

National Aeronautics and
Space Administration

John H. Glenn Research Center
Lewis Field
Plum Brook Station
Sandusky, OH 44870



August 26, 2010

Reply to Attn of: QD

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Final Status Survey Report, Attachment 4, Pentolite Ditch, for the Plum Brook Reactor Facility, Licenses Nos. TR-3, Docket No. 50-30 and R-93, Docket No. 50-185

Enclosed for your review is Attachment 4 to the Final Status Survey Report supporting eventual termination of the licenses for the Plum Brook Reactor Facility.

The complete Final Status Survey Report will consist of a series of Attachments, each addressing an individual survey area or group of survey areas or environmental areas as described in our NRC approved Final Status Survey Plan. The final submission will be the main body of the Final Status Survey Report which will consolidate and summarize the details presented in the Attachments.

This Attachment addresses the Final Status Survey of the Pentolite Ditch Area (Environmental Area A2300). It supports our conclusion that radiological remediation of the area has been completed and it meets the criteria for unrestricted release specified in 10 CFR 20.1402.

Should you have any questions or need additional information, please contact me at NASA Plum Brook Station, 6100 Columbus Avenue, Sandusky, Ohio 44870, or by telephone at (419) 621-3277.

Sincerely,

A handwritten signature in black ink, appearing to read "Keith M. Peacock". The signature is fluid and cursive, with a long horizontal stroke at the end.

Keith M. Peacock
NASA Decommissioning Program Manager

NMSSD1
FSME

Enclosure

Plum Brook Reactor Facility Final Status Survey Report, Attachment 4, Pentolite Ditch
(Environmental Area A2300), revision 0, dated August 25, 2010

cc:

USNRC/C. J. Glenn (FSME)

USNRC/J. Webb (FSME)

USNRC/J. Tapp RIII/DNMS/DB

ODH/M. J. Rubadue

Plum Brook Reactor Facility

Final Status Survey Report

Attachment 4

Revision 0

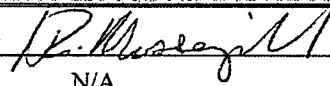
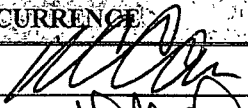
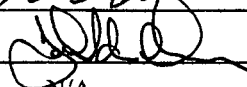
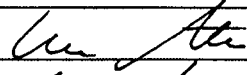
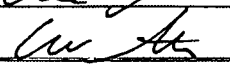
**Pentolite Ditch
(Environmental Area A2300)**

FINAL STATUS SURVEY REPORT ROUTING AND APPROVAL SHEET

Document Title: Final Status Survey Report,
Attachment 4
Pentolite Ditch (Environmental Area A2300)

Revision Number: 0

ROUTING

	SIGNATURE	DATE
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Prepared By	N/A	
REVIEW & CONCURRENCE		
Independent Technical Reviewer	R. Case 	8/25/10
Other Reviewer, QA Manager	J. Thomas 	8/25/2010
Other Reviewer	N/A	
FSS/Characterization Manager	W. Stoner 	8/25/10
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**NASA PBRF DECOMMISSIONING PROJECT
CHANGE/CANCELLATION RECORD**

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A2300)

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LIST OF ACRONYMS & SYMBOLS

α	alpha; denotes alpha radiation, also type I error probability in hypothesis testing
A	Area, also detector open area
A _{EMC}	Area corresponding to the area factor calculated using the scan MDC
AEC	Atomic Energy Commission
ALARA	As Low As Reasonable Achievable
β	beta; denotes beta radiation, also type II error probability in hypothesis testing
b _i	background counts in observation interval
B _R	Background count rate
BPL	Byproduct License
CFR	Code of Federal Regulations
CRB	Cold Retention Basin
cm	centimeters
cpm	counts per Minute
Δ	delta, DCGL _W – LGBR
d'	Scan surveyor sensitivity index
DCGL	Derived Concentration Guideline Level
DCGL _{EMC}	DCGL for small areas of elevated activity, used with the Elevated Measurement Comparison test (EMC)
DCGL _W	DCGL for average concentrations over a survey unit, used with statistical tests. (the “W” suffix denotes “Wilcoxon”)
DODT	Direct Offsite Disposal Threshold
dpm	disintegrations per minute
E _i	Detector, or instrument efficiency
E _s	Surface efficiency
E _t	Total efficiency
EMC	Elevated Measurement Comparison
EPA	US Environmental Protection Agency
ERB	Emergency Retention Basin
FPR	Final Post Remediation
FSS	Final Status Survey
FSSP	Final Status Survey Plan
FSSR	Final Status Survey Report
γ	gamma, denotes gamma radiation
g	gram
HTD	Hard To Detect
HRA	Hot Retention Area
i	observation counting interval during scan surveys
IM	Investigative Measurement
in.	inch
LBGR	Lower Bound of the Gray Region
m ²	square meters
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual

LIST OF ACRONYMS & SYMBOLS, Continued

MDC	Minimum Detectable Concentration
MDC _{scan}	Minimum Detectable Concentration for scanning surveys
MDC _{static}	Minimum Detectable Concentration for static surface activity measurements
MDCR	Minimum Detectable Count Rate
mrem	millirem
MW	Megawatt
MWH	Mongomery-Watson-Harza
NASA	National Aeronautics and Space Administration
N	Number of FSS measurements or samples established in a survey design
NA	Not Applicable
NaI	Sodium Iodide
ncpm	net counts per minute
NRC	US Nuclear Regulatory Commission
PBOW	Plum Brook Ordinance Works
PBRF	Plum Brook Reactor Facility
PBS	Plum Brook Station
PNL	Pacific Northwest Laboratory
Φ	Standard normal distribution function
p	surveyor efficiency for scan surveys
pCi/g	picocuries per gram
%	percent
QC	Quality Control
RAL	Remediation Action Level (50% of the DCGL)
RESRAD	RESidual RADioactive – a pathway analysis computer code developed by Argonne National Laboratory for assessment of radiation doses. It is used to derive cleanup guideline values for soils contaminated with radioactive materials
RESRAD-BUILD	A companion code to RESRAD for evaluating indoor building contamination and developing site-specific DCGLs
s	seconds
σ	generic symbol for standard deviation of a population
S ⁺	Sign Test statistic
SNL	Sandia National Laboratory
SR	Survey Request
t _s	sample count time
t _b	background count time
TBD	Technical Basis Document
μ	Mean activity concentration
UL	Upper limit of the confidence interval about the mean
VSP	Visual Sample Plan
WEMS	Waste Effluent Monitoring Station
Z _{1-α}	Proportion of standard normal distribution values less than 1- α
Z _{1-β}	Proportion of standard normal distribution values less than 1- β
∞	Mathematical symbol for infinity

1.0 Introduction

This report presents the results of the final status radiological survey of the Plum Brook Reactor Facility (PBRF) Pentolite Ditch (Environmental Area A2300). This report is identified as Attachment 4 of the PBRF Final Status Survey Report (FSSR)¹. This attachment describes the Pentolite Ditch, its operational history and final condition for the final status survey (FSS). This attachment describes the methods used in the FSS and presents the results of the survey and sample measurements.

As stated in the PBRF Final Status Survey Plan (FSSP) [NASA 2007], the goal of the decommissioning project is to release the facility for unrestricted use in compliance with the criteria in US NRC 10CFR20 Subpart E. The principal criterion is that the dose to future site occupants will be less than 25 mrem/y. 10CFR20 Subpart E also requires that residual contamination be reduced to levels as low as reasonably achievable (ALARA). A Derived Concentration Guideline Level (DCGL) for surface and sub-surface soils has been established for PBRF soils, per Table 3-1 of the FSSP [NASA 2007] and Technical Basis Document (TBD) PBRF-TBD-09-001 [PBRF 2009]. In accordance with the FSSP and TBD-09-001 [PBRF 2009], the primary DCGLs for surface soils are as follows:

- Co-60 is 3.8 pCi/g,
- Sr-90 is 5.4 pCi/g, and
- Cs-137 is 14.7 pCi/g.

Furthermore, surrogate DCGLs for soil of the Pentolite Ditch were established in Table 5-2 of PBRF-TBD-09-001 [PBRF 2009]. The surrogate DCGL (based on Cs-137) is 13.34 pCi/g.

The survey measurement results and supporting information presented herein demonstrate that residual contamination levels in each survey unit of the Pentolite Ditch are well below the DCGL. Additionally, it is shown that residual contamination has been reduced to levels that are consistent with the ALARA requirement. Therefore, the Pentolite Ditch meets the criteria for unrestricted release.

Section 2.0 of the report provides a description of the Pentolite Ditch. This includes the location of the ditch in relation to the Waste Effluent Monitoring Station (WEMS) and other PBRF buildings and facilities. This section also discusses the final configuration of the Pentolite Ditch for the FSS and scope of the FSS for this area.

A brief history of operations is presented in Section 3.0. A chronology of significant milestones is followed by history of operations with radioactive materials. Post shutdown and decommissioning activities are summarized.

Section 4.0 presents the FSS design for the Pentolite Ditch. This section includes FSS Plan requirements applicable to the Pentolite Ditch, breakdown into survey units and assignment of

¹ The PBRF Final Status Survey Report comprises the report main body and several attachments. The attachments present survey results for individual buildings and open land areas. The entire final report will provide the basis for requesting termination of NRC Licenses TR-3 and R-93 in accordance with 10CFR50.82 (b) (6).

MARSSIM [USNRC 2000] classification to each, the survey design approach, and instrumentation used for the FSS and measurement sensitivities.

Survey results are presented in Section 5.0. This section includes a summary of the FSS measurements performed in the Pentolite Ditch survey units, comparison to the DCGL, tests performed and an evaluation of residual contamination levels relative to the ALARA criterion.

Supporting information is contained in Appendices. Appendix A contains photos and schematics to supplement the text. Survey design maps and tables of coordinates for the measurement locations in each survey unit are provided in Appendix B. Soil sample results are provided in Appendix C.

2.0 Pentolite Ditch Description

The Pentolite Ditch [PBRF 2010] is a drainage canal that is approximately one half mile long extending eastward from PBRF WEMS outfall to its confluence with Plum Brook. The Pentolite Ditch, identified as Environmental Area A2300, is shown on the map identified as Figure 1. Photographic documentation of Pentolite Ditch, prior to remediation, is provided in Exhibits 2, 3 and 4 in Appendix A.

Liquid effluents (such as storm drainage, waste waters including man-made radioactive contamination, and processed lake dilution water) from the nuclear test facility were released into the Pentolite Ditch via the WEMS.

The WEMS [PBRF 2009c] had built-in capabilities for automatically closing the WEMS sluice gates when radioactivity levels exceeded pre-set limits. These limits were set to preclude the release of radioactivity level releases that would exceed the Federal licensing limits. During operation, the WEMS sluice gates closed numerous times for a variety of reasons ranging from detected high radioactivity levels, equipment malfunctions and weather related conditions like freezing and flooding conditions. When the WEMS sluice gates closed, planned radioactive discharges were terminated and the effluent waters were usually permitted to backup in the effluent trenches or were pumped into a 5 million gallon Emergency Retention Basin for temporary storage. See Exhibits 14 and 15 for views of the WEMS outfall into Pentolite Ditch.

2.1 Pentolite Ditch Construction

The Pentolite Ditch was constructed in the 1958-61 timeframe as part of PBRF site water management infrastructure. A 1958 vintage site map shows a small unnamed surface stream running west to east just south of Pentolite Road. During PBRF construction, the Pentolite ditch was created by straightening and extending the stream channel to run parallel to Pentolite Road from Garage Road on the west to the Plum Brook on the east. In about 1958, the ditch was excavated from a 4 foot bottom to a “V” profile, roughly 12-15 feet wide and 6 feet deep during the reactor construction period. The Ditch was designed to receive surface runoff from Plum Brook areas south of Pentolite Road and to drain the Pentolite Road right of way as well as receive liquid effluents from the PBRF. The ditch was designed to accommodate maximum expected WEMS outflow and surface runoff from the 100-year rainfall event [PBRF 2010].

The ditch lies within unconsolidated deposits comprised of glacial till, glacial lake deposits and soils derived from silt and shale, clay and mudstone beds which underlie the site. The soil in the vicinity of the Pentolite Ditch has been extensively disturbed by construction activities. Depth to bedrock at the northern portion of the Plum Brook site is typically about 25 feet [USACE 2003].

On several occasions since initial construction, the ditch bed has been dredged to remove accumulated sediment and debris and the banks graded to remove vegetation growth. Soil and sediment removed by these activities were spread on nearby land areas south of the ditch [PBRF 2010].

Currently, Pentolite Ditch is approximately 2750 feet long and runs west to east just south of Pentolite Road from south of the WEMS at the west end and intersects with Plum Brook at the east end.

2.2 Final Configuration and Scope of Remediation in Pentolite Ditch for Final Status Survey

Pentolite Ditch area was cleaned and grubbed of trees, brush and debris prior to surveys and remediation efforts commencing.

Pentolite Ditch was dammed (See Exhibit 11 of Appendix A) and the piping was installed to bypass Pentolite Ditch (See Exhibits 8 and 9 of Appendix A). Residual water from Pentolite Ditch was pumped to batch tanks, processed, sampled, analyzed and released.

The entire Pentolite Ditch proper, a portion of Plum Brook south of Pentolite Ditch and a small portion of Un-named Stream south of Pentolite Ditch was remediated by initially excavating the stream bed and banks in one 6” lift and then performing subsequent remediation of areas identified by radiological survey results. When surveys indicated that the action level was met, the area was remediated. When surveys indicated that the survey area was below the Remediation Action Level (RAL), no remediation was performed.

Remediation continued until surveys indicated that the area was below the RAL. Surrounding Class 1 survey units and the Class 1 survey units south of Pentolite Ditch were remediated in the same manner as the Pentolite Ditch was remediated (See Exhibits 12 through 20 of Appendix A). Refer to Exhibits 22 and 23 of Appendix A for photographic documentation of the final configuration of Pentolite Ditch.

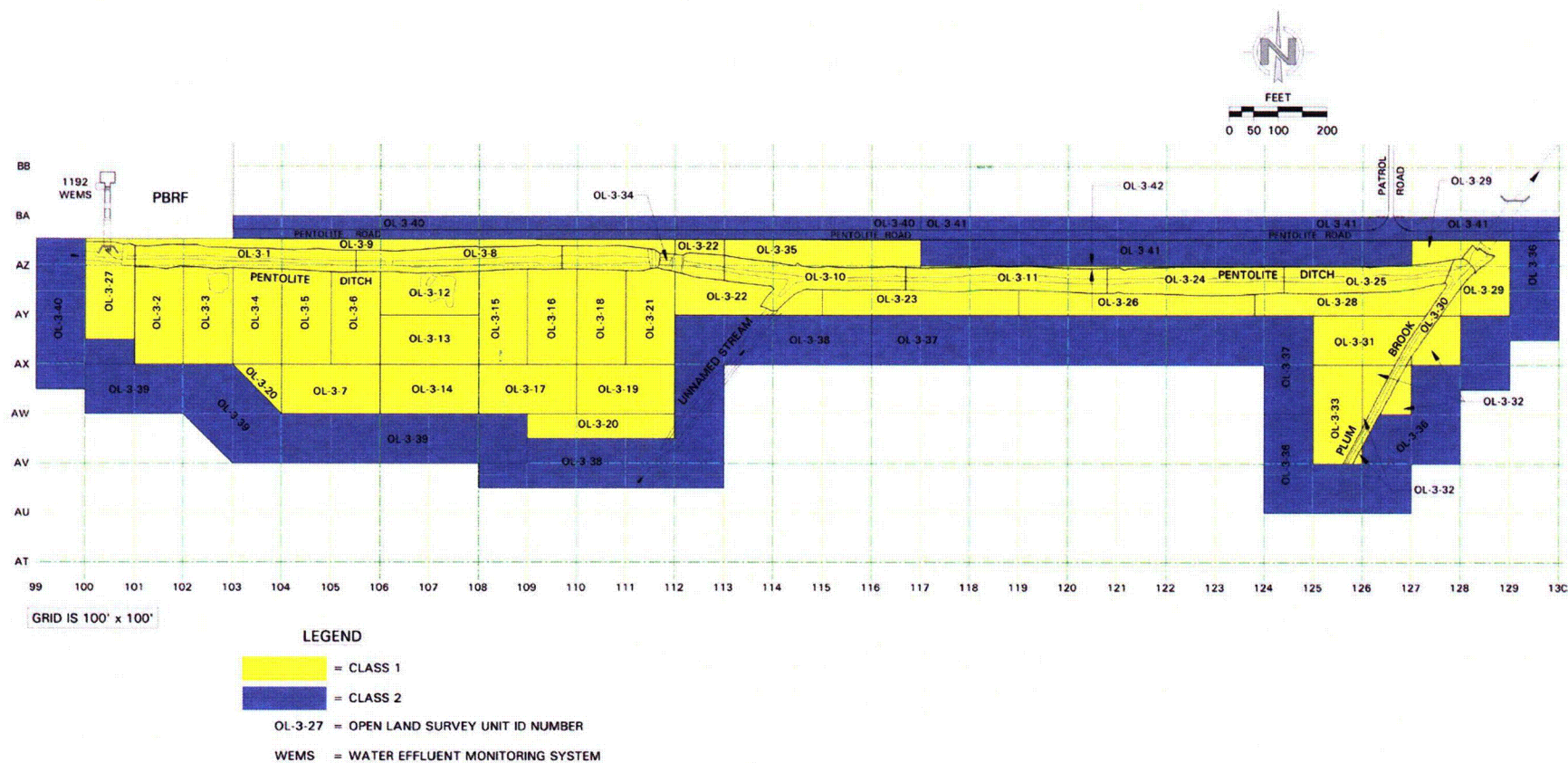
East of the Pentolite Ditch cross-over, Class 1 survey units not located within the stream proper were remediated based on surveys performed by Radiation Protection personnel, as stated above.

In accordance with Work Execution Packages (WEP), PBRF-WEP-09-003 and PBRF-WEP-09-004 the soil from Pentolite Ditch and Environs (A2300) was removed and staged in two piles. The first pile was greater than the DCGL and the second pile was >RAL but <DCGL. See Section 3.2 for further details on the soil staging segregation and disposal process.

SR-170 was written to direct the performance of subsurface soil samples after remediation of Pentolite Ditch and the areas south of the ditch (Areas of Concern) was complete. The SR required collection of subsurface soil samples to a depth of 2 meters, below the first 0.15 meters (or 6 inches) of surface soil.

A total of 82 samples were collected at 41 sub-surface locations within Pentolite Ditch. Four of the 82 samples had Cs-137 activity above the MDA. No sample results were above the MDA for Co-60. The highest identified sample activity was from Sample Point #26, which was located in Pentolite Ditch approximately 100 feet west of the Plum Brook confluence, at a depth of 1-2 meters. The Cs-137 activity was 2.37 pCi/g for Cs-137 and <MDA for Co-60. This activity is equivalent to 17% of unity.

Figure 1, Pentolite Ditch Final Status Survey Unit Breakdown



3.0 Pentolite Ditch History and Operations with Radioactive Materials

The PBRF 60MW test reactor started up on June 14, 1961 and operated until January 5, 1973. During this operations period, liquid effluent from all sources at the PBRF site, except sanitary sewage and settling basin waste, was released through the WEMS to Pentolite Ditch. Prior to startup of the reactor facility, the liquid effluent from the site, including groundwater and storm runoff, also primarily flowed through Pentolite Ditch and smaller ditches north of the site to the offsite environment.

The Atomic Energy Commission originally licensed the 60 MW PBRF for startup operations with a provisional license in March 1961 and a final license (TR-3) in December 1963. The Mock-up Reactor was licensed (R-93) in July 1964. These licenses, subsequently, fell under the current US Nuclear Regulatory Commission in 1975. The licenses prescribed the Federal limits for PBRF release of radionuclides to the environment.

As mentioned in Section 2.0 of this report, the WEMS continuously collected and discharged the effluent waters from PBRF sources to Pentolite Ditch. Typical flow rates from reactor operations were in the 400 to 1000 gallons per minute range; these rates varied depending on plant evolutions including controlled radioactively contaminated and clean water releases and dilution water flows and weather factors such as dry spells and heavy rains. Effluents consisted of the following:

- Excess lake water softened by the precipitator (400-800 gpm),
- Cooling tower blow-down,
- Ground water,
- Building clean sump outputs,
- Radioactively contaminated discharges, and
- Area runoff directly into the storm drains system.

An exception to the aforementioned effluent discharge system was the sanitary sewer discharge that was contained in separate piping to the PBS sanitary waste treatment plant.

The radioactively contaminated water sources were primarily from the HRA, the CRBs and ERB discharges (the normal collection systems for radioactively contaminated water), plus accidental spills and cross contamination of clean system discharges (for example, reactor primary cooling water leakage into the de-ionized water system that ended up in clean sumps).

Generally, controlled releases were made from the areas where radioactively contaminated (hot) waters were retained, such as the HRA, the CRBs and ERB mentioned previously. Dilution waters were supplied to the ditch with mixing prior to release off-site through the WEMS. There were two heavy rain events (one in 1966 and the other in 1969) that exceeded 9 inches per day and caused major problems on site such as a buildup of sludge (sand, mud and silt) in the HRA tanks from flooding in various building basement sumps including the hot waste sumps.

Releases to the Pentolite Ditch were controlled by PBRF procedures in accordance with AEC and NRC regulations. The WEMS gate was designed to close if there was an inadvertent release of contaminated liquid that exceeded regulatory limits or if the WEMS malfunctioned. These actions

were designed to control the releases of radioactive contaminants to Pentolite Ditch to within Federal regulatory limits.

3.1 Disposition of Materials in the Post-Shutdown Period

The radioactive contamination in Pentolite Ditch originated principally from PBRF operations. Atmospheric atomic bomb testing during the 1950s and 1960s contributed man-made radioisotopes to PBRF and Pentolite Ditch background levels.

Following termination of operations of the two PB reactors in early 1973, Pentolite Ditch remained active and was to be maintained in acceptable condition for effluent flows from the operable building groundwater sump pumps and storm drainage.

Following termination of operations of the reactor on January 5, 1973 and before June 30th of 1973, the WEMS remained active and was to be maintained in that condition until there was no radiological release hazard. Prior to deactivation, the following conditions were in place:

- No liquid radioactive waste discharges had occurred for two months prior to deactivation. A rainfall of 1" in 24 hours and an accumulated rainfall of 2" had occurred and the liquid effluent radioactivity level had not exceeded 1×10^{-7} $\mu\text{Ci/ml}$ beta-gamma and 3×10^{-8} $\mu\text{Ci/ml}$ alpha since the beginning of the two month period.
- Prior to shutting down the WEMS, the PBRF trenches, catch basins, settling basins and the WEMS inlet basin were flushed to remove silt and sand.
- The end condition after the shutdown in 1973 was that the WEMS was deactivated and the gates left open to the Pentolite ditch.

Subsequent to July 1st 1973, the WEMS was controlled according to Nuclear Regulatory Commission Licenses TR-3, R-93 and Broad By-Product Material License BPL No. 34-06706-03. Periodic effluent sampling for radioactivity was conducted as part of the PBRF facility and environmental program to demonstrate compliance with AEC/NRC regulations. The annual reports to the AEC/NRC provide the details of significant events or changes in status during the period between 1973 and the approval of the PBRF Decommissioning Plan [NASA 2007a] in 2001.

In 1985, Teledyne Isotopes, Inc. conducted a radiological characterization study for decommissioning planning and in 1998 GTS Duratek conducted a confirmatory survey of radiological conditions at PBRF. The survey results indicated that the west end near the WEMS and the east end nearest Plum Brook were radioactively contaminated higher than the remainder of the ditch. Four shallow cores indicated that contamination was confined to depths less than 6 inches.

During the 1998 confirmatory survey, conducted by GTS Duratek, eight sediment samples were collected along the ditch. The analytical results showed that the total activity ranged

from 10 to 30 pCi/g. The residual activity from Cs-137 ranged from 2 to 15 pCi/g and from Co-60 from 0 to 1 pCi/g.

In 2004, a comprehensive characterization survey of the area was conducted, by NASA subcontractor Montgomery-Watson-Harza (MWH). During the gamma scan surveys, the area of concern grew an additional 42,577 square meters, out from the bounds of Pentolite Ditch proper, in the north and south directions from the ditch. One hundred and twenty surface soil and sediment samples were selected for analysis. The results indicate that Co-60 and Cs-137 was present in 49 surface samples at activity levels above the action level (50% of the interim DCGL Unity Test for Co-60 and Cs-137). The results further indicated that Co-60 and Cs-137 was present in 40 samples at concentrations exceeding 90% of the interim DCGL Unity Test. The maximum Co-60 and Cs-137 activities, 16.65 pCi/g and 1,093 pCi/g respectively, were observed at a location just east of the WEMS outfall. Additionally, 86 subsurface soil samples from 24 locations were selected for analysis. The results indicate that Co-60 and Cs-137 were present in 15 subsurface soil samples at activity levels above the action level. The results further indicate that Co-60 and Cs-137 were present in 12 subsurface soil samples (10 at 1 foot, 1 at 3 feet and 1 at 7 feet) at activity levels exceeding 90% of the interim DCGL Unity Test. The maximum Co-60 and Cs-137 activities were 0.92 pCi/g and 65.16 pCi/g respectively.

3.2 Decommissioning

The Pentolite Ditch Environmental Area (A2300) was remediated in the following manner:

- Brush, trees and debris removed from the Class 1 and Class 2 survey units.
- Pentolite bypass piping system installed, dams installed and tanks staged to control excavation water.
- Batched water was processed, sampled and discharged.
- Areas remediated based on contamination levels.
- Soil segregated into piles based on sample results. The excavated soil was staged into two piles, the first pile was > the DCGL (referred to as the Direct Off-Site Disposal Threshold or DODT) and the second pile was known to be > the RAL (50% of the DCGL) but < the DCGL (referred to as "the contaminated stockpile").
- The soil from the first pile (>DCGL) was shipped to an approved waste disposal facility.
- Soil from the second pile (>RAL but <DCGL) was loaded into trucks and transported to the soil farming area, within the PBRF Restricted Area, for processing.
- Suspect material was surveyed and sorted using the MACTEC Development Corporation SS-Series Conveyor Soil Sorting System. The criterion for soil rejection was established for small and large material volumes. The small volume action level was established at the DCGL. The large volume was 50% of the DCGL. Rejected materials were staged for shipment to an approved waste disposal facility.

The total estimated amount of soil removed from the Pentolite Ditch area was 35,472 tons.

Subsurface sampling was performed for these areas during Final Post Remediation (FPR) survey efforts as delineated in SR-170. This FPR survey established that no further remediation was necessary prior to commencing Final Status Survey for the Pentolite Ditch or adjacent Class 1 Areas.

The development of the sample criterion in SR-170 utilized three scenarios:

- (1) A non-parametric sample plan developed using VSP.
- (2) A biased sample plan in the Pentolite Ditch. As the ditch had undergone extensive remediation at depth with significant removal of the ditch banks the biased sampling was as follows:
 - Pentolite Ditch's centerline was sampled at 200' intervals with the first sample point east of the WEMS outfall and the flow prevention ditch which are located at the west end of the impacted portions of Pentolite Ditch.
 - These biased samples include a sample from the Class 1 designated portion of the unnamed creek, and samples from the Class 1 designated portions of Plum Brook which are upstream and south of the Pentolite Ditch/Plum Brook confluence.
- (3) A biased sample plan which acquires samples at seven sample locations determined from previous characterization efforts. These seven locations all contained Cs-137 activity levels above the remediation action level at depths greater than 6 inches.

The Pentolite Ditch Environmental Areas (A2300) were prepared for FSS and surveyed in accordance with the FSSP [NASA 2007].

4.0 Survey Design and Implementation for the Pentolite Ditch

The survey design and implementation for Pentolite Ditch is as follows:

- Section 4.1 discusses numerous factors relating to FSS plan design requirements including the site specific DCGL values for soil, DCGL values for other media, radionuclide mixtures expected, surrogate DCGL values, equations used, area factors, survey unit size requirements and scan coverage requirements for Class 1 and Class 2 areas.
- Section 4.2 discusses the area classification and survey unit breakdowns.
- Section 4.3 discusses the number of measurements and samples conducted in each survey unit.
- Section 4.4 discusses the instrument and measurement sensitivities.

4.1 FSS Plan Requirements

The goal of the PBRF decommissioning project is to release the site for unrestricted use in compliance with the NRC's annual dose limit of 25 mrem/yr plus ALARA. The NRC dose limits apply to residual radioactivity that is distinguishable from background. The DCGL

values established within the FSSP [NASA 2007] will not be increased without prior NRC approval.

4.1.1 Site-Specific DCGL Values for Soil

The surface soil DCGL values are provided in Table 3-1 of the FSSP [NASA 2007] and listed in Table 1 of this report. The DCGL values are the volumetric activity of the first 6 inches of soil, in pCi/g, that will be used during FSS to determine compliance with the 25 mrem/yr unrestricted use criterion.

Table 1, DCGL Values for Surface Soil

Radionuclide	DCGL (pCi/g)
Co-60	3.8
Sr-90	5.4
Cs-137	14.7

To provide a consistent level of analysis for the contamination of surface soil, a site-specific analysis approach was used for the PBRF.

The dose model selected for analyzing residual soil contamination, RESRAD Version 6.0.

The dose assessments and DCGL calculations for surface soil, are described in detail in Attachment B, "Approach and Basis for Development of Site-Specific Derived Concentration Guideline Levels (DCGL)" of the FSSP [NASA 2007].

Model input parameters were developed and justified for each assessment and can be found in the FSSP, Attachment B, Tables B-1 through B-8.

4.1.2 DCGL for Other Media

In accordance with the FSS Plan [NASA 2007], the DCGL for sediment (e.g., stream or ditch silt) is the same as the surface soil. The DCGL for subsurface soil is the same as surface soil.

4.1.3 Radionuclide Mixture for FSS

The evaluations of radionuclide mixtures for soil are contained in Attachment A of the FSSP [NASA 2007], "Radionuclide Distribution Basis for DCGL Determination,

and FSS of the PBRF". Current and representative sample data were used to determine the final radionuclide mixtures for FSS.

Per NUREG-1757 [USNRC 2006], the Nuclear Regulatory Commission (NRC) staff considers radionuclides and exposure pathways that contribute no greater than 10% of the 25 mrem/yr dose criteria to be insignificant contributors. This 10% limit for insignificant contributors is an aggregate limitation only. That is, the sum of the dose contributions from all radionuclides and pathways considered insignificant was no greater than 10% of the dose criteria of 25 mrem/yr per 10 CFR Part 20, Subpart E.

For PBRF soil, the doses from all radionuclides other than Cs-137, Co-60, and Sr-90 totaled 0.5 mrem/yr. Because this dose is 2% of the 25 mrem/yr limit, all radionuclides other than Cs-137, Co-60, and Sr-90 were eliminated from further consideration. To ensure the 25 mrem/yr criterion is met, any open land survey unit where the mean of FSS soil sample results indicates that the dose may be greater than 24.5 mrem/yr is reviewed for compliance with the unrestricted use limit.

4.1.4 Surrogate DCGL and the Unity Rule

Two surrogate DCGLs, one for scans and one for soil samples, were used during the FSS of Pentolite Ditch.

For scanning, the radionuclide mixture reported for Pentolite Ditch soils in TBD-09-001 [PBRF 2009], Table 5-2 is Cs-137 at 96.9 %, Sr-90 at 1.7%, and Co-60 at 1.4 %. For PBRF soils, the dose from all radionuclides other than Cs-137, Sr-90, and Co-60 totaled 0.5 mrem/yr. Because this dose is only 2% of the 25 mrem/yr limit, all radionuclides, other than Cs-137, Sr-90, and Co-60, were eliminated from further consideration. To ensure the 25 mrem/yr criterion is met, Scans of the soil were performed with a gamma scintillation detector utilizing a Cs-137 window. Since the scan is for a single nuclide, a surrogate calculation was used to account for both Sr-90 and Co-60. Based on the evaluation of characterization soil sample data provided in TBD PBRF-TBD-09-001, "Radionuclide Distributions and Adjusted DCGLs for Site Soils" [PBRF 2009], a surrogate DCGL value ($DCGL_{SUR}$) was determined for the hard-to-detect (HTD) radionuclide of concern, Sr-90, using Cs-137. The $DCGL_{SUR}$ value was determined to be 13.34 pCi/g for FSS gamma scans of the Pentolite Ditch.

Soil samples were analyzed by a gamma spectroscopy system, which is capable of detecting both Cs-137 and Co-60, therefore a surrogate calculation was performed to account for the Sr-90 component, utilizing Cs-137 as the surrogate nuclide. The result of this calculation is 14.02 pCi/g. The Co-60 DCGL as listed in the FSSP is 3.8 pCi/g. A unity rule calculation was performed on the sample results to quantify the total activity for each sample.

4.1.4.1 Surrogate Equation

The surrogate DCGL is computed based on the distribution ratio between the hard-to-detect radionuclides and the easy-to-detect radionuclides. The surrogate DCGL is calculated using the following equation:

$$Surrogate_{DCGL} = \frac{1}{\left[\left(\frac{1}{DCGL_{Sur}} \right) + \left(\frac{R_2}{DCGL_2} \right) + \left(\frac{R_3}{DCGL_3} \right) + \dots + \left(\frac{R_n}{DCGL_n} \right) \right]}$$

Where: $DCGL_{SUR}$ = Surrogate radionuclide DCGL

$DCGL_2, 3 \dots n$ = DCGL for radionuclides to be represented by the surrogate

R_n = Ratio of concentration (or nuclide mixture fraction) of radionuclide “n” to surrogate radionuclide.

4.1.4.2 Unity Rule Equation

The unity rule is typically used as the first test to evaluate compliance with radiological criteria for license termination when more than one radionuclide has been determined to be potentially present. In lieu of a single DCGL, a unity rule calculation is used to demonstrate compliance with the soil unrestricted use limit. A surrogate DCGL, if applicable, would be used in the unity rule calculation. The unity rule is:

$$\frac{C_1}{DCGL_1} + \frac{C_2}{DCGL_2} + \dots + \frac{C_n}{DCGL_n} \leq 1$$

Where: C_n = concentration of radionuclide n and

$DCGL_n$ = DCGL of radionuclide n.

4.1.4.3 Area Factors

Area factor is a value that is used to adjust the $DCGL_W$ to estimate the $DCGL_{EMC}$ and the MDC for Class 1 survey units. The area factor is the magnitude by which the residual radioactivity in a small area of elevated activity can exceed the $DCGL_W$ and still be in compliance with the release criteria or $DCGL_{EMC}$.

The area factor is the multiple of the DCGL that is permitted in the area of elevated residual radioactivity without requiring remediation. The area factor is related to the size of the area over which the elevated residual radioactivity is distributed. That area, denoted A_{EMC} , is generally bordered by levels of residual radioactivity below the DCGL, and is determined by an investigation. The area factor is the ratio of dose per unit area or volume for the default surface area for the applicable dose modeling scenario to that generated using the area of elevated residual radioactivity, A_{EMC} . Area factors for surface soil are provided in Table 3-4 of the FSSP [NASA 2007] and

are shown in Table 2. Area factor assumptions and calculations are provided in Attachment B of the FSSP [NASA 2007].

Table 2, Surface Soil Area Factors

Elevated Area (m²)	1	2	3	5	10	15	25	100	250	2,000
Area Factor	10.4	6.2	4.7	3.4	2.3	1.9	1.6	1.2	1.1	1

4.1.4.4 Survey Unit Size

Survey units are typically limited in size to ensure each area is assigned an adequate number of data points. The survey unit sizes for PBRF are provided in Table 4-1 of the FSSP [NASA 2007] and in Table 3. Note that the maximum survey unit size for Class 1 surface soils is 2,000 m².

Table 3, Recommended Survey Unit Area Size Requirements for FSS

Class	Land
1	up to 2000 m ²
2	up to 10,000 m ²
3	up to 100,000 m ²

4.1.4.5 Scan Coverage for Class 1 and Class 2 Areas

The area covered by scan measurement is based on the survey unit classification. A 100% accessible area scan of Class 1 survey units is required. The emphasis is placed on scanning the higher risk areas of Class 2 survey units. The percentage of scan coverage in Class 2 areas is proportional to the potential for finding contamination that is close to the DCGL. No Class 3 survey units were identified within the Pentolite Ditch Environmental Area (A2300). Minimum scan survey coverage requirements for the PBRF are provided in Table 5-1 of the FSSP [NASA 2007] and Table 4 below.

**Table 4, Minimum Scan Survey Coverage
By Classification**

Scan Survey Coverage			
Scan Coverage	Class 1	Class 2	Class 3
	100%	10 to 100%	Minimum of 10%

4.2 Area Classification and Survey Unit Breakdown

At the time the FSSP [NASA 2007] was initially submitted to the NRC for review and approval, the Pentolite Ditch and its environs were still being characterized. The area classification is provided in Table 2-2 of the FSSP [NASA 2007], and states that Pentolite Ditch and Environs (A2300) contain 574,000 ft² of Class 1 area. However, Attachment D, Figure D-33 contains a map of the PBRF Environmental Areas and depicts a small portion of Pentolite Ditch as having Class 1, Class 2 and Class 3 areas. This appears to be in disagreement with Table 2-2 of the FSSP [NASA 2007].

As stated in Section 3.1, a comprehensive characterization was conducted by NASA subcontractor MWH, in 2004 and the results indicated that the impacted Class 1 area extended south and north of the ditch proper. This increased the impacted area to a total of 36 Class 1 survey units, totaling 681,328 ft² of surface area and 6 Class 2 survey units, totaling 560,421 ft² of surface area were identified to buffer the Class 1 areas, per Section 2.1 of the FSSP [NASA 2007]. This is equivalent to a 19% increase in Class 1 surface area and a 100% increase in Class 2 surface area, since no Class 2 area was identified in Table 2-2 of the FSSP [NASA 2007]. Refer to Figure 1 for a map of the survey units and their classification. Table 5 provides the current classification of the area and the corresponding FSSP [NASA 2007] classification for the area.

Table 5 was reviewed to ensure that no areas were classified “downward” from classifications assigned in the FSS Plan [NASA 2007].

Table 5, Pentolite Ditch Survey Units for FSS

Survey Unit	Class	Description ⁽¹⁾	FSSP Classification ⁽²⁾
OL-3-1	1	Pentolite Ditch from 101 to 105.5	1
OL-3-2	1	Pentolite Ditch Adjacent Areas – AX-101 & AY-101	1
OL-3-3	1	Pentolite Ditch Adjacent Areas – AX-102 & AY-102	1
OL-3-4	1	Pentolite Ditch Adjacent Areas – AX-103 & AY-103	1
OL-3-5	1	Pentolite Ditch Adjacent Areas – AX-104 & AY-104	1

Table 5, Pentolite Ditch Survey Units for FSS

Survey Unit	Class	Description ⁽¹⁾	FSSP Classification ⁽²⁾
OL-3-6	1	Pentolite Ditch Adjacent Areas – AX-105 & AY-105	1
OL-3-7	1	Pentolite Ditch Adjacent Areas – AW-104 & AW-105	New Class 1 SU that was not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-8	1	Pentolite Ditch from 105.5 to 109.7	1
OL-3-9	1	Pentolite Ditch Adjacent Areas – North of Ditch to Road Line 100 to 110	1
OL-3-10	1	Pentolite Ditch from 113 to 116.7	1
OL-3-11	1	Pentolite Ditch from 116.7 to 120.8	1
OL-3-12	1	Pentolite Ditch Adjacent Areas – AY-106 & AY-107	1
OL-3-13	1	Pentolite Ditch Adjacent Areas – AX-106 & AX-107	1
OL-3-14	1	Pentolite Ditch Adjacent Areas – AW-106 & AW-107	New Class 1 SU that was not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-15	1	Pentolite Ditch Adjacent Areas – AX-108 & AY-108	1
OL-3-16	1	Pentolite Ditch Adjacent Areas – AX-109 & AY-109	1
OL-3-17	1	Pentolite Ditch Adjacent Areas – AW-108 & AW-109	New Class 1 SU that was not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-18	1	Pentolite Ditch Adjacent Areas – AX-110 & AY-110	New Class 1 SU that was not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-19	1	Pentolite Ditch Adjacent Areas – AW-110 & AW-111	1
OL-3-20	1	Pentolite Ditch Adjacent Areas – AV-109 –AV-111 North & AW-103 NE	New Class 1 SU that was not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-21	1	Pentolite Ditch Adjacent Areas – AX-111 & AY-111	1
OL-3-22	1	Pentolite Ditch Adjacent Areas – AY-112, AY-113, AY-114	1
OL-3-23	1	Pentolite Ditch Adjacent Areas – AY-115 through AY-118	1
OL-3-24	1	Pentolite Ditch from 120.8 to 124.4	1
OL-3-25	1	Pentolite Ditch from 124.4 to piling wall	1
OL-3-26	1	Pentolite Ditch Adjacent Areas – AY-119 through AY-123.8	1
OL-3-27	1	Pentolite Ditch from 100 to 101, AY-100, AX-100 North	1
OL-3-28	1	Pentolite Ditch Adjacent Areas – AY-123.8 through AY-127	1

Table 5, Pentolite Ditch Survey Units for FSS

Survey Unit	Class	Description ⁽¹⁾	FSSP Classification ⁽²⁾
OL-3-29	1	Pentolite Ditch Adjacent Areas – AX-127, AX-128, AY-128	1
OL-3-30	1	Plum Brook from AV line to Pentolite Road culverts	1
OL-3-31	1	Pentolite Ditch Adjacent Areas – AX-125, 126, 127 west of Plum Brook	1
OL-3-32	1	Pentolite Ditch Adjacent Areas – AW-126, AV-126 west of PB ; AV-125, AW-125, AX-126, AX-127 east of PB	1
OL-3-33	1	Pentolite Ditch Adjacent Areas – AW-125, AV-125 west of PB	1
OL-3-34	1	Pentolite Ditch from 109.7 to 113	1
OL-3-35	1	Pentolite Ditch Adjacent Areas – North of Ditch to Pentolite Road from 113 line to 117 line	New Class 1 SU that was not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-36	2	AU-124/125/ 126, AV-124/126/127, AW-127/128N, AX-128/129N, AY-129, AZ-129 South of Pentolite Road	New boundary Class 2 SU that were not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-37	2	AX-116 to 124, AW-124	New boundary Class 2 SU that were not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-38	2	AU-108N to 112N, AV-109S to 111S, AV-112, AW-112, AX-112 to 115	New boundary Class 2 SU that were not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-39	2	AW-100 to 102, AW-103SW, AV-102NE, AV-103-108	New boundary Class 2 SU that were not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-40	2	AW-99N, AX-99, AX-100N, AY-99, AZ-99 South of Pentolite Road, AZ-103 to 116 North of Pentolite Road	New boundary Class 2 SU that were not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-41	2	AZ-117 to 126 North and South of Pentolite Road, AZ-127 to 129 North of Pentolite Road	New boundary Class 2 SU that were not identified in Table 2-2 of FSSP ⁽³⁾
OL-3-42	1	AY-117 to AY-126 North of Pentolite Ditch	1

Table 5 Notes:

1. See Figure 1 for a map of Pentolite Ditch that identifies the survey unit locations and their corresponding grid coordinate designation.
2. The FSS Plan [NASA 2007] classifications were based on area history and available characterization data. The specific Class 1 survey units were not defined, only a total surface area was identified.
3. Denotes a survey unit whose classification was changed from that listed in the FSSP Table 2-2 [NASA 2007] or one that was not specifically identified (and classified) in Table 2-2.

Table 6 provides the survey unit breakdown, by MARSSIM classification.

Table 6, Pentolite Ditch Survey Unit Breakdown by MARSSIM Classification

Class	No. of Survey Units	Surface Area (m ²)	% of Survey Units	% of Surface Area	Average Area of Survey Units (m ²)
1	36	65,277	85.7	55.4	1,813.3
2	6	52,555	14.3	44.6	9,759.2
Total	42	117,832	100.0	100	

4.3 Number of Measurements and Samples

The Final Status Survey for Pentolite Ditch was covered by several Survey Design and Survey Request (SR) documents. Survey Design number 30 covered the one (1) Class 1 survey unit immediately north of Pentolite Ditch (SU OL-3-42). Survey Design number 32 covered the thirty-five (35) Class 1 survey units that make-up Pentolite Ditch. Survey Design number 35 covered the six (6) Class 2 survey units that border the Class 1 Pentolite Ditch survey units. See Exhibit 5 of Appendix A for a view of surveys being performed in Pentolite Ditch.

The number of measurements and samples for each Pentolite Ditch survey unit was determined using the MARSSIM statistical hypothesis testing framework as outlined in the FSS Plan. The Sign Test was selected because background soil concentrations are small when compared to the applicable DCGL_W. Decision error probabilities for the Sign Test are set at $\alpha = 0.05$ (Type I error) and $\beta = 0.10$ (Type II error) in accordance with the FSSP.

The Visual Sample Plan (VSP) software was used to determine the number of FSS measurements in each survey unit within the Pentolite Ditch.² When the Sign Test is selected, the VSP software uses MARSSIM Equation 5-2 to calculate the number of measurements. Equation 5.2 is shown below:

$$N = 1.2 \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{4 \left[\Phi\left(\frac{\Delta}{\sigma}\right) - 0.5 \right]^2} \quad \text{(Equation 1)}$$

Where:

1.2 = adjustment factor to add 20% to the calculated number of samples, per a MARSSIM requirement to provide a margin for measurement sufficiency,

² The FSS Plan (Section 5.2.4) states that a qualified software product, such as Visual Sample Plan[®] [PNL 2010], may be used in the survey design process.

N = Number of measurements or samples,
 α = the type I error probability,
 β = the type II error probability,
 $Z_{1-\alpha}$ = proportion of standard normal distribution $< 1 - \alpha$ (1.6449 for $\sigma = 0.05$),
 $Z_{1-\beta}$ = proportion of standard normal distribution $< 1 - \beta$ (1.2816 for $\beta = 0.1$),
 $\Phi(\Delta/\sigma)$ = value of cumulative standard normal distribution over the interval $-\infty, \Delta/\sigma$,
 Δ = the “relative shift”, defined as the DCGL – the Lower Bound of the Gray Region (LGBR), and
 σ = the standard deviation of residual contamination in the area to be surveyed (or a similar area).

The MARSSIM module of VSP requires user inputs for the following parameters: α , β , Δ , σ and the DCGL_w. The number of measurements, N , for the 42 Pentolite Ditch survey units were calculated in two survey designs. Table 7 summarizes the survey design calculations and lists the values of the key VSP input parameters.

Table 7, Pentolite Ditch Survey Design Summary

Design No.	Survey Units	Class	DCGL	LGBR	LGBR/DCGL	Δ	σ	Δ/σ	N
32	OL-3-1 through OL-3-35 and OL-3-42	1	13.34	9	0.7	4.3	1.7	2.5	11
35	OL-3-36 through OL-3-41	2	13.34	13	0.98	0.3	0.2	1.3	11

Table 7 Notes:

1. The data reported in Table 7 is taken from the Survey Design reports listed. They are maintained in the PBRF Document Control System.
2. Units are in pCi/g except for N which is unit-less.
3. Spreadsheet rounding and significant figures are the reason for small differences in the values provided in this Table and the values documented in the data contained in the Survey Design reports.
4. Values provided in Table are typical values for the survey units within that specific design.

Selection of design input parameters followed guidance in the FSS Plan. The Plan states that “the LGBR is initially set at 0.5 times the DCGL_w, but may be adjusted to obtain a value for the relative shift (Δ/σ) between 1 and 3”.

The VSP software automatically performs an analysis to examine the sensitivity of the number of samples, N , to critical input parameter values. The following is obtained from the VSP report for survey unit OL-3-30 (with modifications). The sensitivity of N is explored by varying the standard deviation from 2.67 to 4 pCi/g (an increase of 50%) with the lower bound of gray region from ranging from 50 to 60 % of the DCGL. The value of beta, probability of mistakenly concluding that the survey units mean concentration is greater than the DCGL is varied from 0.05 to 0.15. While the VSP sensitivity analysis also varies the value of α , the sensitivity of N to changes in α is not evaluated here.

Table 8 summarizes the results of this analysis. The region of most interest in the Table is for $\alpha = 0.05$ (required to be fixed), $\beta = 0.10$ (may be adjusted) and the LBGR at 50% to 60% of the DCGL. The sensitivity of N to expected measurement variability is examined first. With the LBGR set to 60%, $\alpha = 0.05$ and $\beta = 0.10$, a 50 % increase in σ increases N from 12 to 16. At this LBGR value, N is sensitive to measurement variability. With the LBGR set to 50% of the DCGL, the sensitivity is decreased; a 50 % increase in σ increases N from 11 to 13.

However, in contrast, the sensitivity of N to an incorrect conclusion that the survey unit will pass (owner's risk) is low. When the LBGR is set at 60 %, of the DCGL (holding σ and α constant) and β is increased from 0.10 to 0.15, the number of measurements is decreased from 12 to 10. When the LBGR set at 50 %, of the DCGL, (holding σ and α constant) and β is increased from 0.10 to 0.15, the number of measurements is decreased from 11 to 9. These results show that N = 11 represents a reasonable number of measurements for FSS of the Pentolite Ditch, in view of parameter values applied to the designs.

Table 8, Sensitivity Analysis for OL-3-30 Design

Number of Samples							
Cs-137 DCGL _{SUR} =14.02 ⁽¹⁾		$\alpha=0.05$ ⁽²⁾		$\alpha=0.10$		$\alpha=0.15$	
Co-60 DCGL _W =3.8 ⁽¹⁾		$\sigma=4.0$ ⁽¹⁾⁽³⁾	$\sigma=2.67$	$\sigma=4.0$	$\sigma=2.67$	$\sigma=4.0$	$\sigma=2.67$
LBGR=60% ⁽¹⁾⁽⁴⁾	B=0.05	20	15	16	12	13	10
	B=0.10	16	12	12	9	10	8
	B=0.15	13	10	10	8	8	6
LBGR=50%	B=0.05	16	14	13	11	11	9
	B=0.10	13	11	10	9	8	7
	B=0.15	11	9	8	7	7	6
LBGR=40%	B=0.05	15	14	12	11	10	9
	B=0.10	12	11	9	8	8	7
	B=0.15	10	9	8	7	6	6

Table 8 Notes:

1. Units of DCGL, σ and LBGR are pCi/g.
2. α = alpha, probability of mistakenly concluding that $\mu < \text{DCGL}$.
3. σ = Standard Deviation.
4. LBGR = Lower Bound of Gray Region (as % of DCGL)
 β = beta, probability of mistakenly concluding that $\mu > \text{DCGL}$

Visual Sample Plan was also used to determine the grid size, the random starting location coordinates (for Class 1 and 2 survey units) and to display the measurement locations on survey unit maps drawn to scale. Refer to Appendix B for location coordinate tables and scale VSP maps showing measurement locations for each Pentolite Ditch survey unit.

The survey designs also specified scan survey coverage and action levels based on FSS plan requirements in Table 4. If the scan sensitivity of the detectors used in Class 1 survey units was below the DCGL_W, the number of measurements in each survey unit is determined

solely by the Sign Test. If the scan sensitivity was not below the $DCGL_w$, the number of measurements was increased as determined by the Elevated Measurement Test.³

4.4 Instrumentation and Measurement Sensitivity

Instruments used in the FSS of each survey unit were selected and identified in the appropriate survey design. Their detection sensitivities were shown to be sufficient to meet the required action levels for the MARSSIM class of each survey unit.

In accordance with the FSSP [NASA 2007], gamma scanning was performed over land surfaces to identify locations of residual surface activity. NaI gamma scintillation detectors (typically 2" x 2") were used for these scans. Scanning was generally performed by moving the detector in a serpentine pattern within 10 cm (4 in) from the surface, while advancing at a rate not to exceed 0.5 m (20 in) per second. Technicians responded to indications of elevated areas, both audible and visual, while surveying. Upon detecting an increase in visual or audible response, the technician reduced the scan speed or paused and isolated the elevated area. If the elevated activity was verified to exceed the established investigation level, the area was bounded (e.g., marked or flagged and measured to obtain an estimated affected surface area).

A summary of the a priori detection sensitivities, for Ludlum model 44-10 (2" x 2" NaI detector) used to scan the open land survey units that constitute Pentolite Ditch, is provided in Table 9. Measurement sensitivities provided in this section relate both to the gamma scan sensitivities and the static measurement sensitivities.

Table 9, Detection Sensitivities of 44-10 for Cs-137

Background (cpm)	MDCR ⁽²⁾ (ncpm) ⁽³⁾	MDC _{scan} ⁽¹⁾ (pCi/g)
25	50.3	2.21
50	71.2	3.13
100	100.6	4.43
150	123.2	5.42
200	142.3	6.26
250	159.1	7.00
300	174.3	7.67
350	188.3	8.28
400	201.3	8.85
450	213.5	9.39
500	225.0	9.90

Table 9 Notes:

1. MDC=Minimum Detectable Concentration, in pCi/g.
2. MDCR=Minimum Detectable Count Rate, in ncpm.
3. ncpm=net counts per minute=gross counts per minute – background counts per minute.

³ As discussed in the next section, the scan sensitivities of instruments used in the FSS of the Pentolite Ditch were below the $DCGL_w$, and no increase in the number of measurements calculated using the Sign Test was required.

5.0 Pentolite Ditch Survey Results

Results of the Pentolite Ditch FSS are presented in this section. This section includes scan survey frequencies (% of areas covered) for each survey unit and occurrence of events where scan investigation levels were exceeded. Investigations performed and the results are summarized. Soil sample results, for each survey unit, along with comparison tests of survey unit maximum and average values with the DCGL_w are provided. No statistical tests were required. It is shown that levels of residual contamination have been reduced to levels that are ALARA. Soil activity concentrations are compared to EPA trigger levels in accordance with the 2002 Memorandum of Understanding between the NRC and EPA [USEPA 2002]. This section closes with a summary which concludes that applicable criteria for release of the Pentolite Ditch for unrestricted use are satisfied and all FSS Plan requirements are met.

Additionally, Section 9.2 of the FSS plan states that measurements performed during characterization, turnover and investigation surveys can be used as FSS data if they are performed according to the same requirements as the final survey data. These requirements include:

- (1) The survey data is representative of the as-left survey unit condition and is not impacted by further remediation;
- (2) The application of isolation measures to the survey unit to prevent re-contamination and to maintain final configuration; and
- (3) The data collection and design were in accordance with FSS methods (e.g., MDC_{scan}, investigation levels, survey data point number and location, statistical tests, and EMC tests) [PBRF 2009a].

Therefore, in accordance with Survey Request 179 (SR-179), surveys of Pentolite Ditch by FSS personnel were conducted in concert with the demolition contractor in an effort to allow Pre-Remediation-Remediation-Post-Remediation phases to be performed more efficiently. All surveys conducted for this purpose were performed in accordance with the FSS plan requirements above. See Exhibits 5, 6, 7, 11, 12 and 16 through 20 of Appendix A for photographic documentation of remediation and performance of surveys associated with the Pentolite Ditch FSS.

Five Survey Requests (SR's) directed the final status surveys and sampling that were conducted at Pentolite Ditch, SR-179, SR-180, SR-181, SR-189 and SR-192. Scanning, static measurements, pre- and post remediation surveys, judgmental sampling and systematic sampling were covered by these SR's.

SR-179 was written to direct the performance of final status surveys of the soil in the Class 1 areas that constitute Pentolite Ditch. The following Class 1 Survey Units were surveyed under this SR: OL-3-1 through OL-3-29, OL-3-31 through OL-3-35 and OL-3-42. Compliance is demonstrated through the use of the unity rule.

SR-180 was written to direct the performance of systematic soil sampling in support of FSS for all Class 1 survey units that constitute Pentolite Ditch. Specifically, Survey Units OL-3-1 through OL-3-35 and OL-3-42 are covered by this SR. Compliance is demonstrated through the use of the unity rule.

SR-181 was written to direct the performance of Final Post Remediation Surveys in the Pentolite Ditch Crossover Culvert Pipes and to verify completion of remediation activities. An overview of the results of surveys conducted in support of SR-181, but the crossover culvert pipes are considered buried piping and shall be addressed in Attachment 09 of the FSS Report. See Exhibits 12, 13 and 21 of Appendix A for photographic documentation.

SR-189 was written to direct the performance of Final Status Surveys of the soil in the Plum Brook area south of Pentolite Road. This SR directed the 100% scan of all soil surfaces in Survey Unit (SU) OL-3-30, this included both water covered and non-water covered soil areas.

SR-192 was written to direct the performance of FSS surveys for Class 2 Survey Units OL-3-36 through OL-3-41.

5.1 Surveys and Investigations

5.1.1 Scan Surveys

In accordance with the requirements contained in SR-179, 100% of all Class 1 survey units were scanned with the Ludlum 2350-1 with the 44-10 detector setup with a window for Cs-137 energies. A scan action level of 250 ncpm, which corresponds to 7.85 pCi/g, was established, per the SR. Static measurements were conducted at each location that exceeded the action level and judgmental soil samples were collected at the discretion of the FSS/Characterization Supervisor or Engineer.

In accordance with the requirements contained in SR-180, 50% of all Class 2 survey unit land areas were scanned with the Ludlum 2350-1 with the 44-10 detector setup with a window for Cs-137 energies. A scan action level of 250 ncpm, which corresponds to 7.85 pCi/g, was established, per the SR. Static measurements were conducted at each location that exceeded the action level and judgmental soil samples were collected at the discretion of the FSS/Characterization Supervisor or Engineer.

Scan survey results were reviewed to confirm that the scan coverage requirement (as % of survey unit area) was satisfied for all survey units. QC scans were reviewed and analyzed by the FSS/Characterization Engineer while processing Survey Unit Release Records. The results of QC replicate surveys were also reviewed to confirm that the minimum coverage requirement of 5% was satisfied. Results of the Pentolite Ditch scan surveys are compiled in Table 10. See Exhibit 5 of Appendix A for a photograph of the Pentolite Ditch survey being conducted.

Table 10, Scan Survey Results

Survey Unit ⁽¹⁾	C l a s s	SR #	Surface Area of Survey Unit (in Square Feet)	Scan Survey Coverage (%) ⁽²⁾	QC Replicate Scan Coverage (%) ⁽²⁾	Investigation Level Exceeded ⁽³⁾
OL-3-1	1	179 ⁽¹⁾	21,097	100	6.4	No
OL-3-2	1	179 ⁽¹⁾	19,625	100	5.1	No
OL-3-3	1	179 ⁽¹⁾	19,844	100	6.0	No
OL-3-4	1	179 ⁽¹⁾	19,373	100	5.2	No
OL-3-5	1	179 ⁽¹⁾	19,028	100	6.3	No
OL-3-6	1	179 ⁽¹⁾	18,076	100	5.3	No
OL-3-7	1	179 ⁽¹⁾	20,000	100	5.0	No
OL-3-8	1	179 ⁽¹⁾	21,293	100	5.9	No
OL-3-9	1	179 ⁽¹⁾	20,296	100	5.1	No
OL-3-10	1	179 ⁽¹⁾	21,312	100	5.2	No
OL-3-11	1	179 ⁽¹⁾	21,214	100	5.4	No
OL-3-12	1	179 ⁽¹⁾	17,874	100	5.6	No
OL-3-13	1	179 ⁽¹⁾	20,000	100	5.0	No
OL-3-14	1	179 ⁽¹⁾	20,000	100	5.0	No
OL-3-15	1	179 ⁽¹⁾	19,152	100	5.2	No
OL-3-16	1	179 ⁽¹⁾	19,322	100	5.2	No
OL-3-17	1	179 ⁽¹⁾	20,000	100	5.0	No
OL-3-18	1	179 ⁽¹⁾	19,299	100	5.2	No
OL-3-19	1	179 ⁽¹⁾	20,000	100	5.0	No
OL-3-20	1	179 ⁽¹⁾	20,000	100	5.0	No
OL-3-21	1	179 ⁽¹⁾	19,191	100	5.2	No
OL-3-22	1	179 ⁽¹⁾	20,424	100	7.8	No
OL-3-23	1	179 ⁽¹⁾	20,279	100	5.1	No
OL-3-24	1	179 ⁽¹⁾	21,076	100	6.0	No
OL-3-25	1	179 ⁽¹⁾	18,835	100	5.8	No
OL-3-26	1	179 ⁽¹⁾	21,435	100	5.0	No
OL-3-27	1	179 ⁽¹⁾	19,595	100	7.1	No
OL-3-28	1	179 ⁽¹⁾	17,842	100	5.6	No
OL-3-29	1	179 ⁽¹⁾	18,290	100	5.5	No
OL-3-30	1	189 ⁽¹⁾⁽⁴⁾	14,662	100	5.5	Yes ⁽⁵⁾
OL-3-31	1	179 ⁽¹⁾	19,608	100	5.1	No
OL-3-32	1	179 ⁽¹⁾	15,912	100	6.3	No
OL-3-33	1	179 ⁽¹⁾	18,671	100	5.4	No
OL-3-34	1	179 ⁽¹⁾	16,241	100	6.4	No
OL-3-35	1	179 ⁽¹⁾	20,332	100	5.9	No
OL-3-36	2	192 ⁽⁶⁾	104,123	51.6	5.6	No
OL-3-37	2	192 ⁽⁶⁾	100,000	50.8	5.9	No
OL-3-38	2	192 ⁽⁶⁾	100,000	51.1	5.4	No
OL-3-39	2	192 ⁽⁶⁾	100,000	51.2	6.0	No
OL-3-40	2	192 ⁽⁶⁾	73,692	50.2	6.5	No
OL-3-41	2	192 ⁽⁶⁾	86,735	54.5	5.1	No
OL-3-42	1	179 ⁽¹⁾	2,130	100	8.5	No

Table 10 Notes:

- Except as noted, scan surveys performed under SR-179 and systematic soil sampling was performed under SR-180.
- The % scan coverage is given as the % of the area scanned in the initial survey.

(Table 10 Notes continued)

3. From survey unit Release Record.
4. Scanning and Investigative surveys and sampling for IM-1 and IM-2 were performed under SR-189.
5. Underwater surveys performed under SR-189 establish a scan investigation level of 125 ncpm, which corresponds to an activity of 3.92 pCi/g. However, during initial post remediation surveys, two static measurements were taken. The first static measurement location, taken at IM-1, was 162 ncpm and the second static measurement location, taken at IM-2, was 119 ncpm. Soil samples were collected at both locations and the sample results indicated that all locations were less than the DCGL. No further action was taken. The 125 ncpm (3.92 pCi/g) scan investigation level was derived from PBRF-TBD-09-006, "An Evaluation of the 2350-1/44-10 NaI Detector Response in Water Covered Areas."
6. Scan survey and systematic soil sampling were performed under SR-192.

The results provided in Table 10 show that scan coverage requirements were satisfied for all survey units. Table 10 results also shows that scan investigation level were exceeded in one survey unit, OL-3-30 (see note #5 above).

5.1.2 Static Measurements and Judgmental Soil Samples

As discussed in Section 5.0, pre-remediation, remediation and post-remediation surveys for Class 1 survey units within Pentolite Ditch were performed in tandem with the demolition contractor's performance of soil remediation activities. Therefore, elevated scans or static measurements indicated that remediation was necessary. After the remediation was performed additional scans were conducted to ensure that the remediation was complete. The final scan of each area became part of the FSS release record for that survey unit.

Survey unit OL-3-30, is located in Plum Brook at the confluence of Plum Brook and Pentolite Ditch. Refer to Figure 1 for the exact location of survey unit OL-3-30. See Exhibits 10 and 11 of Appendix A for photo of the Pentolite Ditch and Plum Brook confluence. Per SR-189, 100 % scans were performed underwater using the Ludlum 2350-1 with the 44-10 detector setup with a window for Cs-137 energies. During those initial pre and post remediation scans, two (2) IM locations were identified. However, only one of the two IM locations was above the scan action level, of 125 ncpm (3.92 pCi/g), established in SR-189.

NOTE: Technical Basis Document PBRF-TBD-09-006, "An Evaluation of the 2350/44-10 NaI Detector Response in Water Covered Areas" [PBRF 2009b] was written that determined the effectiveness of the aforementioned detector in water covered areas [PBRF 2009b]. The results of the TBD determined that a 2 inch covering of water decreases the detector response from between 20% to 32%. The aforementioned TBD provided several recommendations that would aid in minimizing the impact of scanning a water covered surface. These recommendations included the following:

- Establish background in the water covered areas,
- Hold the detector tube in contact with the underwater soil instead of 4" above,
- Reduce the distance between the serpentine lines to 8",

- Limit the scan speed to 4" per second, and
- Reduce the scan investigation level from 250 ncpm (7.85 pCi/g) to 125 ncpm (3.92 pCi/g).

Static measurements were conducted at the two locations, IM-1 and IM-2. However, only IM-1 was identified as being greater than the scan investigation level. IM-1 static measurement was 162 ncpm and IM-2 was 119 ncpm. Judgmental soil samples were collected at both locations and indicated the following:

- IM-1 Cs-137 activity was 1.03 pCi/g and Co-60 was <MDA, and
- IM-2 Cs-137 activity was 1.12 pCi/g and Co-60 was <MDA.

Since the sample activities were well below the DCGL_{SUR} for Cs-137 (14.02 pCi/g), no further action was taken.

5.1.3 Systematic Soil Sampling

5.1.3.1 Soil Sampling for Class 1 Areas

SR-180 was written to direct the performance of Final Status Survey soil sampling in the following Class 1 Survey Units: OL-3-1 through OL-3-35 and OL-3-42 located in Pentolite Ditch and the adjacent excavated areas. The directions contained in the SR were based upon requirements given by Final Status Survey Design # 32. The DCGL_{SUR} for sampling is 14.02 pCi/g for Cs-137 and the DCGL_W is 3.8 pCi/g for Co-60. Compliance with the DCGL is demonstrated through the use of the unity rule. The results are as follows:

- Three hundred and ninety-nine samples were collected, processed and analyzed.
- Of the 399 samples collected and analyzed, 148 were > MDA for Cs-137 and no sample was >MDA for Co-60.
- The highest activity was at OL-3-2 Sample Point (SP) 2. The activity at this location was $7.62\text{E}+00$ pCi/g \pm $6.01\text{E}-01$ pCi/g for Cs-137 and <MDA Co-60.
- The average Cs-137 activity was $4.46\text{E}-01$ pCi/g \pm $1.33\text{E}-01$ pCi/g for Cs-137.
- All 399 samples were <MDA for Co-60.

Table 11 provides a summary of soil sample results by survey unit. See Appendix C for a complete list of individual soil sample results.

5.1.3.2 Soil Sampling for Class 2 Areas

SR-192 was written to direct the performance of Final Status Survey soil sampling in the following Class 2 Survey Units: OL-3-36 through OL-3-41 that surround the Class 1 survey units that constitute the Pentolite Ditch proper. The directions contained in the SR were based upon requirements given by Final Status Survey Design # 35. The DCGL_{SUR} for sampling is 14.02 pCi/g for Cs-137 and the DCGL_W

is 3.8 pCi/g for Co-60. Compliance with the DCGL is demonstrated through the use of the unity rule. The results are as follows:

- Sixty-six soil samples were collected, processed and analyzed.
- Of the 66 samples collected and analyzed, 46 were > MDA for Cs-137 and no sample was >MDA for Co-60.
- The highest activity was at OL-3-37 Sample Point (SP) 7. The activity at this location was $3.35\text{E}+00$ pCi/g \pm $4.11\text{E}-01$ pCi/g for Cs-137 and <MDA Co-60.
- The average Cs-137 activity was $4.12\text{E}-01$ pCi/g \pm $1.31\text{E}-01$ pCi/g for Cs-137.
- All 66 samples were <MDA for Co-60.

Table 11 provides a summary of soil sample results by survey unit. See Appendix C for a complete list of individual soil sample results.

5.1.3.3 Quality Control Sample Analysis

In accordance with Section 12.7 of the FSSP [NASA 2007], the objective of QA/QC implementation is to ensure that the survey data collected are of the type and quality required to demonstrate that the dose from residual contamination is below the 25 mrem/yr unrestricted use criteria and to support a decision to terminate the PBRF license. Proper application of QA/QC ensures that:

- the elements of the FSS plan are implemented in accordance with the approved procedures;
- surveys are conducted by trained personnel using calibrated instrumentation;
- the quality of the data collected is adequate;
- all phases of survey package design and implementation are properly reviewed, and oversight is provided; and
- corrective actions, when identified, are implemented in a timely manner and are determined to be effective.

Section 12.7.2 of the FSSP [NASA 2007] further states that replicate sample analyses will be used to monitor sample precision. A minimum of one out of every twenty (5%) FSS samples collected will be reanalyzed or homogenized, split and submitted for independent analyses. This evaluation is performed as follows:

- Determine the resolution for each known nuclide concentration by dividing the initial activity by its corresponding 1σ uncertainty.
- Determine the ratio of each nuclide concentration by dividing the duplicate sample result by the initial sample result.
- The results are acceptable if the agreement ratio falls within the values given in Table 12-1 of the FSSP [NASA 2007] for the corresponding resolution.

For Pentolite Ditch Environmental Area (A2300), a total of 43 QC samples were collected, processed and analyzed (37 from Class 1 areas and 6 from Class 2 areas). The results are as follows:

- 37 QC samples from Class 1 areas (399 total samples) constitutes a ratio of 9.3% QC samples to total sample population,
- 6 QC samples from Class 2 areas (66 total samples) constitutes a ratio of 9.1% QC samples to total sample population, and
- All 43 QC samples (37 from Class 1 areas and 6 from Class 2 areas) were analyzed and the resolution was determined and the ratios were all within the acceptable range provided in Table 12-1 of the FSSP [NASA 2007].

See Appendix C for QC Comparison results, per FSSP Section 12.7.2.

Table 11, Pentolite Ditch Systematic Soil Sample Results By Survey Unit

Survey Unit ID	No. of Measurements	Cs-137, DCGL _{SUR} = 14.02 pCi/g				Co-60, DCGL _w = 3.80 pCi/g				Average Unity Fraction
		Maximum (pCi/g)	Test Result: Maximum < DCGL _{SUR}	Average ⁽¹⁾ (pCi/g)	Test Result: Average < DCGL _{SUR}	Maximum (pCi/g)	Test Result: Maximum < DCGL _w	Average ⁽¹⁾ (pCi/g)	Test Result: Average < DCGL _w	
OL-3-1	11	0.220	Yes	0.096	Yes	0.139	Yes	0.121	Yes	0.039
OL-3-2	11	7.620	Yes	0.801	Yes	0.137	Yes	0.118	Yes	0.088
OL-3-3	11	0.506	Yes	0.160	Yes	0.149	Yes	0.129	Yes	0.045
OL-3-4	11	1.060	Yes	0.201	Yes	0.145	Yes	0.123	Yes	0.047
OL-3-5	11	0.550	Yes	0.153	Yes	0.140	Yes	0.119	Yes	0.042
OL-3-6	11	0.390	Yes	0.180	Yes	0.141	Yes	0.124	Yes	0.046
OL-3-7	11	0.325	Yes	0.202	Yes	0.148	Yes	0.128	Yes	0.048
OL-3-8	14	0.127	Yes	0.086	Yes	0.136	Yes	0.125	Yes	0.039
OL-3-9	11	0.569	Yes	0.157	Yes	0.140	Yes	0.118	Yes	0.042
OL-3-10	11	0.158	Yes	0.088	Yes	0.139	Yes	0.122	Yes	0.038
OL-3-11	11	0.098	Yes	0.085	Yes	0.144	Yes	0.129	Yes	0.040
OL-3-12	11	0.295	Yes	0.101	Yes	0.135	Yes	0.124	Yes	0.040
OL-3-13	11	0.614	Yes	0.149	Yes	0.149	Yes	0.126	Yes	0.044
OL-3-14	11	0.785	Yes	0.253	Yes	0.148	Yes	0.124	Yes	0.051
OL-3-15	11	1.650	Yes	0.220	Yes	0.132	Yes	0.114	Yes	0.046
OL-3-16	11	0.359	Yes	0.104	Yes	0.132	Yes	0.116	Yes	0.038
OL-3-17	11	0.247	Yes	0.111	Yes	0.139	Yes	0.120	Yes	0.040
OL-3-18	11	0.547	Yes	0.137	Yes	0.141	Yes	0.125	Yes	0.043
OL-3-19	11	0.414	Yes	0.195	Yes	0.140	Yes	0.124	Yes	0.046
OL-3-20	11	0.695	Yes	0.182	Yes	0.149	Yes	0.128	Yes	0.047
OL-3-21	11	0.606	Yes	0.267	Yes	0.148	Yes	0.126	Yes	0.052
OL-3-22	11	0.604	Yes	0.176	Yes	0.146	Yes	0.124	Yes	0.045
OL-3-23	11	0.471	Yes	0.204	Yes	0.143	Yes	0.128	Yes	0.048
OL-3-24	11	0.099	Yes	0.085	Yes	0.145	Yes	0.128	Yes	0.039

Table 11, Pentolite Ditch Systematic Soil Sample Results By Survey Unit

Survey Unit ID	No. of Measurements	Cs-137, DCGL _{SUR} = 14.02 pCi/g				Co-60, DCGL _w = 3.80 pCi/g				Average Unity Fraction
		Maximum (pCi/g)	Test Result: Maximum < DCGL _{SUR}	Average ⁽¹⁾ (pCi/g)	Test Result: Average < DCGL _{SUR}	Maximum (pCi/g)	Test Result: Maximum < DCGL _w	Average ⁽¹⁾ (pCi/g)	Test Result: Average < DCGL _w	
OL-3-25	11	0.121	Yes	0.084	Yes	0.149	Yes	0.120	Yes	0.038
OL-3-26	11	0.777	Yes	0.253	Yes	0.140	Yes	0.125	Yes	0.051
OL-3-27	11	1.130	Yes	0.361	Yes	0.144	Yes	0.129	Yes	0.060
OL-3-28	11	1.270	Yes	0.491	Yes	0.140	Yes	0.129	Yes	0.069
OL-3-29	11	0.956	Yes	0.265	Yes	0.146	Yes	0.127	Yes	0.052
OL-3-30	11	0.340	Yes	0.207	Yes	0.145	Yes	0.130	Yes	0.049
OL-3-31	11	0.939	Yes	0.313	Yes	0.148	Yes	0.135	Yes	0.058
OL-3-32	11	0.387	Yes	0.259	Yes	0.149	Yes	0.140	Yes	0.055
OL-3-33	11	0.446	Yes	0.257	Yes	0.142	Yes	0.138	Yes	0.055
OL-3-34	11	0.243	Yes	0.082	Yes	0.145	Yes	0.123	Yes	0.038
OL-3-35	11	0.475	Yes	0.289	Yes	0.141	Yes	0.129	Yes	0.054
OL-3-36	11	0.350	Yes	0.234	Yes	0.145	Yes	0.127	Yes	0.050
OL-3-37	11	3.350	Yes	0.676	Yes	0.144	Yes	0.135	Yes	0.084
OL-3-38	11	0.720	Yes	0.292	Yes	0.131	Yes	0.118	Yes	0.052
OL-3-39	11	0.316	Yes	0.237	Yes	0.149	Yes	0.134	Yes	0.052
OL-3-40	11	0.366	Yes	0.200	Yes	0.146	Yes	0.123	Yes	0.047
OL-3-41	11	0.432	Yes	0.268	Yes	0.144	Yes	0.131	Yes	0.053
OL-3-42	11	0.382	Yes	0.192	Yes	0.149	Yes	0.126	Yes	0.047
Total	465	-	-	-	-	-	-	-	-	-
Maximum	-	7.62	-	0.801	-	0.149	-	0.14	-	0.088
Average	-	-	-	0.223	-	-	-	0.126	-	0.05

Table 11 Note:

1. If actual value was less than the MDA, the MDA value was used to calculate the average value.

5.2 ALARA Evaluation

It is shown that residual contamination in the Pentolite Ditch has been reduced to levels that are ALARA, using a method acceptable to the NRC. The NRC guidance on determining that residual contamination levels are ALARA includes the following:

“In light of the conservatism in the building surface and surface soil generic screening levels developed by the NRC, NRC staff presumes, absent information to the contrary, those licensees who remediate building surfaces or soil to the generic screening levels do not need to provide analyses to demonstrate that these screening levels are ALARA. In addition, if residual radioactivity cannot be detected, it may be presumed that it had been reduced to levels that are ALARA. Therefore the licensee may not need to conduct an explicit analysis to meet the ALARA requirement.”⁴

The applicable NRC surface soil screening values are: Co-60, 3.8; Sr-90, 1.7 and Cs-137, 11 (all in pCi/g). From Appendix C, the highest activity was at OL-3-2 Sample Point (SP) 2. The activity at this location was 7.62E+00 pCi/g Cs-137 and <MDA Co-60. These values are well below the applicable NRC surface soil screening values stated above. Since Cs-137 is the surrogate for Sr-90 and the Sr-90: Cs-137 activity ratio is only 0.017, the activity concentration of Sr-90 is also well below the screening level. The average Cs-137 activity was 4.46E-01±1.33E-01 pCi/g for Class 1 areas and 4.12E-01±1.31E-01 pCi/g for Class 2 areas. All samples were <MDA for Co-60. Therefore, all soil sample results are below their respective screening level values. From these comparisons, it is concluded that the ALARA criterion is satisfied.

5.3 Comparison with EPA Trigger Levels

The PBRF license termination process includes a review of residual contamination levels in groundwater and soil, as applicable, in accordance with the October 2002 Memorandum of Understanding (MOU) between the US NRC and the US Environmental Protection Agency (EPA) [USEPA 2002]. Concentrations of individual radionuclides, identified as “trigger levels” for further review and consultation between the agencies, are published in the MOU. The trigger levels applicable to the PBRF for residual soil concentrations of the radionuclides of concern are:

- Co-60, 4 pCi/g,
- Sr-90 (plus daughter activity), 23 pCi/g and
- Cs-137 (plus daughter activity), 6 pCi/g.

⁴ This guidance was initially published in Draft Regulatory Guide DG-4006, but has been reissued in NUREG-1757 Volume 2, Appendix N.

From Appendix C, the average Cs-137 activity was $4.38\text{E-}01 \pm 1.32\text{E-}01$ pCi/g for Class 1 areas and $4.12\text{E-}01 \pm 1.31\text{E-}01$ pCi/g for Class 2 areas. All samples were <MDA for Co-60. These average values are well below the applicable EPA Trigger Levels stated above. Since Cs-137 is the surrogate for Sr-90 and the Sr-90: Cs-137 activity fraction is only 0.0175, the activity concentration of Sr-90 is also well below the trigger level.

5.4 Conclusions

The results presented above demonstrate that the Pentolite Ditch satisfies all FSS Plan commitments and meets the release criteria in 10CFR20 Subpart E. The principal conclusions are:

- Scan surveys were performed in all 42 survey units with scan coverage equal to (for Class 1 areas) or in excess of (for Class 2 areas) the percentage requirements stated in the FSSP [NASA 2007].
- Residual surface soil contamination above investigation levels was detected in only one of 42 survey units. Soil sample results indicated that the activity present was well below the DCGLs.
- All 465 systematic soil sample results were less than the applicable DCGL_w values for Cs-137 and Co-60.
- Residual soil concentration measurement results are shown to be less than NRC screening level values - demonstrating that the ALARA criterion is satisfied.
- Residual activity concentrations measured in the soil survey unit were compared to, and found to be less than EPA trigger levels.
- No changes from what was proposed in the FSS Plan were made except that the Class 1 area was expanded based on characterization results, by 107,328 square feet (or a 19% increase) from the estimated impacted Class 1 area provided in the FSSP [NASA 2007]. Additionally, six (6) Class 2 survey units, totaling 560,421 ft^2 of surface area were established as a buffer zone around the Class 1 survey units.

6.0 References

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7.0 Appendices

Appendix A – Exhibits

Appendix B – Survey Unit Maps and Tables Showing Measurement Locations

Appendix C –Soil Sample Results

Plum Brook Reactor Facility
Final Status Survey Report
Attachment 4

Pentolite Ditch
(Environmental Area A2300)

Revision 0

Appendix A

Exhibits

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Exhibit 1, Pentolite Ditch Survey Unit Breakdown

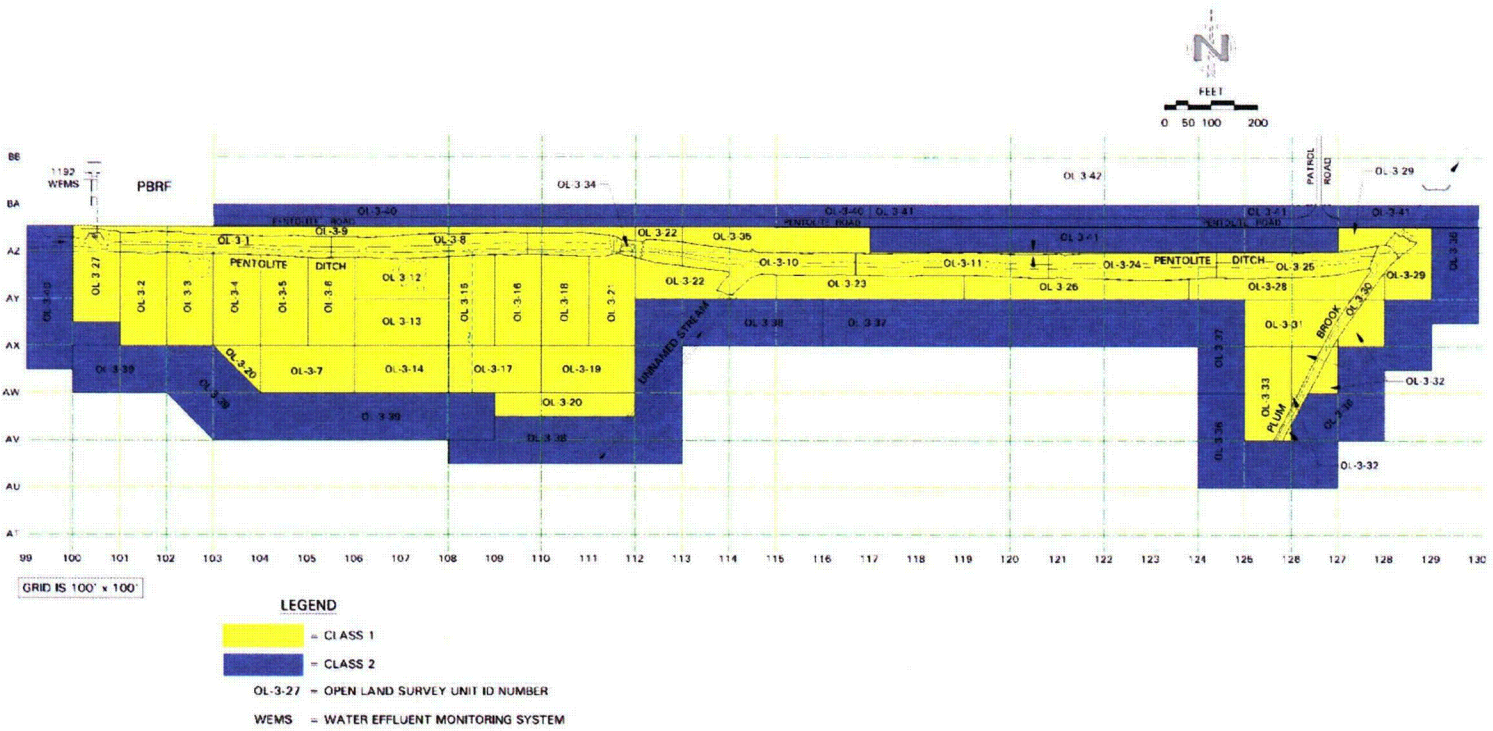


Exhibit 2, Pentolite Ditch prior to Excavation
Pentolite Ditch Looking West



Confluence of Pentolite Ditch and Plum Brook



Exhibit 3, South of Pentolite Ditch
Survey Units South of Pentolite Ditch, looking South



Survey Units South of Pentolite Ditch, looking South



Exhibit 4, Views of Pentolite Ditch
Pentolite Ditch South Bank Looking East



Ditch Looking West



Exhibit 5, Pentolite Ditch Survey
Survey of Ditch



Ditch Survey



Exhibit 6, Pentolite Ditch Excavation
Load-out of Soil



Excavation looking South



Exhibit 7, Pentolite Ditch Excavation
Pentolite Ditch Excavation looking West



Excavation South of Pentolite Ditch



**Exhibit 8, Installation of Bypass Piping for Pentolite Ditch
Pumps for Bypass Piping**



Bypass Piping



Exhibit 9, Installation of Bypass Line for Pentolite Ditch
Installation of Bypass Line under Pentolite Road



Installed Bypass Piping



Exhibit 10, Confluence of Pentolite Ditch with Plum Brook
Dam Downstream of Pentolite Ditch/Plum Brook Confluence



Dam Looking South



Exhibit 11, Pentolite Ditch and Plum Brook

Dam Looking East with Sheet Pile Installed on Pentolite Ditch



Exhibit 12, Excavation Work on Pentolite Ditch
Excavation of Pentolite Ditch



Excavation of Pipe Culverts



Exhibit 13, Pipe Culverts
Close-up of Pipe Culverts



Survey of Pipe



Exhibit 14, WEMS Outfall
Sediment at WEMS Outfall



Excavation of the WEMS Outfall



Exhibit 15, Excavation of WEMS Outfall
Load-out of Sediment at WEMS Outfall



Exhibit 16, Views of Pentolite Ditch Excavations
Deeper Excavation South of Pentolite Road



Excavation and Survey at East End of Pentolite Ditch



Exhibit 17, Views of Pentolite Ditch Excavations
North-South Cross Over Land Bridge



Excavation Looking West



Exhibit 18, Views of Pentolite Ditch Excavations
Excavation Looking East



Scraping the Banks



Exhibit 19, Views of Pentolite Ditch Excavation
Load-out of Soil



Deeper Excavation



Exhibit 20, Views of Pentolite Ditch Excavation
Soil Excavation



Land Area South of Pentolite Ditch Looking East



Exhibit 21, Pipe Culverts
Installation of Sleeve inside Pipe Culverts



Installed Pipe Sleeves



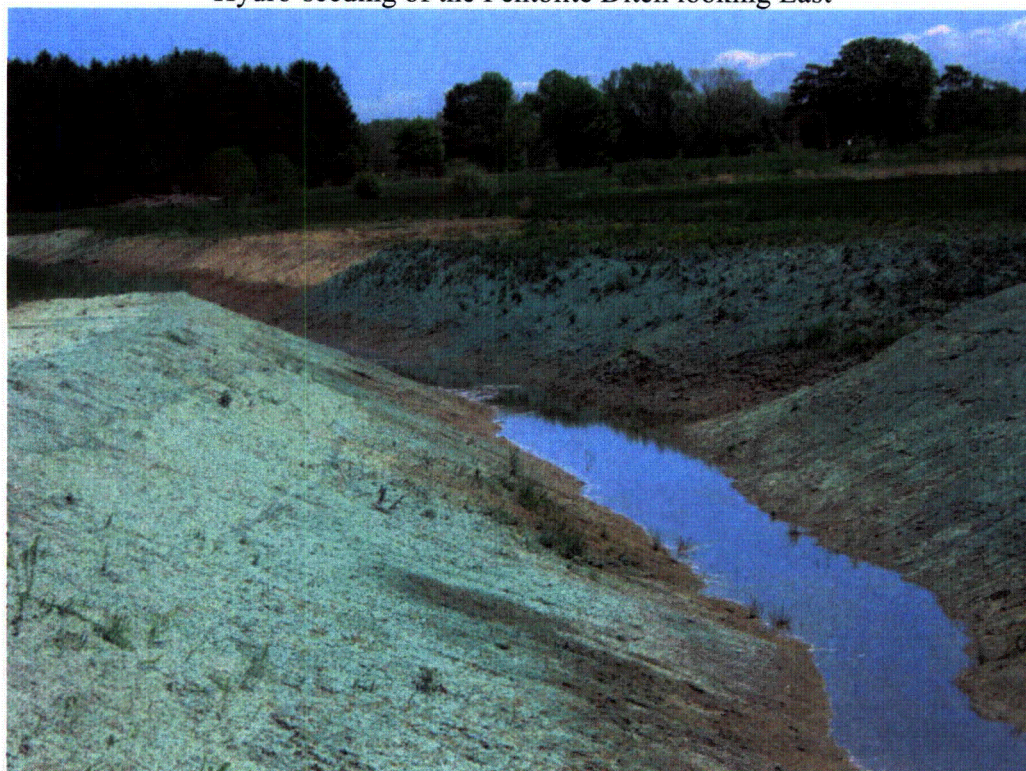
Exhibit 22, Stone Dam
Stone Dam East End of Pentolite Ditch



Exhibit 23, Completed Restoration of Pentolite Ditch
Hydro-seeding of the Pentolite Ditch looking East



Hydro-seeding of the Pentolite Ditch looking East



Plum Brook Reactor Facility
Final Status Survey Report
Attachment 4

Pentolite Ditch
(Environmental Area A2300)

Revision 0

Appendix B

Survey Unit Maps and Tables Showing
Measurement Locations

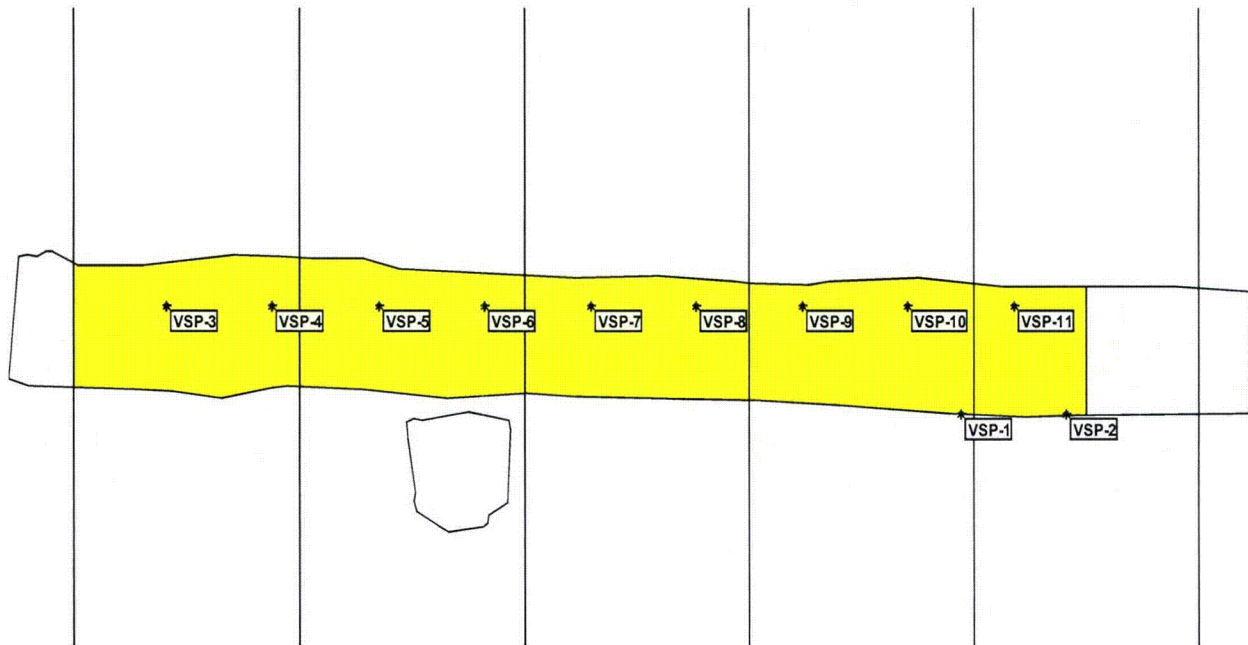
Index of Pentolite Ditch (OL-3) Survey Unit Maps and Tables of Coordinates

Survey Unit	Description	Page Number	Number of Pages
OL-3-1	Pentolite Ditch from 101 to 105.5	4	1
OL-3-2	Pentolite Ditch Adjacent Areas – AX-101 & AY-101	5	1
OL-3-3	Pentolite Ditch Adjacent Areas – AX-102 & AY-102	6	1
OL-3-4	Pentolite Ditch Adjacent Areas – AX-103 & AY-103	7	1
OL-3-5	Pentolite Ditch Adjacent Areas – AX-104 & AY-104	8	1
OL-3-6	Pentolite Ditch Adjacent Areas – AX-105 & AY-105	9	1
OL-3-7	Pentolite Ditch Adjacent Areas – AW-104 & AW-105	10	1
OL-3-8	Pentolite Ditch from 105.5 to 109.7	11	1
OL-3-9	Pentolite Ditch Adjacent Areas – North of Ditch to Road Line 100 to 110	12	1
OL-3-10	Pentolite Ditch from 113 to 116.7	13	1
OL-3-11	Pentolite Ditch from 116.7 to 120.8	14	1
OL-3-12	Pentolite Ditch Adjacent Areas – AY-106 & AY-107	15	1
OL-3-13	Pentolite Ditch Adjacent Areas – AX-106 & AX-107	16	1
OL-3-14	Pentolite Ditch Adjacent Areas – AW-106 & AW-107	17	1
OL-3-15	Pentolite Ditch Adjacent Areas – AX-108 & AY-108	18	1
OL-3-16	Pentolite Ditch Adjacent Areas – AX-109 & AY-109	19	1
OL-3-17	Pentolite Ditch Adjacent Areas – AW-108 & AW-109	20	1
OL-3-18	Pentolite Ditch Adjacent Areas – AX-110 & AY-110	21	1
OL-3-19	Pentolite Ditch Adjacent Areas – AW-110 & AW-111	22	1
OL-3-20	Pentolite Ditch Adjacent Areas – AV-109 –AV-111 North & AW-103 NE	23	1
OL-3-21	Pentolite Ditch Adjacent Areas – AX-111 & AY-111	24	1
OL-3-22	Pentolite Ditch Adjacent Areas – AY-112, AY-113, AY-114	25	1
OL-3-23	Pentolite Ditch Adjacent Areas – AY-115 through AY-118	26	1
OL-3-24	Pentolite Ditch from 120.8 to 124.4	27	1
OL-3-25	Pentolite Ditch from 124.4 to piling wall	28	1
OL-3-26	Pentolite Ditch Adjacent Areas – AY-119 through AY-123.8	29	1
OL-3-27	Pentolite Ditch from 100 to 101, AY-100, AX-100 North	30	1
OL-3-28	Pentolite Ditch Adjacent Areas – AY-123.8through AY-127	31	1
OL-3-29	Pentolite Ditch Adjacent Areas – AX-127, AX-128, AY-128	32	1
OL-3-30	Plumbrook from AV line to Pentolite Road culverts	33	1
OL-3-31	Pentolite Ditch Adjacent Areas – AX-125, 126, 127 west of Plumbrook	34	1
OL-3-32	Pentolite Ditch Adjacent Areas – AW-126, AV-126 west of PB ; AV-125, AW-125, AX-126, AX-127 east of PB	35	1
OL-3-33	Pentolite Ditch Adjacent Areas – AW-125, AV-125 west of PB	36	1
OL-3-34	Pentolite Ditch from 109.7 to 113	37	1
OL-3-35	Pentolite Ditch Adjacent Areas – North of Ditch to Pentolite Road from 113 line to 117 line	38	1
OL-3-36	AU-124/125/ 126, AV-124/126/127, AW-127/128N, AX-128/129N, AY-129, AZ-129 South of Pentolite Road	39	1
OL-3-37	AX-116 to 124, AW-124	40	1
OL-3-38	AU-108N to 112N, AV-109S to 111S, AV-112, AW-112, AX-112 to 115	41	1
OL-3-39	AW-100 to 102, AW-103SW, AV-102NE, AV-103-108	42	1

Index of Pentolite Ditch (OL-3) Survey Unit Maps and Tables of Coordinates

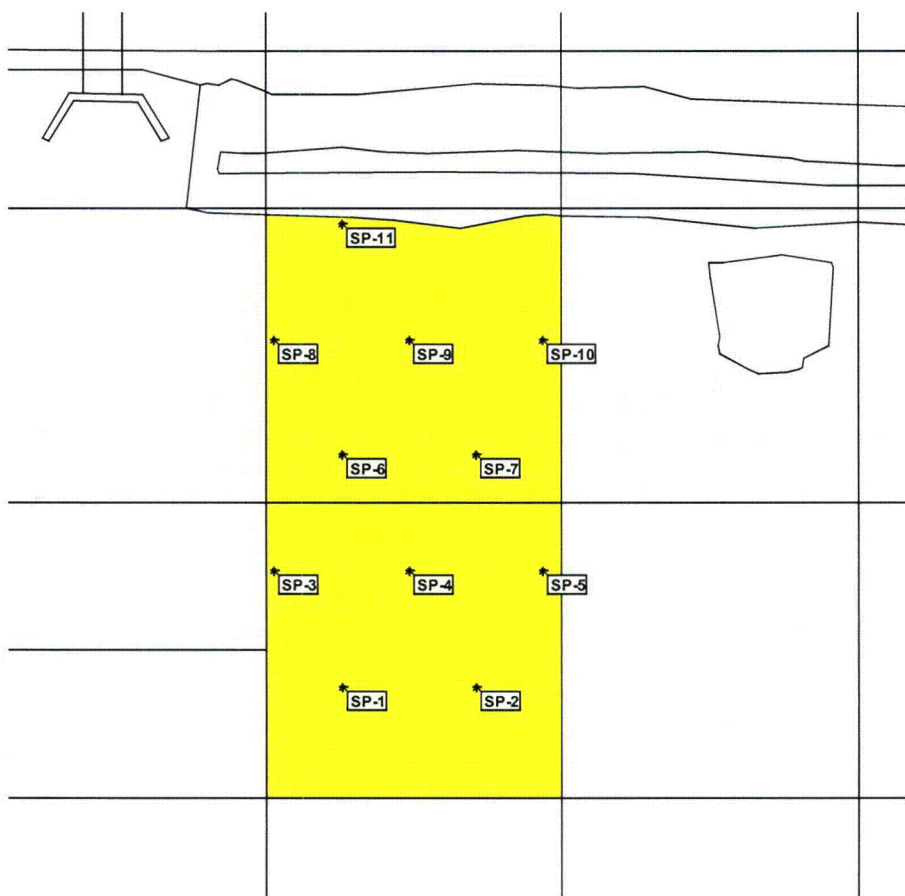
Survey Unit	<i>Description</i>	Page Number	Number of Pages
OL-3-40	AW-99N, AX-99, AX-100N, AY-99, AZ-99 South of Pentolite Road, AZ-103 to 116 North of Pentolite Road	43	1
OL-3-41	AZ-117 to 126 North and South of Pentolite Road, AZ-127 to 129 North of Pentolite Road	44	1
OL-3-42	AY-117 to AY-126 North of Pentolite Ditch	45	1

Survey Unit OL-3-1



OL 3-1 Area: Pentolite Ditch from Line 101 to 105.5 Measurement Locations and results			
X Coord	Y Coord	Label	Type
394	1' from south edge of ditch	VSP-1	Systematic
441	1' from south edge of ditch	VSP-2	Systematic
41	15' from north edge of ditch	VSP-3	Systematic
88.5	17' from north edge of ditch	VSP-4	Systematic
135.5	17' from north edge of ditch	VSP-5	Systematic
182.5	13' from north edge of ditch	VSP-6	Systematic
229.5	9' from north edge of ditch	VSP-7	Systematic
276.5	10' from north edge of ditch	VSP-8	Systematic
324	8' from north edge of ditch	VSP-9	Systematic
371	11' from north edge of ditch	VSP-10	Systematic
418	6' from north edge of ditch	VSP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from the center of the ditch excavation on the grid 101 line			

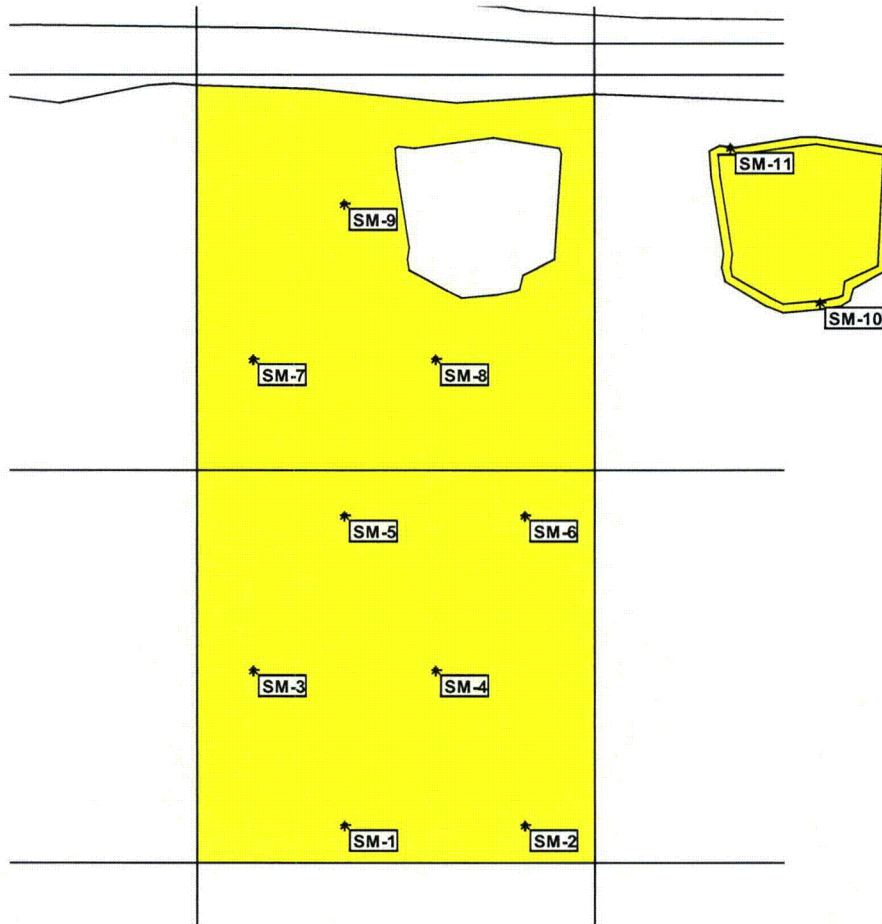
Survey Unit OL-3-2



OL 3-2 Area: Pentolite Ditch Adjacent Areas – AX-101 & AY-101 Measurement Locations and results			
X Coord	Y Coord	Label	Type
25	38	SP-1	Systematic
70	38	SP-2	Systematic
2	77	SP-3	Systematic
48	77	SP-4	Systematic
93	77	SP-5	Systematic
25	116	SP-6	Systematic
70	116	SP-7	Systematic
2	156	SP-8	Systematic
48	156	SP-9	Systematic
93	156	SP-10	Systematic
25	195	SP-11	Systematic

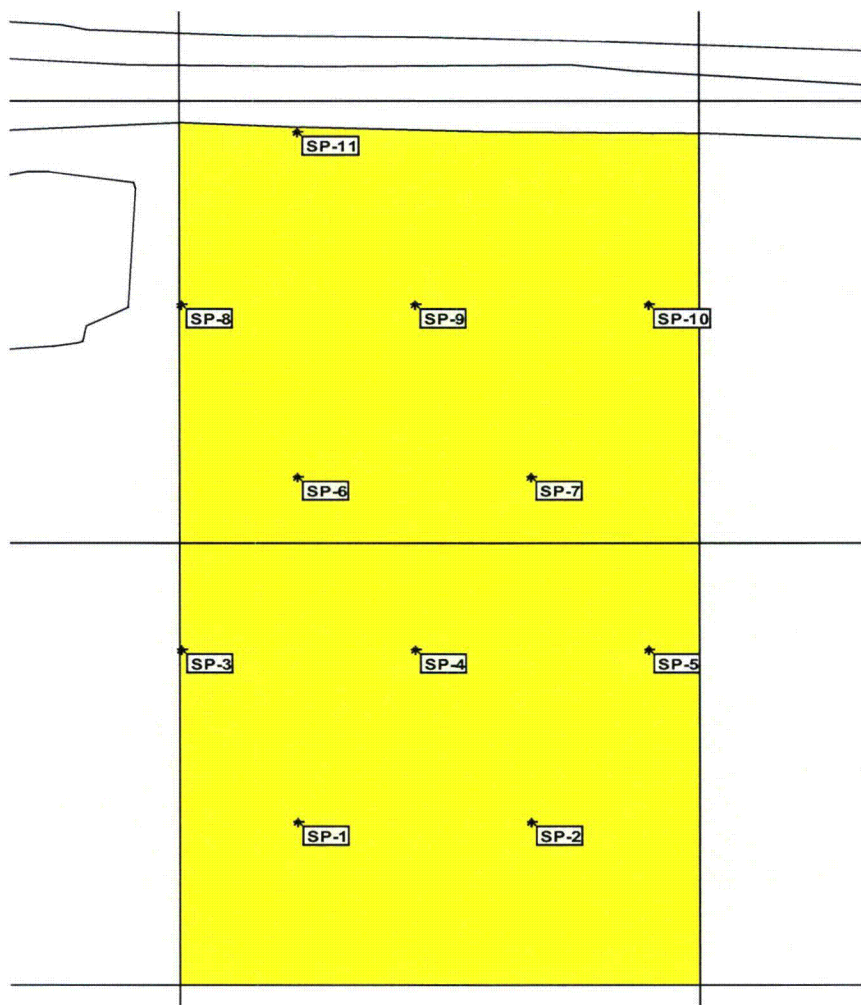
* The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AX 101.

Survey Unit OL-3-3



OL 3-3 Area: Pentolite Ditch Adjacent Areas – AX-102 & AY-102 Measurement Locations and results			
X Coord	Y Coord	Label	Type
37.0	9.5	SP-1	Systematic
82.7	9.5	SP-2	Systematic
14.2	49.0	SP-3	Systematic
59.9	49.0	SP-4	Systematic
37.0	88.5	SP-5	Systematic
82.7	88.5	SP-6	Systematic
14.2	128.1	SP-7	Systematic
59.9	128.1	SP-8	Systematic
37.0	167.6	SP-9	Systematic
9.0	1.4' from top	SP-10	Systematic
2.3	0.2' from top	SP-11	Systematic
*The X, Y coordinates for samples SP-1 thru SP-9 are from grid pin AX-102. The X coordinate for samples SP-10 and SP-11 are from the point shown on the map.			

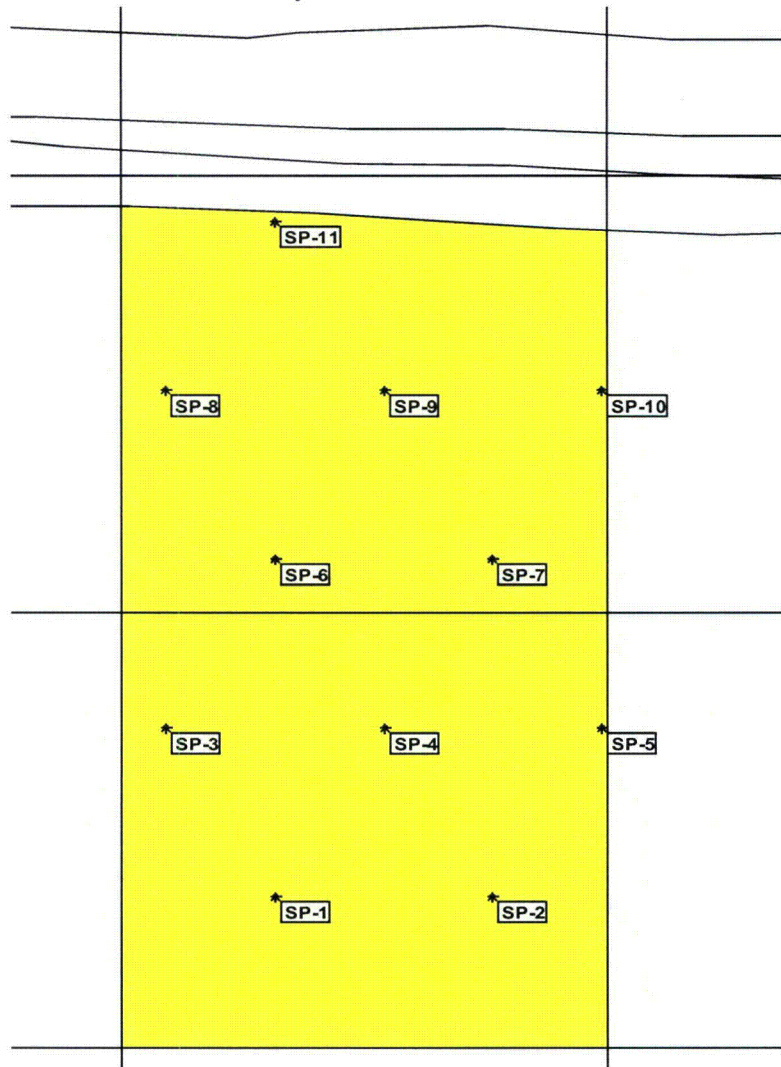
Survey Unit OL-3-4



OL 3-4 Area: Pentolite Ditch Adjacent Areas – AX-103 & AY-103 Measurement Locations and results			
X Coord	Y Coord	Label	Type
23	37	SP-1	Systematic
68	37	SP-2	Systematic
0.2	76	SP-3	Systematic
45	76	SP-4	Systematic
90	76	SP-5	Systematic
23	115	SP-6	Systematic
68	115	SP-7	Systematic
0.2	154	SP-8	Systematic
45	154	SP-9	Systematic
90	154	SP-10	Systematic
23	193	SP-11	Systematic

*The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AX 103.

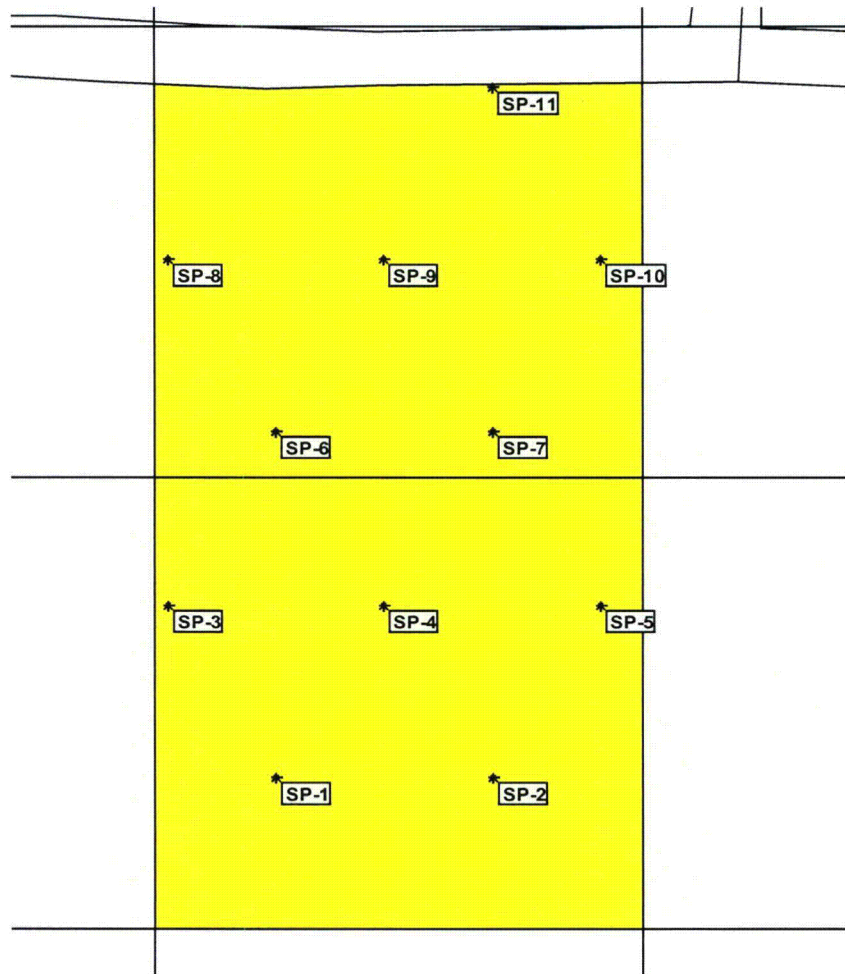
Survey Unit OL-3-5



OL 3-5 Area: Pentolite Ditch Adjacent Areas – AX-104 & AY-104 Measurement Locations and results			
X Coord	Y Coord	Label	Type
32	34	SP-1	Systematic
77	34	SP-2	Systematic
9	73	SP-3	Systematic
54	73	SP-4	Systematic
99	73	SP-5	Systematic
32	112	SP-6	Systematic
77	112	SP-7	Systematic
9	150	SP-8	Systematic
54	150	SP-9	Systematic
99	150	SP-10	Systematic
32	189	SP-11	Systematic

The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AX 104.

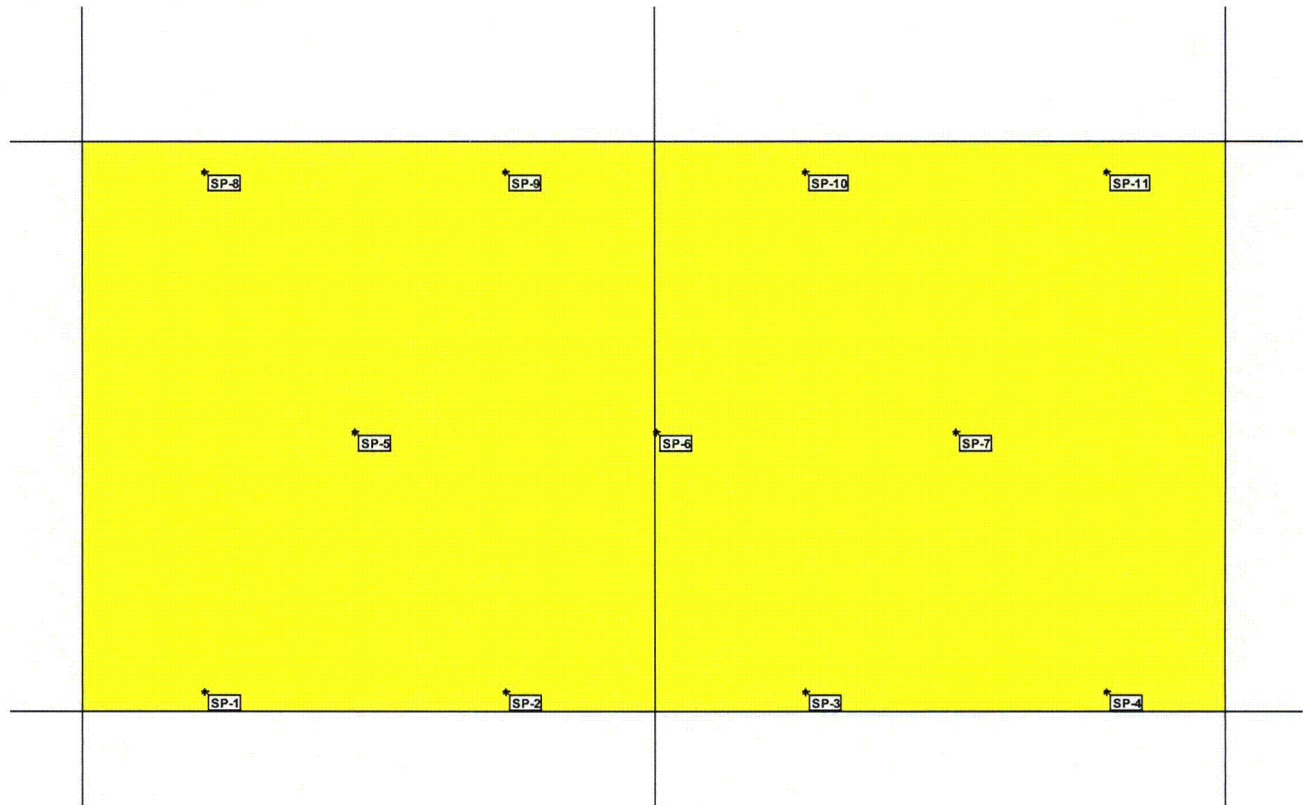
Survey Unit OL-3-6



OL 3-6 Area: Pentolite Ditch Adjacent Areas – AX-105 & AY-105 Measurement Locations and results			
X Coord	Y Coord	Label	Type
25	33	SP-1	Systematic
70	33	SP-2	Systematic
3	72	SP-3	Systematic
47	72	SP-4	Systematic
92	72	SP-5	Systematic
25	110	SP-6	Systematic
70	110	SP-7	Systematic
3	148	SP-8	Systematic
47	148	SP-9	Systematic
92	148	SP-10	Systematic
70	187	SP-11	Systematic

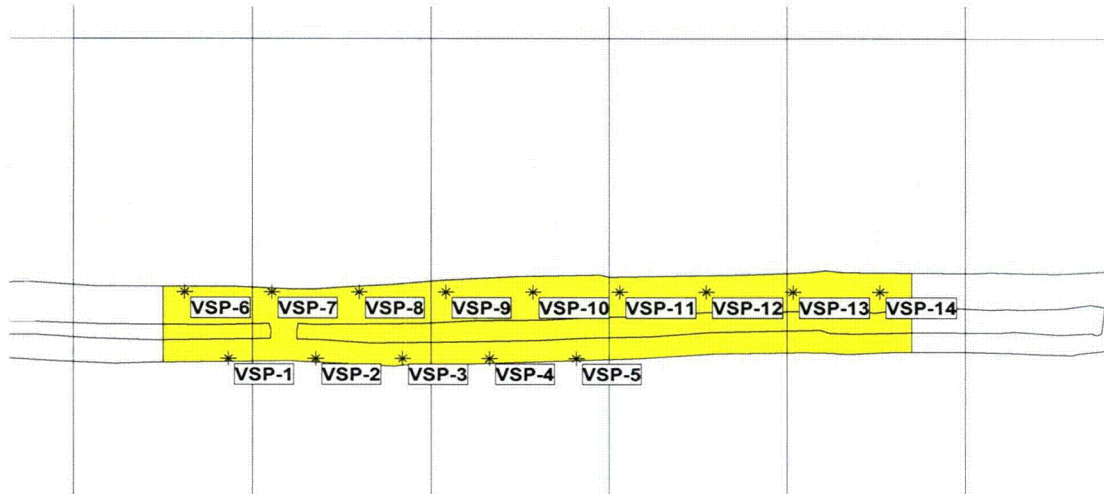
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AX 105.

Survey Unit OL-3-7



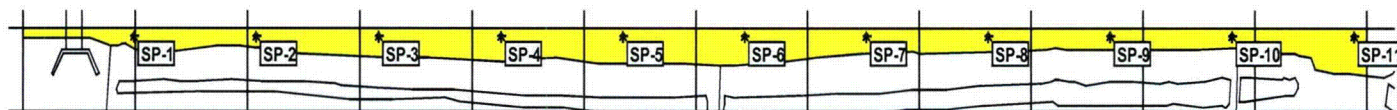
OL 3-7 Area: Pentolite Ditch Adjacent Areas – AW-104 & AW-105 Measurement Locations and results			
X Coord	Y Coord	Label	Type
22	3	SP-1	Systematic
74	3	SP-2	Systematic
128	3	SP-3	Systematic
179	3	SP-4	Systematic
48	49	SP-5	Systematic
100	49	SP-6	Systematic
153	49	SP-7	Systematic
22	95	SP-8	Systematic
74	95	SP-9	Systematic
128	95	SP-10	Systematic
179	95	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AW 104.			

Survey Unit OL-3-8



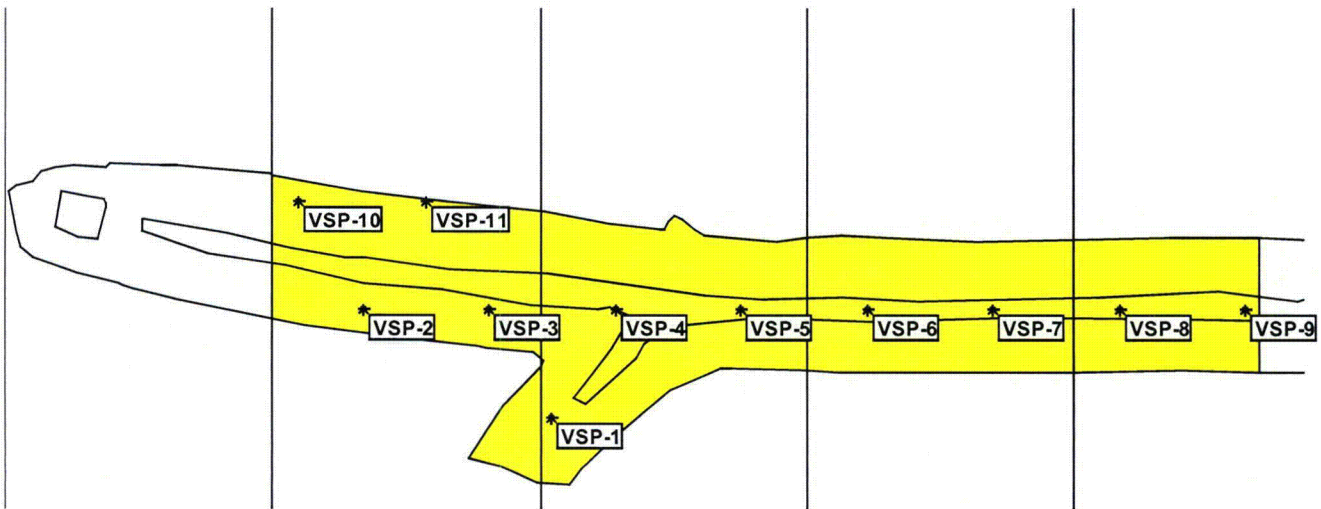
OL 3-8 Area: Pentolite Ditch from 105.5 to 109.7 Measurement Locations and results			
X Coord	Y Coord	Label	Type
37	2' from south edge of ditch	VSP-1	Systematic
85	3' from south edge of ditch	VSP-2	Systematic
134	4' from south edge of ditch	VSP-3	Systematic
183	4' from south edge of ditch	VSP-4	Systematic
232	2' from south edge of ditch	VSP-5	Systematic
13	3' from north edge of ditch	VSP-6	Systematic
61	1' from north edge of ditch	VSP-7	Systematic
110	2.5' from north edge of ditch	VSP-8	Systematic
159	7.5' from north edge of ditch	VSP-9	Systematic
208	8' from north edge of ditch	VSP-10	Systematic
256	9' from north edge of ditch	VSP-11	Systematic
305	9' from north edge of ditch	VSP-12	Systematic
354	12' from north edge of ditch	VSP-13	Systematic
403	12' from north edge of ditch	VSP-14	Systematic
The X coordinate for samples SP-1 thru SP-14 are from the center of the ditch excavation on the grid 105.5 line.			

Survey Unit OL-3-9



OL 3-9			
Area: Pentolite Ditch Adjacent Areas – North of Ditch to Road Line 100 to 110			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
98	-6	SP-1	Systematic
208	-6	SP-2	Systematic
317	-6	SP-3	Systematic
426	-6	SP-4	Systematic
535	-6	SP-5	Systematic
644	-6	SP-6	Systematic
753	-6	SP-7	Systematic
862	-6	SP-8	Systematic
971	-6	SP-9	Systematic
1080	-6	SP-10	Systematic
1189	-6	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from the northwest corner of Survey Unit 3-9 where the survey unit abuts Pentolite Road.			

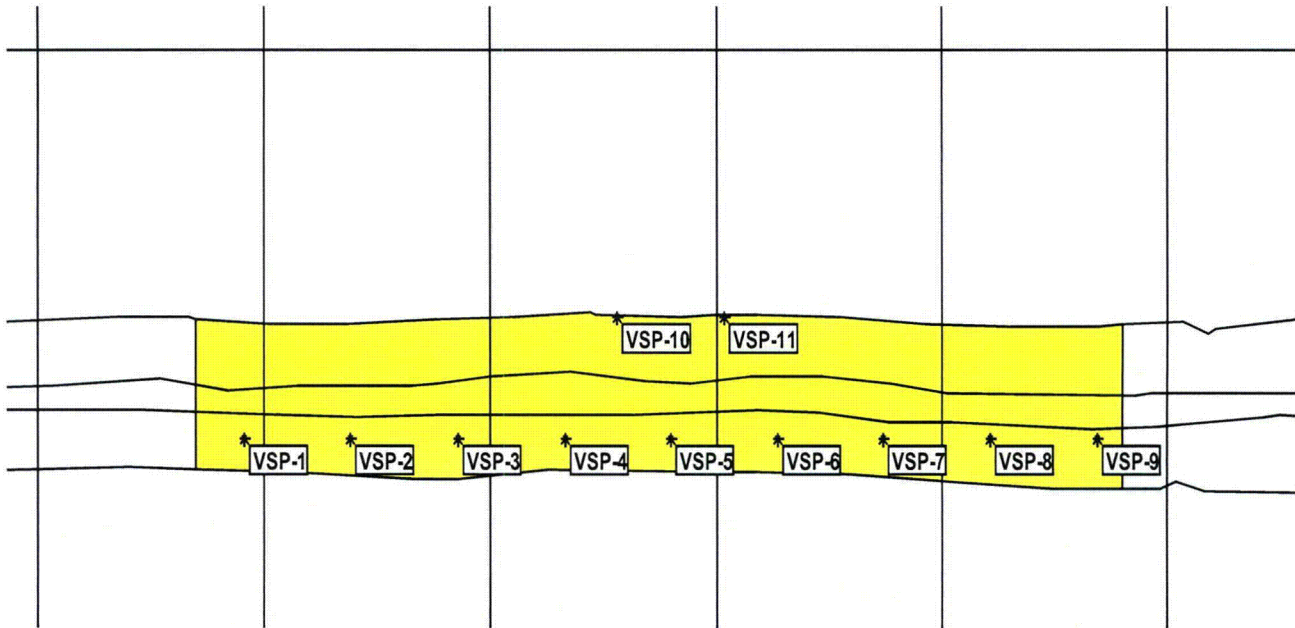
Survey Unit OL-3-10



115

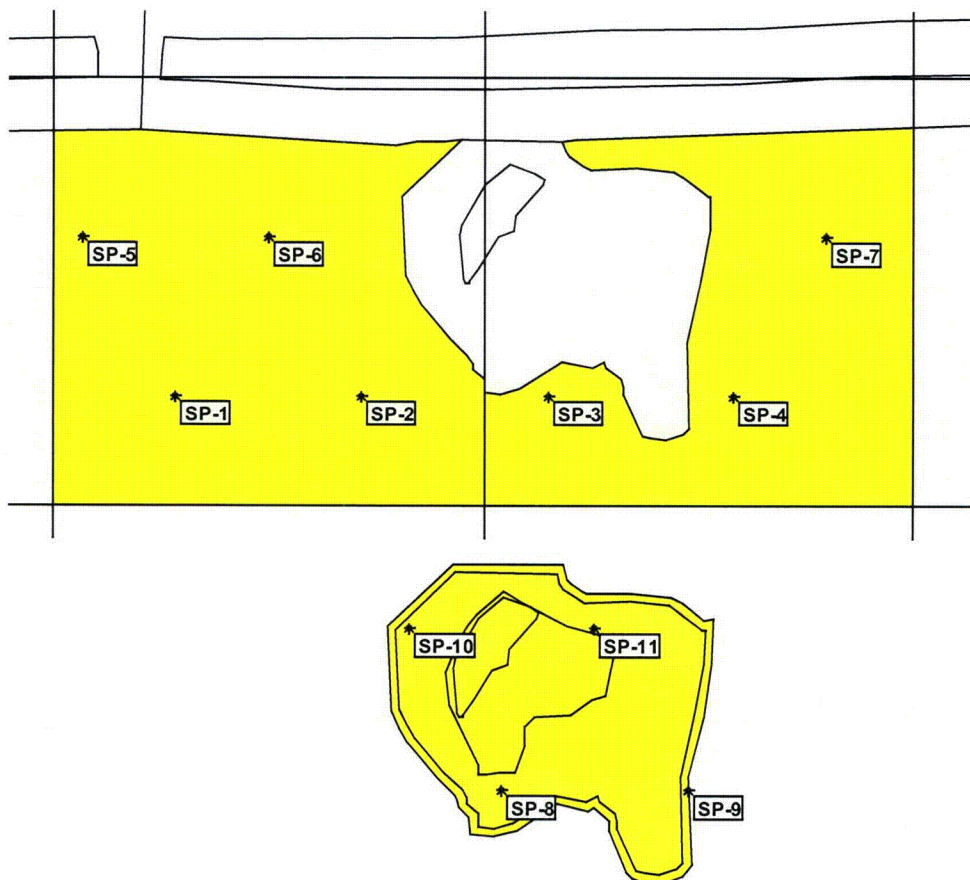
OL 3-10 Area: Pentolite Ditch from 113 to 116.7 Measurement Locations and results			
X Coord	Y Coord	Label	Type
105	77' from north edge of ditch	VSP-1	Systematic
34	9' from south edge of ditch	VSP-2	Systematic
82	15' from south edge of ditch	VSP-3	Systematic
129	31' from north edge of ditch	VSP-4	Systematic
176	Centerline of ditch	VSP-5	Systematic
223	Centerline of ditch	VSP-6	Systematic
271	Centerline of ditch	VSP-7	Systematic
318	Centerline of ditch	VSP-8	Systematic
365	Centerline of ditch	VSP-9	Systematic
11	8' from north edge of ditch	VSP-10	Systematic
58	2' from north edge of ditch	VSP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from the center of the ditch excavation on the grid 113 line.			

Survey Unit OL-3-11



OL 3-11 Area: Pentolite Ditch from 116.7 to 120.8 Measurement Locations and results			
X Coord	Y Coord	Label	Type
22	9.5' from south edge of ditch	VSP-1	Systematic
69	12' from south edge of ditch	VSP-2	Systematic
116	12' from south edge of ditch	VSP-3	Systematic
163	11' from south edge of ditch	VSP-4	Systematic
210	11' from south edge of ditch	VSP-5	Systematic
258	11' from south edge of ditch	VSP-6	Systematic
305	13' from south edge of ditch	VSP-7	Systematic
352	16' from south edge of ditch	VSP-8	Systematic
399	18' from south edge of ditch	VSP-9	Systematic
187	1' from north edge of ditch	VSP-10	Systematic
234	1' from north edge of ditch	VSP-11	Systematic
The X coordinate for samples SP-1 thru SP-11 are from the center of the ditch excavation on the grid 116.7 line.			

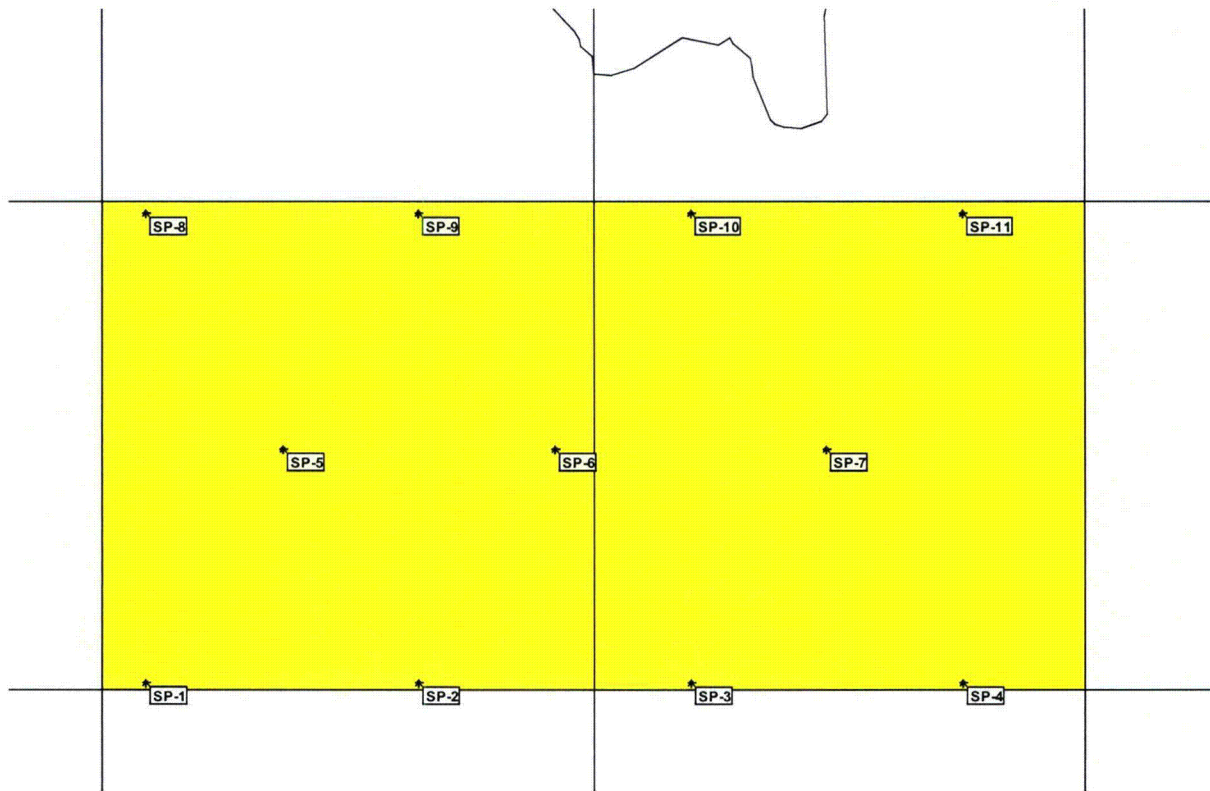
Survey Unit OL-3-12



OL 3-12 Area: Pentolite Ditch Adjacent Areas – AY-106 & AY-107 Measurement Locations and results			
X Coord	Y Coord	Label	Type
29	26	SP-1	Systematic
72	26	SP-2	Systematic
115	26	SP-3	Systematic
159	26	SP-4	Systematic
7	63	SP-5	Systematic
50	63	SP-6	Systematic
180	63	SP-7	Systematic
107	36	SP-8	Systematic
147	36	SP-9	Systematic
85	74	SP-10	Systematic
127	74	SP-11	Systematic

The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AY 106.

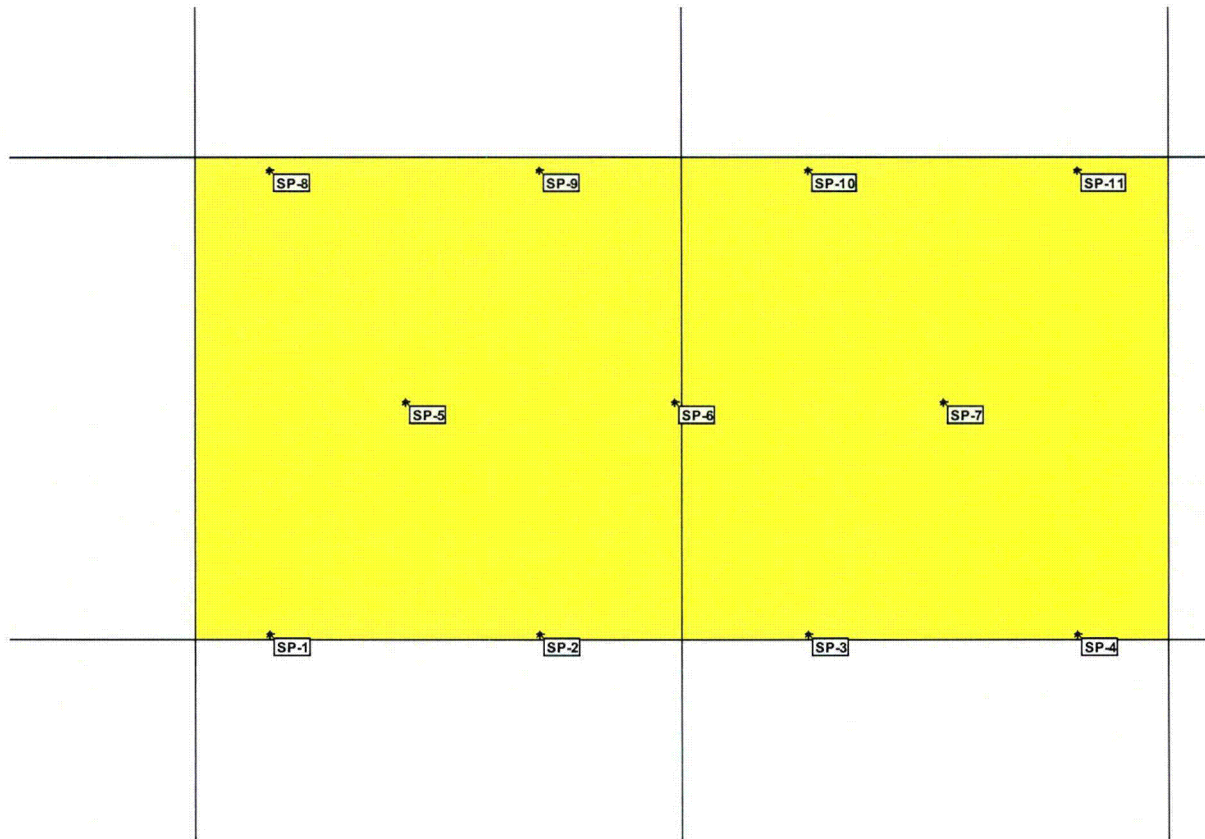
Survey Unit OL-3-13



OL 3-13 Area: Pentolite Ditch Adjacent Areas – AX-106 & AX-107 Measurement Locations and results			
X Coord	Y Coord	Label	Type
9	1.0	SP-1	Systematic
65	1.0	SP-2	Systematic
120	1.0	SP-3	Systematic
176	1.0	SP-4	Systematic
37	49	SP-5	Systematic
92	49	SP-6	Systematic
148	49	SP-7	Systematic
9	97	SP-8	Systematic
65	97	SP-9	Systematic
120	97	SP-10	Systematic
176	97	SP-11	Systematic

The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AX 106.

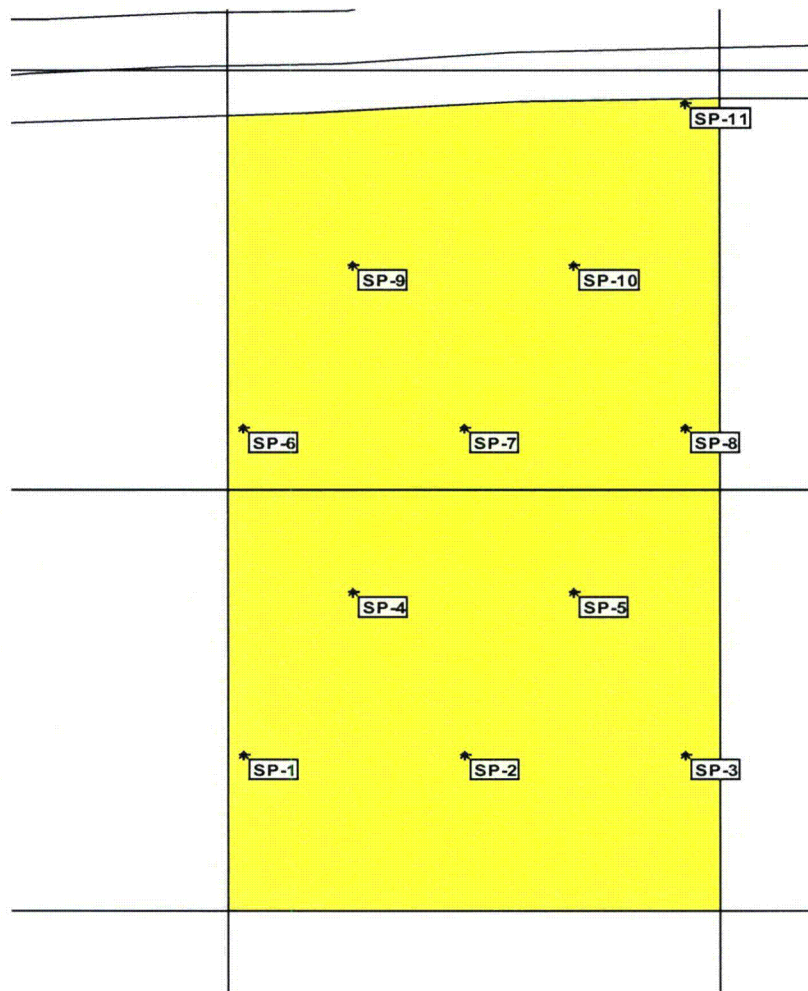
Survey Unit OL-3-14



OL 3-14			
Area: Pentolite Ditch Adjacent Areas – AW-106 & AW-107			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
15	0.4	SP-1	Systematic
71	0.4	SP-2	Systematic
126	0.4	SP-3	Systematic
182	0.4	SP-4	Systematic
43	48	SP-5	Systematic
98	48	SP-6	Systematic
154	48	SP-7	Systematic
15	96	SP-8	Systematic
71	96	SP-9	Systematic
126	96	SP-10	Systematic
182	96	SP-11	Systematic

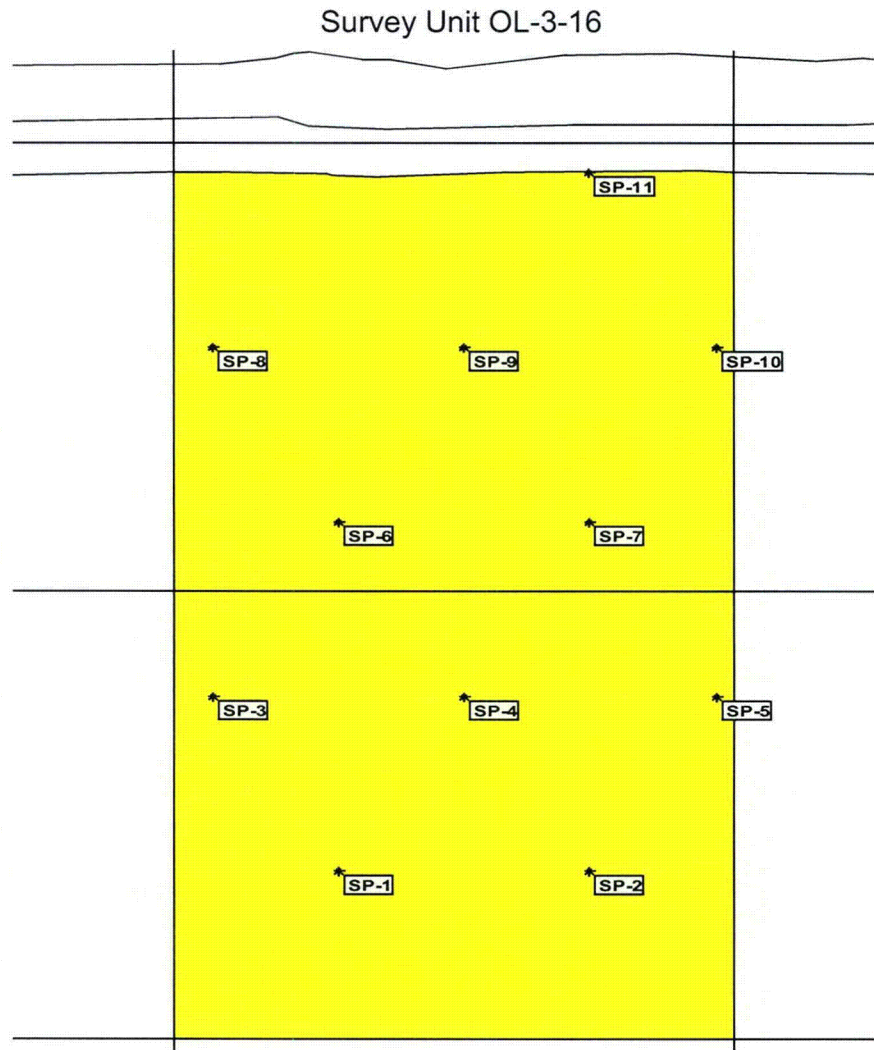
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AW 106.

Survey Unit OL-3-15



OL 3-15 Area: Pentolite Ditch Adjacent Areas – AX-108 & AY-108 Measurement Locations and results			
X Coord	Y Coord	Label	Type
3	37	SP-1	Systematic
48	37	SP-2	Systematic
93	37	SP-3	Systematic
26	75	SP-4	Systematic
70	75	SP-5	Systematic
3	114	SP-6	Systematic
48	114	SP-7	Systematic
93	114	SP-8	Systematic
26	153	SP-9	Systematic
70	153	SP-10	Systematic
93	3' south of ditch edge	SP-11	Systematic

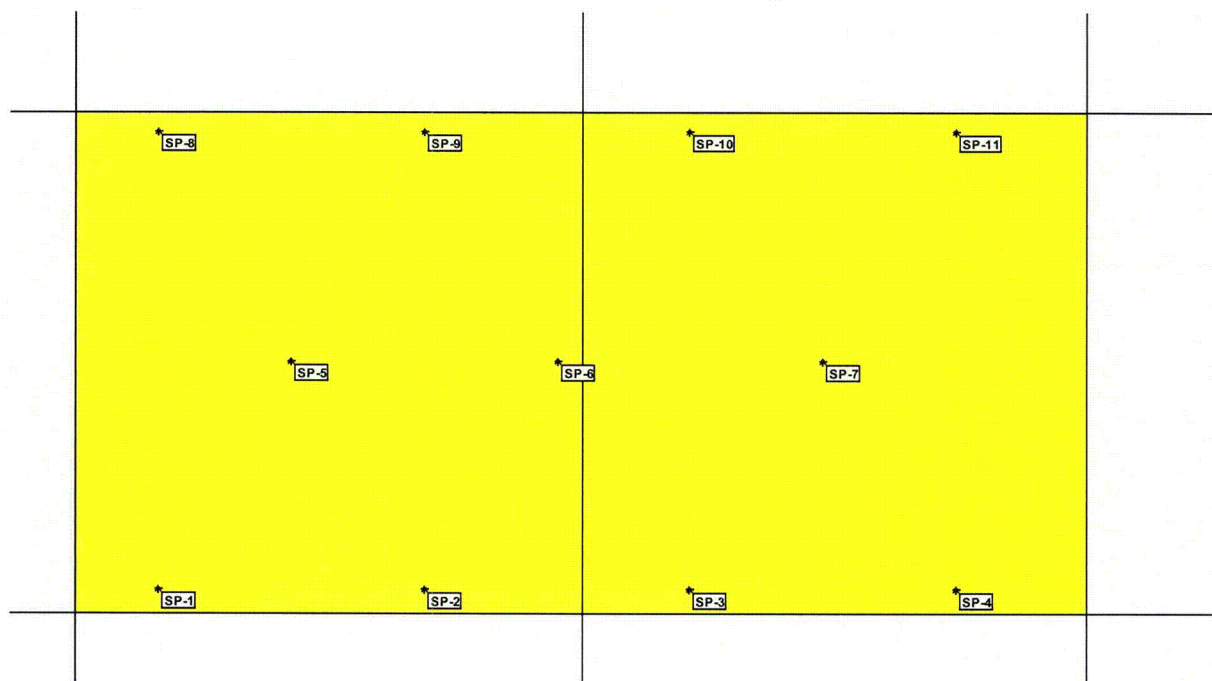
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AX 108, (Y co-ordinate for SP-11 is as described).



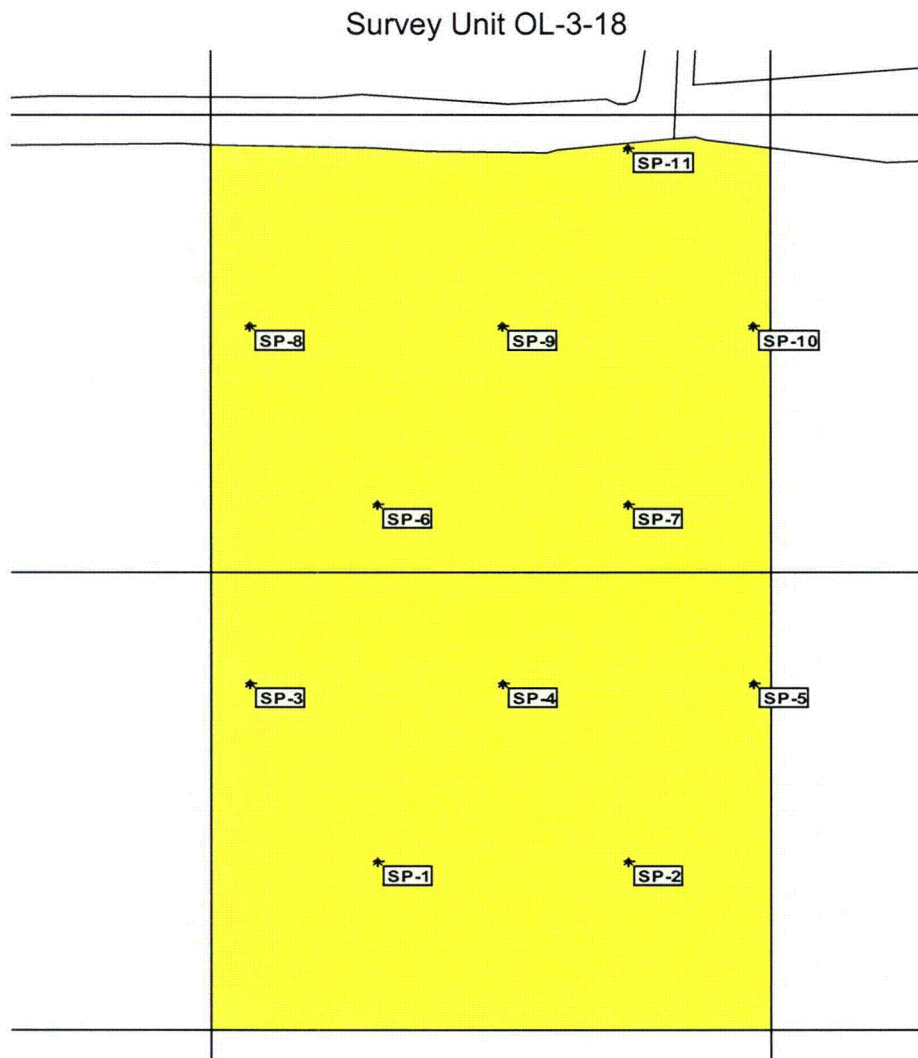
OL 3-16 Area: Pentolite Ditch Adjacent Areas – AX-109 & AY-109 Measurement Locations and results			
X Coord	Y Coord	Label	Type
29	37	SP-1	Systematic
74	37	SP-2	Systematic
7	76	SP-3	Systematic
52	76	SP-4	Systematic
97	76	SP-5	Systematic
29	115	SP-6	Systematic
74	115	SP-7	Systematic
7	154	SP-8	Systematic
52	154	SP-9	Systematic
97	154	SP-10	Systematic
74	3' south of ditch edge	SP-11	Systematic

The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AX 109, (Y co-ordinate for SP-11 is as described).

Survey Unit OL-3-17



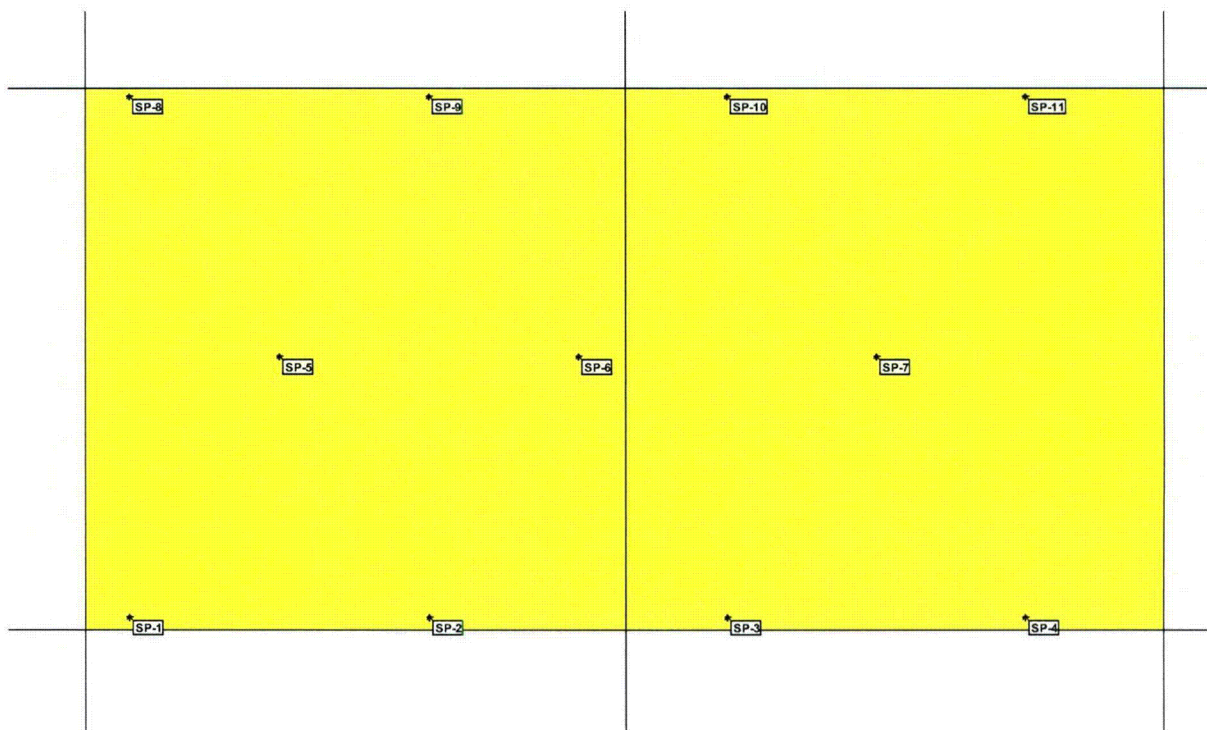
OL 3-17			
Area: Pentolite Ditch Adjacent Areas – AW-108 & AW-109			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
16	5	SP-1	Systematic
69	5	SP-2	Systematic
12	5	SP-3	Systematic
174	5	SP-4	Systematic
42	50	SP-5	Systematic
95	50	SP-6	Systematic
148	50	SP-7	Systematic
16	96	SP-8	Systematic
69	96	SP-9	Systematic
121	96	SP-10	Systematic
174	96	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AW108.			



OL 3-18 Area: Pentolite Ditch Adjacent Areas – AX-110 & AY-110 Measurement Locations and results			
X Coord	Y Coord	Label	Type
30	37	SP-1	Systematic
75	37	SP-2	Systematic
7	76	SP-3	Systematic
52	76	SP-4	Systematic
97	76	SP-5	Systematic
30	115	SP-6	Systematic
75	115	SP-7	Systematic
7	154	SP-8	Systematic
52	154	SP-9	Systematic
97	154	SP-10	Systematic
75	2' south of ditch edge	SP-11	Systematic

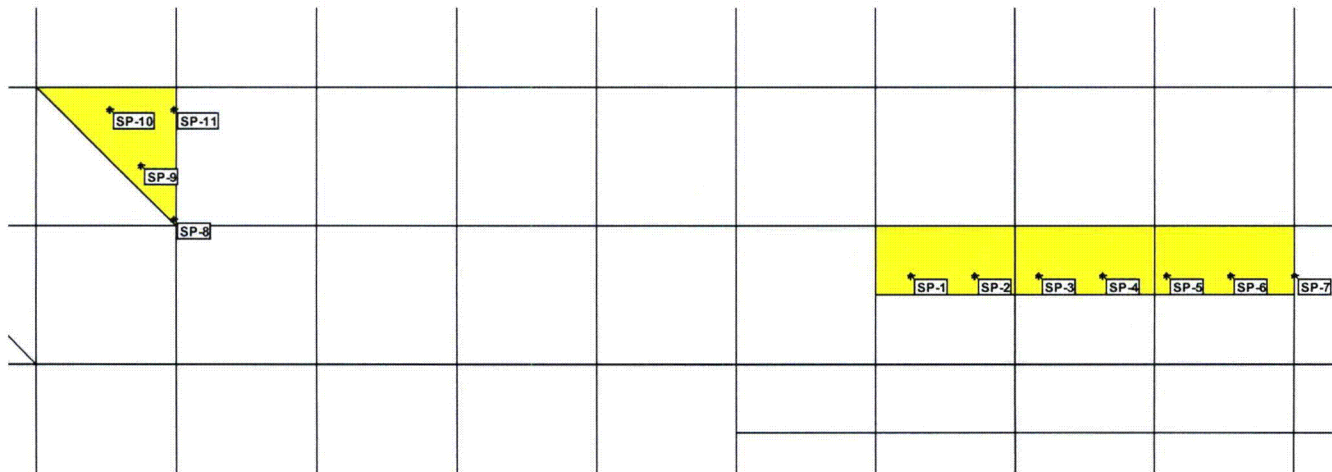
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AX 110.(SP 11 Y coordinate as listed).

Survey Unit OL-3-19



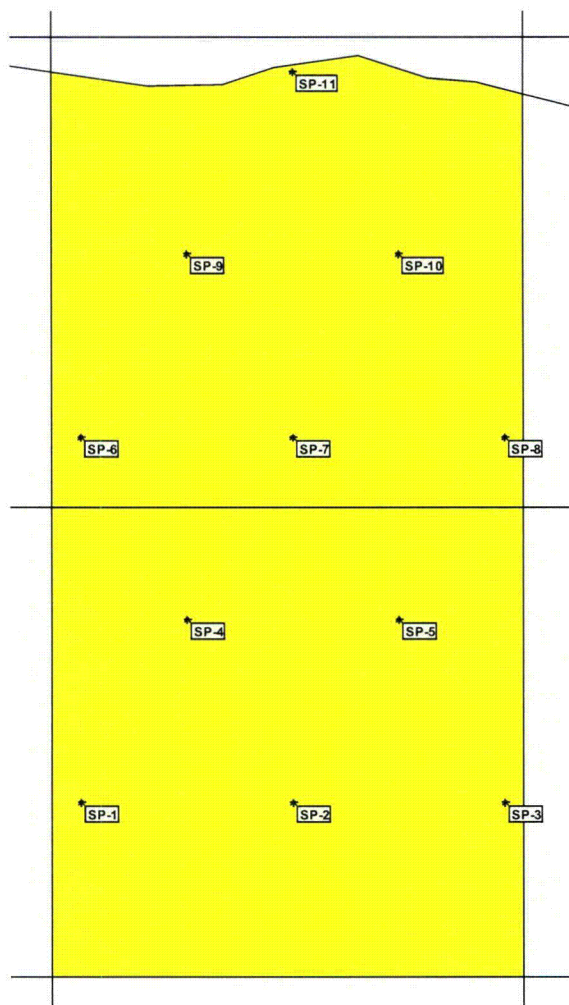
OL 3-19 Area: Pentolite Ditch Adjacent Areas – AW-110 & AW-111 Measurement Locations and results			
X Coord	Y Coord	Label	Type
8	2	SP-1	Systematic
63	2	SP-2	Systematic
119	2	SP-3	Systematic
174	2	SP-4	Systematic
36	50	SP-5	Systematic
91	50	SP-6	Systematic
146	50	SP-7	Systematic
8	98	SP-8	Systematic
63	98	SP-9	Systematic
119	98	SP-10	Systematic
174	98	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AW 110.			

Survey Unit OL-3-20



OL 3-20 Area: Pentolite Ditch Adjacent Areas – AV-109 –AV-111 North & AW-103 NE Measurement Locations and results			
X Coord	Y Coord	Label	Type
35' east of grid pin AW 109	36'south of grid pin AW 109	SP-1	Systematic
79' east of grid pin AW 109	36'south of grid pin AW 109	SP-2	Systematic
123' east of grid pin AW 109	36'south of grid pin AW 109	SP-3	Systematic
167' east of grid pin AW 109	36'south of grid pin AW 109	SP-4	Systematic
211' east of grid pin AW 109	36'south of grid pin AW 109	SP-5	Systematic
255' east of grid pin AW 109	36'south of grid pin AW 109	SP-6	Systematic
299' east of grid pin AW 109	36'south of grid pin AW 109	SP-7	Systematic
2' west of grid pin AX 104	96' south of grid pin AX 104	SP-8	Systematic
25' west of grid pin AX 104	55' south of grid pin AX 104	SP-9	Systematic
48' west of grid pin AX 104	18' south of grid pin AX 104	SP-10	Systematic
2' west of grid pin AX 104	18' south of grid pin AX 104	SP-11	Systematic
^a The X, Y coordinates for samples SP-1 thru SP-7 are from grid pin AW 109.			
^b The X, Y coordinates for samples SP-8 thru SP-11 are from grid pin AX 104.			

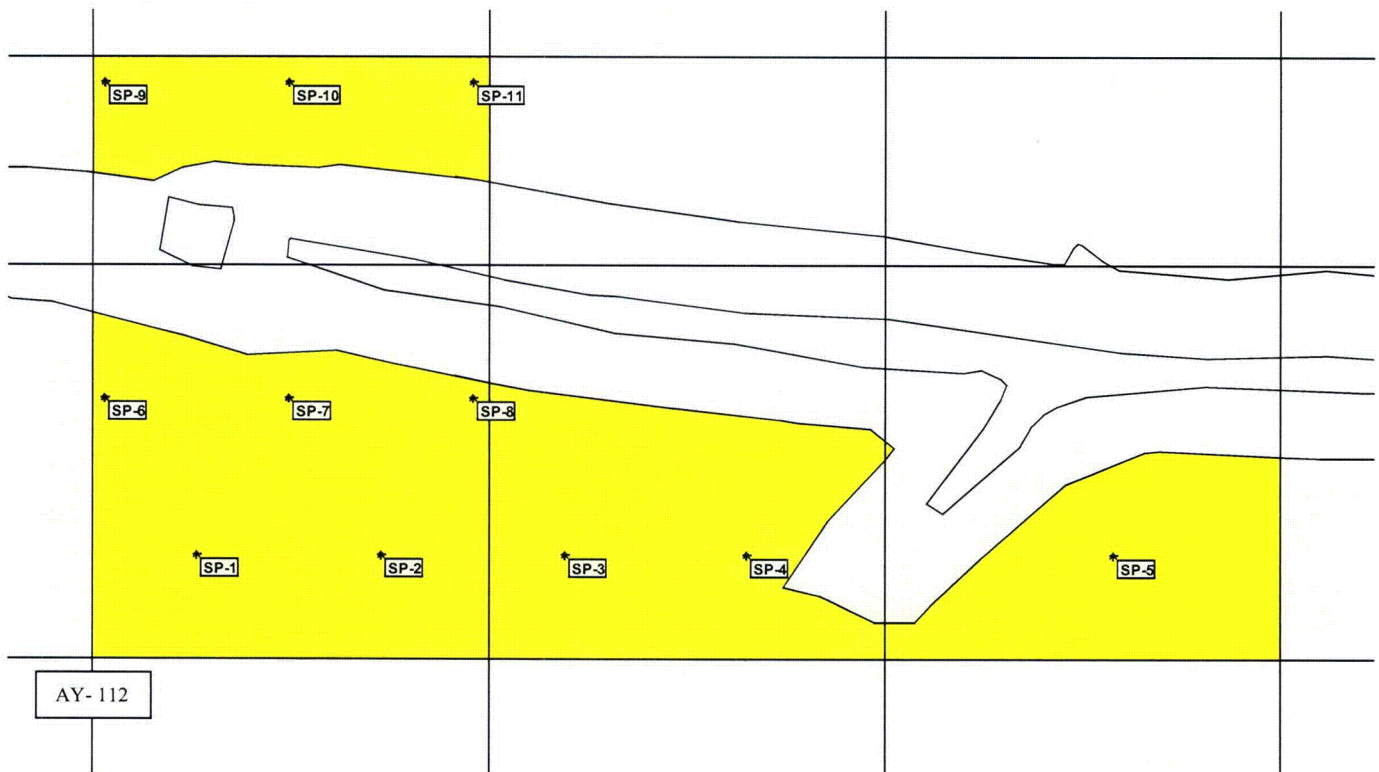
Survey Unit OL-3-21



OL 3-21 Area: Pentolite Ditch Adjacent Areas – AX-111 & AY-111 Measurement Locations and results			
X Coord	Y Coord	Label	Type
6	37	SP-1	Systematic
51	37	SP-2	Systematic
96	37	SP-3	Systematic
29	76	SP-4	Systematic
74	76	SP-5	Systematic
6	115	SP-6	Systematic
51	115	SP-7	Systematic
96	115	SP-8	Systematic
29	154	SP-9	Systematic
74	154	SP-10	Systematic
51	2' south of ditch edge	SP-11	Systematic

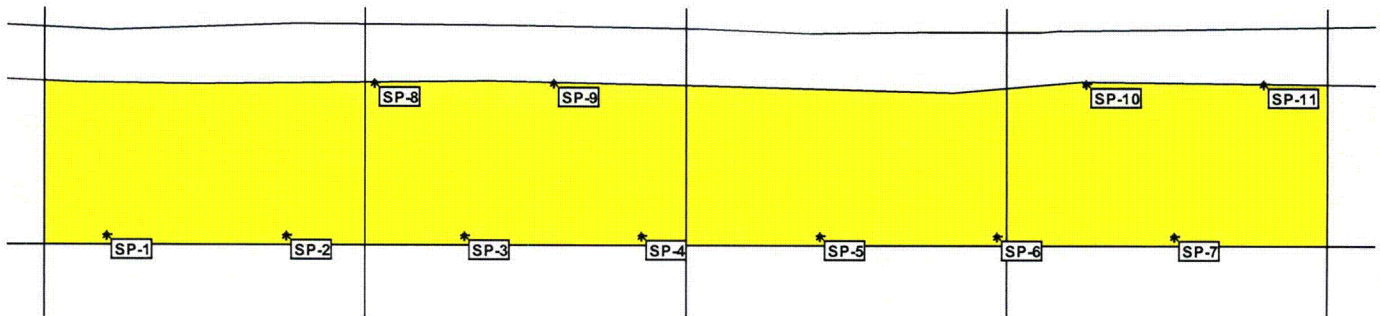
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AY 111 or as directed.

Survey Unit OL-3-22



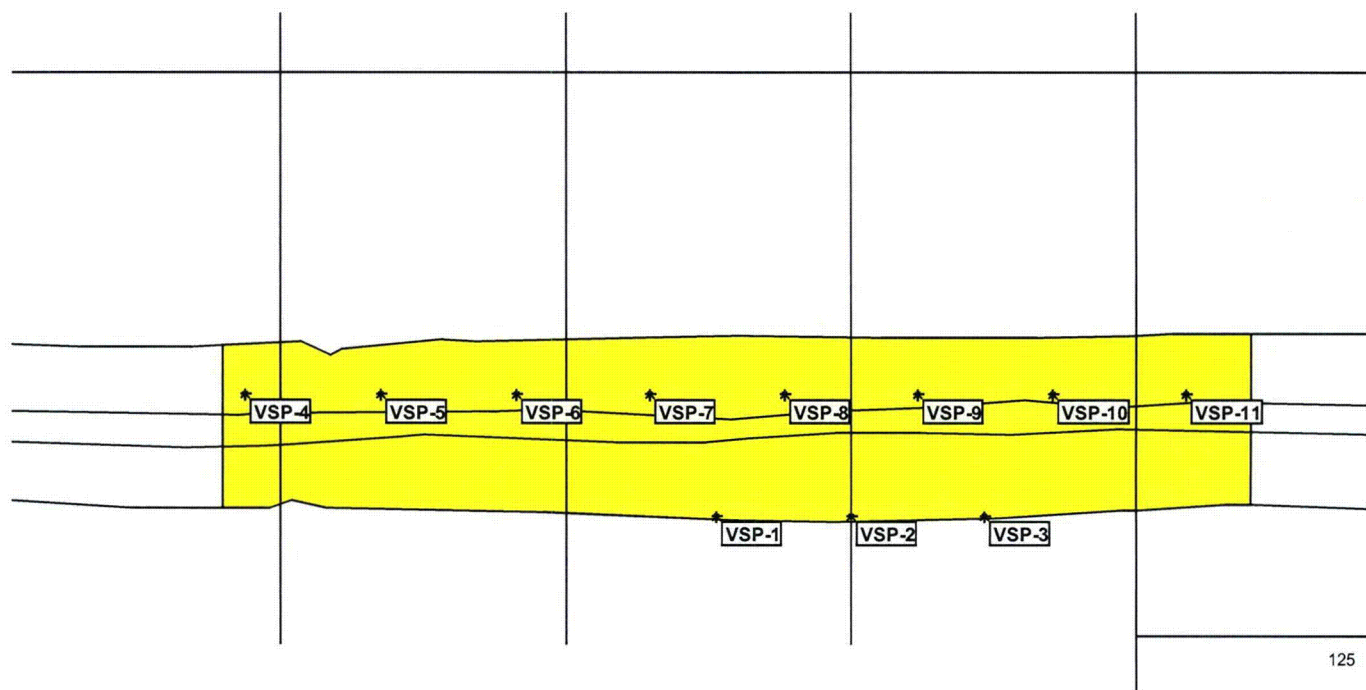
OL 3-22 Area: Pentolite Ditch Adjacent Areas – AY-112, AY-113, AY-114 Measurement Locations and results			
X Coord	Y Coord	Label	Type
26	26	SP-1	Systematic
72	26	SP-2	Systematic
118	26	SP-3	Systematic
164	26	SP-4	Systematic
257	26	SP-5	Systematic
3	66	SP-6	Systematic
49	66	SP-7	Systematic
95	5' south of ditch edge	SP-8	Systematic
3	146	SP-9	Systematic
49	146	SP-10	Systematic
95	146	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AY 112 or as directed.			

Survey Unit OL-3-23



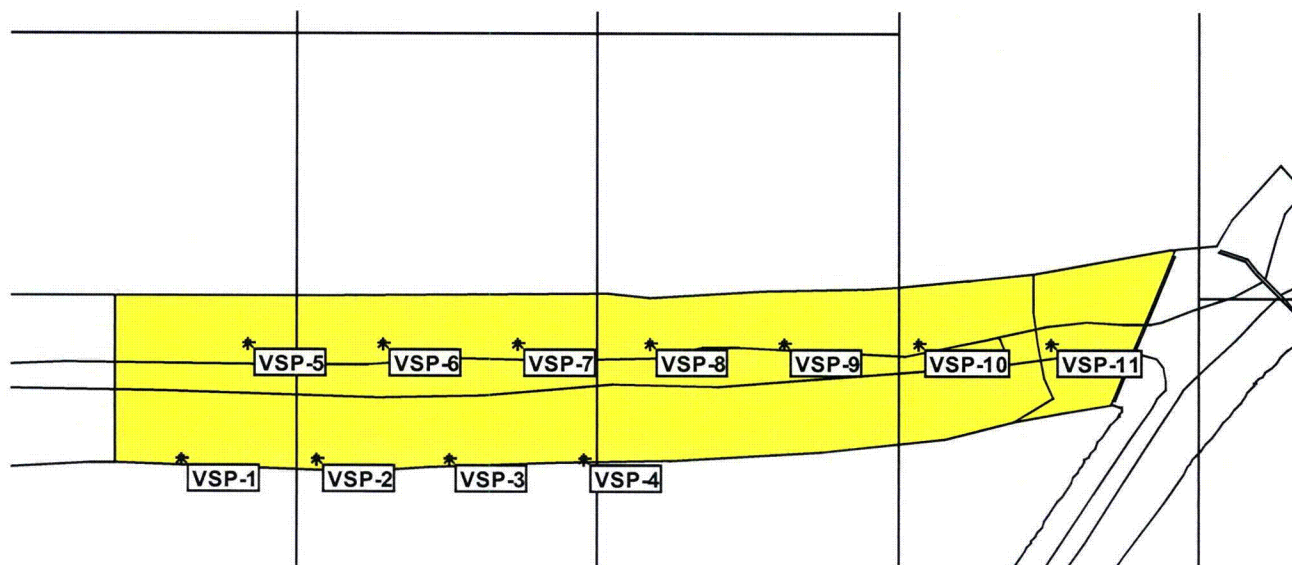
OL 3-23 Area: Pentolite Ditch Adjacent Areas – AY-115 through AY-118 Measurement Locations and results			
X Coord	Y Coord	Label	Type
20	3	SP-1	Systematic
75	3	SP-2	Systematic
130	3	SP-3	Systematic
185	3	SP-4	Systematic
240	3	SP-5	Systematic
295	3	SP-6	Systematic
350	3	SP-7	Systematic
103	1' south of ditch edge	SP-8	Systematic
158	2' south of ditch edge	SP-9	Systematic
323	2' south of ditch edge	SP-10	Systematic
378	2' south of ditch edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AY 115 or as directed.			

Survey Unit OL-3-24



OL 3-24 Area: Pentolite Ditch from 120.8 to 124.4 Measurement Locations and results			
X Coord	Y Coord	Label	Type
173.3048	1' from south edge of ditch	SP-1	Systematic
220.3414	2' from south edge of ditch	SP-2	Systematic
267.3779	1' from south edge of ditch	SP-3	Systematic
8.6770	16' from north edge of ditch	SP-4	Systematic
55.7135	16' from north edge of ditch	SP-5	Systematic
102.7500	17' from north edge of ditch	SP-6	Systematic
149.7866	17' from north edge of ditch	SP-7	Systematic
196.8231	18' from north edge of ditch	SP-8	Systematic
243.8596	17' from north edge of ditch	SP-9	Systematic
290.8962	17' from north edge of ditch	SP-10	Systematic
337.9327	18' from north edge of ditch	SP-11	Systematic
The X coordinate for samples SP-1 thru SP-11 are from the center of the ditch excavation on the grid 120.7 line			

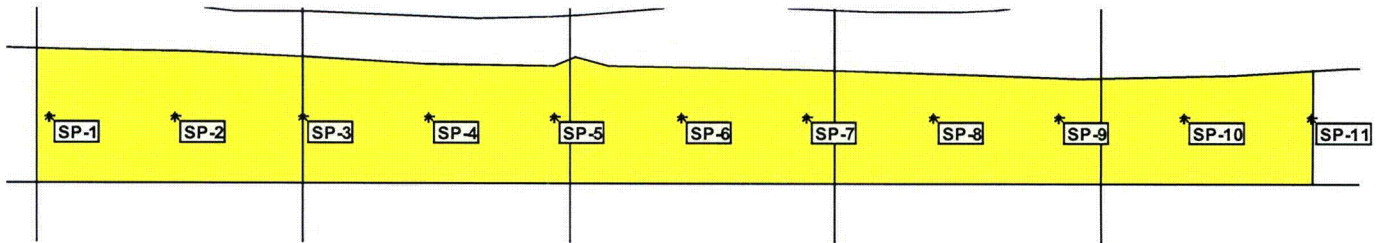
Survey Unit OL-3-25



125

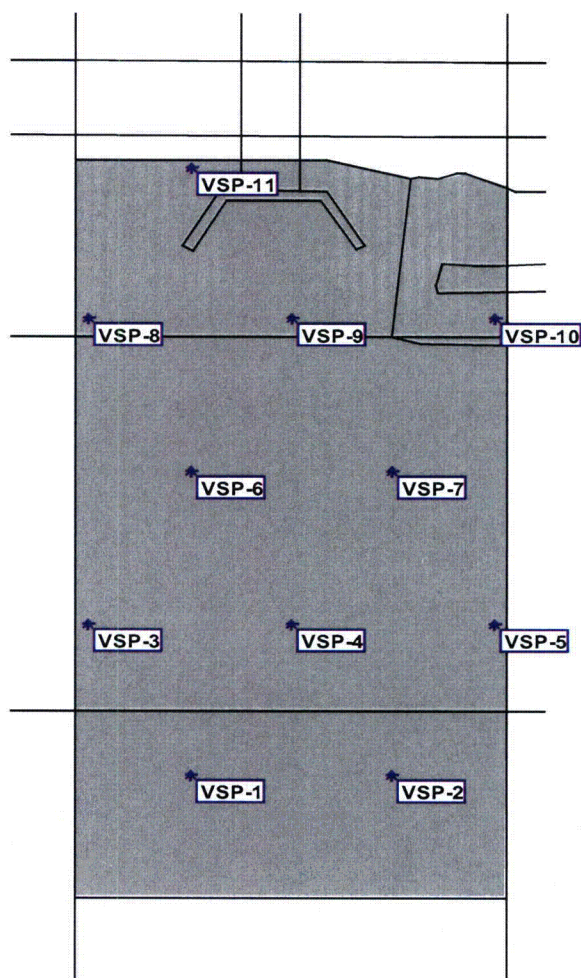
OL 3-25			
Area: Pentolite Ditch from 124.4 to piling wall			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
22	1' from south edge of ditch	VSP-1	Systematic
67	4' from south edge of ditch	VSP-2	Systematic
111	2' from south edge of ditch	VSP-3	Systematic
156	1' from south edge of ditch	VSP-4	Systematic
45	16' from north edge of ditch	VSP-5	Systematic
89	16' from north edge of ditch	VSP-6	Systematic
134	17' from north edge of ditch	VSP-7	Systematic
178	15' from north edge of ditch	VSP-8	Systematic
223	18' from north edge of ditch	VSP-9	Systematic
267	21' from north edge of ditch	VSP-10	Systematic
312	29' from north edge of ditch	VSP-11	Systematic
The X coordinate for samples SP-1 thru SP-11 are from the center of the ditch excavation on the grid 124.4 line.			

Survey Unit OL-3-26



OL 3-26			
Area: Pentolite Ditch Adjacent Areas – AY-119 through AY-123.8			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
5	25	SP-1	Systematic
52	25	SP-2	Systematic
99	25	SP-3	Systematic
146	25	SP-4	Systematic
193	25	SP-5	Systematic
240	25	SP-6	Systematic
287	25	SP-7	Systematic
334	25	SP-8	Systematic
381	25	SP-9	Systematic
428	25	SP-10	Systematic
475	25	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AY 119.			

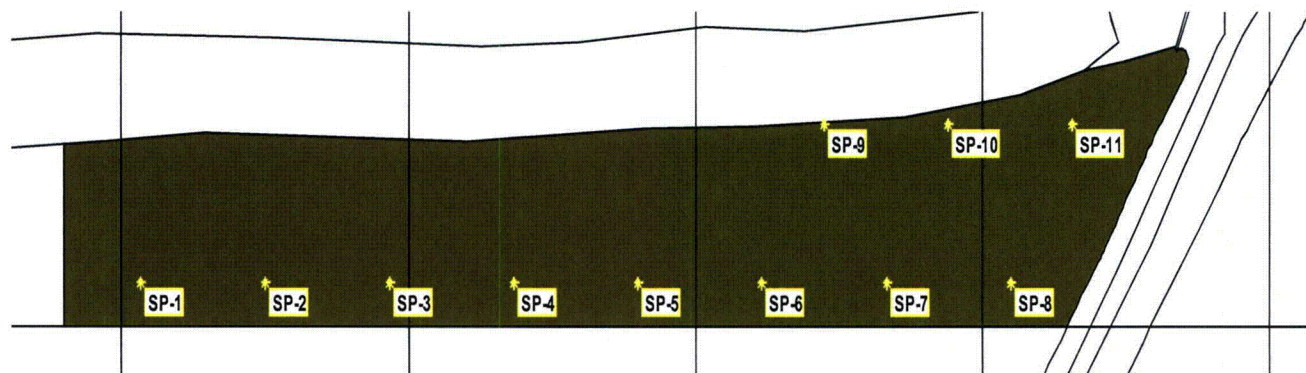
Survey Unit OL-3-27



OL 3-27 Area: Pentolite Ditch from 100 to 101, AY-100, AX-100 North Measurement Locations and results			
X Coord	Y Coord	Label	Type
27	-118	VSP-1	Systematic
74	-118	VSP-2	Systematic
4	-77	VSP-3	Systematic
51	-77	VSP-4	Systematic
98	-77	VSP-5	Systematic
27	-36	VSP-6	Systematic
74	-36	VSP-7	Systematic
4	5	VSP-8	Systematic
51	5	VSP-9	Systematic
98	5	VSP-10	Systematic
27	45	VSP-11	Systematic

*The X, Y coordinates for samples SP-1 thru SP-11 are from pin AZ100.

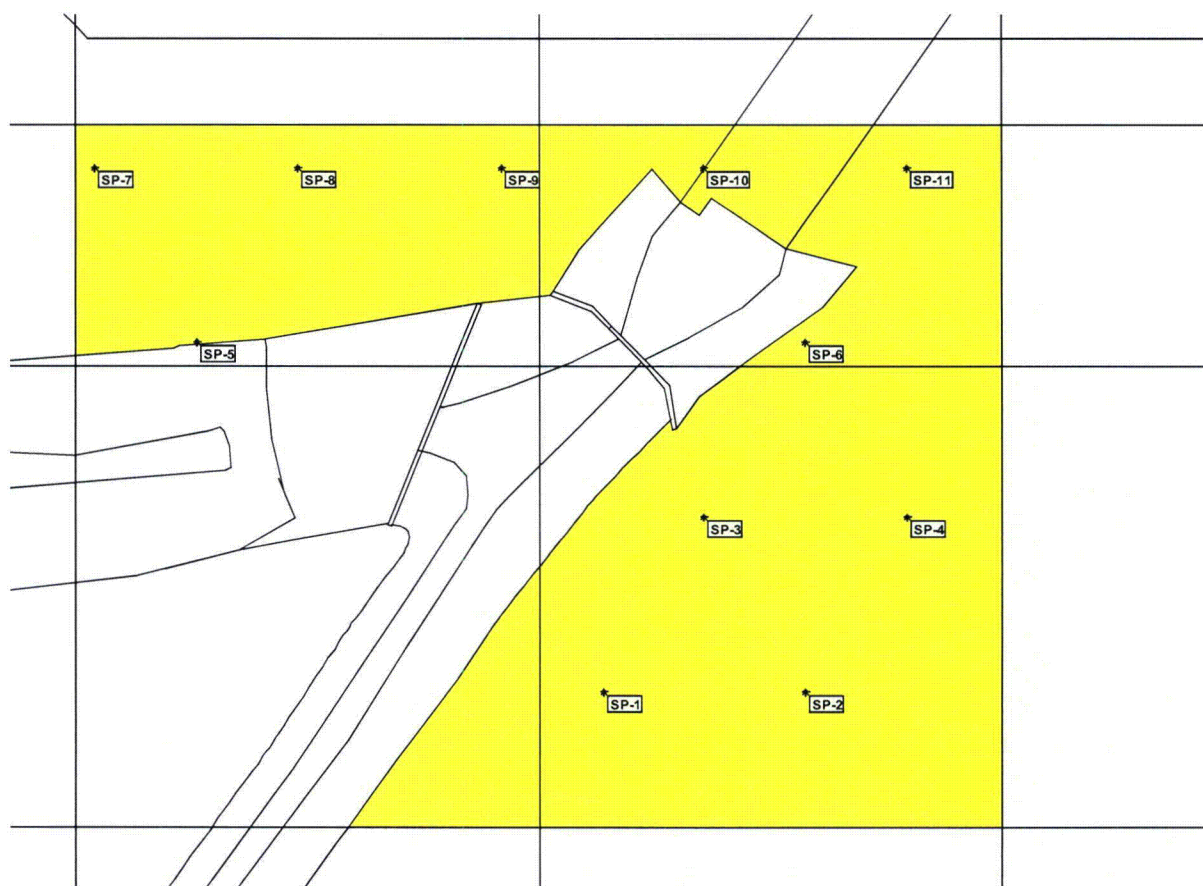
Survey Unit OL-3-28



OL 3-28			
Area: Pentolite Ditch Adjacent Areas – AY-123.8 through AY-127			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
7	10	SP-1	Systematic
50	10	SP-2	Systematic
93	10	SP-3	Systematic
137	10	SP-4	Systematic
180	10	SP-5	Systematic
223	10	SP-6	Systematic
266	10	SP-7	Systematic
309	10	SP-8	Systematic
245	1' south of ditch edge	SP-9	Systematic
288	5' south of ditch edge	SP-10	Systematic
331	12' south of ditch edge	SP-11	Systematic

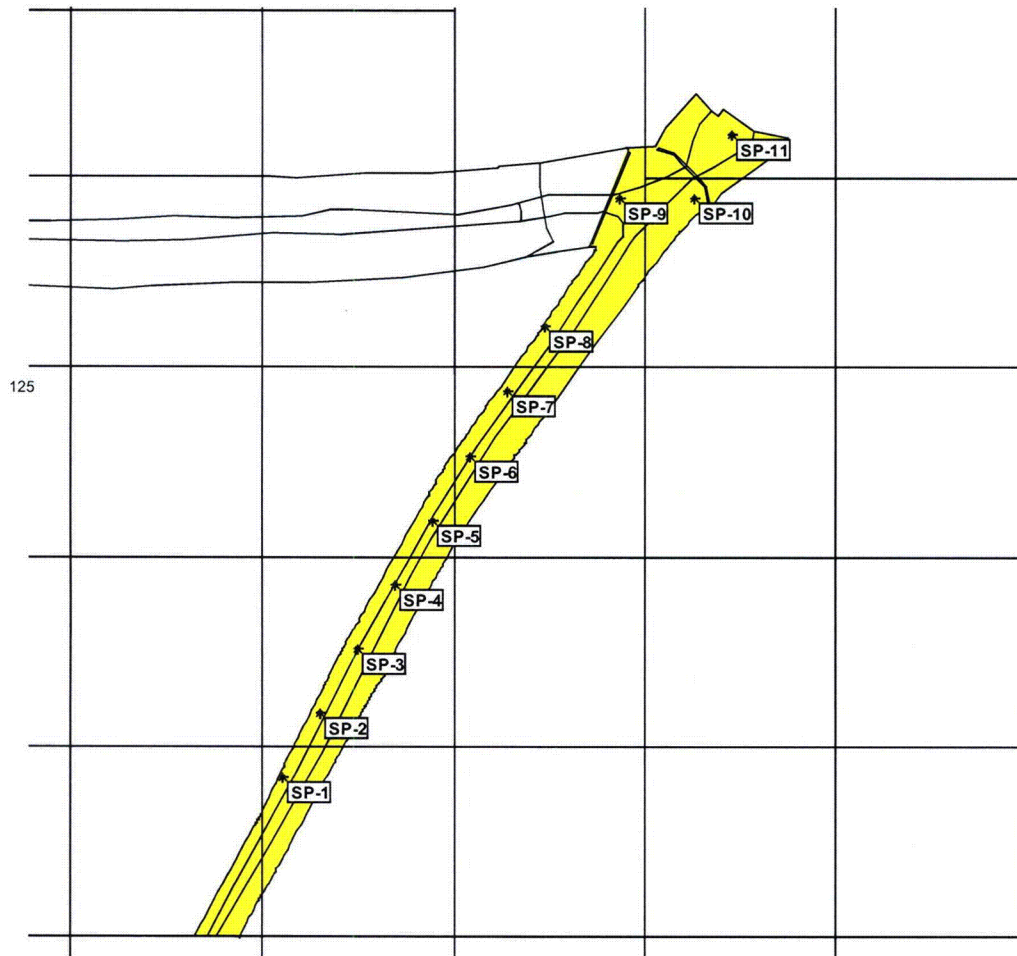
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AY-124 or as directed.

Survey Unit OL-3-29



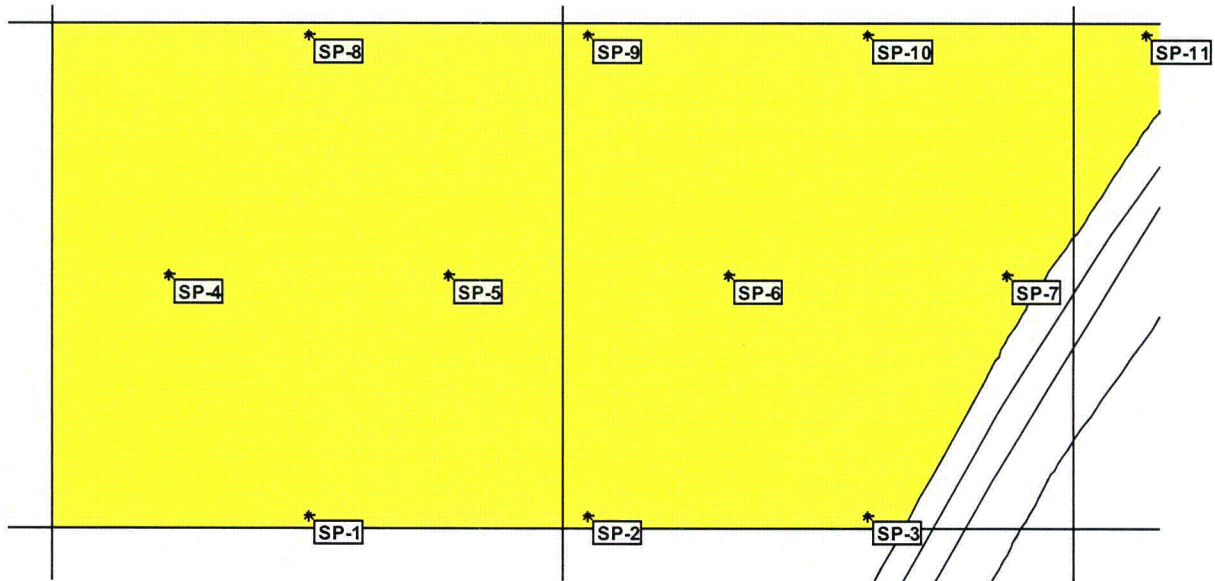
OL 3-29			
Area: Pentolite Ditch Adjacent Areas – AX-127, AX-128, AY-128			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
-86	29	SP-1	Systematic
-42	29	SP-2	Systematic
-64	67	SP-3	Systematic
-20	67	SP-4	Systematic
-174	1' north of ditch edge	SP-5	Systematic
-42	105	SP-6	Systematic
-196	143	SP-7	Systematic
-152	143	SP-8	Systematic
-108	143	SP-9	Systematic
-64	143	SP-10	Systematic
-20	143	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AY-129 or as directed.			

Survey Unit OL-3-30



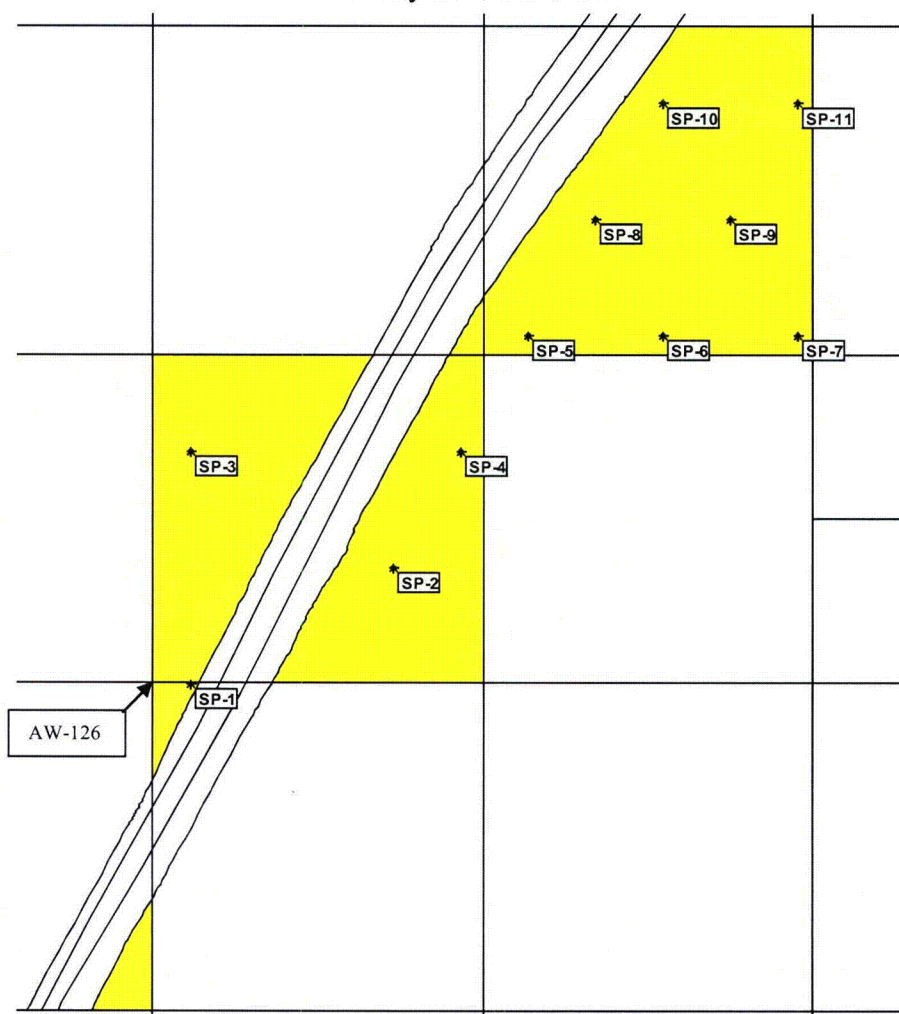
OL 3-30			
Area: Plumbrook from AV line to Pentolite Road culverts			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
2' from west edge of brook	81.7829	SP-1	Systematic
6' from west edge of brook	115.7582	SP-2	Systematic
8' from west edge of brook	149.7335	SP-3	Systematic
8' from west edge of brook	183.7088	SP-4	Systematic
8' from west edge of brook	217.6841	SP-5	Systematic
9' from west edge of brook	251.6595	SP-6	Systematic
5' from west edge of brook	285.6348	SP-7	Systematic
1' from west edge of brook	319.6101	SP-8	Systematic
3' from steel dam wall	387.5607	SP-9	Systematic
43' from steel dam wall	387.5607	SP-10	Systematic
33' from west edge of brook	421.5360	SP-11	Systematic
The Y coordinate for samples SP-1 thru SP-11 are from the center of the Plum Brook on the south boundary of the survey unit			

Survey Unit OL-3-31



OL 3-31			
Area: Pentolite Ditch Adjacent Areas – AX-125, 126, 127 west of Plumbrook			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
50	3	SP-1	Systematic
105	3	SP-2	Systematic
160	3	SP-3	Systematic
23	50	SP-4	Systematic
78	50	SP-5	Systematic
133	50	SP-6	Systematic
188	50	SP-7	Systematic
50	98	SP-8	Systematic
105	98	SP-9	Systematic
160	98	SP-10	Systematic
215	98	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AX 125 or as directed.			

Survey Unit OL-3-32



OL 3-32

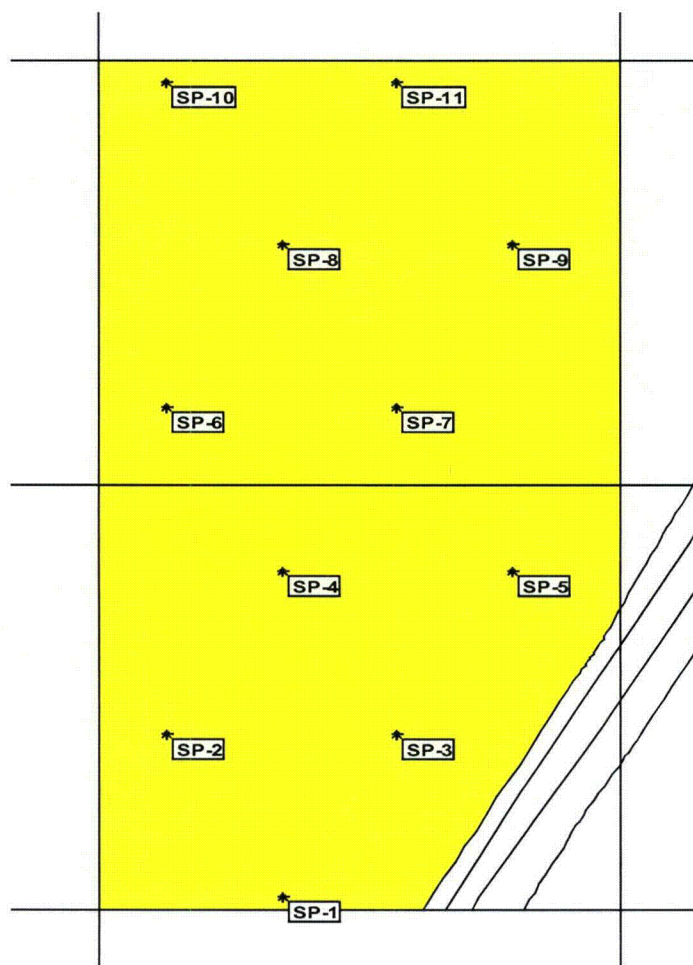
Area: Pentolite Ditch Adjacent Areas – AW-126, AV-126 west of PB ; AV-125, AW-125, AX-126, AX-127 east of PB

Measurement Locations and results

X Coord	Y Coord	Label	Type
12	-1	SP-1	Systematic
73	35	SP-2	Systematic
12	70	SP-3	Systematic
93	70	SP-4	Systematic
114	105	SP-5	Systematic
155	105	SP-6	Systematic
196	105	SP-7	Systematic
134	141	SP-8	Systematic
175	141	SP-9	Systematic
155	176	SP-10	Systematic
196	176	SP-11	Systematic

The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AW-126 or as directed.

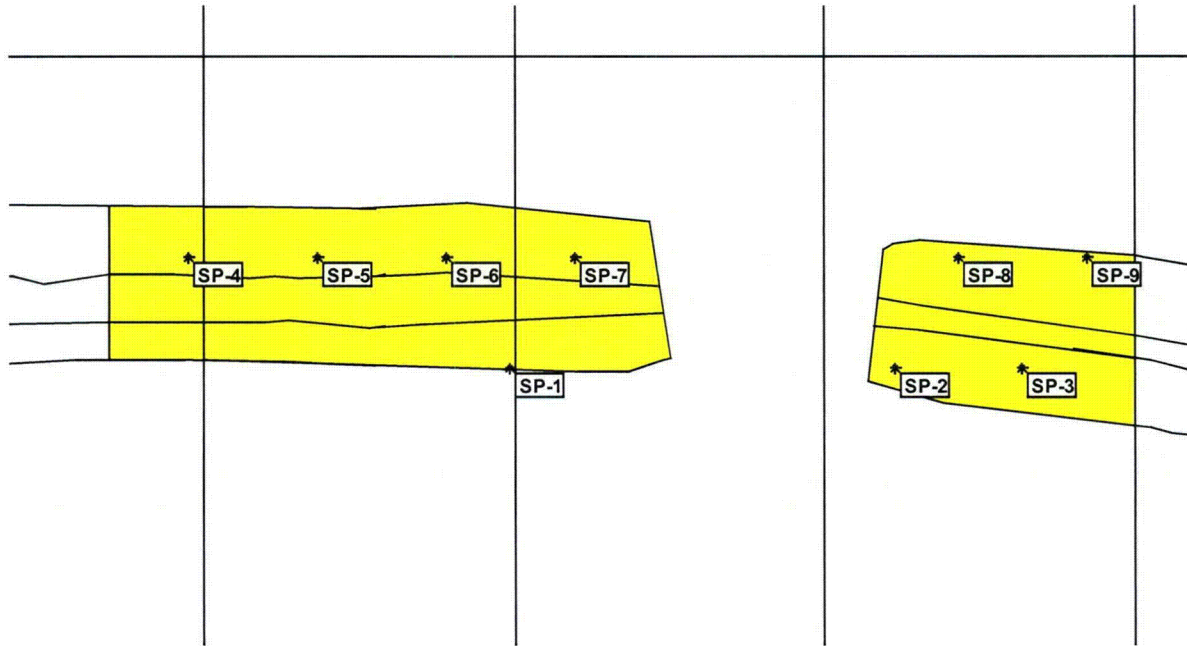
Survey Unit OL-3-33



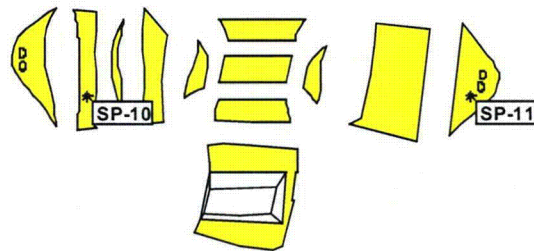
OL 3-33 Area: Pentolite Ditch Adjacent Areas – AW-125, AV-125 west of PB Measurement Locations and results			
X Coord	Y Coord	Label	Type
35	3	SP-1	Systematic
13	41	SP-2	Systematic
57	41	SP-3	Systematic
35	80	SP-4	Systematic
80	80	SP-5	Systematic
13	118	SP-6	Systematic
57	118	SP-7	Systematic
35	156	SP-8	Systematic
80	156	SP-9	Systematic
13	195	SP-10	Systematic
57	195	SP-11	Systematic

The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AV-125 or as directed.

Survey Unit OL-3-34



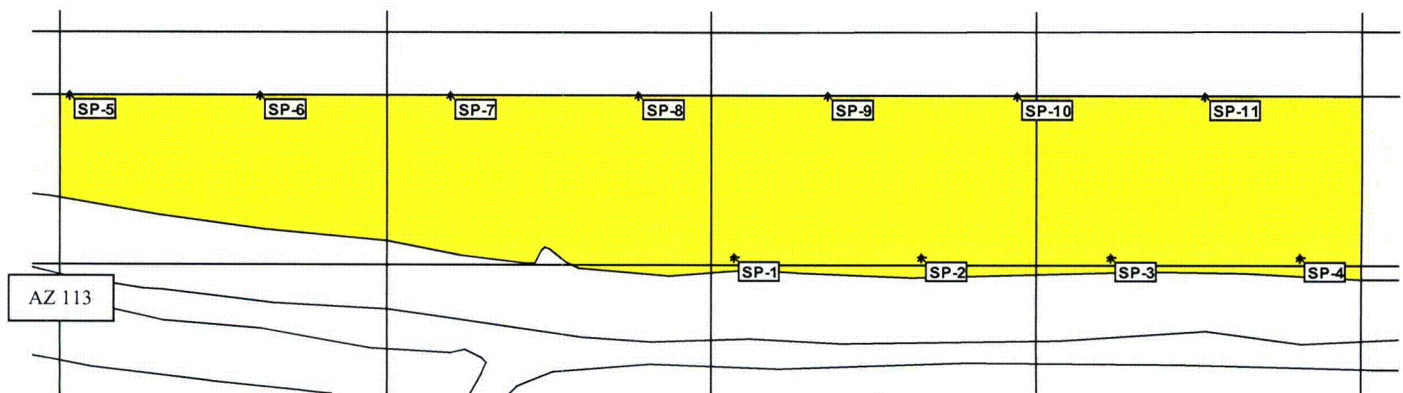
110



OL 3-34 Area: Pentolite Ditch from 109.7 to 113 Measurement Locations and results			
X Coord	Y Coord	Label	Type
129	1' from south edge of ditch	SP-1	Systematic
253	5' from south edge of ditch	SP-2	Systematic
294	12' from south edge of ditch	SP-3	Systematic
26	32	SP-4	Systematic
67	32	SP-5	Systematic
108	32	SP-6	Systematic
149	32	SP-7	Systematic
273	5' from north edge of ditch	SP-8	Systematic
314	2' from south edge of ditch	SP-9	Systematic
1' from edge above culverts	10' from south edge of ditch	SP-10	Systematic
2' above culverts	8' from south edge of ditch	SP-11	Systematic

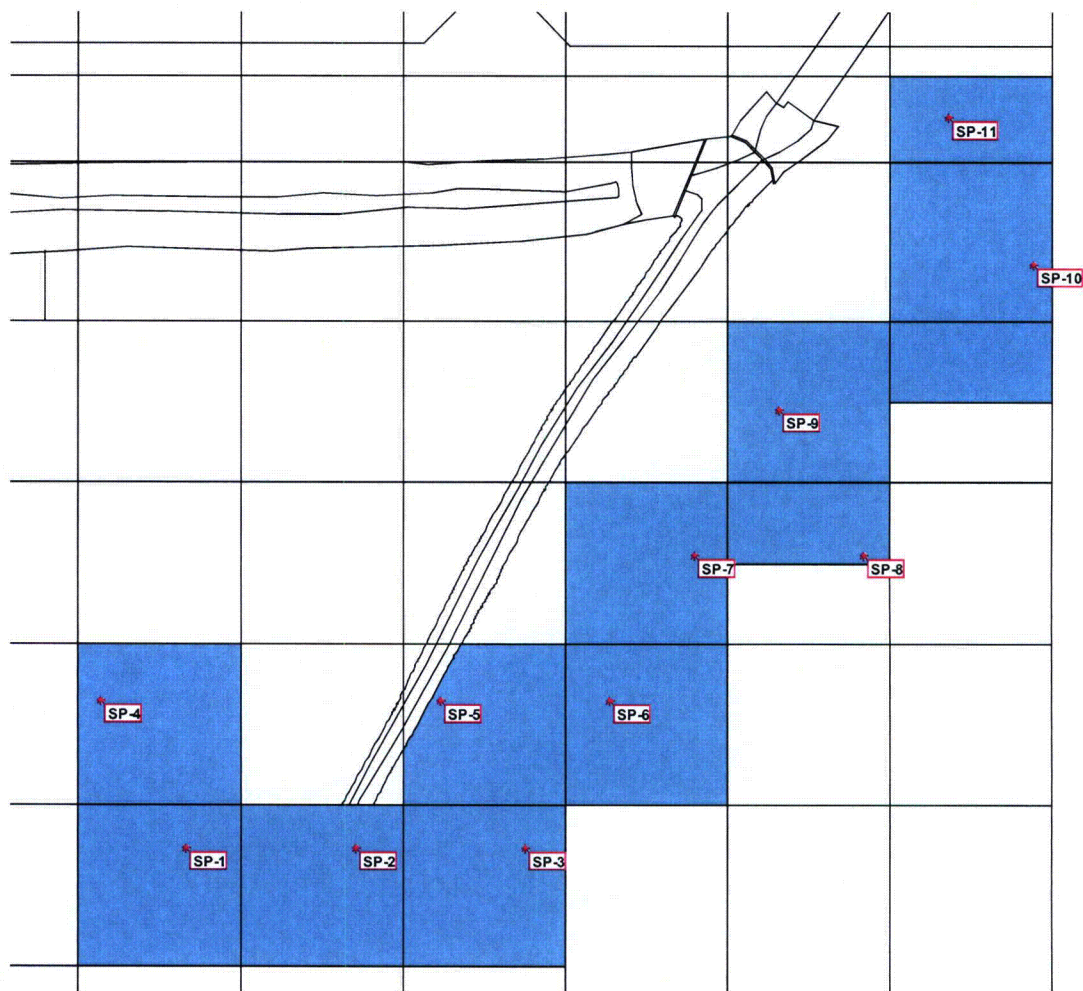
^a The X coordinate for samples SP-1 thru SP-9 are from the southeast corner of survey unit at top of ditch.
^b The Y coordinate for samples SP-4 thru SP-7 are from the southeast corner of survey unit at top of ditch.

Survey Unit OL-3-35



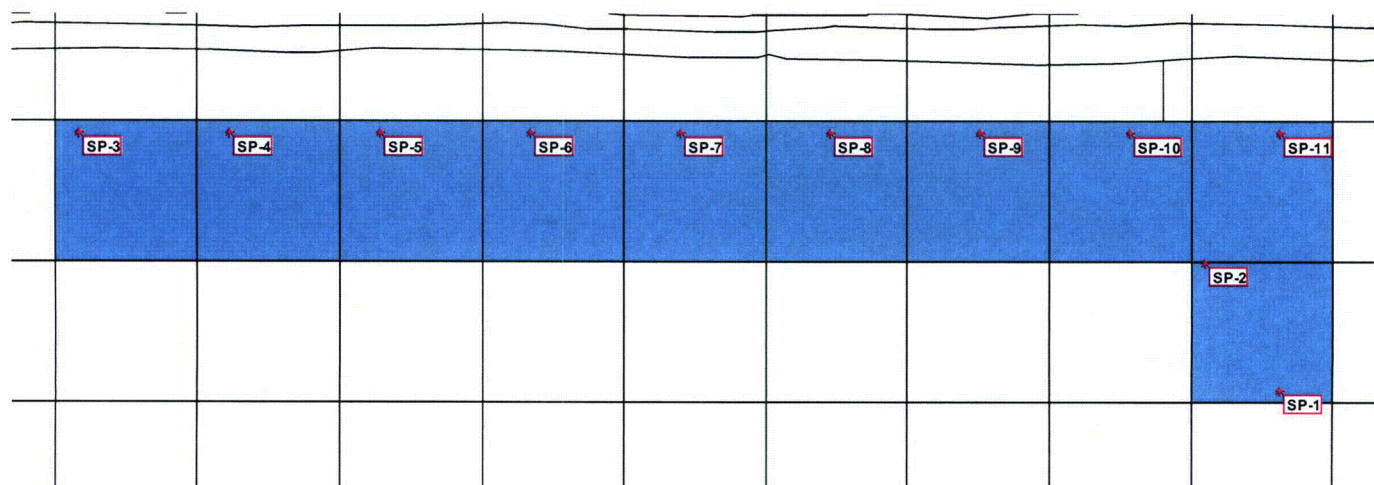
OL 3-35			
Area: Pentolite Ditch Adjacent Areas – North of Ditch to Pentolite Road from 113 line to 117 line			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
207	2	SP-1	Systematic
265	2	SP-2	Systematic
323	2	SP-3	Systematic
381	2	SP-4	Systematic
3	53	SP-5	Systematic
61	53	SP-6	Systematic
119	53	SP-7	Systematic
177	53	SP-8	Systematic
235	53	SP-9	Systematic
293	53	SP-10	Systematic
351	53	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AZ-133 or as directed.			

Survey Unit OL-3-36



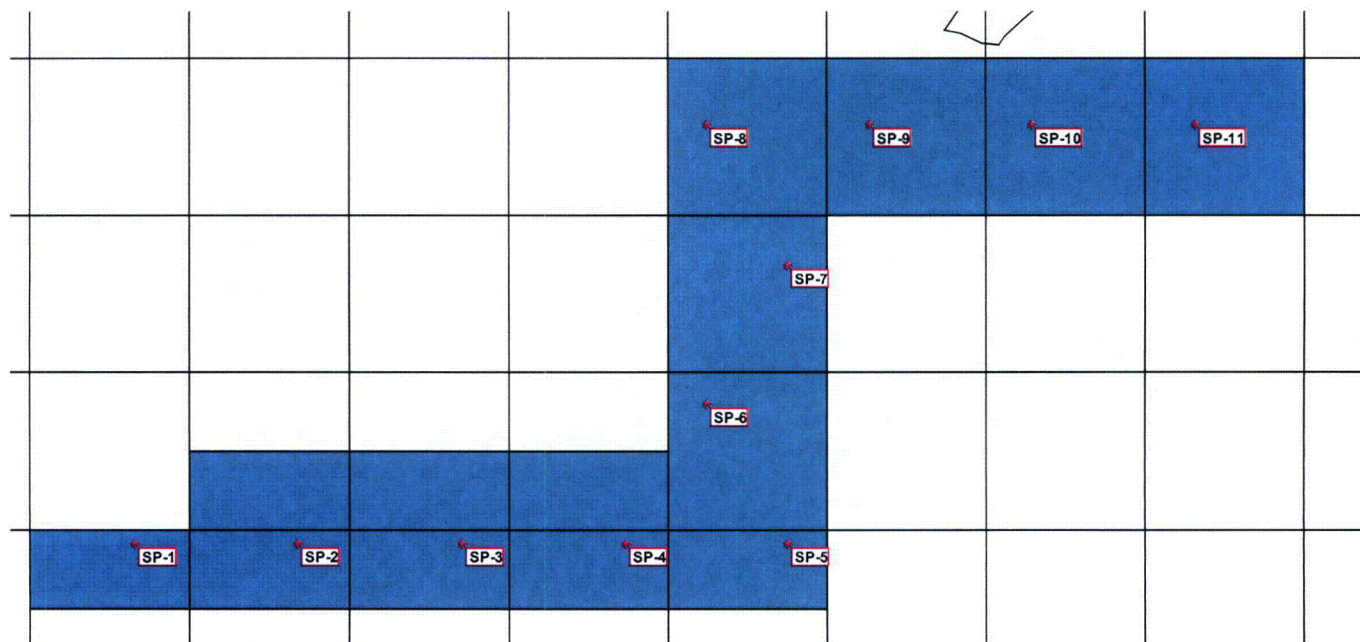
OL 3-36			
Area: AU-124/125/ 126, AV-124/126/127, AW-127/128N, AX-128/129N, AY-129, AZ-129 South of Pentolite Road			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
67	74	SP-1	Systematic
172	74	SP-2	Systematic
276	74	SP-3	Systematic
15	164	SP-4	Systematic
224	164	SP-5	Systematic
329	164	SP-6	Systematic
381	255	SP-7	Systematic
485	255	SP-8	Systematic
433	345	SP-9	Systematic
590	436	SP-10	Systematic
538	526	SP-11	Systematic
The X,Y coordinates for samples SP-1 thru SP-11 are from grid pin #AU 124			

Survey Unit OL-3-37



OL 3-37			
Area: AX-116 to 124, AW-124			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
863	-92	SP-1	Systematic
810	-0.5	SP-2	Systematic
18	91	SP-3	Systematic
123	91	SP-4	Systematic
229	91	SP-5	Systematic
335	91	SP-6	Systematic
441	91	SP-7	Systematic
547	91	SP-8	Systematic
653	91	SP-9	Systematic
759	91	SP-10	Systematic
865	91	SP-11	Systematic
The X,Y coordinates for samples SP-1 thru SP-11 are from grid pin #AX 116.			

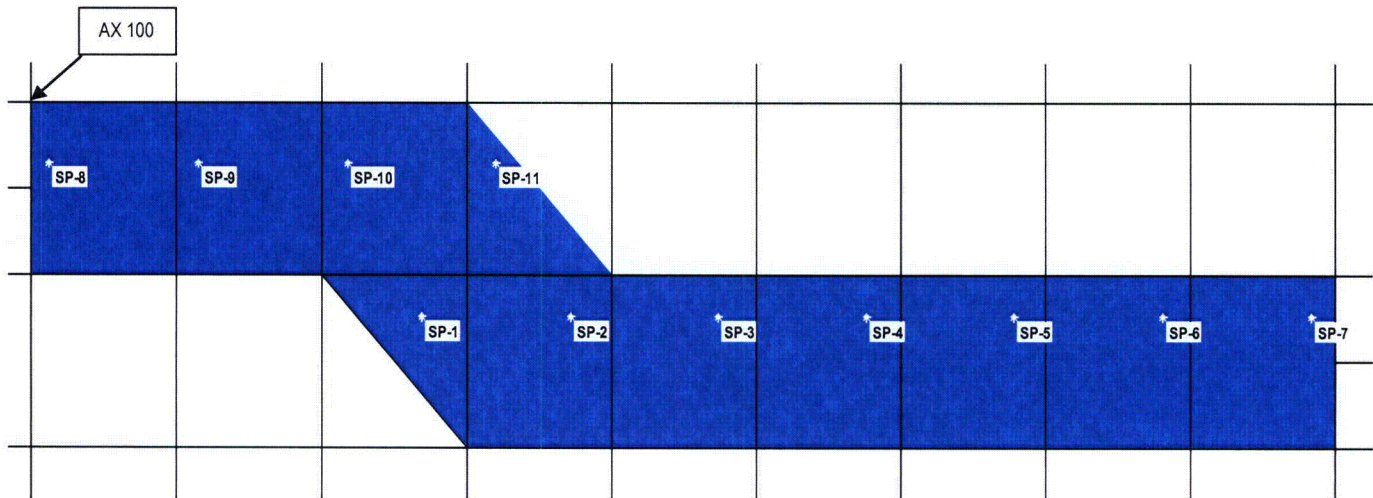
Survey Unit OL-3-38



OL 3-38			
Area: AU-108N to 112N, AV-109S to 111S, AV-112, AW-112, AX-112 to 115			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
60	-18	SP-1	Systematic
162	-18	SP-2	Systematic
265	-18	SP-3	Systematic
367	-18	SP-4	Systematic
470	-18	SP-5	Systematic
419	70	SP-6	Systematic
470	159	SP-7	Systematic
419	248	SP-8	Systematic
521	248	SP-9	Systematic
623	248	SP-10	Systematic
726	248	SP-11	Systematic

The X,Y coordinates for samples SP-1 thru SP-11 are from grid pin #AV 108.

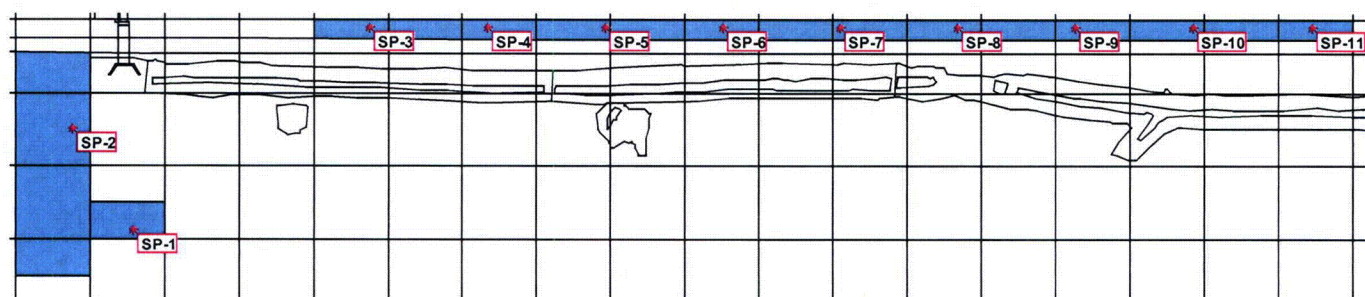
Survey Unit OL-3-39



OL 3-39			
Area: AW-100 to 102, AW-103SW, AV-102NE, AV-103-108			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
269	-125	SP-1	Systematic
371	-125	SP-2	Systematic
474	-125	SP-3	Systematic
576	-125	SP-4	Systematic
679	-125	SP-5	Systematic
781	-125	SP-6	Systematic
884	-125	SP-7	Systematic
13	-36	SP-8	Systematic
115	-36	SP-9	Systematic
218	-36	SP-10	Systematic
320	-36	SP-11	Systematic

The X,Y coordinates for samples SP-1 thru SP-11 are from grid pin #AX 100

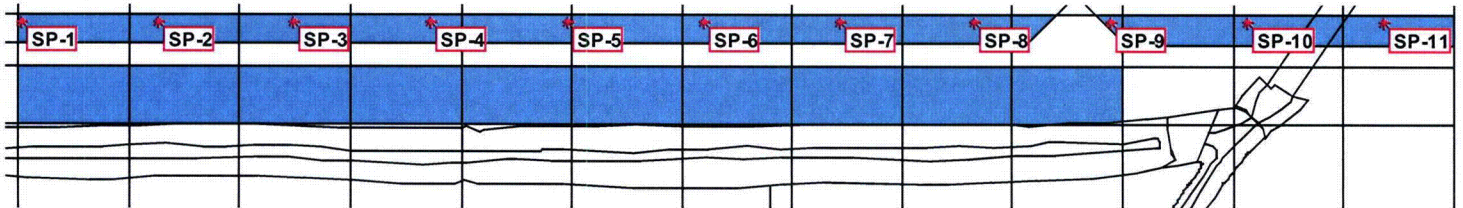
Survey Unit OL-3-40



OL 3-40			
Area: AW-99N, AX-99, AX-100N, AY-99, AZ-99 South of Pentolite Road, AZ-103 to 116 North of Pentolite Road			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
159	13	SP-1	Systematic
80	150	SP-2	Systematic
77	-12	SP-3	Systematic
236	-12	SP-4	Systematic
394	-12	SP-5	Systematic
554	-12	SP-6	Systematic
712	-12	SP-7	Systematic
871	-12	SP-8	Systematic
1029	-12	SP-9	Systematic
1188	-12	SP-10	Systematic
1347	-12	SP-11	Systematic

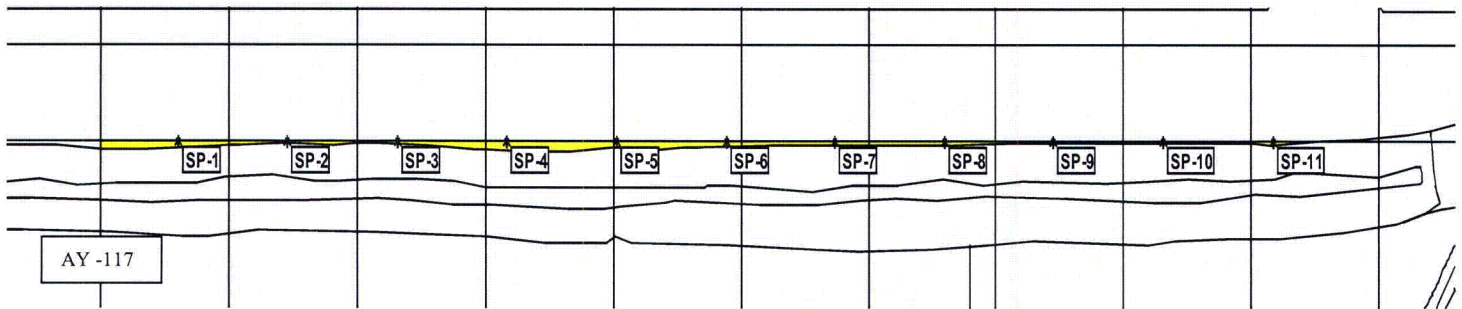
The X,Y coordinates for samples SP-1 & SP-2 are from grid pin #AX 99.
The X,Y coordinates for samples SP-3 thru SP-11 are from grid pin #BA 103.

Survey Unit OL-3-41



OL 3-41			
Area: AZ-117 to 126 North and South of Pentolite Road, AZ-127 to 129 North of Pentolite Road			
Measurement Locations and results			
X Coord	Y Coord	Label	Type
4	8	SP-1	Systematic
127	8	SP-2	Systematic
250	8	SP-3	Systematic
373	8	SP-4	Systematic
496	8	SP-5	Systematic
619	8	SP-6	Systematic
742	8	SP-7	Systematic
865	8	SP-8	Systematic
988	8	SP-9	Systematic
1111	8	SP-10	Systematic
1234	8	SP-11	Systematic
The X,Y coordinates for samples SP-1 thru SP-11 are from grid pin #BA117.			

Survey Unit OL-3-42



OL 3-42 Area: AY-117 to AY-126 North of Pentolite Ditch Measurement Locations and results			
X Coord	Y Coord	Label	Type
60	-1.0	SP-1	Systematic
146	-1.0	SP-2	Systematic
232	-1.0	SP-3	Systematic
318	-1.0	SP-4	Systematic
404	-1.0	SP-5	Systematic
490	-1.0	SP-6	Systematic
576	-1.0	SP-7	Systematic
662	-1.0	SP-8	Systematic
748	-1.0	SP-9	Systematic
834	-1.0	SP-10	Systematic
920	-1.0	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are from grid pin AZ-117 or as directed.			

Plum Brook Reactor Facility
Final Status Survey Report
Attachment 4

Pentolite Ditch
(Environmental Area A2300)

Revision 0

Appendix C

Soil Sample Results

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**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

Plum Brook Reactor Facility FSSR, Attachment 4
Appendix C, Rev. 0, Page 3 of 20

CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _{eff}	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-1 SP-1	PB09-03337	SR-180-1	350.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.14E-02	1.24E-01
OL-3-1 SP-2	PB09-03339	SR-180-3	379.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.85E-02	1.19E-01
OL-3-1 SP-3	PB09-03340	SR-180-4	320.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.91E-02	1.36E-01
OL-3-1 SP-4	PB09-03342	SR-180-5	369.5	2.20E-01	9.87E-02	<MDA	<MDA	0.0157	N/A		1.27E-01
OL-3-1 SP-5	PB09-03343	SR-180-6	399.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.16E-01	1.13E-01
OL-3-1 SP-6	PB09-03344	SR-180-7	430.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.62E-02	1.01E-01
OL-3-1 SP-7	PB09-03345	SR-180-8	382.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.83E-02	1.23E-01
OL-3-1 SP-8	PB09-03346	SR-180-9	388.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.34E-02	1.12E-01
OL-3-1 SP-9	PB09-03347	SR-180-10	337.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.90E-02	1.39E-01
OL-3-1 SP-10	PB09-03348	SR-180-11	403.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.03E-02	1.12E-01
OL-3-1 SP-11	PB09-03349	SR-180-12	350.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.13E-02	1.24E-01
OL-3-2 SP-1	PB09-04417	SR-180-100	328.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.69E-01	1.37E-01
OL-3-2 SP-2	PB09-04418	SR-180-101	398.2	7.62E+00	6.01E-01	<MDA	<MDA	0.5435	N/A		1.09E-01
OL-3-2 SP-3	PB09-04419	SR-180-102	345.8	2.12E-01	1.00E-01	<MDA	<MDA	0.0151	N/A		1.36E-01
OL-3-2 SP-4	PB09-04423	SR-180-104	438.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.20E-02	9.91E-02
OL-3-2 SP-5	PB09-04424	SR-180-105	420.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.14E-02	1.12E-01
OL-3-2 SP-6	PB09-04425	SR-180-106	368.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.70E-02	1.22E-01
OL-3-2 SP-7	PB09-04426	SR-180-107	422.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.00E-02	1.03E-01
OL-3-2 SP-8	PB09-04427	SR-180-108	384.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.80E-01	1.22E-01
OL-3-2 SP-9	PB09-04428	SR-180-109	392.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.29E-01	1.15E-01
OL-3-2 SP-10	PB09-04429	SR-180-110	395.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.21E-02	1.10E-01
OL-3-2 SP-11	PB09-04430	SR-180-111	361.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.31E-02	1.30E-01
OL-3-3 SP-1	PB09-04715	SR-180-196	351.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.11E-02	1.24E-01
OL-3-3 SP-2	PB09-04716	SR-180-197	323.6	2.77E-01	1.18E-01	<MDA	<MDA	0.0197	N/A		1.45E-01
OL-3-3 SP-3	PB09-04717	SR-180-198	321.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.05E-01	1.41E-01
OL-3-3 SP-4	PB09-04718	SR-180-199	388.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.34E-02	1.12E-01
OL-3-3 SP-5	PB09-04719	SR-180-200	380.2	2.03E-01	9.35E-02	<MDA	<MDA	0.0145	N/A		1.24E-01
OL-3-3 SP-6	PB09-04720	SR-180-201	371.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.64E-02	1.21E-01
OL-3-3 SP-7	PB09-04723	SR-180-203	401.5	1.83E-01	8.62E-02	<MDA	<MDA	0.0130	N/A		1.17E-01
OL-3-3 SP-8	PB09-04724	SR-180-204	334.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.48E-02	1.48E-01
OL-3-3 SP-9	PB09-04725	SR-180-205	359.8	5.06E-01	1.48E-01	<MDA	<MDA	0.0361	N/A		1.21E-01
OL-3-3 SP-10	PB09-04726	SR-180-206	315.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.50E-02	1.49E-01
OL-3-3 SP-11	PB09-04727	SR-180-207	389.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.28E-02	1.16E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-4 SP-1	PB09-04444	SR-180-124	394.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.24E-02	1.10E-01
OL-3-4 SP-2	PB09-04445	SR-180-125	431.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.96E-02	1.09E-01
OL-3-4 SP-3	PB09-04447	SR-180-127	322.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.29E-02	1.45E-01
OL-3-4 SP-4	PB09-04448	SR-180-128	362.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.82E-02	1.24E-01
OL-3-4 SP-5	PB09-04449	SR-180-129	370.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.69E-02	1.17E-01
OL-3-4 SP-6	PB09-04450	SR-180-130	325.9	2.12E-01	1.03E-01	<MDA	<MDA	0.0151	N/A		1.44E-01
OL-3-4 SP-7	PB09-04451	SR-180-131	327.0	1.06E+00	2.46E-01	<MDA	<MDA	0.0758	N/A		1.38E-01
OL-3-4 SP-8	PB09-04452	SR-180-132	334.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.53E-02	1.30E-01
OL-3-4 SP-9	PB09-04453	SR-180-133	431.2	2.74E-01	1.02E-01	<MDA	<MDA	0.0195	N/A		1.09E-01
OL-3-4 SP-10	PB09-04454	SR-180-134	407.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.97E-02	1.11E-01
OL-3-4 SP-11	PB09-04455	SR-180-135	373.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.14E-01	1.16E-01
OL-3-5 SP-1	PB09-04456	SR-180-136	316.5	5.50E-01	1.65E-01	<MDA	<MDA	0.0393	N/A		1.37E-01
OL-3-5 SP-2	PB09-04457	SR-180-137	339.2	3.74E-01	1.56E-01	<MDA	<MDA	0.0267	N/A		1.38E-01
OL-3-5 SP-3	PB09-04458	SR-180-138	439.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.45E-02	1.03E-01
OL-3-5 SP-4	PB09-04459	SR-180-139	444.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.01E-01	9.78E-02
OL-3-5 SP-5	PB09-04460	SR-180-140	335.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.94E-02	1.40E-01
OL-3-5 SP-6	PB09-04462	SR-180-141	412.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.88E-02	1.09E-01
OL-3-5 SP-7	PB09-04463	SR-180-142	398.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.24E-01	1.09E-01
OL-3-5 SP-8	PB09-04464	SR-180-143	414.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.25E-02	1.13E-01
OL-3-5 SP-9	PB09-04465	SR-180-144	363.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.80E-02	1.24E-01
OL-3-5 SP-10	PB09-04467	SR-180-146	351.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.55E-02	1.34E-01
OL-3-5 SP-11	PB09-04468	SR-180-147	401.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.10E-02	1.08E-01
OL-3-6 SP-1	PB09-04510	SR-180-148	392.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.65E-02	1.20E-01
OL-3-6 SP-2	PB09-04511	SR-180-149	363.9	2.01E-01	9.51E-02	<MDA	<MDA	0.0144	N/A		1.29E-01
OL-3-6 SP-3	PB09-04512	SR-180-150	332.4	2.57E-01	1.12E-01	<MDA	<MDA	0.0183	N/A		1.41E-01
OL-3-6 SP-4	PB09-04513	SR-180-151	333.9	3.90E-01	1.38E-01	<MDA	<MDA	0.0278	N/A		1.41E-01
OL-3-6 SP-5	PB09-04514	SR-180-152	332.7	3.36E-01	1.25E-01	<MDA	<MDA	0.0239	N/A		1.36E-01
OL-3-6 SP-6	PB09-04515	SR-180-153	386.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.80E-02	1.22E-01
OL-3-6 SP-7	PB09-04517	SR-180-155	368.0	2.66E-01	1.09E-01	<MDA	<MDA	0.0189	N/A		1.28E-01
OL-3-6 SP-8	PB09-04518	SR-180-156	351.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.07E-02	1.28E-01
OL-3-6 SP-9	PB09-04519	SR-180-157	352.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.51E-02	1.33E-01
OL-3-6 SP-10	PB09-04520	SR-180-158	363.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.04E-01	6.20E-02
OL-3-6 SP-11	PB09-04522	SR-180-159	355.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.98E-02	1.27E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-7 SP-1	PB09-04728	SR-180-208	362.0	2.35E-01	1.01E-01	<MDA	<MDA	0.0168	N/A		1.20E-01
OL-3-7 SP-2	PB09-04729	SR-180-209	353.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.49E-02	1.33E-01
OL-3-7 SP-3	PB09-04730	SR-180-210	332.2	2.03E-01	6.88E-02	<MDA	<MDA	0.0145	N/A		6.79E-02
OL-3-7 SP-4	PB09-04732	SR-180-212	312.7	3.25E-01	1.30E-01	<MDA	<MDA	0.0232	N/A		1.50E-01
OL-3-7 SP-5	PB09-04733	SR-180-213	357.5	3.23E-01	1.18E-01	<MDA	<MDA	0.0230	N/A		1.26E-01
OL-3-7 SP-6	PB09-04734	SR-180-214	341.3	2.16E-01	9.91E-02	<MDA	<MDA	0.0154	N/A		1.28E-01
OL-3-7 SP-7	PB09-04735	SR-180-215	350.0	1.98E-01	9.61E-02	<MDA	<MDA	0.0141	N/A		1.34E-01
OL-3-7 SP-8	PB09-04736	SR-180-216	323.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.76E-02	1.39E-01
OL-3-7 SP-9	PB09-04737	SR-180-217	336.7	2.76E-01	1.13E-01	<MDA	<MDA	0.0197	N/A		1.29E-01
OL-3-7 SP-10	PB09-04738	SR-180-218	317.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.46E-02	1.48E-01
OL-3-7 SP-11	PB09-04739	SR-180-219	345.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.22E-02	1.31E-01
OL-3-8 SP-1	PB09-03476	SR-180-13	354.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.48E-02	1.33E-01
OL-3-8 SP-2	PB09-03478	SR-180-15	369.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.02E-01	1.27E-01
OL-3-8 SP-3	PB09-03479	SR-180-16	381.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.47E-02	1.14E-01
OL-3-8 SP-4	PB09-03480	SR-180-17	342.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.29E-02	1.32E-01
OL-3-8 SP-5	PB09-03482	SR-180-18	344.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.27E-01	1.36E-01
OL-3-8 SP-6	PB09-03483	SR-180-19	331.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.61E-02	1.31E-01
OL-3-8 SP-7	PB09-03484	SR-180-20	376.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.54E-02	1.20E-01
OL-3-8 SP-8	PB09-03485	SR-180-21	364.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.07E-01	1.29E-01
OL-3-8 SP-9	PB09-03486	SR-180-22	388.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.35E-02	1.12E-01
OL-3-8 SP-10	PB09-03487	SR-180-23	348.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.14E-02	1.30E-01
OL-3-8 SP-11	PB09-03488	SR-180-24	354.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.48E-02	1.33E-01
OL-3-8 SP-12	PB09-03489	SR-180-25	352.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.09E-02	1.23E-01
OL-3-8 SP-13	PB09-03490	SR-180-26	389.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.28E-02	1.16E-01
OL-3-8 SP-14	PB09-03491	SR-180-27	407.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.37E-02	1.15E-01
OL-3-9 SP-1	PB09-04984	SR-180-292	341.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.22E-01	1.27E-01
OL-3-9 SP-2	PB09-04985	SR-180-293	396.7	1.93E-01	6.63E-02	<MDA	<MDA	0.014	N/A		3.94E-02
OL-3-9 SP-3	PB09-04987	SR-180-295	379.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	9.49E-02	1.15E-01
OL-3-9 SP-4	PB09-04988	SR-180-296	375.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.99E-02	1.25E-01
OL-3-9 SP-5	PB09-04989	SR-180-297	391.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	9.20E-02	1.11E-01
OL-3-9 SP-6	PB09-04990	SR-180-298	335.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.93E-02	1.40E-01
OL-3-9 SP-7	PB09-04991	SR-180-299	345.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.09E-01	1.30E-01
OL-3-9 SP-8	PB09-04992	SR-180-300	334.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.25E-01	1.30E-01
OL-3-9 SP-9	PB09-04993	SR-180-301	371.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.63E-02	1.21E-01
OL-3-9 SP-10	PB09-04994	SR-180-302	347.8	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.72E-01	1.25E-01
OL-3-9 SP-11	PB09-04995	SR-180-303	351.7	5.69E-01	1.59E-01	<MDA	<MDA	0.041	N/A		1.28E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-10 SP-1	PB09-03571	SR-180-28	411.9	1.58E-01	7.92E-02	<MDA	<MDA	0.0113	N/A		1.14E-01
OL-3-10 SP-2	PB09-03573	SR-180-30	372.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.66E-02	1.17E-01
OL-3-10 SP-3	PB09-03574	SR-180-31	338.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.42E-02	1.28E-01
OL-3-10 SP-4	PB09-03575	SR-180-32	338.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.86E-02	1.39E-01
OL-3-10 SP-5	PB09-03576	SR-180-33	402.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.20E-02	1.08E-01
OL-3-10 SP-6	PB09-03577	SR-180-34	344.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.71E-02	1.36E-01
OL-3-10 SP-7	PB09-03578	SR-180-35	398.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.13E-02	1.13E-01
OL-3-10 SP-8	PB09-03579	SR-180-36	345.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.26E-02	1.26E-01
OL-3-10 SP-9	PB09-03580	SR-180-37	400.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.50E-02	1.17E-01
OL-3-10 SP-10	PB09-03582	SR-180-38	393.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.63E-02	1.20E-01
OL-3-10 SP-11	PB09-03583	SR-180-39	382.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.41E-02	1.18E-01
OL-3-11 SP-1	PB09-03622	SR-180-40	367.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.76E-02	1.18E-01
OL-3-11 SP-2	PB09-03624	SR-180-42	321.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.76E-02	1.35E-01
OL-3-11 SP-3	PB09-03625	SR-180-43	364.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.24E-02	1.29E-01
OL-3-11 SP-4	PB09-03626	SR-180-44	356.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.00E-02	1.22E-01
OL-3-11 SP-5	PB09-03627	SR-180-45	361.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.31E-02	1.30E-01
OL-3-11 SP-6	PB09-03628	SR-180-46	340.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.37E-02	1.28E-01
OL-3-11 SP-7	PB09-03629	SR-180-47	327.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.17E-02	1.44E-01
OL-3-11 SP-8	PB09-03630	SR-180-48	315.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.04E-02	1.38E-01
OL-3-11 SP-9	PB09-03631	SR-180-49	382.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.84E-02	1.23E-01
OL-3-11 SP-10	PB09-03632	SR-180-50	367.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.75E-02	1.18E-01
OL-3-11 SP-11	PB09-03633	SR-180-51	338.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.86E-02	1.39E-01
OL-3-12 SP-1	PB09-04652	SR-180-172	337.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.46E-02	1.29E-01
OL-3-12 SP-2	PB09-04653	SR-180-173	358.3	2.95E-01	1.16E-01	<MDA	<MDA	0.0211	N/A		1.38E-01
OL-3-12 SP-3	PB09-04654	SR-180-174	354.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.00E-02	1.27E-01
OL-3-12 SP-4	PB09-04655	SR-180-175	387.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.36E-02	1.12E-01
OL-3-12 SP-5	PB09-04657	SR-180-177	412.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.42E-02	1.09E-01
OL-3-12 SP-6	PB09-04658	SR-180-178	362.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.32E-02	1.20E-01
OL-3-12 SP-7	PB09-04659	SR-180-179	415.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.23E-02	1.13E-01
OL-3-12 SP-8	PB09-04660	SR-180-180	338.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.38E-02	1.33E-01
OL-3-12 SP-9	PB09-04662	SR-180-181	322.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.85E-02	1.35E-01
OL-3-12 SP-10	PB09-04663	SR-180-182	390.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.68E-02	1.20E-01
OL-3-12 SP-11	PB09-04664	SR-180-183	359.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.90E-02	1.25E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-13 SP-1	PB09-04740	SR-180-220	368.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.75E-02	1.18E-01
OL-3-13 SP-2	PB09-04742	SR-180-221	351.7	6.14E-01	1.69E-01	<MDA	<MDA	0.044	N/A		1.34E-01
OL-3-13 SP-3	PB09-04743	SR-180-222	403.0	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.04E-02	1.12E-01
OL-3-13 SP-4	PB09-04744	SR-180-223	406.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.02E-02	1.07E-01
OL-3-13 SP-5	PB09-04746	SR-180-225	377.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.52E-02	1.20E-01
OL-3-13 SP-6	PB09-04747	SR-180-226	320.9	3.02E-01	1.21E-01	<MDA	<MDA	0.022	N/A		1.36E-01
OL-3-13 SP-7	PB09-04748	SR-180-227	316.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	9.49E-02	1.49E-01
OL-3-13 SP-8	PB09-04749	SR-180-228	355.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.99E-02	1.27E-01
OL-3-13 SP-9	PB09-04750	SR-180-229	337.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.46E-02	1.29E-01
OL-3-13 SP-10	PB09-04751	SR-180-230	342.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	9.61E-02	1.37E-01
OL-3-13 SP-11	PB09-04752	SR-180-231	379.0	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.49E-02	1.19E-01
OL-3-14 SP-1	PB09-04756	SR-180-232	338.5	7.85E-01	2.10E-01	<MDA	<MDA	0.056	N/A		1.28E-01
OL-3-14 SP-2	PB09-04757	SR-180-233	317.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.23E-01	1.48E-01
OL-3-14 SP-3	PB09-04758	SR-180-234	331.2	2.91E-01	1.16E-01	<MDA	<MDA	0.021	N/A		1.36E-01
OL-3-14 SP-4	PB09-04759	SR-180-235	327.5	2.19E-01	7.21E-02	<MDA	<MDA	0.016	N/A		6.64E-02
OL-3-14 SP-5	PB09-04762	SR-180-237	326.3	4.25E-01	1.42E-01	<MDA	<MDA	0.030	N/A		1.38E-01
OL-3-14 SP-6	PB09-04763	SR-180-238	364.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.82E-02	1.19E-01
OL-3-14 SP-7	PB09-04764	SR-180-239	398.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.92E-02	1.18E-01
OL-3-14 SP-8	PB09-04765	SR-180-240	342.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.07E-01	1.32E-01
OL-3-14 SP-9	PB09-04766	SR-180-241	352.6	3.75E-01	1.48E-01	<MDA	<MDA	0.027	N/A		1.23E-01
OL-3-14 SP-10	PB09-04767	SR-180-242	330.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	2.15E-01	1.42E-01
OL-3-14 SP-11	PB09-04768	SR-180-243	375.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.60E-02	1.16E-01
OL-3-15 SP-1	PB09-04769	SR-180-244	356.8	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.00E-02	1.22E-01
OL-3-15 SP-2	PB09-04770	SR-180-245	385.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.79E-02	1.22E-01
OL-3-15 SP-3	PB09-04772	SR-180-247	422.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	6.75E-02	1.03E-01
OL-3-15 SP-4	PB09-04773	SR-180-248	355.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.06E-01	1.32E-01
OL-3-15 SP-5	PB09-04774	SR-180-249	372.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.62E-02	1.21E-01
OL-3-15 SP-6	PB09-04775	SR-180-250	374.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.62E-02	1.16E-01
OL-3-15 SP-7	PB09-04776	SR-180-251	363.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	6.03E-02	6.45E-02
OL-3-15 SP-8	PB09-04777	SR-180-252	386.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.34E-02	1.17E-01
OL-3-15 SP-9	PB09-04778	SR-180-253	408.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	6.98E-02	1.06E-01
OL-3-15 SP-10	PB09-04779	SR-180-254	380.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.88E-02	1.23E-01
OL-3-15 SP-11	PB09-04780	SR-180-255	347.6	1.65E+00	2.74E-01	<MDA	<MDA	0.118	N/A		1.30E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-16 SP-1	PB09-04782	SR-180-256	388.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.35E-02	1.12E-01
OL-3-16 SP-2	PB09-04783	SR-180-257	421.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.11E-02	1.11E-01
OL-3-16 SP-3	PB09-04784	SR-180-258	376.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.54E-02	1.20E-01
OL-3-16 SP-4	PB09-04785	SR-180-259	389.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.33E-02	1.12E-01
OL-3-16 SP-5	PB09-04786	SR-180-260	354.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.46E-02	1.32E-01
OL-3-16 SP-6	PB09-04787	SR-180-261	395.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.18E-02	1.14E-01
OL-3-16 SP-7	PB09-04789	SR-180-263	393.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	9.62E-02	1.19E-01
OL-3-16 SP-8	PB09-04790	SR-180-264	439.2	3.59E-01	1.13E-01	<MDA	<MDA	0.026	N/A		1.03E-01
OL-3-16 SP-9	PB09-04791	SR-180-265	395.0	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.22E-02	1.10E-01
OL-3-16 SP-10	PB09-04792	SR-180-266	376.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.97E-02	1.25E-01
OL-3-16 SP-11	PB09-04793	SR-180-267	372.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.69E-02	1.21E-01
OL-3-17 SP-1	PB09-04803	SR-180-268	391.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.29E-02	1.11E-01
OL-3-17 SP-2	PB09-04804	SR-180-269	369.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.45E-02	6.36E-02
OL-3-17 SP-3	PB09-04805	SR-180-270	342.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.13E-01	1.32E-01
OL-3-17 SP-4	PB09-04806	SR-180-271	376.3	2.47E-01	1.01E-01	<MDA	<MDA	0.018	N/A		1.16E-01
OL-3-17 SP-5	PB09-04807	SR-180-272	338.8	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.85E-02	1.39E-01
OL-3-17 SP-6	PB09-04809	SR-180-274	366.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.79E-02	1.19E-01
OL-3-17 SP-7	PB09-04810	SR-180-275	351.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.54E-02	1.34E-01
OL-3-17 SP-8	PB09-04811	SR-180-276	349.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.08E-01	1.29E-01
OL-3-17 SP-9	PB09-04812	SR-180-277	351.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.12E-02	1.24E-01
OL-3-17 SP-10	PB09-04813	SR-180-278	343.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.82E-01	1.37E-01
OL-3-17 SP-11	PB09-04814	SR-180-279	367.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.71E-02	1.23E-01
OL-3-18 SP-1	PB09-04815	SR-180-280	347.7	2.12E-01	9.72E-02	<MDA	<MDA	0.015	N/A		1.25E-01
OL-3-18 SP-2	PB09-04816	SR-180-281	357.2	5.47E-01	1.59E-01	<MDA	<MDA	0.039	N/A		1.31E-01
OL-3-18 SP-3	PB09-04817	SR-180-282	380.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.46E-02	1.19E-01
OL-3-18 SP-4	PB09-04818	SR-180-283	361.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.90E-02	1.20E-01
OL-3-18 SP-5	PB09-04819	SR-180-284	382.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.84E-02	1.23E-01
OL-3-18 SP-6	PB09-04820	SR-180-285	363.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.25E-02	1.29E-01
OL-3-18 SP-7	PB09-04822	SR-180-286	371.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.64E-02	1.21E-01
OL-3-18 SP-8	PB09-04823	SR-180-287	375.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.59E-02	1.16E-01
OL-3-18 SP-9	PB09-04824	SR-180-288	339.0	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.85E-02	1.38E-01
OL-3-18 SP-10	PB09-04826	SR-180-290	374.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.62E-02	1.16E-01
OL-3-18 SP-11	PB09-04827	SR-180-291	332.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.20E-01	1.41E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-19 SP-1	PB09-05067	SR-180-328	366.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.19E-02	1.28E-01
OL-3-19 SP-2	PB09-05068	SR-180-329	400.0	4.14E-01	1.27E-01	<MDA	<MDA	0.030	N/A		1.13E-01
OL-3-19 SP-3	PB09-05069	SR-180-330	335.1	2.92E-01	1.33E-01	<MDA	<MDA	0.021	N/A		1.40E-01
OL-3-19 SP-4	PB09-05070	SR-180-331	330.4	3.73E-01	1.32E-01	<MDA	<MDA	0.027	N/A		1.37E-01
OL-3-19 SP-5	PB09-05071	SR-180-332	408.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	6.98E-02	1.07E-01
OL-3-19 SP-6	PB09-05072	SR-180-333	453.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	6.62E-02	1.04E-01
OL-3-19 SP-7	PB09-05073	SR-180-334	351.7	3.83E-01	1.30E-01	<MDA	<MDA	0.027	N/A		1.28E-01
OL-3-19 SP-8	PB09-05074	SR-180-335	397.8	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.87E-02	1.09E-01
OL-3-19 SP-9	PB09-05075	SR-180-336	352.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.50E-02	1.33E-01
OL-3-19 SP-10	PB09-05076	SR-180-337	360.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.88E-02	1.25E-01
OL-3-19 SP-11	PB09-05078	SR-180-339	340.2	2.27E-01	1.05E-01	<MDA	<MDA	0.016	N/A		1.38E-01
OL-3-20 SP-1	PB09-04191	SR-180-88	332.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.53E-02	1.36E-01
OL-3-20 SP-2	PB09-04192	SR-180-89	315.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.50E-02	1.49E-01
OL-3-20 SP-3	PB09-04193	SR-180-90	371.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.68E-02	1.17E-01
OL-3-20 SP-4	PB09-04194	SR-180-91	434.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.53E-02	1.04E-01
OL-3-20 SP-5	PB09-04196	SR-180-93	384.2	6.95E-01	1.68E-01	<MDA	<MDA	0.0496	N/A		1.13E-01
OL-3-20 SP-6	PB09-04197	SR-180-94	330.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.58E-02	1.36E-01
OL-3-20 SP-7	PB09-04198	SR-180-95	325.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.21E-02	1.44E-01
OL-3-20 SP-8	PB09-04199	SR-180-96	384.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.78E-02	1.13E-01
OL-3-20 SP-9	PB09-04200	SR-180-97	332.0	4.17E-01	1.40E-01	<MDA	<MDA	0.0298	N/A		1.36E-01
OL-3-20 SP-10	PB09-04202	SR-180-98	343.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	2.15E-01	1.37E-01
OL-3-20 SP-11	PB09-04203	SR-180-99	342.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.34E-02	1.27E-01
OL-3-21 SP-1	PB09-05106	SR-180-364	413.6	2.71E-01	1.01E-01	<MDA	<MDA	0.019	N/A		1.05E-01
OL-3-21 SP-2	PB09-05107	SR-180-365	316.8	2.96E-01	1.24E-01	<MDA	<MDA	0.021	N/A		1.48E-01
OL-3-21 SP-3	PB09-05108	SR-180-366	323.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.76E-02	1.39E-01
OL-3-21 SP-4	PB09-05109	SR-180-367	416.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	6.85E-02	1.05E-01
OL-3-21 SP-5	PB09-05111	SR-180-369	356.8	<MDA	<MDA	<MDA	<MDA	0.000	N/A	2.03E-01	1.27E-01
OL-3-21 SP-6	PB09-05112	SR-180-370	385.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.40E-02	1.13E-01
OL-3-21 SP-7	PB09-05113	SR-180-371	368.7	2.65E-01	1.08E-01	<MDA	<MDA	0.019	N/A		1.28E-01
OL-3-21 SP-8	PB09-05114	SR-180-372	332.9	2.54E-01	1.09E-01	<MDA	<MDA	0.018	N/A		1.36E-01
OL-3-21 SP-9	PB09-05115	SR-180-373	350.1	3.32E-01	1.21E-01	<MDA	<MDA	0.024	N/A		1.24E-01
OL-3-21 SP-10	PB09-05116	SR-180-374	369.6	3.64E-01	1.27E-01	<MDA	<MDA	0.026	N/A		1.27E-01
OL-3-21 SP-11	PB09-05117	SR-180-375	349.6	6.06E-01	1.64E-01	<MDA	<MDA	0.043	N/A		1.29E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-22 SP-1	PB09-05009	SR-180-316	382.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.46E-02	1.14E-01
OL-3-22 SP-2	PB09-05011	SR-180-318	374.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.57E-02	1.20E-01
OL-3-22 SP-3	PB09-05012	SR-180-319	330.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.62E-02	1.31E-01
OL-3-22 SP-4	PB09-05013	SR-180-320	353.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.49E-02	1.33E-01
OL-3-22 SP-5	PB09-05014	SR-180-321	404.5	2.09E-01	8.94E-02	<MDA	<MDA	0.015	N/A		1.11E-01
OL-3-22 SP-6	PB09-05015	SR-180-322	364.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.82E-02	1.19E-01
OL-3-22 SP-7	PB09-05016	SR-180-323	369.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.11E-02	1.27E-01
OL-3-22 SP-8	PB09-05017	SR-180-324	362.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.82E-02	1.24E-01
OL-3-22 SP-9	PB09-05018	SR-180-325	371.9	6.04E-01	1.59E-01	<MDA	<MDA	0.043	N/A		1.17E-01
OL-3-22 SP-10	PB09-05019	SR-180-326	321.4	2.41E-01	1.11E-01	<MDA	<MDA	0.017	N/A		1.46E-01
OL-3-22 SP-11	PB09-05020	SR-180-327	387.2	3.28E-01	1.15E-01	<MDA	<MDA	0.023	N/A		1.16E-01
OL-3-23 SP-1	PB09-05092	SR-180-352	348.1	4.56E-01	1.43E-01	<MDA	<MDA	0.033	N/A		1.25E-01
OL-3-23 SP-2	PB09-05093	SR-180-353	359.1	3.29E-01	1.22E-01	<MDA	<MDA	0.023	N/A		1.31E-01
OL-3-23 SP-3	PB09-05094	SR-180-354	316.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	3.20E-01	1.43E-01
OL-3-23 SP-4	PB09-05095	SR-180-355	324.0	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.51E-01	1.34E-01
OL-3-23 SP-5	PB09-05097	SR-180-357	335.5	4.71E-01	1.47E-01	<MDA	<MDA	0.034	N/A		1.35E-01
OL-3-23 SP-6	PB09-05098	SR-180-358	360.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.91E-02	1.21E-01
OL-3-23 SP-7	PB09-05099	SR-180-359	375.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.24E-01	1.25E-01
OL-3-23 SP-8	PB09-05100	SR-180-360	352.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.06E-02	1.28E-01
OL-3-23 SP-9	PB09-05102	SR-180-361	371.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.08E-02	1.27E-01
OL-3-23 SP-10	PB09-05103	SR-180-362	371.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.68E-02	1.17E-01
OL-3-23 SP-11	PB09-05104	SR-180-363	384.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.38E-02	1.17E-01
OL-3-24 SP-1	PB09-03690	SR-180-52	407.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.01E-02	1.07E-01
OL-3-24 SP-2	PB09-03692	SR-180-54	355.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.98E-02	1.27E-01
OL-3-24 SP-3	PB09-03693	SR-180-55	401.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.95E-02	1.08E-01
OL-3-24 SP-4	PB09-03694	SR-180-56	341.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.78E-02	1.37E-01
OL-3-24 SP-5	PB09-03695	SR-180-57	353.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.02E-02	1.28E-01
OL-3-24 SP-6	PB09-03696	SR-180-58	352.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.09E-02	1.23E-01
OL-3-24 SP-7	PB09-03697	SR-180-59	324.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.25E-02	1.45E-01
OL-3-24 SP-8	PB09-03698	SR-180-60	320.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.84E-02	1.41E-01
OL-3-24 SP-9	PB09-03699	SR-180-61	320.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.89E-02	1.36E-01
OL-3-24 SP-10	PB09-03702	SR-180-62	341.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.77E-02	1.37E-01
OL-3-24 SP-11	PB09-03703	SR-180-63	381.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.44E-02	1.18E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-25 SP-1	PB09-03704	SR-180-64	369.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.71E-02	1.18E-01
OL-3-25 SP-2	PB09-03706	SR-180-66	364.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.79E-02	1.24E-01
OL-3-25 SP-3	PB09-03707	SR-180-67	370.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.03E-01	1.17E-01
OL-3-25 SP-4	PB09-03708	SR-180-68	331.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.04E-02	1.41E-01
OL-3-25 SP-5	PB09-03709	SR-180-69	417.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.79E-02	1.08E-01
OL-3-25 SP-6	PB09-03710	SR-180-70	402.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.09E-02	1.08E-01
OL-3-25 SP-7	PB09-03711	SR-180-71	427.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.01E-02	1.10E-01
OL-3-25 SP-8	PB09-03712	SR-180-72	348.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.14E-02	1.29E-01
OL-3-25 SP-9	PB09-03713	SR-180-73	383.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.21E-01	1.13E-01
OL-3-25 SP-10	PB09-03714	SR-180-74	314.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.54E-02	1.49E-01
OL-3-25 SP-11	PB09-03715	SR-180-75	429.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.60E-02	1.05E-01
OL-3-26 SP-1	PB09-05079	SR-180-340	342.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.33E-02	1.27E-01
OL-3-26 SP-2	PB09-05080	SR-180-341	431.8	<MDA	<MDA	<MDA	<MDA	0.000	N/A	6.95E-02	1.09E-01
OL-3-26 SP-3	PB09-05083	SR-180-343	344.7	2.70E-01	1.10E-01	<MDA	<MDA	0.019	N/A		1.26E-01
OL-3-26 SP-4	PB09-05084	SR-180-344	335.8	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.94E-02	1.40E-01
OL-3-26 SP-5	PB09-05085	SR-180-345	395.0	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.18E-02	1.14E-01
OL-3-26 SP-6	PB09-05086	SR-180-346	327.5	4.37E-01	1.44E-01	<MDA	<MDA	0.031	N/A		1.33E-01
OL-3-26 SP-7	PB09-05087	SR-180-347	348.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.62E-02	1.35E-01
OL-3-26 SP-8	PB09-05088	SR-180-348	342.0	7.77E-01	1.88E-01	<MDA	<MDA	0.055	N/A		1.32E-01
OL-3-26 SP-9	PB09-05089	SR-180-349	362.5	6.52E-01	1.68E-01	<MDA	<MDA	0.046	N/A		1.20E-01
OL-3-26 SP-10	PB09-05090	SR-180-350	392.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.64E-02	1.20E-01
OL-3-26 SP-11	PB09-05091	SR-180-351	380.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.45E-02	1.19E-01
OL-3-27 SP-1	PB09-03717	SR-180-76	352.0	2.89E-01	1.16E-01	<MDA	<MDA	0.0206	N/A		1.33E-01
OL-3-27 SP-2	PB09-03719	SR-180-78	347.7	2.34E-01	1.05E-01	<MDA	<MDA	0.0167	N/A		1.35E-01
OL-3-27 SP-3	PB09-03720	SR-180-79	348.1	2.34E-01	1.05E-01	<MDA	<MDA	0.0167	N/A		1.35E-01
OL-3-27 SP-4	PB09-03722	SR-180-80	341.0	2.72E-01	1.11E-01	<MDA	<MDA	0.0194	N/A		1.28E-01
OL-3-27 SP-5	PB09-03723	SR-180-81	351.1	7.24E-01	1.79E-01	<MDA	<MDA	0.0516	N/A		1.28E-01
OL-3-27 SP-6	PB09-03724	SR-180-82	325.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.35E-01	1.44E-01
OL-3-27 SP-7	PB09-03725	SR-180-83	363.4	5.11E-01	1.48E-01	<MDA	<MDA	0.0365	N/A		1.20E-01
OL-3-27 SP-8	PB09-03726	SR-180-84	331.0	2.91E-01	1.17E-01	<MDA	<MDA	0.0207	N/A		1.36E-01
OL-3-27 SP-9	PB09-03727	SR-180-85	381.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.86E-02	1.23E-01
OL-3-27 SP-10	PB09-03728	SR-180-86	353.8	1.13E+00	2.24E-01	<MDA	<MDA	0.0804	N/A		1.23E-01
OL-3-27 SP-11	PB09-03729	SR-180-87	392.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.22E-02	1.15E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-28 SP-1	PB09-05118	SR-180-376	312.3	5.62E-01	1.85E-01	<MDA	<MDA	0.040	N/A		1.39E-01
OL-3-28 SP-2	PB09-05119	SR-180-377	362.7	7.97E-01	1.90E-01	<MDA	<MDA	0.057	N/A		1.30E-01
OL-3-28 SP-3	PB09-05120	SR-180-378	322.0	4.19E-01	1.42E-01	<MDA	<MDA	0.030	N/A		1.40E-01
OL-3-28 SP-4	PB09-05122	SR-180-379	393.0	6.60E-01	1.62E-01	<MDA	<MDA	0.047	N/A		1.11E-01
OL-3-28 SP-5	PB09-05124	SR-180-381	385.4	4.70E-01	1.38E-01	<MDA	<MDA	0.033	N/A		1.17E-01
OL-3-28 SP-6	PB09-05125	SR-180-382	347.3	4.35E-01	1.40E-01	<MDA	<MDA	0.031	N/A		1.25E-01
OL-3-28 SP-7	PB09-05126	SR-180-383	335.6	1.27E+00	2.51E-01	<MDA	<MDA	0.091	N/A		1.40E-01
OL-3-28 SP-8	PB09-05127	SR-180-384	359.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.89E-02	1.26E-01
OL-3-28 SP-9	PB09-05128	SR-180-385	318.2	3.29E-01	1.27E-01	<MDA	<MDA	0.023	N/A		1.37E-01
OL-3-28 SP-10	PB09-05129	SR-180-386	373.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.31E-01	1.26E-01
OL-3-28 SP-11	PB09-05130	SR-180-387	350.8	2.41E-01	1.03E-01	<MDA	<MDA	0.017	N/A		1.29E-01
OL-3-29 SP-1	PB09-05170	SR-180-412	321.0	3.98E-01	1.39E-01	<MDA	<MDA	0.0284	N/A		1.35E-01
OL-3-29 SP-2	PB09-05171	SR-180-413	359.5	3.74E-01	1.30E-01	<MDA	<MDA	0.0267	N/A		1.31E-01
OL-3-29 SP-3	PB09-05172	SR-180-414	317.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	4.47E-02	7.10E-02
OL-3-29 SP-4	PB09-05174	SR-180-416	321.3	9.56E-01	2.68E-01	<MDA	<MDA	0.0682	N/A		1.46E-01
OL-3-29 SP-5	PB09-05175	SR-180-417	370.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.06E-02	1.22E-01
OL-3-29 SP-6	PB09-05176	SR-180-418	336.7	2.66E-01	1.14E-01	<MDA	<MDA	0.0190	N/A		1.39E-01
OL-3-29 SP-7	PB09-05177	SR-180-419	354.5	2.50E-01	1.04E-01	<MDA	<MDA	0.0178	N/A		1.27E-01
OL-3-29 SP-8	PB09-05178	SR-180-420	349.6	2.55E-01	1.06E-01	<MDA	<MDA	0.0182	N/A		1.24E-01
OL-3-29 SP-9	PB09-05179	SR-180-421	344.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.03E-01	1.36E-01
OL-3-29 SP-10	PB09-05180	SR-180-422	346.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.19E-02	1.30E-01
OL-3-29 SP-11	PB09-05182	SR-180-423	314.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.08E-02	1.38E-01
OL-3-30 SP-1	PB09-04665	SR-180-184	321.2	2.65E-01	1.13E-01	<MDA	<MDA	0.0189	N/A		1.35E-01
OL-3-30 SP-2	PB09-04666	SR-180-185	343.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.64E-01	1.37E-01
OL-3-30 SP-3	PB09-04667	SR-180-186	322.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.61E-01	1.40E-01
OL-3-30 SP-4	PB09-04668	SR-180-187	314.0	2.84E-01	1.19E-01	<MDA	<MDA	0.0202	N/A		1.38E-01
OL-3-30 SP-5	PB09-04669	SR-180-188	331.9	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.04E-02	1.41E-01
OL-3-30 SP-6	PB09-04670	SR-180-189	350.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.10E-02	1.29E-01
OL-3-30 SP-7	PB09-04671	SR-180-190	329.8	3.40E-01	1.27E-01	<MDA	<MDA	0.0243	N/A		1.32E-01
OL-3-30 SP-8	PB09-04672	SR-180-191	338.1	2.31E-01	8.86E-02	<MDA	<MDA	0.0165	N/A		6.94E-02
OL-3-30 SP-9	PB09-04674	SR-180-193	342.0	3.17E-01	1.20E-01	<MDA	<MDA	0.0226	N/A		1.27E-01
OL-3-30 SP-10	PB09-04675	SR-180-194	335.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.94E-02	1.40E-01
OL-3-30 SP-11	PB09-04676	SR-180-195	322.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	2.49E-01	1.45E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-31 SP-1	PB09-05135	SR-180-388	337.1	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.90E-02	1.39E-01
OL-3-31 SP-2	PB09-05136	SR-180-389	328.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.90E-01	1.37E-01
OL-3-31 SP-3	PB09-05137	SR-180-390	352.3	3.00E-01	1.18E-01	<MDA	<MDA	0.021	N/A		1.33E-01
OL-3-31 SP-4	PB09-05138	SR-180-391	401.5	2.59E-01	9.99E-02	<MDA	<MDA	0.018	N/A		1.12E-01
OL-3-31 SP-5	PB09-05140	SR-180-393	355.1	2.06E-01	9.47E-02	<MDA	<MDA	0.015	N/A		1.27E-01
OL-3-31 SP-6	PB09-05142	SR-180-394	328.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	9.13E-02	1.43E-01
OL-3-31 SP-7	PB09-05143	SR-180-395	312.1	3.21E-01	1.26E-01	<MDA	<MDA	0.023	N/A		1.44E-01
OL-3-31 SP-8	PB09-05144	SR-180-396	360.1	3.62E-01	1.28E-01	<MDA	<MDA	0.026	N/A		1.30E-01
OL-3-31 SP-9	PB09-05145	SR-180-397	344.8	4.02E-01	1.34E-01	<MDA	<MDA	0.029	N/A		1.31E-01
OL-3-31 SP-10	PB09-05146	SR-180-398	316.6	9.39E-01	2.21E-01	<MDA	<MDA	0.067	N/A		1.48E-01
OL-3-31 SP-11	PB09-05147	SR-180-399	325.6	2.84E-01	1.16E-01	<MDA	<MDA	0.020	N/A		1.38E-01
OL-3-32 SP-1	PB09-05184	SR-180-424	318.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.32E-01	1.48E-01
OL-3-32 SP-2	PB09-05185	SR-180-425	311.6	3.34E-01	1.29E-01	<MDA	<MDA	0.0238	N/A		1.45E-01
OL-3-32 SP-3	PB09-05186	SR-180-426	344.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.71E-02	1.36E-01
OL-3-32 SP-4	PB09-05188	SR-180-428	321.8	3.16E-01	1.27E-01	<MDA	<MDA	0.0225	N/A		1.46E-01
OL-3-32 SP-5	PB09-05189	SR-180-429	315.4	3.42E-01	1.29E-01	<MDA	<MDA	0.0244	N/A		1.43E-01
OL-3-32 SP-6	PB09-05190	SR-180-430	316.0	2.96E-01	1.24E-01	<MDA	<MDA	0.0211	N/A		1.49E-01
OL-3-32 SP-7	PB09-05191	SR-180-431	343.7	2.58E-01	1.08E-01	<MDA	<MDA	0.0184	N/A		1.31E-01
OL-3-32 SP-8	PB09-05192	SR-180-432	348.8	3.55E-01	1.26E-01	<MDA	<MDA	0.0253	N/A		1.25E-01
OL-3-32 SP-9	PB09-05193	SR-180-433	327.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.05E-01	1.43E-01
OL-3-32 SP-10	PB09-05194	SR-180-434	327.6	2.32E-01	1.03E-01	<MDA	<MDA	0.0165	N/A		1.38E-01
OL-3-32 SP-11	PB09-05195	SR-180-435	319.7	3.87E-01	1.37E-01	<MDA	<MDA	0.0276	N/A		1.36E-01
OL-3-33 SP-1	PB09-05152	SR-180-400	322.8	<MDA	<MDA	<MDA	<MDA	0.000	N/A	2.09E-01	1.35E-01
OL-3-33 SP-2	PB09-05153	SR-180-401	344.9	2.48E-01	1.08E-01	<MDA	<MDA	0.018	N/A		1.36E-01
OL-3-33 SP-3	PB09-05154	SR-180-402	318.1	2.30E-01	1.06E-01	<MDA	<MDA	0.016	N/A		1.42E-01
OL-3-33 SP-4	PB09-05155	SR-180-403	321.1	4.46E-01	1.47E-01	<MDA	<MDA	0.032	N/A		1.35E-01
OL-3-33 SP-5	PB09-05157	SR-180-405	319.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.88E-02	1.41E-01
OL-3-33 SP-6	PB09-05158	SR-180-406	322.7	3.36E-01	1.27E-01	<MDA	<MDA	0.024	N/A		1.35E-01
OL-3-33 SP-7	PB09-05159	SR-180-407	313.0	3.51E-01	1.35E-01	<MDA	<MDA	0.025	N/A		1.50E-01
OL-3-33 SP-8	PB09-05160	SR-180-408	317.6	2.07E-01	1.01E-01	<MDA	<MDA	0.015	N/A		1.37E-01
OL-3-33 SP-9	PB09-05162	SR-180-409	319.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.92E-01	1.41E-01
OL-3-33 SP-10	PB09-05163	SR-180-410	351.9	3.24E-01	1.23E-01	<MDA	<MDA	0.023	N/A		1.33E-01
OL-3-33 SP-11	PB09-05164	SR-180-411	353.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.03E-02	1.28E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-34 SP-1	PB09-04594	SR-180-160	427.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.67E-02	1.02E-01
OL-3-34 SP-2	PB09-04595	SR-180-161	381.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.87E-02	1.23E-01
OL-3-34 SP-3	PB09-04596	SR-180-162	341.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.31E-02	1.32E-01
OL-3-34 SP-4	PB09-04597	SR-180-163	403.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.07E-02	1.08E-01
OL-3-34 SP-5	PB09-04598	SR-180-164	358.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.37E-02	1.31E-01
OL-3-34 SP-6	PB09-04599	SR-180-165	375.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.57E-02	1.20E-01
OL-3-34 SP-7	PB09-04600	SR-180-166	375.0	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.61E-02	1.16E-01
OL-3-34 SP-8	PB09-04602	SR-180-167	322.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	9.30E-02	1.45E-01
OL-3-34 SP-9	PB09-04603	SR-180-168	350.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.10E-02	1.29E-01
OL-3-34 SP-10	PB09-04604	SR-180-169	396.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.10E-01	1.10E-01
OL-3-34 SP-11	PB09-04606	SR-180-171	343.3	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.26E-02	1.31E-01
OL-3-35 SP-1	PB09-04996	SR-180-304	353.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.07E-02	1.23E-01
OL-3-35 SP-2	PB09-04997	SR-180-305	332.2	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.43E-01	1.41E-01
OL-3-35 SP-3	PB09-04998	SR-180-306	323.3	2.86E-01	1.17E-01	<MDA	<MDA	0.020	N/A		1.39E-01
OL-3-35 SP-4	PB09-04999	SR-180-307	343.5	3.27E-01	1.22E-01	<MDA	<MDA	0.023	N/A		1.27E-01
OL-3-35 SP-5	PB09-05000	SR-180-309	406.8	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.16E-01	1.15E-01
OL-3-35 SP-6	PB09-05003	SR-180-310	317.7	4.75E-01	1.53E-01	<MDA	<MDA	0.034	N/A		1.37E-01
OL-3-35 SP-7	PB09-05004	SR-180-311	361.6	3.83E-01	1.32E-01	<MDA	<MDA	0.027	N/A		1.30E-01
OL-3-35 SP-8	PB09-05005	SR-180-312	339.0	2.61E-01	1.09E-01	<MDA	<MDA	0.019	N/A		1.33E-01
OL-3-35 SP-9	PB09-05006	SR-180-313	375.1	3.61E-01	1.23E-01	<MDA	<MDA	0.026	N/A		1.16E-01
OL-3-35 SP-10	PB09-05007	SR-180-314	368.1	3.76E-01	1.29E-01	<MDA	<MDA	0.027	N/A		1.28E-01
OL-3-35 SP-11	PB09-05008	SR-180-315	348.9	3.66E-01	1.28E-01	<MDA	<MDA	0.026	N/A		1.25E-01
OL-3-42 SP-1	PB09-05291	SR-180-436	314.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.54E-02	1.49E-01
OL-3-42 SP-2	PB09-05292	SR-180-437	337.8	2.86E-01	1.15E-01	<MDA	<MDA	2%	N/A		1.29E-01
OL-3-42 SP-3	PB09-05294	SR-180-439	366.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.79E-01	1.19E-01
OL-3-42 SP-4	PB09-05295	SR-180-440	337.6	2.29E-01	1.05E-01	<MDA	<MDA	2%	N/A		1.39E-01
OL-3-42 SP-5	PB09-05296	SR-180-441	333.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.00E-02	1.41E-01
OL-3-42 SP-6	PB09-05297	SR-180-442	330.3	2.46E-01	1.10E-01	<MDA	<MDA	2%	N/A		1.42E-01
OL-3-42 SP-7	PB09-05298	SR-180-443	405.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.54E-01	1.07E-01
OL-3-42 SP-8	PB09-05299	SR-180-444	337.8	2.29E-01	7.45E-02	<MDA	<MDA	2%	N/A		6.95E-02
OL-3-42 SP-9	PB09-05302	SR-180-445	357.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.14E-01	1.22E-01
OL-3-42 SP-10	PB09-05303	SR-180-446	337.5	2.52E-01	1.08E-01	<MDA	<MDA	2%	N/A		1.29E-01
OL-3-42 SP-11	PB09-05304	SR-180-447	336.6	2.30E-01	1.06E-01	<MDA	<MDA	2%	N/A		1.39E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 1 (SR-180) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		Unity Fraction	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
Total Number			399	130	130	0	0	399	0	269	399
Maximum Value			453.1	7.62E+00	6.01E-01	0.00E+00	0.00E+00	0.5435	0.0	3.20E-01	1.50E-01
Average Value			359.2	4.38E-01	1.32E-01	0.00E+00	0.00E+00	0.0107	0.0	9.19E-02	1.25E-01
Standard Deviation			30.33	6.70E-01	5.50E-02	0.00E+00	0.00E+00	0.0314	0.0	3.17E-02	1.47E-02

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 2 (SR-192) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		% Unity	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-36 SP-1	PB09-04829	SR-192-1	349.5	2.66E-01	1.09E-01	<MDA	<MDA	2%	N/A		1.24E-01
OL-3-36 SP-2	PB09-04830	SR-192-2	322.7	3.03E-01	1.24E-01	<MDA	<MDA	2%	N/A		1.45E-01
OL-3-36 SP-3	PB09-04831	SR-192-3	339.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.35E-02	1.33E-01
OL-3-36 SP-4	PB09-04832	SR-192-4	357.0	2.15E-01	8.83E-02	<MDA	<MDA	2%	N/A		6.09E-02
OL-3-36 SP-5	PB09-04834	SR-192-6	326.9	3.41E-01	1.27E-01	<MDA	<MDA	2%	N/A		1.38E-01
OL-3-36 SP-6	PB09-04835	SR-192-7	340.9	1.82E-01	9.10E-02	<MDA	<MDA	1%	N/A		1.28E-01
OL-3-36 SP-7	PB09-04836	SR-192-8	336.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.22E-01	1.40E-01
OL-3-36 SP-8	PB09-04837	SR-192-9	365.6	2.84E-01	1.10E-01	<MDA	<MDA	2%	N/A		1.23E-01
OL-3-36 SP-9	PB09-04838	SR-192-10	337.9	3.32E-01	1.24E-01	<MDA	<MDA	2%	N/A		1.29E-01
OL-3-36 SP-10	PB09-04839	SR-192-11	340.9	3.50E-01	1.26E-01	<MDA	<MDA	2%	N/A		1.32E-01
OL-3-36 SP-11	PB09-04840	SR-192-12	319.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.76E-02	1.41E-01
OL-3-37 SP-1	PB09-04955	SR-192-13	354.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.47E-02	1.33E-01
OL-3-37 SP-2	PB09-04956	SR-192-14	349.6	2.31E-01	1.01E-01	<MDA	<MDA	2%	N/A		1.29E-01
OL-3-37 SP-3	PB09-04957	SR-192-15	345.6	7.66E-01	1.91E-01	<MDA	<MDA	5%	N/A		1.36E-01
OL-3-37 SP-4	PB09-04958	SR-192-16	336.1	4.58E-01	1.45E-01	<MDA	<MDA	3%	N/A		1.34E-01
OL-3-37 SP-5	PB09-04959	SR-192-17	378.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.94E-02	1.24E-01
OL-3-37 SP-6	PB09-04960	SR-192-18	313.7	4.42E-01	1.48E-01	<MDA	<MDA	3%	N/A		1.44E-01
OL-3-37 SP-7	PB09-04962	SR-192-19	323.8	3.35E+00	4.11E-01	<MDA	<MDA	24%	N/A		1.34E-01
OL-3-37 SP-8	PB09-04963	SR-192-20	311.7	4.31E-01	1.50E-01	<MDA	<MDA	3%	N/A		1.51E-01
OL-3-37 SP-9	PB09-04964	SR-192-21	328.2	6.80E-01	1.80E-01	<MDA	<MDA	5%	N/A		1.38E-01
OL-3-37 SP-10	PB09-04965	SR-192-22	335.2	3.00E-01	1.43E-01	<MDA	<MDA	2%	N/A		1.30E-01
OL-3-37 SP-11	PB09-04966	SR-192-23	356.7	6.16E-01	1.69E-01	<MDA	<MDA	4%	N/A		1.32E-01
OL-3-38 SP-1	PB09-05197	SR-192-37	383.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.40E-02	1.14E-01
OL-3-38 SP-2	PB09-05199	SR-192-39	390.3	2.86E-01	1.06E-01	<MDA	<MDA	2%	N/A		1.16E-01
OL-3-38 SP-3	PB09-05200	SR-192-40	370.8	7.20E-01	1.75E-01	<MDA	<MDA	5%	N/A		1.17E-01
OL-3-38 SP-4	PB09-05202	SR-192-41	392.0	2.28E-01	9.76E-02	<MDA	<MDA	2%	N/A		1.20E-01
OL-3-38 SP-5	PB09-05203	SR-192-42	348.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.64E-02	6.47E-02
OL-3-38 SP-6	PB09-05204	SR-192-43	324.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.93E-01	1.34E-01
OL-3-38 SP-7	PB09-05205	SR-192-44	406.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.39E-02	1.16E-01
OL-3-38 SP-8	PB09-05206	SR-192-45	338.6	4.12E-01	1.38E-01	<MDA	<MDA	3%	N/A		1.28E-01
OL-3-38 SP-9	PB09-05207	SR-192-46	358.9	4.37E-01	1.56E-01	<MDA	<MDA	3%	N/A		1.31E-01
OL-3-38 SP-10	PB09-05208	SR-192-47	351.1	3.07E-01	1.16E-01	<MDA	<MDA	2%	N/A		1.28E-01
OL-3-38 SP-11	PB09-05209	SR-192-48	350.0	3.98E-01	1.33E-01	<MDA	<MDA	3%	N/A		1.24E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 2 (SR-192) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		% Unity	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-39 SP-1	PB09-05210	SR-192-49	318.2	3.16E-01	1.24E-01	<MDA	<MDA	2%	N/A		1.37E-01
OL-3-39 SP-2	PB09-05211	SR-192-50	380.8	2.89E-01	1.11E-01	<MDA	<MDA	2%	N/A		1.23E-01
OL-3-39 SP-3	PB09-05213	SR-192-52	324.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	2.45E-01	1.45E-01
OL-3-39 SP-4	PB09-05214	SR-192-53	311.6	3.00E-01	1.26E-01	<MDA	<MDA	2%	N/A		1.51E-01
OL-3-39 SP-5	PB09-05215	SR-192-54	316.1	2.32E-01	1.09E-01	<MDA	<MDA	2%	N/A		1.49E-01
OL-3-39 SP-6	PB09-05216	SR-192-55	365.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.04E-01	1.23E-01
OL-3-39 SP-7	PB09-05217	SR-192-56	360.0	2.47E-01	1.03E-01	<MDA	<MDA	2%	N/A		1.21E-01
OL-3-39 SP-8	PB09-05218	SR-192-57	329.8	2.96E-01	1.21E-01	<MDA	<MDA	2%	N/A		1.42E-01
OL-3-39 SP-9	PB09-05219	SR-192-58	352.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.06E-02	1.28E-01
OL-3-39 SP-10	PB09-05220	SR-192-59	390.4	2.28E-01	9.53E-02	<MDA	<MDA	2%	N/A		1.11E-01
OL-3-39 SP-11	PB09-05222	SR-192-60	336.9	2.66E-01	1.14E-01	<MDA	<MDA	2%	N/A		1.39E-01
OL-3-40 SP-1	PB09-05228	SR-192-61	398.2	2.82E-01	1.05E-01	<MDA	<MDA	2%	N/A		1.09E-01
OL-3-40 SP-2	PB09-05229	SR-192-62	322.5	3.66E-01	1.36E-01	<MDA	<MDA	3%	N/A		1.46E-01
OL-3-40 SP-3	PB09-05231	SR-192-64	339.5	2.28E-01	1.05E-01	<MDA	<MDA	2%	N/A		1.38E-01
OL-3-40 SP-4	PB09-05232	SR-192-65	380.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.45E-02	1.18E-01
OL-3-40 SP-5	PB09-05233	SR-192-66	372.4	2.62E-01	1.07E-01	<MDA	<MDA	2%	N/A		1.26E-01
OL-3-40 SP-6	PB09-05234	SR-192-67	390.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.26E-02	1.15E-01
OL-3-40 SP-7	PB09-05235	SR-192-68	358.5	3.41E-01	1.25E-01	<MDA	<MDA	2%	N/A		1.31E-01
OL-3-40 SP-8	PB09-05236	SR-192-69	387.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.33E-02	1.16E-01
OL-3-40 SP-9	PB09-05237	SR-192-70	435.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.88E-02	1.08E-01
OL-3-40 SP-10	PB09-05238	SR-192-71	360.6	3.20E-01	1.17E-01	<MDA	<MDA	2%	N/A		1.25E-01
OL-3-40 SP-11	PB09-05239	SR-192-72	399.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.10E-01	1.18E-01
OL-3-41 SP-1	PB09-04968	SR-192-25	342.9	3.95E-01	1.34E-01	<MDA	<MDA	3%	N/A		1.27E-01
OL-3-41 SP-2	PB09-04970	SR-192-27	355.1	3.25E-01	1.19E-01	<MDA	<MDA	2%	N/A		1.27E-01
OL-3-41 SP-3	PB09-04971	SR-192-28	340.6	4.32E-01	1.41E-01	<MDA	<MDA	3%	N/A		1.28E-01
OL-3-41 SP-4	PB09-04972	SR-192-29	388.3	1.89E-01	8.91E-02	<MDA	<MDA	1%	N/A		1.21E-01
OL-3-41 SP-5	PB09-04973	SR-192-30	312.8	3.08E-01	1.23E-01	<MDA	<MDA	2%	N/A		1.44E-01
OL-3-41 SP-6	PB09-04974	SR-192-31	350.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.19E-01	1.24E-01
OL-3-41 SP-7	PB09-04975	SR-192-32	326.5	2.99E-01	1.22E-01	<MDA	<MDA	2%	N/A		1.44E-01
OL-3-41 SP-8	PB09-04976	SR-192-33	379.9	4.26E-01	1.32E-01	<MDA	<MDA	3%	N/A		1.19E-01
OL-3-41 SP-9	PB09-04977	SR-192-34	325.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.07E-01	1.34E-01
OL-3-41 SP-10	PB09-04978	SR-192-35	333.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.00E-02	1.41E-01
OL-3-41 SP-11	PB09-04979	SR-192-36	356.5	2.54E-01	1.23E-01	<MDA	<MDA	2%	N/A		1.27E-01

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS**

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CLASS 2 (SR-192) SOIL SAMPLE RESULTS											
Location	Sample Log #	Sample #	Weight (g)	Cs-137		Co-60		% Unity	Cs:Co	Cs-137	Co-60
				DCGL _(eff)	14.02	DCGL	3.8			MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
Total Number			66	46	46	0	0	66	0	20	66
Maximum Value			435.9	3.35E+00	4.11E-01	0.00E+00	0.00E+00	24%	0.0	2.45E-01	1.51E-01
Average Value			351.9	4.12E-01	1.31E-01	0.00E+00	0.00E+00	2%	0.0	1.02E-01	1.28E-01
Standard Deviation			27.13	4.61E-01	4.81E-02	0.00E+00	0.00E+00	3%	0.0	4.40E-02	1.55E-02

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE
QC COMPARISON**

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QC SOIL SAMPLE SUMMARY DATA											
Location	HPGe Log #	Sample #	(g)	Cs-137		Co-60		Fraction	Cs:Co	Cs-137	Co-60
										MDA	MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-3-1 SP-1 QC	PB09-03338	SR-180-2	368.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.15E-02	1.27E-01
OL-3-8 SP-1 QC	PB09-03477	SR-180-14	402.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.05E-02	1.12E-01
OL-3-10 SP-1 QC	PB09-03572	SR-180-29	388.2	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.31E-02	1.16E-01
OL-3-11 SP-1 QC	PB09-03623	SR-180-41	351.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.54E-02	1.34E-01
OL-3-24 SP-1 QC	PB09-03691	SR-180-53	391.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.66E-02	1.20E-01
OL-3-25 SP-1 QC	PB09-03705	SR-180-65	363.5	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.04E-01	1.29E-01
OL-3-27 SP-1 QC	PB09-03718	SR-180-77	328.1	2.42E-01	9.34E-02	<MDA	<MDA	0.0173	N/A		6.87E-02
OL-3-20 SP-4 QC	PB09-04195	SR-180-92	410.4	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	7.31E-02	1.14E-01
OL-3-2 SP-3 QC	PB09-04422	SR-180-103	369.3	1.37E-01	6.27E-02	<MDA	<MDA	0.0098	N/A		6.10E-02
OL-3-3 SP-6 QC	PB09-04720	SR-180-201	371.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	4.44E-02	6.22E-02
OL-3-4 SP-2 QC	PB09-04446	SR-180-126	454.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	6.27E-02	9.56E-02
OL-3-5 SP-9 QC	PB09-04466	SR-180-145	405.8	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	1.03E-01	1.07E-01
OL-3-6 SP-6 QC	PB09-04516	SR-180-154	317.1	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	2.92E-01	1.42E-01
OL-3-34 SP-10 QC	PB09-04605	SR-180-170	335.5	2.43E-01	1.09E-01	<MDA	<MDA	0.0173	N/A		1.40E-01
OL-3-12 SP-4 QC	PB09-04656	SR-180-176	364	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.24E-02	1.29E-01
OL-3-30 SP-8 QC	PB09-04673	SR-180-192	329.9	2.01E-01	8.29E-02	<MDA	<MDA	0.0144	N/A		6.83E-02
OL-3-3 SP-6 QC	PB09-04722	SR-180-202	349	<MDA	<MDA	<MDA	<MDA	0.000	N/A	4.84E-02	6.24E-02
OL-3-7 SP-3 QC	PB09-04731	SR-180-211	322.7	1.98E-01	6.91E-02	<MDA	<MDA	0.014	N/A		6.74E-02
OL-3-13 SP-4 QC	PB09-04745	SR-180-224	395.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.58E-02	1.19E-01
OL-3-14 SP-4 QC	PB09-04760	SR-180-236	344.5	2.66E-01	7.96E-02	<MDA	<MDA	0.019	N/A		6.81E-02
OL-3-15 SP-2 QC	PB09-04771	SR-180-246	369.6	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.31E-01	1.22E-01
OL-3-16 SP-6 QC	PB09-04788	SR-180-262	407.7	<MDA	<MDA	<MDA	<MDA	0.000	N/A	0.06997	0.10664
OL-3-17 SP-5 QC	PB09-04808	SR-180-273	341.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.31E-02	1.32E-01
OL-3-18 SP-9 QC	PB09-04825	SR-180-289	350.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.10E-02	1.29E-01
OL-3-9 SP-2 QC	PB09-04986	SR-180-294	351.9	1.74E-01	5.76E-02	<MDA	<MDA	0.012	N/A		4.27E-02
OL-3-35 SP-4 QC	PB09-05002	SR-180-308	317.1	2.67E-01	1.14E-01	<MDA	<MDA	0.019	N/A		1.42E-01
OL-3-22 SP-1 QC	PB09-05010	SR-180-317	420.3	<MDA	<MDA	<MDA	<MDA	0.000	N/A	7.14E-02	1.12E-01
OL-3-19 SP-10 QC	PB09-05077	SR-180-338	356.5	<MDA	<MDA	<MDA	<MDA	0.000	N/A	8.00E-02	1.22E-01
OL-3-26 SP-2 QC	PB09-05082	SR-180-342	406.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	6.98E-02	1.11E-01
OL-3-23 SP-4 QC	PB09-05096	SR-180-356	319.9	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.28E-01	1.47E-01
OL-3-21 SP-4 QC	PB09-05110	SR-180-368	375.4	<MDA	<MDA	<MDA	<MDA	0.000	N/A	1.12E-01	1.25E-01
OL-3-28 SP-4 QC	PB09-05123	SR-180-380	353.3	6.20E-01	1.80E-01	<MDA	<MDA	0.044	N/A		1.33E-01
OL-3-31 SP-4 QC	PB09-05139	SR-180-392	337.3	3.02E-01	1.21E-01	<MDA	<MDA	0.022	N/A		1.39E-01
OL-3-33 SP-4 QC	PB09-05156	SR-180-404	327.2	2.11E-01	1.03E-01	<MDA	<MDA	0.015	N/A		1.43E-01
OL-3-29 SP-3QC	PB09-05173	SR-180-415	405.6	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	4.16E-02	5.36E-02
OL-3-32 SP-3QC	PB09-05187	SR-180-427	339.7	<MDA	<MDA	<MDA	<MDA	0.0000	N/A	8.35E-02	1.33E-01
OL-3-42 SP-2 QC	PB09-05293	SR-180-438	334	3.82E-01	1.34E-01	<MDA	<MDA	3%	N/A		1.30E-01
OL-3-36 SP-4 QC	PB09-04833	SR-192-5	349.5	1.77E-01	6.04E-02	<MDA	<MDA	1%	N/A		4.48E-02
OL-3-37 SP-11 QC	PB09-04967	SR-192-24	325.6	6.27E-01	1.73E-01	<MDA	<MDA	4%	N/A		1.39E-01
OL-3-41 SP-1 QC	PB09-04969	SR-192-26	340.6	3.11E-01	1.22E-01	<MDA	<MDA	2%	N/A		1.38E-01
OL-3-38 SP-1 QC	PB09-05198	SR-192-38	381.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.86E-02	1.23E-01
OL-3-39 SP-2 QC	PB09-05212	SR-192-51	424.1	1.52E-01	5.91E-02	<MDA	<MDA	1%	N/A		5.32E-02
OL-3-40 SP-2 QC	PB09-05230	SR-192-63	348.3	2.65E-01	1.09E-01	<MDA	<MDA	2%	N/A		1.29E-01
Total Number			43	17	17	0	0	43	0	26	43
Maximum Value			453.1	7.62E+00	6.01E-01	0.00E+00	0.00E+00	0.5435	0.0	3.20E-01	1.50E-01
Average Value			359.5	4.46E-01	1.33E-01	0.00E+00	0.00E+00	0.0107	0.0	9.19E-02	1.25E-01
Standard Deviation			30.33	6.67E-01	5.60E-02	0.00E+00	0.00E+00	0.0314	0.0	3.17E-02	1.47E-02

**APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE
QC COMPARISON**

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QC Comparison (FSSP Section 12.7.2)									
Location	HPGe Log #	Sample #	Original	Replicate	Original 2	Resolution	Ratio	Pass	
OL-3-1 SP-1 QC	PB09-03338	SR-180-2	<MDA	<MDA				YES	
OL-3-8 SP-1 QC	PB09-03477	SR-180-14	<MDA	<MDA				YES	
OL-3-10 SP-1 QC	PB09-03572	SR-180-29	1.58E-01	7.31E-02	7.92E-02	4	0.5	YES	
OL-3-11 SP-1 QC	PB09-03623	SR-180-41	<MDA	<MDA				YES	
OL-3-24 SP-1 QC	PB09-03691	SR-180-53	<MDA	<MDA				YES	
OL-3-25 SP-1 QC	PB09-03705	SR-180-65	<MDA	<MDA				YES	
OL-3-27 SP-1 QC	PB09-03718	SR-180-77	2.89E-01	2.42E-01	1.16E-01	5	0.8	YES	
OL-3-20 SP-4 QC	PB09-04195	SR-180-92	<MDA	<MDA				YES	
OL-3-2 SP-3 QC	PB09-04422	SR-180-103	2.12E-01	1.37E-01	1.00E-01	4	0.6	YES	
OL-3-3 SP-6 QC	PB09-04720	SR-180-201	<MDA	<MDA				YES	
OL-3-4 SP-2 QC	PB09-04446	SR-180-126	<MDA	<MDA				YES	
OL-3-5 SP-9 QC	PB09-04466	SR-180-145	<MDA	<MDA				YES	
OL-3-6 SP-6 QC	PB09-04516	SR-180-154	<MDA	<MDA				YES	
OL-3-34 SP-10 QC	PB09-04605	SR-180-170	2.43E-01	1.10E-01	1.09E-01	4	0.5	YES	
OL-3-12 SP-4 QC	PB09-04656	SR-180-176	<MDA	<MDA				YES	
OL-3-30 SP-8 QC	PB09-04673	SR-180-192	2.31E-01	2.01E-01	8.86E-02	5	0.9	YES	
OL-3-3 SP-6 QC	PB09-04722	SR-180-202	<MDA	<MDA				YES	
OL-3-7 SP-3 QC	PB09-04731	SR-180-211	2.03E-01	1.98E-01	6.88E-02	6	1.0	YES	
OL-3-13 SP-4 QC	PB09-04745	SR-180-224	<MDA	<MDA				YES	
OL-3-14 SP-4 QC	PB09-04760	SR-180-236	2.19E-01	2.66E-01	7.21E-02	6	1.2	YES	
OL-3-15 SP-2 QC	PB09-04771	SR-180-246	<MDA	<MDA				YES	
OL-3-16 SP-6 QC	PB09-04788	SR-180-262	<MDA	<MDA				YES	
OL-3-17 SP-5 QC	PB09-04808	SR-180-273	<MDA	<MDA				YES	
OL-3-18 SP-9 QC	PB09-04825	SR-180-289	<MDA	<MDA				YES	
OL-3-9 SP-2 QC	PB09-04986	SR-180-294	1.93E-01	1.74E-01	6.63E-02	6	0.9	YES	
OL-3-35 SP-4 QC	PB09-05002	SR-180-308	3.27E-01	2.67E-01	1.22E-01	5	0.8	YES	
OL-3-22 SP-1 QC	PB09-05010	SR-180-317	<MDA	<MDA				YES	
OL-3-19 SP-10 QC	PB09-05077	SR-180-338	<MDA	<MDA				YES	
OL-3-26 SP-2 QC	PB09-05082	SR-180-342	<MDA	<MDA				YES	
OL-3-23 SP-4 QC	PB09-05096	SR-180-356	<MDA	<MDA				YES	
OL-3-21 SP-4 QC	PB09-05110	SR-180-368	<MDA	<MDA				YES	
OL-3-28 SP-4 QC	PB09-05123	SR-180-380	6.60E-01	6.20E-01	1.62E-01	8	0.9	YES	
OL-3-31 SP-4 QC	PB09-05139	SR-180-392	2.59E-01	3.02E-01	9.99E-02	5	1.2	YES	
OL-3-33 SP-4 QC	PB09-05156	SR-180-404	4.46E-01	2.11E-01	1.47E-01	6	0.5	YES	
OL-3-29 SP-3QC	PB09-05173	SR-180-415	<MDA	<MDA				YES	
OL-3-32 SP-3QC	PB09-05187	SR-180-427	<MDA	<MDA				YES	
OL-3-42 SP-2 QC	PB09-05293	SR-180-438	2.86E-01	3.82E-01	1.06E-01	5	1.3	YES	
OL-3-36 SP-4 QC	PB09-04833	SR-192-5	2.15E-01	1.77E-01	8.83E-02	5	0.8	YES	
OL-3-37 SP-11 QC	PB09-04967	SR-192-24	6.16E-01	6.27E-01	1.69E-01	7	1.0	YES	
OL-3-41 SP-1 QC	PB09-04969	SR-192-26	3.95E-01	3.11E-01	1.34E-01	6	0.8	YES	
OL-3-38 SP-1 QC	PB09-05198	SR-192-38	<MDA	<MDA				YES	
OL-3-39 SP-2 QC	PB09-05212	SR-192-51	2.89E-01	1.52E-01	1.11E-01	5	0.5	YES	
OL-3-40 SP-2 QC	PB09-05230	SR-192-63	3.66E-01	2.65E-01	1.36E-01	5	0.7	YES	
Total Number			18	18	18	18	18	N/A	
Maximum Value			453.1	7.62E+00	6.01E-01	0.00E+00	0.00E+00	N/A	
Average Value			359.5	4.46E-01	1.33E-01	0.00E+00	0.00E+00	N/A	
Standard Deviation			30.33	6.67E-01	5.60E-02	0.00E+00	0.00E+00	N/A	

Acceptance Criteria

Resolution	Ratio
< 4	0.4 - 2.5
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.8 - 1.25
> 200	0.85 - 1.18

1. If both results are < MDA, they are in agreement.
2. When comparing a positive result to a <MDA result, assume that the sample result is positive at the MDA and use the MDA value to determine the ratio.