and sampled to a depth of 12 feet to confirm the presence or absence of total uranium at depth. Past analytical data taken for litigation purposes indicated that total uranium concentrations exceed the FRL at approximately 5 feet in depth. Samples were taken at regular 4 foot intervals. Boring depth was based on the need to test soil 3 feet below the modeled depth at this location.
- Boring 12285 was advanced to a depth of 25 feet to bound the excavation and determine if the projected extent of excavation will require relocation of a transformer tower and power lines. The tower foundation extends 16 to 20 feet below grade.
- Soil borings 12282, 12286, 12289, and 12292 (Phase 1) were limited to on-property locations. If laboratory analyses suggested off-property concentrations exceeding FRLs, borings 12284, 12288, 12291, and 12294 shown on Figure 1-2 were to be advanced and sampled. These on and off-property borings were to be 25 feet deep.

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- Analyses of samples from borings 12287, 12290, and 12293 were to be used to refine the vertical extent of excavation from total uranium within the STP. These borings were to be 25 feet deep.
- Analyses of samples from borings 12295 and 12296 and boring 12283 were to be used to refine the extent of excavation from total uranium to the west and south, respectively. These borings were to be 25 feet deep.

Table 2-1 presents the rationale for each boring. Appendix A presents the boring locations (NAD83 State Planar Coordinates), boring depths, and sample identification numbers.

**TABLE 2-1
PROPOSED BORINGS AND SAMPLING STRATEGY**

Boring	Purpose / Strategy	On/Off Site	Depth (feet)
12277	Bound aerial deposition contamination NE of STP	On	8
12278	Bound contamination NE of STP - Phase II	Off	8
12279	Bound aerial deposition contamination NE of STP	On	12
12280	Confirm historical data for total uranium at depth	On	8
12281	Bound aerial deposition contamination NE of STP	On	8
12282	Initial Boring - Phase 1	On	25
12283	Phase II	Off	25
12284	Phase III	Off	25
12285	If transformer tower needs to be relocated	On	25
12286	Initial Boring - Phase 1	Off	25
12287	Phase II	Off	25
12288	Phase III	Off	25
12289	Initial Boring - Phase 1	On	25
12290	Phase II	Off	25
12291	Phase III	Off	25
12292	Initial Boring - Phase 1	On	25
12293	Phase II	Off	25
12294	Phase III	Off	25
12295	Extent of excavation West	On	25
12296	Extent of excavation West	On	25

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2.2 SOIL SAMPLING AND ANALYSIS STRATEGY

Boring locations were surveyed and staked prior to drilling operations. Three borings were relocated: 12285, 12295, and 12296. The following table provides the new coordinates and the reason for the move:

Boring	Relocated Coordinates	Reason for Move
12285	N 480247.00 E 1351775.00	Original Location was too close to an overhead utility line - moved 10 feet south
12295	N 480038.42 E 1351421.73	Encounter utilities on two boring attempts, relocated 10 feet north.
12296	N 480176.52 E 1351362.63	Area was too wet and unstable for the drill rig, relocated approximately 13 feet west.

Boreholes that were moved from their original surveyed location were resurveyed upon abandonment of the borings. Table 2-2 shows the planned sampling intervals for each boring depth.

Field personnel used a truck-mounted hollow stem auger rig and a Geoprobe® to advance the borings and collect soil samples as prescribed in the PSP. Table 2-2 shows the proposed sampling intervals, the actual depth are included in Appendix A.

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TABLE 2-2 REPRESENTATIVE SAMPLE INTERVALS*

Sample Interval for 8 ft Borings (ft)	Sample Interval for 12 ft Borings (ft)	Sample Interval for 25 ft Borings (ft)	Laboratory Analysis
1.5 - 2.0	3.5 - 4.0	3.5 - 4.0	Total Uranium
3.5 - 4.0	7.5 - 8.0	7.5 - 8.0	Total Uranium
5.5 - 6.0	11.5 - 12.0	11.5 - 12.0	Total Uranium
7.5 - 8.0		15.5 - 16.0	Total Uranium
		19.5 - 20.0	Total Uranium
		24.5 - 25.0	Total Uranium

*Note: Soil sampling was continuous for lithologic log preparation

Sampling was conducted from September 3, 1995 through September 15, 1995. The field geologist prepared lithologic logs for each soil core using the Unified Soil Classification System in accordance with the Sitewide CERCLA Quality Assurance Plan (SCQ). Soil sampling proceeded as prescribed in Section 2.2 of the PSP. Table 2-3 presents the requirements for on-site and off-site laboratory analyses and sample containers.

TABLE 2-3 TOTAL URANIUM ANALYTICAL REQUIREMENTS

Lab	Analyte	Sample Matrix	ASL	Holding Time	Analytical Method (TAL)	Container
On-Site	Total Uranium	Solid	B	6 months	BromoPADAP or ICMPS (TAL A)	500 ml Glass or Plastic
On-Site	Total Uranium	Solid	D	6 months	Alpha Spectroscopy (TAL B)	500 ml Glass or Plastic
Offsite	Total Uranium	Solid	D	6 months	Alpha Spectroscopy (TAL B)	500 ml Glass or Plastic

The PSP provides additional details on boring and sampling techniques and sample handling. Any variance or field change from PSP guidance required completion of a Variation/Field Change Notice Form (V/FCN)

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and written approval of the Project Lead. The two field changes approved during the project are summarized in Table 2-4.

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TABLE 2-4 SUMMARY OF VARIANCES/FIELD CHANGES

V/F Number	Variance or Change
50.03.59.05-1	1) Correction of auger method described in PSP to prevent downward migration of perched groundwater. 2) Clarification of the split-spoon counting method used to determine the necessary number of rinsate samples. 3) Correction of PSP error in requirement for archiving samples.
50.03.59.05-2	1) Change of sampling interval in five borings necessitated by poor sample recovery. 2) Relocation of three boring locations due to underground utilities or unstable terrain. 3) Documentation that refusal was encountered above planned sampling depths.

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3.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

3.1 PROCEDURES AND MANUALS

The SCQ (Document FD-1000) and PSP present the basic quality assurance/ quality control requirements for the project. The following documents provided additional guidance.

**TABLE 3-1
QA/QC GUIDANCE DOCUMENTS**

DOCUMENT NUMBER	TITLE
ADM-02	Field Project Prerequisites
DRL-02	Solids Sampling in Drilled Boreholes
EQT-04	Photovac MicroTIP Photoionization Detector - Calibration, Operation, and Maintenance
EQT-05	Geodimeter 4000 Surveying System - Operation, Maintenance, and Calibration
EQT-06	Geoprobe Model 5400 - Operation and Maintenance
SMPL-01	Solids Sampling
SMPL-21	Collection of Field Quality Control Samples
SDP 766-S-1000	Shipping Samples to Offsite Laboratories
	Trimble Pathfinder Pro-XL GPS Operation Manual

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4.0 FIELD OPERATIONS AND DATA MANAGEMENT

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Field operations proceeded as planned. This section lists the guidance documents for the major tasks.

4.1 EQUIPMENT DECONTAMINATION

Sampling equipment was decontaminated as specified in the PSP and Procedure SMPL-01(Section 6.11).

4.2 HEALTH AND SAFETY

All work was performed in accordance with applicable Environmental Monitoring Project Procedures. RM-0021, Safety Performance Requirements Manual, FDF Work Permit, Radiation Work Permit, Penetration Permit, and other applicable permits.

4.3 DISPOSITION OF WASTES

Investigation-derived wastes were managed as specified in accordance with SCEP Waste Disposition Support Services (WDSS) through the Project Waste Identification Document (PWID) process.

4.4 DATA MANAGEMENT

All PSP data were managed as specified in the PSP and Section 5.1 of the SCQ.

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5.0 RESULTS OF INVESTIGATION

Appendix A presents the boring locations, sample identification numbers, sample intervals, and analytical results for the Phase 1 sampling program. No sample concentrations exceeded on- or off-site FRLs, so no Phase 2 sampling was required. No cultural objects were encountered during the sampling. Table 5-1 shows the borings with the highest observed concentrations, the corresponding soil depth, and the analytical method.

**TABLE 5-1
HIGHEST TOTAL URANIUM CONCENTRATIONS OBSERVED**

BORING ID NUMBER	TOTAL URANIUM CONCENTRATION (ppm)	SOIL DEPTH (feet)	ANALYTICAL METHOD
12295	14.1	7.5-8.0	ICP/MSor BRPDP (on-site)
12292	7.30	3.0-3.5	ICP/MSor BRPDP (on-site)
12290	6.94	3.5-4.0	ICP/MSor BRPDP (on-site)
12287	3.98	3.5-4.0	Alpha Spectroscopy (off-site)
12282	3.84	15.5-16.0	ICP/MSor BRPDP (on-site)
12283	3.56	3.5-4.0	ICP/MSor BRPDP (on-site)

All other total uranium concentrations were less than 3.50 ppm. Concentrations in rinsate samples were below detection limits. A review of the analytical data suggests the following conclusions:

- The samples containing the highest concentrations were collected within the STP boundary. Otherwise, no strong pattern of contamination is apparent. The highest concentrations observed were observed in different borings and, generally, at varying depths.
- No strong correlation between total uranium concentration and depth is apparent, whereas the RI data suggested decreasing concentrations with depth. The difference may be due to the fact that sampling under this PSP was concentrated in and around the STP, where increased infiltrations may occur around foundations, filter beds, and other structures.
- Concentrations obtained by different methods or different laboratories compare favorably.
- The analysis of equipment rinsates shows careful sample collection and handling technique.

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Figure 5-1 shows the revised excavation limits based on kriging the combined RI and PSP data. The volume is substantially smaller than originally anticipated (19,750 cubic yards v. 129,000 cubic yards), although the FRLs established in the ROD are more stringent than the location-specific criteria previously established for OU5 remedial actions. The improved soil database resulting from the project substantially improved the predictions of the kriging model.

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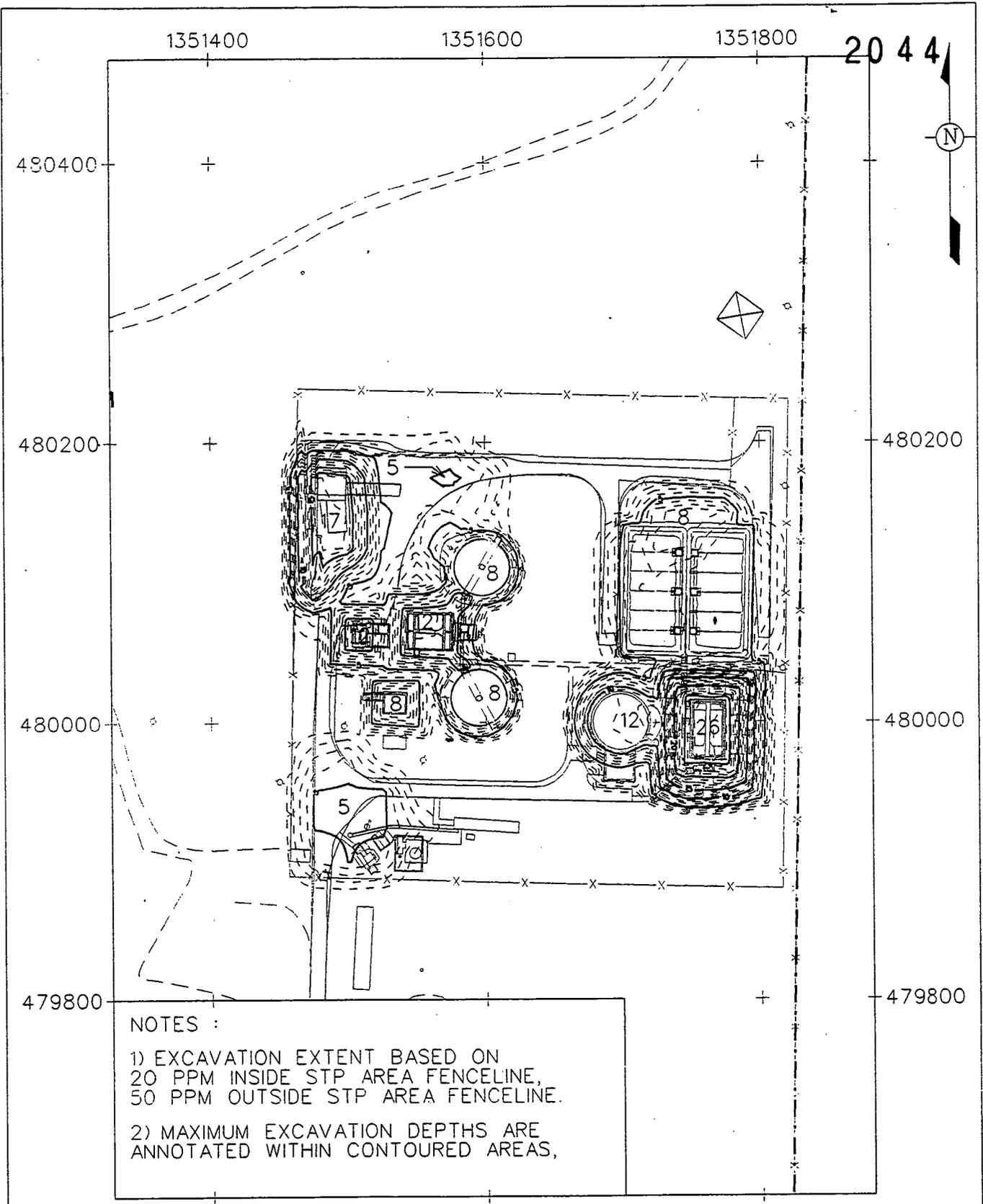
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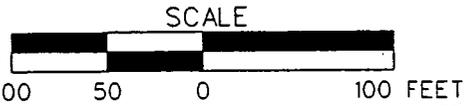
1) EXCAVATION EXTENT BASED ON
20 PPM INSIDE STP AREA FENCELINE,
50 PPM OUTSIDE STP AREA FENCELINE.

2) MAXIMUM EXCAVATION DEPTHS ARE
ANNOTATED WITHIN CONTOURED AREAS,

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NOT FOR CONSTRUCTION

- FEMP BOUNDARY
- EXCAVATION, MAJOR CONTOURS (5')
- EXCAVATION, MINOR CONTOURS (1')



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FIGURE 5-1. STP AREA EXCAVATION DEPTHS

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APPENDIX A
BORING LOCATIONS (NAD83 STATE PLANAR COORDINATES),
SAMPLE IDENTIFICATION NUMBERS, SAMPLE INTERVALS,
AND ANALYTICAL RESULTS

APPENDIX A
SAMPLE IDENTIFIERS, LOCATIONS, DEPTHS, AND ANALYSES
 (Shaded cells reflect changes from proposed locations and depths.)

Boring ID Number	Sample ID Number	Easting	Northing	Proposed Sample Depth (feet)	Actual Sample Depth (feet)	Total Uranium (dry wt.) (ppm)	Total Uranium (ppm)	Total Uranium (KPA (rinsates))			
12277	A1P2STP-12277-4-R	1351825.00	480600.00	1.5-2.0	1.5-2.0	2.54	N/A	N/A	Alpha Spec. Off-site	N/A	N/A
	A1P2STP-12277-8-R	1351825.00	480600.00	3.5-4.0	3.5-4.0	1.71	N/A	N/A	Alpha Spec. On-site	N/A	N/A
	A1P2STP-12277-12-R	1351825.00	480600.00	5.5-6.0	5.5-6.0	1.52	N/A	N/A	Alpha Spec. On-site	N/A	N/A
	A1P2STP-12277-16-R	1351825.00	480600.00	7.5-8.0	7.5-8.0	1.35	N/A	N/A	Alpha Spec. On-site	N/A	N/A
12278	A1P2STP-12278-4-R	1351877.00	480600.00	1.5-2.0	1.5-2.0	NS	N/A	N/A	Alpha Spec. On-site	N/A	N/A
	A1P2STP-12278-8-R	1351877.00	480600.00	3.5-4.0	3.5-4.0	NS	N/A	N/A	Alpha Spec. On-site	N/A	N/A
	A1P2STP-12278-12-R	1351877.00	480600.00	5.5-6.0	5.5-6.0	NS	N/A	N/A	Alpha Spec. On-site	N/A	N/A
	A1P2STP-12278-16-R	1351877.00	480600.00	7.5-8.0	7.5-8.0	NS	N/A	N/A	Alpha Spec. On-site	N/A	N/A
12279	A1P2STP-12279-8-R	1351563.00	480510.00	3.5-4.0	3.5-4.0	1.42	N/A	N/A	Alpha Spec. On-site	N/A	N/A
	A1P2STP-12279-16-R	1351563.00	480510.00	7.5-8.0	7.5-8.0	N/A	N/A	N/A	Alpha Spec. On-site	2.2	N/A
	A1P2STP-12279-16-R-D	1351563.00	480510.00	7.5-8.0	7.5-8.0	1.56	N/A	2.1	Alpha Spec. On-site	N/A	N/A
	A1P2STP-12279-24-R	1351563.00	480512.00	11.5-12.0	11.5-12.0	1.67	N/A	N/A	Alpha Spec. On-site	N/A	N/A

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TABLE A
(continued)

Boring ID Number	Sample ID Number	Eastings	Northing	Proposed Sample Depth (feet)	Actual Sample Depth (feet)	Total Uranium (dry wt.) (ppm)	ICP/MS or BRPDP On-site	Alpha Spec. On-site	Alpha Spec. Off-site	Total Uranium (ppm)
12280	A1P2STP-12280-4-R	1351825.00	480500.00	1.5-2.0	1.5-2.0	1.98	N/A	N/A	N/A	N/A
	A1P2STP-12280-8-R	1351825.00	480500.00	3.5-4.0	3.5-4.0	1.42	N/A	N/A	N/A	N/A
	A1P2STP-12280-12-R	1351825.00	480500.00	5.5-6.0	5.5-6.0	1.28	N/A	N/A	N/A	N/A
	A1P2STP-12280-16-R	1351825.00	480500.00	7.5-8.0	7.5-8.0	0.997	N/A	N/A	N/A	N/A
	A1P2STP-12280-24-R	1351825.00	480500.00		11.5-12.0	1.28	N/A	N/A	N/A	N/A
	A1P2STP-12280-32-R	1351825.00	480500.00		15.5-16.0	1.41	N/A	N/A	N/A	N/A
12281	A1P2STP-12281-4-R	1351825.00	480400.00	1.5-2.0	1.5-2.0	2.34	N/A	N/A	N/A	N/A
	A1P2STP-12281-8-R	1351825.00	480400.00	3.5-4.0	3.5-4.0	1.49	N/A	N/A	N/A	N/A
	A1P2STP-12281-12-R	1351825.00	480400.00	5.5-6.0	5.5-6.0	1.03	N/A	N/A	N/A	N/A
	A1P2STP-12281-16-R	1351825.00	480400.00	7.5-8.0	7.5-8.0	1.02	N/A	N/A	N/A	N/A
12282	A1P2STP-12282-8-R	1351825.00	480300.00	3.5-4.0	3.5-4.0	N/A	N/A	2.65	N/A	N/A
	A1P2STP-12282-8-R-D	1351825.00	480300.00	3.5-4.0	3.5-4.0	1.68	3.3	N/A	N/A	N/A
	A1P2STP-12282-16-R	1351825.00	480300.00	7.5-8.0	7.5-8.0	1.03	N/A	N/A	N/A	N/A
	A1P2STP-12282-24-R	1351825.00	480300.00	11.5-12.0	11.5-12.0	1.55	N/A	N/A	N/A	N/A
	A1P2STP-12282-32-R	1351825.00	480300.00	15.5-16.0	15.5-16.0	3.84	N/A	N/A	N/A	N/A
	A1P2STP-12282-40-R	1351825.00	480300.00	19.5-20.0	19.5-20.0	2.35	N/A	N/A	N/A	N/A
	A1P2STP-12282-48-R	1351825.00	480300.00	24.5-25.0	25.5-26.0	2.85	N/A	N/A	N/A	N/A

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TABLE A
(continued)

Boring ID Number	Sample ID Number	Eastings	Northings	Proposed Sample Depth (feet)	Actual Sample Depth (feet)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (ppm)
12283	A1P2STP-12283-8-R	1351650.00	479900.00	3.5-4.0	3.5-4.0	3.56	N/A	N/A	N/A
	A1P2STP-12283-16-R	1351650.00	479900.00	7.5-8.0	7.5-8.0	1.18	N/A	N/A	N/A
	A1P2STP-12283-24-R	1351650.00	479900.00	11.5-12.0	11.5-12.0	1.13	N/A	N/A	N/A
	A1P2STP-12283-32-R	1351650.00	479900.00	15.5-16.0	15.5-16.0	3.11	N/A	N/A	N/A
	A1P2STP-12283-40-R	1351650.00	479900.00	19.5-20.0	19.5-20.0	N/A	N/A	1.26	N/A
	A1P2STP-12283-40-R-D	1351650.00	479900.00	19.5-20.0	19.5-20.0	0.781	1.3	N/A	N/A
	A1P2STP-12283-50-R	1351650.00	479900.00	24.5-25.0	24.5-25.0	0.966	N/A	N/A	N/A
	A1P2STP-12284-8-R	1351880.00	480300.00	3.5-4.0	3.5-4.0	NS	N/A	N/A	N/A
12284	A1P2STP-12284-16-R	1351880.00	480300.00	7.5-8.0	7.5-8.0	NS	N/A	N/A	N/A
	A1P2STP-12284-24-R	1351880.00	480300.00	11.5-12.0	11.5-12.0	NS	N/A	N/A	N/A
	A1P2STP-12284-32-R	1351880.00	480300.00	15.5-16.0	15.5-16.0	NS	N/A	N/A	N/A
	A1P2STP-12284-40-R	1351880.00	480300.00	19.5-20.0	19.5-20.0	NS	N/A	N/A	N/A
	A1P2STP-12284-50-R	1351880.00	480300.00	24.5-25.0	24.5-25.0	NS	N/A	N/A	N/A

TABLE A
(continued)

Boring ID Number	Sample ID Number	Easting	Northing	Proposed Sample Depth (feet)	Actual Sample Depth (feet)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (ppm)
12285	A1P2STP-12285-8-R	1351775.00	480247.00	3.5-4.0	3.5-4.0	1.48	N/A	N/A	N/A
	A1P2STP-12285-16-R	1351775.00	480247.00	7.5-8.0	7.5-8.0	1.59	N/A	N/A	N/A
	A1P2STP-12285-25R	1351775.00	480247.00	11.5-12.0	12.0-12.5	N/A	N/A	2.15	N/A
	A1P2STP-12285-25-R-D	1351775.00	480247.00	11.5-12.0	12.0-12.5	1.39	2.8	N/A	N/A
	A1P2STP-12285-31-R	1351775.00	480247.00	15.5-16.0	15.0-15.5	1.32	N/A	N/A	N/A
	A1P2STP-12285-40-R	1351775.00	480247.00	19.5-20.0	19.5-20.0	1.43	N/A	N/A	N/A
12286	A1P2STP-12285-50-R	1351775.00	480247.00	24.5-25.0	24.5-25.0	1.61	N/A	N/A	N/A
	A1P2STP-12286-8-R	1351830.00	480200.00	3.5-4.0	3.5-4.0	3.06	N/A	N/A	N/A
	A1P2STP-12286-16-R	1351830.00	480200.00	7.5-8.0	7.5-8.0	1.57	N/A	N/A	N/A
	A1P2STP-12286-24-R	1351830.00	480200.00	11.5-12.0	11.5-12.0	1.75	N/A	N/A	N/A
	A1P2STP-12286-32-R	1351830.00	480200.00	15.5-16.0	15.5-16.0	1.52	N/A	N/A	N/A
	A1P2STP-12286-40-R	1351830.00	480200.00	19.5-20.0	19.5-20.0	1.27	N/A	N/A	N/A
	A1P2STP-12286-50-R	1351830.00	480200.00	24.5-25.0	24.5-25.0	1.57	N/A	N/A	N/A

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TABLE A
(continued)

Boring ID Number	Sample ID Number	Easting	Northing	Proposed Sample Depth (feet)	Actual Sample Depth (feet)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (ppm)
12287	A1P2STP-12287-8-R	1351562.00	480038.00	3.5-4.0	3.5-4.0	N/A	N/A	3.98	N/A
	A1P2STP-12287-8-R-D	1351562.00	480038.00	3.5-4.0	3.5-4.0	3.45	4.6	N/A	N/A
	A1P2STP-12287-16-R	1351562.00	480038.00	7.5-8.0	7.5-8.0	1.21	N/A	N/A	N/A
	A1P2STP-12287-24-R	1351562.00	480038.00	11.5-12.0	11.5-12.0	1.34	N/A	N/A	N/A
	A1P2STP-12287-32-R	1351562.00	480038.00	15.5-16.0	15.5-16.0	1.79	N/A	N/A	N/A
	A1P2STP-12287-40-R	1351562.00	480038.00	19.5-20.0	19.5-20.0	1.64	N/A	N/A	N/A
	A1P2STP-12287-50-R	1351562.00	480038.00	24.5-25.0	24.5-25.0	1.69	N/A	N/A	N/A
	A1P2STP-12288-8-R	1351875.00	480200.00	3.5-4.0	3.5-4.0	NS	N/A	N/A	N/A
	A1P2STP-12288-16-R	1351875.00	480200.00	7.5-8.0	7.5-8.0	NS	N/A	N/A	N/A
	A1P2STP-12288-24-R	1351875.00	480200.00	11.5-12.0	11.5-12.0	NS	N/A	N/A	N/A
12288	A1P2STP-12288-32-R	1351875.00	480200.00	15.5-16.0	15.5-16.0	NS	N/A	N/A	N/A
	A1P2STP-12288-40-R	1351875.00	480200.00	19.5-20.0	19.5-20.0	NS	N/A	N/A	N/A
	A1P2STP-12288-40-R-D	1351875.00	480200.00	19.5-20.0	19.5-20.0	NS	N/A	N/A	N/A
	A1P2STP-12288-50-R	1351875.00	480200.00	24.5-25.0	24.5-25.0	NS	N/A	N/A	N/A

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TABLE A
(continued)

Boring ID Number	Sample ID Number	Easting	Northing	Proposed Sample Depth (feet)	Actual Sample Depth (feet)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (ppm)
12289	A1P2STP-12289-8-R	1351822.00	480100.00	3.5-4.0	3.5-4.0	2.58	N/A	N/A	N/A
	A1P2STP-12289-16-R	1351822.00	480100.00	7.5-8.0	7.5-8.0	2.23	N/A	N/A	N/A
	A1P2STP-12289-24-R	1351822.00	480100.00	11.5-12.0	11.5-12.0	1.46	N/A	N/A	N/A
	A1P2STP-12289-32-R	1351822.00	480100.00	15.5-16.0	15.5-16.0	2.46	N/A	N/A	N/A
	A1P2STP-12289-40-R	1351822.00	480100.00	19.5-20.0	19.5-20.0	1.41	N/A	N/A	N/A
	A1P2STP-12289-50-R	1351822.00	480100.00	24.5-25.0	24.5-25.0	1.41	N/A	N/A	N/A
12290	A1P2STP-12290-8-R	1351625.00	480100.00	3.5-4.0	3.5-4.0	6.94	N/A	N/A	N/A
	A1P2STP-12290-16-R	1351625.00	480100.00	7.5-8.0	7.5-8.0	3.05	N/A	N/A	N/A
	A1P2STP-12290-24-R	1351625.00	480100.00	11.5-12.0	11.5-12.0	1.06	N/A	N/A	N/A
	A1P2STP-12290-32-R	1351625.00	480100.00	15.5-16.0	15.5-16.0		N/A	2.19	N/A
	A1P2STP-12290-32-R-D	1351625.00	480100.00	15.5-16.0	15.5-16.0	1.78	2.6	N/A	N/A
	A1P2STP-12290-40-R	1351625.00	480100.00	19.5-20.0	19.5-20.0	NS	N/A	N/A	N/A
12291	A1P2STP-12290-50-R	1351625.00	480100.00	24.5-25.0	24.5-25.0	NS	N/A	N/A	N/A
	A1P2STP-12291-8-R	1351875.00	480100.00	3.5-4.0	3.5-4.0	NS	N/A	N/A	N/A
	A1P2STP-12291-16-R	1351875.00	480100.00	7.5-8.0	7.5-8.0	NS	N/A	N/A	N/A
	A1P2STP-12291-24-R	1351875.00	480100.00	11.5-12.0	11.5-12.0	NS	N/A	N/A	N/A
	A1P2STP-12291-32-R	1351875.00	480100.00	15.5-16.0	15.5-16.0	NS	N/A	N/A	N/A
	A1P2STP-12291-40-R	1351875.00	480100.00	19.5-20.0	19.5-20.0	NS	N/A	N/A	N/A
A1P2STP-12291-50-R	1351875.00	480100.00	24.5-25.0	24.5-25.0	NS	N/A	N/A	N/A	

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TABLE A
(continued)

Boring ID Number	Sample ID Number	Eastings	Northing	Proposed Sample Depth (feet)	Actual Sample Depth (feet)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (ppm)
12292	A1P2STP-12292-7-R	1351820.00	480000.00	3.5-4.0	3.0-3.5	7.30	N/A	N/A	N/A
	A1P2STP-12292-16-R	1351820.00	480000.00	7.5-8.0	7.5-8.0	N/A	N/A	2.34	N/A
	A1P2STP-12292-16-R-D	1351820.00	480000.00	7.5-8.0	7.5-8.0	2.32	2.8	N/A	N/A
	A1P2STP-12292-24-R	1351820.00	480000.00	11.5-12.0	11.5-12.0	1.40	N/A	N/A	N/A
	A1P2STP-12292-32-R	1351820.00	480000.00	15.5-16.0	15.5-16.0	2.49	N/A	N/A	N/A
	A1P2STP-12292-41-R	1351820.00	480000.00	19.5-20.0	20.0-20.5	1.86	N/A	N/A	N/A
	A1P2STP-12292-50-R	1351820.00	480000.00	24.5-25.0	24.5-25.0	1.71	N/A	N/A	N/A
	A1P2STP-12293-8-R	1351719.00	480074.00	3.5-4.0	3.5-4.0	14.1	N/A	N/A	N/A
	A1P2STP-12293-16-R	1351719.00	480074.00	7.5-8.0	7.5-8.0	7.54	N/A	N/A	N/A
	A1P2STP-12293-24-R	1351719.00	480074.00	11.5-12.0	11.5-12.0	0.723	N/A	N/A	N/A
12293	A1P2STP-12293-32-R	1351719.00	480074.00	15.5-16.0	15.5-16.0	0.990	N/A	N/A	N/A
	A1P2STP-12293-40-R	1351719.00	480074.00	19.5-20.0	19.5-20.0	1.16	N/A	N/A	N/A
	A1P2STP-12293-50-R	1351719.00	480074.00	24.5-25.0	24.5-25.0	N/A	N/A	2.15	N/A
	A1P2STP-12293-50-R-D	1351719.00	480074.00	24.5-25.0	24.5-25.0	1.26	2.5	N/A	N/A

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TABLE A
(continued)

Boring ID Number	Sample ID Number	Easting	Northing	Proposed Sample Depth (feet)	Actual Sample Depth (feet)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (dry wt.) (ppm)	Total Uranium (ppm)
12296	A1P2STP-12296-8-R	1351362.63	480176.52	3.5-4.0	3.5-4.0	1.72	N/A	N/A	N/A
	A1P2STP-12296-16-R	1351362.63	480176.52	7.5-8.0	7.5-8.0	1.82	N/A	N/A	N/A
	A1P2STP-12296-24-R	1351362.63	480176.52	11.5-12.0	11.5-12.0	1.42	N/A	N/A	N/A
	A1P2STP-12296-32-R	1351362.63	480176.52	15.5-16.0	15.5-16.0	1.39	N/A	N/A	N/A
	A1P2STP-12296-40-R	1351362.63	480176.52	19.5-20.0	19.5-20.0	1.72	N/A	1.83	N/A
	A1P2STP-12296-40-R-D	1351362.63	480176.52	19.5-20.0	19.5-20.0	N/A	2.2	N/A	N/A
	A1P2STP-12296-50-R	1351362.63	480176.52	24.5-25.0	24.5-25.0	1.20	N/A	N/A	N/A
Rinsate	A1P2STP-X-2-R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<0.0
Rinsate	A1P2STP-X-1-R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<0.004
Rinsate	A1P2STP-X-3-R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<0.0
Rinsate	A1P2STP-X-4-R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<0.0

NS = Not sampled.

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APPENDIX B

VARIANCES/FIELD CHANGE NOTICES

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VARIANCE / FIELD CHANGE NOTICE

V/F No. 50.03.59.05-1

WBS NO.: 50.03.59.05

55200-PSP-0001

Page 1 of 1

PROJECT TITLE: A1P11 Pre-Design Investigation for Total Uranium at STP Area (Rev. 0)

Date: 9/3/97

VARIANCE / FIELD CHANGE NOTICE (Include justification):

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This variance addresses three issues of the PSP that require modification or clarification:

- 1) The PSP section describing the use of the dual hollow-stem auger method at locations 12289, 12290 and 12293 requires a correction. The following method will be applied on these boring locations and supersedes the related text of the PSP:

A standard size auger (approx. 4.25-inch ID) will initially be used to collect the required sample intervals until perched groundwater is encountered and core samples are collected to estimate the bottom of the perched groundwater zone. The standard auger will be removed from the borehole and an 8.25-inch ID auger will be advanced to two feet below the bottom of the perched groundwater zone. The auger will then be raised or retracted one foot and a bentonite grout slurry will be pumped to the bottom of the augers. Sufficient volume will be added to create a minimum five-foot bentonite seal across the perched groundwater zone when the 8.25-inch auger is retracted an additional four-feet (minimum). The bentonite seal will be allowed to cure for a minimum of one hour before advancing the standard size auger through the 8.25-inch auger for deeper sample collection below the perched groundwater zone.

Justification:

The method described above describes additional specifications that are not addressed in the PSP and will provide a more effective seal to prevent downward migration of perched groundwater.

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- 2) The PSP specifies that a rinsate sample will be collected for every 20 split spoons or cutting shoes that are decontaminated. For clarification, the split spoon count will include only those split spoons used to collect an actual analytical sample for total uranium.

Justification:

This method sufficiently provides a measure of the effectiveness of the decontamination procedure used on split spoon samplers to ensure cross-contamination is eliminated.

- 3) The PSP states that sample intervals will be archived if the activity exceeds 100 cpm. This should read > 100 corrected counts per minute (ccpm) to account for a subtracted background.

Justification:

The original text stating 100 cpm in the PSP was an error. Background radiation levels in the STP area averages approximately 50-80 cpm.

REQUESTED BY: Mike Frank

Date: September 3, 1997

X IF REQD	VARIANCE/FCN APPROVAL	DATE	X IF REQD	VARIANCE/FCN APPROVAL	DATE
X	QUALITY ASSURANCE <i>R. Ruske</i>	9-4-97	X	PROJECT MANAGER <i>ARZ</i>	9/4/97
	DATA QUALITY MANAGEMENT		X	BCSP SAMPLING & CHARACTERIZ. <i>Q. H. White</i>	9/4/97
	ANALYTICAL CUSTOMER SUPPORT		X	OTHER <i>BA</i>	
	OTHER			OTHER	
VARIANCE/FCN APPROVED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			REVISION REQUIRED: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		

DISTRIBUTION

PROJECT MANAGER:	DOCUMENT CONTROL: Michelle Tudor	OTHER:
QUALITY ASSURANCE:	OTHER:	OTHER: 000033
FIELD MANAGER:	OTHER:	OTHER:

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VARIANCE / FIELD CHANGE NOTICE

V/F No. 50.03.59.05-2

WBS NO.: 50.03.59.05

55200 PSP001

Page 1 of 1

PROJECT TITLE: A1P11 Pre-Design Investigation for Total Uranium at STP Area (Rev. 0)

Date: 9/17/97

VARIANCE / FIELD CHANGE NOTICE (Include justification):

1) This variance documents the change in two sampling intervals from the original PSP requirement due to poor soil core recovery during drilling. The project geologist selected the following sample intervals in lieu of the unavailable intervals:

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	<u>Planned Sample Interval (ft.)</u>	<u>Actual Sample Interval (ft.)</u>
Boring 12285:	11.5-12.0 (interval #24)	12.0-12.5 (interval #25)
Boring 12285:	15.5-16.0 (interval #32)	15.0-15.5 (interval #31)
Boring 12296:	3.5-4.0 (interval #8)	4.5-5.0 (interval #10)
Boring 12296:	7.5-8.0 (interval #16)	9.0-9.5 (interval #19)
Boring 12282:	24.5-25.0 (interval #50)	23.5-24 (interval #48)

Justification:

The planned sample six-inch interval was not available due to poor sample recovery from the split barrel sampler.

2) Borings 12285, 12295 and 12296 were relocated for the following reasons:

<u>Boring</u>	<u>Relocated Coordinates / Reason for Move</u>
12285	N 480247.00, E 1351775.00: Too close to overhead utility line - moved south.
12295*	N 480038.42, E 1351421.73: Encountered utilities on two boring attempts - moved location 10' north.
12296	N 480176.52, E 1351362.63; Area was too wet and unstable for rig - moved west approximately 13'.

*Note: Possible utility pipe was encountered during attempts at the following coordinates for location 12295: N 480034.44, E 1351422.06 and N 480032.05, E 1351422.35.

Justification:

Justification is provided above.

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3) Refusal (rock) was encountered at boring 12290 at 19 feet in the STP area near the trickling filters. The planned depth was 25 feet. Two samples could not be collected, 19.5-20 and 24.5-25 feet. The last sample collected was 15.5-16.0 feet. The soil consisted of grey clay from about 15' to 19'. The total uranium results of the last sample (15.5'-16') will be evaluated to determine if the deeper samples are necessary. If so, the Geoprobe will be re-mobilized to the location (offset by approximately two feet) and collect the deeper samples.

Justification: Collection of the deeper samples would not be necessary if the total uranium results from the 15.5'-16' interval are below the FRL.

REQUESTED BY: Mike Frank

Date: September 17, 1997

X IF REQD	VARIANCE/FCN APPROVAL	DATE	X IF REQD	VARIANCE/FCN APPROVAL	DATE
X	QUALITY ASSURANCE <i>Quote</i>	9-18-97	X	PROJECT MANAGER <i>A. Edwards</i>	9/17/97
	DATA QUALITY MANAGEMENT		X	SEEP SAMPLING & CHARACTERIZ. <i>John H. ...</i>	9/17/97
	ANALYTICAL CUSTOMER SUPPORT			OTHER	
	OTHER			OTHER	

VARIANCE/FCN APPROVED [X] YES [] NO

REVISION REQUIRED: [] YES [x] NO

DISTRIBUTION

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PROJECT MANAGER:	DOCUMENT CONTROL: Michelle Tudor	OTHER:
QUALITY ASSURANCE:	OTHER:	OTHER:
FIELD MANAGER:	OTHER:	OTHER:

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APPENDIX B-4
LETTER REPORT FOR LEAD DELINEATION
IN THE A1PII TRAP RANGE

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