National Aeronautics and
Space Administration

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

March 11, 2011

Reply to Attn of: QD

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

Subject: Final Status Survey Report, Attachment 7, Storm Drains, Pipe Trenches & Other Sub-Surface Excavations, 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 7 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 Storm Drains, Pipe Trenches & Other Sub-Surface Excavations. It supports our conclusion that radiological remediation of the areas have been completed and the areas meet the criteria for unrestricted release specified in 10 CFR 20.1402.

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

Sincerely,

Keith M. Peecook
NASA Decommissioning Program Manager

Enclosure
1. Plum Brook Reactor Facility Final Status Survey Report, Attachment 7, Storm Drains, Pipe Trenches & Other Sub-Surface Excavations, revision 0, dated March 10, 2011.

#SME20
FSME

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 7

Revision 0

Storm Drains, Pipe Trenches & Other Sub-Surface Excavations

FINAL STATUS SURVEY REPORT
ROUTING AND APPROVAL SHEET

Document Title: Final Status Survey Report,
Attachment 7
Storm Drains, Pipe Trenches & Other Sub-Surface Excavations

Revision Number: 0

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	SIGNATURE	DATE
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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
AOC	Area of Concern
ALARA	As Low As Reasonable Achievable
ATS	Assembly, Test and Storage Building
β	beta; denotes beta radiation, also type II error probability in hypothesis testing
b_i	background counts in observation interval
BPL	Byproduct License
CB	Catch Basin
CFR	Code of Federal Regulations
CRB	Cold Retention Basin
cm	centimeters
CMP	Corrugated Metal Pipe
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)"
DL	Drain Line
dpm	disintegrations per minute
dpm/100 cm^2	disintegrations per minute per 100 centimeters squared
EMC	Elevated Measurement Comparison
ERB	Emergency Retention Basin
EPA	US Environmental Protection Agency
FH	Fan House Building
FPR	Final Post Remediation
FSS	Final Status Survey
FSSP	Final Status Survey Plan
FSSR	Final Status Survey Report
ft.	feet
γ	gamma, denotes gamma radiation
g	gram
HL	Hot Lab
HTD	Hard To Detect
HRA	Hot Retention Area
i	observation counting interval during scan surveys
IM	Investigative Measurement

LIST OF ACRONYMS & SYMBOLS, Continued

in.	inch
LBGR	Lower Bound of the Gray Region
m^2	square meters
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
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
MOU	Memorandum of Understanding
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
OL	Open Land
PBOW	Plum Brook Ordinance Works
PBRF	Plum Brook Reactor Facility
PNL	Pacific Northwest Laboratory
PPH	Primary Pump House
QC	Quality Control
Φ	Standard normal distribution function
p	surveyor efficiency for scan surveys
pCi/g	picocuries per gram
%	percent
QC	Quality Control
RCP	Rigid Corrugated Pipe
RCRA	Resource Conservation and Recovery Act
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
ROLB	Reactor Office and Laboratory Building
ROB	Reactor Office Building
RSCB	Reactor Security and Control Building
s	seconds
σ	generic symbol for standard deviation of a population
S^+	Sign Test statistic
SDPTSSE	Storm Drains, Pipe Trenches and Other Sub-Surface Excavations
SDS	Storm Drainage System
SEB	Services Equipment Building

LIST OF ACRONYMS & SYMBOLS, Continued

SNL	Sandia National Laboratory
SR	Survey Request
STS	Storm System
SSS	Sanitary Sewer System
TBD	Technical Basis Document
μ	Mean activity concentration
VSP	Visual Sample Plan
WEMS	Waste Effluent Monitoring Station
WEP	Work Execution Plan
WHB	Waste Handling Building
$Z_{1-\alpha}$	Proportion of standard normal distribution values less than $1-\alpha$
$Z_{1-\beta}$	Proportion of standard normal distribution values less than $1-\beta$
∞	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) Storm Drains, Pipe Trenches and Other Sub-Surface Excavations (SDPTSSE). It is Attachment 7 of the PBRF Final Status Survey Report (FSSR) [1]. This attachment describes the operational history and final condition for the final status survey (FSS) of the Storm Drains, Pipe Trenches and Sub-Surface Excavations covered by this document. It describes the methods used in the FSS and presents the results of the survey 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/year. 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 and in Table 2-2 of the Technical Basis Document (TBD) PBRF-TBD-09-001[PBRF 2009]. In accordance with the FSSP and TBD-09-001, the primary DCGLs for surface soil 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 SDPTSSE were established in Table 5-2 of PBRF-TBD-09-001 and are provided in Table 2 of this report.

The survey measurement results and supporting information presented herein demonstrate that residual contamination levels in each survey unit of the SDPTSSE 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 SDPTSSE meets the criteria for unrestricted release.

Section 2.0 of the report provides a description of the SDPTSSE. This section also discusses the final configuration of the SDPTSSE 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 for the SDPTSSE. This section includes FSS Plan requirements applicable to the SDPTSSE, breakdown into survey units and assignment of MARSSIM

[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).

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 SDPTSSE 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 analysis results are provided in Appendix C.

2.0 Storm Drains, Pipe Trenches & Other Sub-Surface Excavations Description

The PBRF site is located near the northern edge of the 6400 acre Plum Brook Station. The site, as described in the NRC license that controls decommissioning activities, comprises 27 acres which contain the Reactor Building and support buildings and facilities.[2] The controlled-access site is bounded on the south by Pentolite Rd., on the west by Line 2 Rd. and on the north and east by a boundary fence. The southwest corner of the site, the intersection of Line 2 and Pentolite Roads is used as a reference location.[3] The coordinates are 41° 23' 03.73" North Latitude and 82° 41' 05.80" West Longitude.[4] Figure 1 shows the principal PBRF buildings and site layout.

The site is generally level with grading to promote surface water drainage to the Water Effluent Monitoring System (WEMS) located at the south east corner of the site [USACE 2004]. The site reference grade level at the Reactor Building is 631 ft. above mean sea level [NACA 1956].[5]

The PBRF 27 acre site contains several multi-story buildings and multiple support structures. Below-grade structures and utilities extend throughout the site. These include underground pipe and utility tunnels, storm drains, catch basins, sanitary sewers, water and gas supply lines, cathodic protection wells and ground water monitoring wells. Prior to the beginning of

[2] See Technical Specifications for the License No. TR-3 (Amendment 13) and License No. R-93 (Amendment 9) [NASA 2007].

[3] Prior to decommissioning, the Reactor Vessel center was typically used as a local reference location for the PBRF.

[4] Note that the coordinate grid system used for construction of the PBRF was a local coordinate system established by the Army Corps of Engineers in the 1940's for construction of the Plum Brook Ordinance Works. This local grid system has been balanced (tied in) to the Ohio regional state plane coordinate system by NASA to align Glenn Research Center and Plum Brook Station geographic references with modern high-accuracy geo-reference systems. This provides the ability to reference locations specified on historical drawings to global latitude and longitude [Hagelin 2010].

[5] The finished floor elevation of the Reactor Building first floor is designated as the 0 ft. elevation for major PBRF buildings. This is one ft. above grade level at the Reactor Building location.

decommissioning, buildings, water processing structures (WEMS, sludge basins, Cold Retention Basins (CRBs), etc.) paved roadways, parking areas, sidewalks and equipment pads covered about 25% of the site. The remainder of the site surface was open land soil areas.

Areas adjacent to the PBRF on the north (north of North Rd.) contained utilities and support facilities for PBRF operations. These included the Assembly Test and Storage (ATS) Building, the former Reactor Office Building (ROB), an electric substation and a deionized water storage tank. All these facilities and the surrounding land area were cleared of licensed radioactive materials and released from the PBRF NRC licenses prior to decommissioning of the PBRF.[6]

2.1 History of Site Operations

Plum Brook Station was formerly a World War II era explosives manufacturing facility and prior to that was occupied by family farms and orchards [Bowles 2006]. Construction of the Plum Brook Ordinance Works (PBOW) in 1941-42, involved razing of existing farms, residences and small commercial buildings and construction of explosives manufacturing facilities. After World War II, the PBOW lay dormant for 10 years. In 1955 the Department of the Army transferred 500 acres in the northern portion of the former Ordinance Works to the National Advisory Committee on Aeronautics (NACA), the NASA predecessor, for construction of the Plum Brook test reactor facility.

The first tasks in the PBRF construction were to remove the PBOW facilities and clean up chemical residues from explosives production. This included removal and cleanup of two large chemical waste water retention basins located in the southeastern portion of the present-day site.

Construction of the Plum Brook Reactor and associated facilities required extensive excavation and backfilling. Soil was excavated to bedrock and bedrock was excavated in construction of the Reactor Building and nearby support buildings and in construction of large water handling facilities, the CRBs and Emergency Retention Basin (ERB) [USACE 2004].

Major PBRF milestones are listed below: [7]

1956 – September, groundbreaking for PBRF.

1956 – Reactor Building construction initiated.

1959 – 1960 Major building construction completed.

1961 – June, 60 MW Test Reactor critical.

[6] License Number TR-3, Amendment No. 6, approved by NRC letter dated Dec. 17, 1976.

[7] Information sources for the site history include construction drawings and photos, PBRF operating cycle reports, PBRF annual reports, memoranda and other historical files maintained by PBRF Document Control.

1973 – January 5th, Reactor shutdown.

1973 – June 30, PBRF facilities placed in "standby" condition.

1985 – Initial radiological characterization, Teledyne Isotopes Inc.

1989 – Follow-up radiological characterization, GTS-Duratek.

2002 – Decommissioning Plan approved. Equipment removal and initial building decontamination commenced.

2005-2010 – Decommissioning of Buildings and Excavation of Soil and Materials.

2010-2011– FSS on Storm Drains, Pipe Trenches and Other Sub-Surface Excavations.

It is noted that the major buildings were completed in the construction period, 1956 - 1960, but modifications to the site that affected areas excavated during decommissioning occurred throughout the operations period. These included installation of cathodic protection wells (1961-62), construction of the Waste Handling Building (1962-64), construction of the Assembly and Test Storage Building (ATS, Building 1142) utility and personnel passage tunnel to the Reactor Building (1964-65), WEMS modifications (several times during 1961 – 1973) and modification of storm drains (1968).

2.2 Site Geology and Soil Description

The Plum Brook Station and the PBRF site are underlain by shale and sandstone formations at varying depths (approximately 2 to 25 ft.) across the station with surface outcrops at some locations. The depth to bedrock is about 25 ft. in the vicinity of the Reactor Building [NASA 2007a]. Surface deposits constitute a mixture of soils derived from fine sand, silt, clay and unconsolidated glacial till [NASA 1959]. Soils in the vicinity of the PBRF are composed of loam, loamy fine sand and fine sandy loam [USACE 2004].

However, the PBRF site soils are highly disturbed and not considered characteristic of native-undisturbed soils in the site vicinity. A series of major disturbances have occurred dating back to the 1940's. Construction of the PBOW involved extensive excavation to construct the ordinance "production lines" and process waste water retention basins. As a result of PBOW operations from 1942 – 1945, the PBRF site was extensively contaminated with chemicals used in the manufacture of Pentolite.[8] A site cleanup campaign was mounted prior to PBRF construction [Bowles 2006]. During this cleanup, unknown quantities of soil were reportedly removed from the site

[8] Pentolite is a military grade high explosive.

and fill material was likely brought in from off-site [USACE 2004]. And, as described in the previous section, construction of the PBRF involved extensive excavation and backfilling throughout the 27 acre site.

2.3 Site Soil Characterization

Site soil characterization results are summarized to identify soil areas requiring remediation (excavation) and to present radionuclide profiles of radiological constituents of PBRF origin. Radiological characterization of PBRF soils has been performed on several occasions after the facility shutdown in 1973. The initial post-shutdown characterization survey performed in 1985 (reported in 1987) by Teledyne Isotopes, Inc. included sampling and analysis of site soils [Tele 1987]. In 1998, GTS Duratek performed a characterization survey to confirm the 1985 Teledyne results and to provide additional data on isotopic composition of contamination. From these studies, it was concluded that the ERB, the Pentolite Ditch, the CRBs and several localized areas required remediation.[9]

In 2004, a comprehensive characterization survey of the site was performed by Montgomery Watson to identify contaminated soil areas and develop radionuclide profiles to guide remediation efforts. The area inside the PBRF site was divided into 11 survey units. Two areas outside the site fence that were known to be contaminated were also characterized; an area east of the WEMS and the Pentolite Ditch. Altogether, 610 surface and 1,043 subsurface soil samples were collected and analyzed by gamma spectroscopy [MWH 2005]. Selected samples were sent to vendor laboratories for analysis of non-gamma emitters.

Remediation action levels (RALs) to guide remediation planning were set at 50% of DCGLs published in the FSS Plan [MWH 2005a]. On this basis and from results of characterization surveys described above, the following areas were identified as requiring remediation:

- Emergency Retention Basin (ERB)
- Cold Retention Basins
- Water Effluent Monitoring System (WEMS)
- Storm Drains and Catch Basins
- Waste Handling Building (WHB) and Fan House (FH) Building sub-foundation (portions)
- Pentolite Ditch and Environs, identified as Areas of Concern (AOCs)

[9] It is noted that the Teledyne and GTS Duratek surveys were performed prior to the issuance of the current release criteria in 10CFR20 Subpart E and the supporting guidance on acceptable methods for characterization and final status surveys to demonstrate compliance. The 1985 and 1998 surveys relied heavily on gross activity analysis of soil samples and exposure rate measurements. These surveys identified locations of contaminated soil but did not provide information needed to determine nuclide profiles, DCGLs, and action levels for remediation and final status survey of site soils.

In addition, several discrete contaminated areas that resulted from spills were defined. Subsequent to the MWH characterization surveys, additional characterization was performed to further delineate these spill areas.[10] They are summarized in Table 1.

Table 1, Spill Area Summary

Name	Location	Approximate Size (ft^2) (1)	Description
Spill Area No. 1	Along E half of PPH S wall	25	Contaminated concrete, asphalt and soil area. Cs-137 up to 1.67 pCi/g & Co-60 up to 4.48 pCi/g (in soil 0 to 6 in depth). Designated as a Co-60 area. (2)
Spill Area No. 2	N of Reactor Building near Catch Basin 4	2000	Site of a 300 gallon liquid spill during transfer of contaminated water in 2005. Was remediated in 2005. Designated as a Co-60 area. (3)
Spill Area No. 3	E side of Hot Lab at Rollup Door	1000	Cs-137 up to 431 pCi/g & Co-60 up to 271 pCi/g (0 to 6 in depth). Designated as a Co-60 area. (3)
Spill Area No. 4 (small area)	S of WHB	22	Smaller of two distinct sub-areas identified as Spill area No. 4. Above scan RAL, but no soil samples > 0.5 x DCGL. (3)
Spill Area No. 4 (main area)	W of Line 3 Rd approximately 100 ft. S of WHB	2400	Larger of two distinct sub-areas identified as Spill area No. 4. Scan results > bkg., but below scan RAL; no soil samples > 0.5 x DCGL. (3)
Spill Area No. 5	S of South CRB	600	Above scan RAL, but no soil samples > 0.5 x DCGL. (3)
Spill Area No. 6	E of SEB & S of Sludge Basins	2500	Scan surveys in 2006 failed to detect levels above bkg., except in one very localized area (~ $2ft^2$) just south of catch basin CB-9A, which was > RAL. (3)
WEMS Spill Area	E of WEMS outside Perimeter Fence	2500	Soil area contaminated from WEMS overflow-flood events. Cs-137 up to 19.1 pCi/g & Co-60 up to 1.28 pCi/g (0 to 6 in depth). (3)

Table 1 Notes:

1. Approximate surface area of potentially impacted areas investigated.
2. Descriptive information and survey results from SR-3
3. Descriptive information and survey results from SR-16 and personal communication, FSS supervisor.

Using characterization survey results, radionuclide profiles were developed for the areas that were identified as requiring remediation. These were published in a technical basis document to establish radionuclide mixtures and DCGLs for FSS of the site soils [PBRF 2009]. The site and impacted adjacent environmental areas were divided into groups with similar radionuclide profiles. Activity fractions of the

[10] Survey Request SR-3, Spill Area No.1 (January 2006) and SR-16, Spill Areas No.2 through No.6 (May 2006).

principal radionuclides, Cs-137, Co-60 and Sr-90 were established for each group. The results are shown in Table 2.[11]

Table 2, Principal Radionuclides and Activity Fractions for Site Soils

Location	Activity Fractions		
	Cs-137	Co-60	Sr-90
Default for PBRF site and Spill Areas 4, 5 & 6.	0.912	0.007	0.081
Spill Areas 1, 2 & 3	0.201	0.714	0.085
Environs Outside Perimeter Fence	0.878	0.037	0.085
Pentolite Ditch and Environs	0.969	0.014	0.017

2.4 Storm Drain System Operation

The Storm Drainage System (SDS) was designed to control and record the volume of surface and wastewater and their associated radioactivity levels to document compliance with Atomic Energy Commission (AEC)/NRC and other regulatory requirements. The storm drainage system bounded the 27-acre reactor site and the effluent was directed to a control point located in the southeast corner of the reactor site adjacent to and inside the PBRF fence. That control point was called the Water Effluent Monitoring Station/System (WEMS), Building 1192, [PBRF 2009b].

The WEMS 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 limits in the PBRF license. Liquid effluents (such as storm drainage, waste waters including man-made radioactive contamination of PBRF origin, and processed lake dilution water) were released into the Pentolite Ditch via the WEMS.

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 (ERB) for temporary storage.

[11] Other radionuclides have been measured in PBRF characterization soil samples. In the FSS Plan, soil DCGLs were published for eight radionuclides (Co-60, Cs-137, Sr-90, Eu-152, Eu-154, Fe-55, Ni-69 and Ni-63. The dose to the Resident Farmer from radionuclides other than the principal three was calculated to be only 0.5 mrem/y. Hence, as this dose is well below the NRC 10% criterion, these radionuclides are considered insignificant.

The SDS was originally constructed in the 1959 to 1963 time frame.[12] Major modifications were made to the system several times to improve performance such as adding a hydro-mat liner to the open ditches, reshaping the flow path, and subsequently adding concrete piping and covering the ditches.[13]

The storm drainage waters contributed to the dilution of controlled radioactive discharges; they also contributed to flushing of the drainage ditches during periods of heavy rainfall. Occasionally, storm waters washed radioactive contaminants from spills and fallout from nuclear bomb testing during the early 1960s that had settled on the ground into the ditches. Storm flow rates varied from low flows during minor rainfalls to high flow conditions during heavy rain falls.

The main on-site storm drainage system, post shutdown, consisted of five laterals plus an under-drain system. A map identifying the storm drain system including an identification of the laterals is contained in Exhibit 2 of Appendix A. A description of the lateral system is as follows:

- Lateral A: Started at Catch Basin 5A near Building 1191 and ran south then east to the WEMS. Lateral A was comprised of about 465' of 30" Rigid Corrugated Pipe (RCP) and 1000' of 18" RCP along with the remains of the hydro-mat liner. Lateral A ran under Line 3 Road in a 43"x 27"x 60' corrugated metal pipe. Laterals C and D joined Lateral A at the south end of Line 3 Road – Lateral C on the west side and Lateral D on the east. (Note- Lateral B was the Pentolite Ditch and was outside the PBRF fenced site.)
- Lateral C: Started at Catch Basin 13A south of Building 1133 and ran to Lateral A along the west side of Line 3 Road. Lateral C was comprised of about 360' of 12" RCP along with the remains of the hydro-mat liner.
- Lateral D: Started at the headwall and Catch Basin 7A near the north Cold Retention Basin and ran south along the east side of Line 3 Road, finally connecting to Lateral A. Approximately 70' of hydro-mat liner (intact) was abandoned near the junction of Lateral D and Lateral A because it originally entered Lateral A at a 45° angle, instead of the present (near 90°). There was approximately 650' of 18" RCP, the remains of the hydro-mat liner, plus 50' of 18" RCP added to straighten the lateral where it connected to Lateral A.
- Main Lateral: Started at the headwall north of Catch Basin 9A and near the raw water flush valve (25V18) pit and runs south to the WEMS settling basin. There were approximately 880' of 36" RCP and the remains of the hydro-mat liner.
- The north lateral ran east and west on the north side of the facility just inside the north fence line. This lateral connected to the main lateral east of the sludge settling basins (1153).

[12] NASA Lewis Research Center – Plum Brook Station Building Plans, NASA PBRF Records Files and Drawings CF-115330 and 115332.

[13] NASA PBRF Drawings PF-06006 & PF-06007.

- Under Drain System: An under drain system was added to drain ground water from under the concrete pipe in Lateral A and the main lateral. This was a 6" Corrugated Metal Pipe (CMP) that ran approximately the last 275' of Lateral A and the last 350' of the main lateral emptying into the WEMS settling basin.

The term "lateral" was historically applied to the original open ditch areas of the PBRF storm drainage system.[14] Other sub-surface storm drainage piping fed into three laterals and was not included in the "lateral" descriptions in this report. For example, there were storm drain sections north of Lateral A headwall that tied directly into Lateral A (CBs 1A, 2A, 3A, 4A, 23, 24, 25, 26, 27, 28, and 33). Also, storm drainage piping south of the headwall tied into Lateral A (CBs 18, and 22 plus three field drains). The areas outside the "lateral" descriptions are addressed in this FSS report.

In addition to the above laterals, there were a number of under-drains and sloped landscaping throughout the site that directed rain and ground water to catch basins. These features were to keep the grounds relatively dry. The SDS consisted of a total of 9200 ft. of pipe ranging in size from 2" to 36" and a total of 56 catch basins.

A map of the SDS is provided in Exhibit 2 of Appendix A. See Exhibits 4, 5, and 9 in Appendix A for photographic documentation of Storm Drains, Pipe Trenches & Other Sub-Surface Excavations prior to remediation.

The Cold Retention Basins, Building 1154, were located east of the Fan House and the Waste Handling Building and on the east side of Line 3 road. The two CRBs were designed as a hold area for quadrant and canal water associated with the 60MW test reactor and mock-up reactor operations. The stored water contained in the CRBs was sometimes released to Lateral D under controlled conditions, after sampling and analysis. The basins were mostly below grade with a roof section that was about 1-2 ft. above grade. The north basin was identified as CRB-1 and the south as CRB-2.

The Fan House (FH), Building 1132, was located south of the Primary Pump House (PPH) and east of the Hot Lab (HL). Primary FH functions were collection and processing of exhaust air and contaminated water from the Reactor Building and other PBRF buildings. Air processing equipment contained in the FH included fans, pumps, compressors, a scrubber, filters, activated carbon absorbers, radiation monitor and exhaust system.

The Waste Handling Building (WHB), Building 1133, was located south of the FH and east of the Hot Retention Area (HRA). The WHB contained equipment for processing contaminated water, protective clothing, miscellaneous contaminated trash, or dry active waste (DAW), equipment and experiment hardware. Waste processing activities spanned decontamination, waste shipment and recycling. The WHB included laundry facilities for decontaminating protective clothing. It contained operating areas for processing and packaging radioactive waste for offsite shipment, an evaporator

[14] PBRF reference drawing RF-06260.

facility for processing high-solids contaminated waste water and work areas for decontaminating reusable equipment and for packaging radioactive waste for storage and shipment. The WHB was designed for operation in close conjunction with the FH and HRA for processing PBRF radioactive wastes.

The Hot Retention Area (HRA), Building 1155, was located south of the FH and west of the HRA. The HRA was designed to provide holding capacity for large volumes of radioactively contaminated water generated in PBRF reactor operations. It functioned as a tank farm for storage, holdup and decay of water from the hot drain system. The hot drain system collected radioactive water from hot sumps in the Reactor Building and the other PBRF buildings. The twelve HRA tanks had a combined capacity of 512,000 gallons. Eight large (60,000 gallon) steel tanks were housed in the vault and four stainless steel, 8000 gallon tanks were buried underground north of the main HRA vault.

Additionally, a large number of underground piping systems were connected to many of the buildings at PBRF including the following: FH, PPH, WHB, Reactor Building, HL, CRBs, SEB, ROLB and the HRA. These piping systems included the following: primary and secondary cooling, contaminated discharge lines, resin transfer lines, valve pits, sewage systems, domestic water system, ventilation system piping, vent and drain lines and utility supply lines.

2.5 Storm Drains, Pipe Trenches & Other Sub-Surface Excavations Construction

During the construction phase of the Reactor Facility (1956 to early 1963) prior to reactor full power operations, the lateral drainage ditches A, C, D and the main laterals were constructed as open ditches. The main lateral was open from Catch Basin 6B just north of the Precipitator (1157) and east to near the east fence line, then south to the WEMS. Lateral A was an open ditch running south from the Reactor Security and Control Building (RSCB) to near the south fence line then east to the WEMS. A 60 foot long 43"x 27" CMP ran under Line 3 Road. The spoils from the ditching were used to fill an existing creek bed that ran through the center of the facility. Pentolite Ditch that ran east and west from the WEMS exit to Plum Brook, was denoted as Lateral B.

Lateral C was an open ditch from the Fan House along the west side of Line 3 Road south to Lateral A. Lateral D was an open ditch from CRB-1 along the east side of Line 3 Road and south to Lateral A.

Piping and catch basins were eventually installed in the north and main lateral from the precipitator east and around the sludge settling basins then south to a headwall near the valve pit (25V18) and raw water flush line. Piping was installed in Lateral C from the Fan House south to near the Waste Storage Pad and Catch Basin 13A.

Early during the 60 MW reactor operations period, the storm drainage system laterals from the headwalls[15] to the WEMS were open ditches lined with a hydro-mat lining and sealed with a cold mastic sealant. The Hot Retention Area (HRA) pump out line discharged effluent into the storm drainage system adjacent to the valve pit near Cold Retention Basin (CRB) # 1. This location was just north of what was to be catch basin 7A. The headwall was visible near catch basin 7A.

The floor drain system for the Hot Lab Building Room 8, Change Room,[16] floor drains and the Mezzanine Room 27 floor drains[16] exited the south end of the building at -3 foot elevation and connected to the storm drainage system toward Catch Basin 3A.

The HRA and the CRB pump out lines also emptied into Lateral D near CRB-1. This water flowed (undiluted) south to Lateral A then east to the WEMS settling basin where it finally mixed with raw water from the main lateral and was diluted to meet effluent release criteria.

Over time, the hydro-mat liners were prone to leakage because of weathering causing cracked joints and required significant maintenance. It was found that the material used was not suitable for that purpose and suffered significant damage from the sun. In 1968, the bottoms of the hydro-mat liners were cut out and unstable base material removed. It is not known where this material was disposed. The ditch bottoms were then graveled and reinforced concrete pipe (RCP) installed. The hydro-mat liner remained in place on the ditch sides. An under drain system was installed on Lateral A and on the main lateral for a distance of about 300' from the WEMS settling basin.

There was an angled corner between Lateral D and the Lateral A east - west section that was squared off also at this time. New piping was also installed for the HRA pump out system, so that the discharge went between CRB 1 and CRB 2 and into the main lateral that runs north and south along the east fence line. The pipe discharged into catch basin 8A and then into the 36" reinforced concrete pipe, which empties into the WEMS settling basin (Facility Change 67-011). This afforded a better mixing of the HRA discharge water and the raw dilution water and reduced the frequency of WEMS gate closures. The CRB pump out discharge remained in Lateral D.

The CRBs were two prism based concrete basins with a capacity of about 500,000 gallons each. The basins were 94 ft. square at the top, 22 ft. square at the bottom and 18 ft. deep. Each basin had a pump that returned stored water to the Quadrant and Canal system. This water could also be pumped to the effluent trench (lateral D of the WEMS system) or transferred between basins. Valving was done in a below grade valve pit located just west of CRB-1. The valve pit was 14.3 ft. long, 10 ft. wide and 7 ft. deep. All electrical feed was through the valve pit to control panels located on the west side of each basin.

[15] PBRF print number PF-65156.

[16] PBRF print number PF-04587.

2.6 Final Configuration and Scope of Remediation of SDPTSSE for Final Status Survey

As areas became available, SDPTSSE were remediated by initially excavating the impacted soil/material 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.

The final configuration of the Storm Drains, Pipe Trenches & Other Sub-Surface Excavations for FSS consisted of a ditch that was excavated and benched, if necessary, as shown in Exhibits 8,11, 12, 14, 16, 17 and 19 of Appendix A.

2.6.1 Storm Drain System Dismantlement

The SDS was dismantled in phases by Decommissioning Contractor in accordance with Work Execution Package (WEP) number PBRF-WEP-09-020, "Storm Drain System Dismantlement". See Figure 1 and Exhibit 1 of Appendix A for a graphical representation of the Storm Drain, Pipe Trench and Other Sub-Surface Excavations conducted at PBRF. The phases of SDS dismantlement were as follows:

- Phase 1 the West Storm Drain System dismantlement consisted of the following:
    - Approximately 520 linear feet (ft.) of piping between CB-28 and CB-4A,
    - CB-28,
    - CB-1A,
    - Roof drain line (DL) to STS-45,
    - (Note-STS is used for "storm system" on some PBRF data sheets to designate pipe sections.)
    - Cold Sump line to STS-45,
    - SDS from STS-45 to CB-2A,
    - Roof drain line to CB-2A,
    - CB-27,
    - SDS between CB-27 and CB-4A,
    - CB-2A,
    - SDS between CB-2A and CB-4A,
    - Approximately 190 linear ft. of SDS piping between Hot Laboratory (HL), Building 1112 and CB-3A,
    - Roof DL STS-82 from southeast end of HL to south end of STS-82,
    - STS-112 from HL to STS-82,
    - STS-82 from south end of STS-112 to CB-3A,
    - Approximately 180 linear ft. of STS between CB-26 and CB-3A
    - CB-26, STS-9, CB-25, STS-24, STS-64, CB-23, STS-75, CB-3A

  - Approximately 190 linear ft. of SDS piping from CB-3A to CB-33 and from CB-4A to CB-5A,
  - STS-53, CB4A, STS-54, CB-33, STS-70, and CB-5A.

- Phase 2 dismantlement of the Storm Drain System North of Reactor Building (RxB), Building 1111, consisted of the following:
  - Approximately 687 linear ft. of SDS between CB-1 and STS-72,
  - CB-1 and STS-36,
  - STS-39,
  - CB-4 and STS-37,
  - STS-41,
  - SDS from CB-3 to west end of STS-42 and CB-3,
  - STS-42 from south end of Unit Sub Station 3 to CB-4,
  - CB-4 and the SDS between CB-4 and CB-5.

- Phase 3 dismantlement of the Storm Drain System East of the RxB consisted of the following:
  - Approximately 283 linear ft. of SDS between CB-10 and STS-71,
  - CB-10, STS-2, CB-9, STS-4, CB-8, STS-3, CB-7, and STS-71.

- Phase 4 dismantlement of the Storm Drain System West of the SEB consisted of the following:
  - Approximately 400 linear ft. of SDS between CB-7A and STS-57,
  - CB-7, STS-20, CB-21, STS-23, CB-20, STS-22, CB-12, STS-59, CB-11, and STS-57.

- Phase 5 dismantlement of the Storm Drain System North of the North Road consisted of the following:
  - Approximately 175 linear ft. of SDS between Man Hole MH-E4 and STS-73,
  - MH-E4, CB-B6 and STS-73,
  - Approximately 285 linear ft. of SDS from STS-56 to STS-65,
  - STS-56, MH-E5, and STS-65,
  - Approximately 195 linear ft. of SDS from CB-5 to STS-58,
  - CB-5, STS-74, CB-6A, and STS-58,
  - Approximately 215 linear ft. of SDS from Reactor Services and Equipment Building (SEB), Building 1131, to STS-66,
  - STS-78,
  - STS-79 from north of SEB to STS-78,
  - CB-6B and STS-66.

- Phase 6 dismantlement of the Storm Drain System East of the RxB consisted of the following:
  - Approximately 460 linear ft. of SDS between Blow-off Pit through CB-12A TO CB-9A,
  - Blow Off Pit, STS-80, CB-12A, STS-67, CB-11A, and STS-60.

  - Approximately 220 linear ft. of SDS between the Valve Pits to the intersection of STS-77 and STS-62,
  - Valve Pits, STS-87, CB-10A, STS-63, STS-62 up to intersection of STA-77,
  - Approximately 610 linear ft. of SDS from CB-14 AND CB-17 TO CB-8A,
  - STS-25, CB-17, STS-24, CB-15, STS-76, CB-16, STS-77, and the remains of STS-62,
  - Approximately 1,505 linear ft. of SDS from what remains of FH-110-1 to CB-8A and then to the WEMS,
  - FH-110-1, CB-8A, STS-68 to the intersection with STS-34, the remaining part of STS-68, CB-18A, and West Lateral-F2 to the intersection with STS-35,
  - STS-35 from CB-18A to West Lateral-F2,
  - West Lateral-F2,
  - STS-69 to CB-17A, CB-17A and the remaining section of STS-69,
  - Approximately 850 linear ft. of SDS from CB-15A to WEMS,
  - CB-15A, STS-30 up to STS-81, STS-81,
  - STS-30, STS-46, CB-16A, and remaining SDS between CB-16A and the WEMS,
  - West Lateral-F1.

- Phase 7 dismantlement the Southern Storm Drain System consisted of the following:
  - Approximately 60 linear ft. of SDS between FH and CB-WH5,
  - Cold sump line to CB-WH5,
  - Approximately 465 linear ft. of SDS from CB-WH5 to STS-6,
  - CB-WH5, STS-1 from north end of line connecting to WHB,
  - Remaining STS-1,
  - STS-13 FD from WHB to CB-WH4,
  - STS-14 cold sump from WHB to CB-WH4,
  - STS-15 roof drain from WHB to CB-WH4,
  - CB-WH4 and STS-5,
  - STS-83,
  - CB-WH3 and STS-5,
  - Approximately 240 linear ft. of SDS from west end of STS-11 to CB-13A,
  - STS-11, CB-WH2, STS-84, CB-WH11, STS-88, STS-95, and CB-13A.

When each phase of the SDS was dismantled, final post remediation surveys were conducted and the excavated areas were turned over to the FSS group for isolation and control and final status survey. See Exhibits 7, 8, and 14 of Appendix A for photographic documentation of Radiological Surveys being conducted after SDS dismantlement. Once final status surveys were completed, the excavated areas were turned over to the Decommissioning Contractor for backfill. See Exhibit 18 of Appendix A.

NOTE; A list of the buried piping remaining shall be provided in Attachment #17, "Buried and Miscellaneous Piping".

2.6.2 Cold Retention Basin Dismantlement

The Cold Retention Basins, Building 1154, were dismantled in phases by the Decommissioning Contractor in accordance with Work Execution Package (WEP) number PBRF-WEP-09-006, "Cold Retention Basin Dismantlement". See Figure 1 for a graphical representation of the Storm Drain, Pipe Trench and Sub Surface Excavations conducted at PBRF. The phases of CRB dismantlement was as follows:

- Roof system dismantlement including the roof, joists and girders,
- Internal systems disassembly including the pumps, piping, ladders, etc.,
- Concrete structure dismantlement,
- Sub-base material excavation, and
- Underlying soil survey and excavation.

Once the CRBs were dismantled in the sequence above, final post remediation surveys were conducted and the excavated areas were turned over to the FSS group for isolation and control and for final status survey. Once final status surveys were completed, the excavated areas were turned over to the Decommissioning Contractor for backfill. See Exhibit 10 of Appendix A.

2.6.3 Impacted Utility Excavations

Impacted utilities were dismantled in phases by the Decommissioning Contractor in accordance with Work Execution Package (WEP) number PBRF-WEP-09-007, "Impacted Utility Excavation". See Figure 1 for a graphical representation of the Storm Drain, Pipe Trench and Sub Surface Excavations conducted at PBRF. The utility excavation was as follows:

- Utility isolation,
- Sanitary Sewer System (SSS) excavation of approximately 815 linear ft. of system piping running east to west along North Road. This includes the following piping:
    - SanS-5,
    - SanS-6,
    - SanS-7,
    - SanS-4, and
    - SanS-8.
- SSS excavation of approximately 585 linear ft. of system piping running between the FH (1132) and the WHB (1133). This includes the following piping:
    - SanS-1A,
    - SanS-1B,
    - SanS-2, and

  - SanS-3.
- Cold Retention Area piping excavation of approximately 1,393 linear ft. of system piping running between the CRBs (1154) and the FH (1132). This includes the following piping:
  - CRB-5, CRB-4-1, CRB-3-1, and CRB-7-1. In addition to the valve pit outside the CRBs,
  - CRB-1, CRB-2, CRB-3, and CRB-4.
- Hot Retention Area piping excavation of approximately 216 linear ft. of system piping running between the CRB valve pit and the FH (1132). This includes the following piping:
  - FH-110-1 and FH-110 sump FH-110.
- Primary Pump House (PPH), Building 1132, and FH utility excavation of approximately 633 linear ft. of system piping surrounding the FH (1132) and the PPH (1134). This includes the following piping:
  - RxB-134,
  - PPH-105, PPH-106, and PPH-107,
  - Resin and valve pit south of PPH, RP-01, RPHD-1, and RPHD-2,
  - FH-103,
  - FH-112 and FH-113.

See Exhibit 3 of Appendix A for a map of the Sanitary Sewer System, at PBRF.

Once the Impacted Utilities were dismantled in the sequence stated above, final post remediation surveys were conducted and then the excavations were turned over to the FSS group for isolation and control and for final status survey. Once final status surveys were completed the excavations were turned back over to the Decommissioning Contractor for backfill.[17] See Exhibit 13 of Appendix A.

2.6.4 Spill Area Excavation

Three Spill Areas were excavated, by the Decommissioning Contractor, in accordance with Work Execution Package (WEP) number PBRF-WEP-09-009, "Spill Area Excavation". See Figure 1 for a graphical representation of the Storm Drain, Pipe Trench and Sub-Surface Excavations conducted at PBRF. The spill areas were known low level waste spills-one near the Hot Lab Building east truck door, one in vicinity of Primary Pump House resin pits, and one adjacent to the Water Effluent Monitoring Station trench. See Exhibits 6 and 15 of Appendix A.

The extents of spill area excavation were based on pre-excavation survey, which were designed to identify the area and depth of excavation necessary to remediate the spill area.

Spoils from spill area excavations were segregated based on radionuclide characterization data. See Exhibit 20 of Appendix A.

[17] If a section of pipe was not excavated and dismantled in the manner stated above, then that pipe was not addressed in this report. The pipe will be addressed in Attachment 9, "Embedded Piping" or Attachment 17, "Buried Piping".

Once the spill areas were excavated, final post remediation surveys were conducted and then the excavations were turned over to the FSS group for isolation and control and for final status survey. Once final status surveys were completed the excavations were turned back over to Decommissioning Contractor for backfill.

2.6.5 Removal of Storm Sewer South of SEB (RCRA Area Excavation)

The Storm Sewer South of SEB (Building 1131) was dismantled in phases by the Decommissioning Contractor in accordance with Work Execution Package (WEP) number PBRF-WEP-09-027, "Removal of Storm Sewer South of Building 1131 Excavation". See Figure 1 and Exhibit 1 of Appendix A for a graphical representation of the Storm Drain, Pipe Trench and Sub-Surface Excavation and Survey Unit Location map for PBRF. The phases of the dismantlement were as follows:

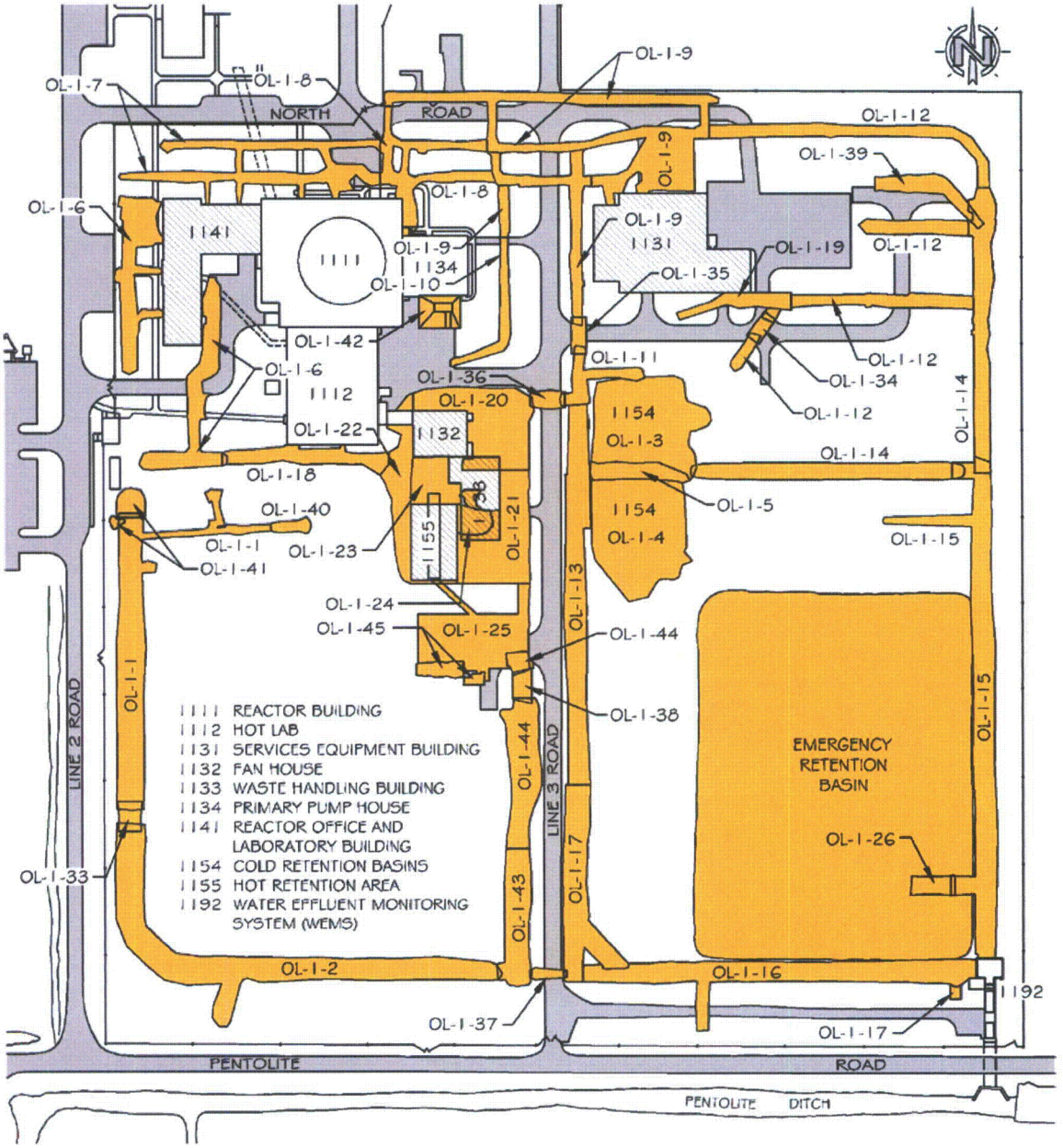
- Phase 1 Resource Conservation and Recovery Act (RCRA) area excavation which consisted the following:
  - Approximately 60 linear ft. of storm drain system piping from CB-13 to SEB (1131),
  - CB-13, STS-27, and CB-14,
  - STS-26,
  - STS-25 and CB-15,
  - Monitoring well EB-RA-05 and underground electrical lines and conduit that serviced recovery wells, RW-01 and RW-02.

- Phase 2 RCRA area excavation which consisted the following:
  - SEB (1131) air intakes and monitoring well EB-RA-05,

See Exhibit 19 of Appendix A for photographic documentation of the RCRA spill area excavation.

Soil from RCRA area excavations were segregated and handled separately from other site soils. See Exhibit 20 of Appendix A. Once RCRA area excavations were completed, final post remediation surveys were conducted and then the excavated areas were turned over to the FSS group for isolation and control and final status survey. Once final status surveys were completed the excavated areas were turned over to the Decommissioning Contractor for backfill.

Figure 1, Storm Drains, Pipe Trenches & Other Sub-Surface Excavation and Survey Unit Location Map



3.0 Storm Drains, Pipe Trenches & Other Sub-Surface Excavations History and Operations with Radioactive Materials

During reactor operations, there were several areas, especially between the Primary Pump House, Hot Lab, and the Fan House, where minor spills of radioactive material occurred on the ground. During resin changes at the Primary Pump House Resin Pit, some area contamination did occur. Additionally, some area contamination occurred when the Hot Lab sump was cleaned in the general vicinity of the Hot Lab rollup door apron and the concrete sump cover. Although these areas were cleaned as much as possible, some low level of contamination found its way to the storm drainage system.

Catch Basin 10, which receives run-off water from the asphalt/gravel area between the PPH and FH, was contaminated shortly after shutdown. The catch basin was cleaned, but area contamination still existed to some degree inside the catch basin and also the 8" corrugated metal pipe which connects Catch Basin 10 to catch basin 9 and beyond. Additionally, contamination likely existed inside the 36" RCP from Catch Basin 8A to the WEMS settling basin. Low levels of contamination were likely present on the existing hydro-mat liner and under the hydro-mat liner of lateral D and beyond to the WEMS settling basin.

The storm drain system at and near the Waste Handling Building south rollup door apron was impacted by several minor spills. The area inside the rollup door was a posted contaminated area and several small spills of radioactive materials occurred just outside the door.

Prior to the installation of the concrete pipe, Lateral D and part of Lateral A were impacted by undiluted HRA discharges. This represented about 650' of liner in Lateral D and about 400' of liner in Lateral A before finally mixing with raw water at the WEMS Settling Basin. After the installation of the concrete pipe, the main lateral was impacted from Catch Basin 8A to the WEMS. The Emergency Retention Basin also drained into the main lateral at Catch Basin 18A. See Exhibit 2 of Appendix A for a Map of the SDS Laterals.

When the concrete pipe was installed, approximately 7700 cubic yards of earth was required to bring the ditches back up to grade. It is not known where this backfill material was obtained.

3.1 Disposition of Materials in the Post-Shutdown Period

Following termination of operations of the 60 MW and mock-up reactors on January 5, 1973 through June 30th of 1973, the WEMS remained active and was maintained in that condition until there was no radiological release hazard. The final end condition was that the WEMS was deactivated and the gates opened to the Pentolite Ditch. Prior to deactivation, the following conditions were met:

- No liquid radioactive waste discharges had occurred for two months,

- A rainfall of 1" in 24 hours and an accumulated rainfall of 2" had occurred, and
- The liquid effluent radioactively level had not exceeded $1x10^{-7}$ μCi/ml beta-gamma and $3x10^{-8}$ μCi/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 slit and sand. Unnecessary loose equipment was removed from the WEMS Butler Building, as were scrap materials inside and outside; electrical heaters and other equipment were shutdown after a WEMS test and the building closed and locked.

Subsequent to July 1st of 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 federal regulations. Reports to the NRC provide the details of significant events or changes in status during the period between 1973 and the approval of the PBRF Decommissioning Plan in 2002.

Radiological characterization information to support decommissioning of PBRF was developed in the 1985 Teledyne Isotopes Characterization Survey and the 1998 GTS Duratek Confirmation Survey. The 1985 study indicated that the accumulated silt in catch basins had gross beta activity ranging from 7 to 330 pCi/g, with an average of 44 pCi/g. Depths and areas of contamination were not reported.

The catch basins were reexamined in the 1998 survey. The beta survey showed that one sample had a maximum concentration of 5,000 dpm/100-cm^2, and the remaining samples had an average concentration of less than 1,200 dpm/100-cm^2. The 1998 gross beta gamma activity measurements were on the order of 15 to 20 pCi/g, similar to the 1985 measurements (44 pCi/g). The 1998 sampling effort also showed that the activity in the catch basins is predominately naturally occurring K-40 at concentrations from 7 to 14 pCi/g. The concentration of Cs-137 and Co-60 ranged from 1 to 11 pCi/g and from 1 to 5 pCi/g, respectively.

Following termination of reactor operations in early 1973, the storm drains, pipe trenches & other sub-surface systems remained active and were to be maintained in acceptable condition for effluent flows from the operable building groundwater sump pumps and storm drainage.

Before and after July 1st of 1973, the storm drains, pipe trenches & other sub-surface systems were controlled according to AEC/NRC licenses. Periodic effluent sampling for radioactivity was conducted as part of the PBRF facility environmental monitoring program to demonstrate compliance with AEC/NRC regulations for effluent discharges.

3.2 Decommissioning

In general, the Storm Drains, Pipe Trenches and Other Sub-Surface Excavations were remediated in the following manner:

- Geographical boundaries of the area of excavation were marked, flagged or identified in some manner.
- Utilities were identified and de-energized.
- Area was cleaned and grubbed of vegetation.
- SDPTSSE was excavated and safety boundaries were established.
- Excavations were inspected periodically.
- Areas remediated based on contamination levels.
- Excavation was guided by walkover scan surveys and excavated soil was segregated.
- The soil >DCGL was shipped to an approved waste disposal facility.
- Soil < DCGL was transported to the soil farming area, within the PBRF Restricted Area, for FSS.

Most of the soil < DCGL was surveyed and sorted using the MACTEC Development Corporation SS-Series Conveyor Soil Survey and 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 action level was 50% of the DCGL. Rejected materials were staged for shipment to an approved waste disposal facility. [18]

Post remediation surveys were performed to ensure that the remediation was complete. Results were compared to the scan action level which was set at 50% of the applicable DCGL.[19] This Final Post Remediation (FPR) surveys and samples established that no further remediation was necessary prior to commencing Final Status Survey for the SDPTSSE. The Storm Drain, Pipe Trench and Sub-Surface Excavations were prepared for FSS and surveyed in accordance with the FSSP [NASA 2007].

4.0 Survey Design and Implementation for Storm Drains, Pipe Trenches & Other Sub-Surface Excavations

The survey design and implementation for SDPTSSE is as follows:

- Section 4.1 discusses 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.

[18] FSS of Excavated Materials is reported in the FSSR Attachment 18.

[19] Investigation levels are established for 2"x2" NaI detector with Ludlum Model 2350-1 that is set up with either the Cesium-137 window or the Cobalt-60 window depending on the radionuclide distribution identified.

- 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 limit applies to residual radioactivity that is distinguishable from background. The DCGL values established in 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 3 of this report. The DCGL values are the volumetric activity concentrations 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 3, 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, the Resident Farmer exposure scenario was implemented in RESRAD Version 6.0.

Section 7.3.1 of the FSSP [NASA 2007] states that sub-surface survey units that have had remediation performed, shall have FSS performed and results compared to surface soil DCGLs.

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 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 is 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

There are two distinct types of surrogate DCGLs, at PBRF. The first surrogate DCGL is for surface soil scanning with NaI detector model 44-10 and the second is for surface and sub-surface soil sample analysis. Technical Basis Document TBD-PBRF-09-001, "Radionuclide Distributions and Adjusted DCGLs for Site Soils" [PBRF 2009] developed a surrogate DCGL value ($DCGL_{SUR}$) for the hard-to-detect (HTD) radionuclide of concern, Sr-90, using Cs-137 or Co-60. Table 2-1 of Technical Basis Document TBD-PBRF-09-001 provides the DCGLs for surface soil, based on analysis of numerous characterization sample results. Furthermore, NUREG-1757 allows for the de-selection of radionuclides that contribute no greater than 10% of the 25 mrem/yr dose criteria.

For PBRF soils, the dose from all radionuclides other than Co-60, Sr-90 and Cs-137 totaled 0.5 mrem/yr. Because this dose is only 2% of the 25 mrem/yr. limit, all radionuclides, other than Co-60, Sr-90, and Cs-137, were eliminated from further consideration. To ensure the 25 mrem/yr. criterion is met, the maximum allowable dose for Open Land Survey Units, at PBRF, shall be:

Maximum allowable dose for Open Land Survey Unit, at PBRF =

25 mrem/yr. (annual dose limit) – 0.5 mrem/yr. (the maximum dose from de-selected radionuclides) = 24.5 mrem/yr.

Table 5-2 of PBRF-09-001 provides the values for surrogate DCGLs for each open land area at PBRF. The values were derived from characterization sample analysis that was used to determine the isotopic mix of Co-60, Sr-90, and Cs-137 for that area. Based on the characterization data, the predominant radionuclide was determined to be either Co-60 or Cs-137, and the other radionuclides were surrogated to the predominant radionuclide.

During scanning activities, the NaI detector is set up in the "windowed mode" to detect the predominant radionuclide for that area, either Cs-137 or Co-60. The other radionuclides are surrogated to the predominant radionuclide and the $DCGL_{SUR}$ are provided in Table 5-2 of Technical Basis Document TBD-PBRF-09-001.

During soil sample analysis, both Cs-137 and Co-60 can be easily detected by gamma spectroscopic analysis. Therefore, only Sr-90 needs to be surrogated to the predominant radionuclide. These soil sample $DCGL_{SUR}$ are determined in the survey design for that survey unit.

See Table 4 for the Surrogate DCGLs that were used for SDPTSSE FSS.

Table 4, Surrogate DCGLs for Soil FSS

Location	Activity Fractions			Surrogate Radionuclide	Scan Survey	Soil Sample
	Cs-137	Co-60	Sr-90		$DCGL_{SUR}$ (pCi/g)	$DCGL_{SUR}$ (pCi/g)
Default for PBRF site and Spill Areas 4, 5 & 6	0.912	0.007	0.081	Cs-137	11.55	11.82(1)
Spill Areas 1, 2 & 3	0.201	0.714	0.085	Co-60	3.28	3.50(2)
Emergency Retention Basin	0.878	0.037	0.085	Cs-137	10.31	11.40(3)

Table 4 Notes:

1. Co-60 soil sample DCGL is 3.8 pCi/g, per Survey Designs 30, 33, 37 and 44.
2. Cs-137 soil sample DCGL is 14.7 pCi/g, per Survey Design 39.
3. Co-60 soil sample DCGL is 3.7 pCi/g, per Survey Design 46.

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:

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

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

DCGL 2, 3…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:

$$\frac{C_1}{DCGL_1}+\frac{C_2}{DCGL_2}+\ldots\frac{C_n}{DCGL_n}\leq 1 \quad \textbf{(Equation 2)}$$

Where: C_n = concentration of radionuclide n and

$DCGL_n$ = DCGL of radionuclide n.

4.1.4.3 Area Factors

The area factor is the multiple of the DCGL that is permitted in an area of elevated residual radioactivity without requiring remediation and still be in compliance with the release criteria. It 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 calculated as the ratio of dose per unit area or volume for the default surface area for the applicable dose modeling scenario to the dose calculated 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 5. Area factor assumptions and calculations are provided in Attachment B of the FSSP [NASA 2007].

Table 5, Surface Soil Area Factors

Elevated Area (m^2)	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 6. Note that the maximum survey unit size for Class 1 surface soils is 2,000 m^2.

Table 6, 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 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. No Class 2 or Class 3 survey units were identified within the SDPTSSE. Minimum scan survey coverage requirements for the PBRF are provided in Table 5-1 of the FSSP [NASA 2007] and Table 7 below.

Table 7, 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 SDPTSSE areas were not fully characterized or remediated. The only reference to SDPTSSE areas identified in the FSSP is provided in Table 2-2 and states that Drainage Systems (Storm Sewers) are Class 1 areas. Therefore, based on the information provided in the FSSP and that remediation was conducted in the SDPTSSE areas, all SDPTSSE are considered Class 1 areas.

Refer to Figure 1 and Exhibit 1 of Appendix A for a location map of each survey unit. Table 6 provides the current classification of the area and the corresponding FSSP [NASA 2007] classification for the area. See Appendix B for a map of each specific survey unit contained within this report.

Table 8 was reviewed to ensure that no areas were classified "downward" from classifications assigned in the FSS Plan [NASA 2007]. "OL" refers to "Open Land".

Table 8, Storm Drains, Pipe Trenches and Sub-Surface Excavations Survey Unit Classification Comparison to FSSP

Survey Unit	Class	Description[1]	FSSP Classification[2]
OL-1-1	1	Storm Drains – Section 2-1	1
OL-1-2	1	Storm Drains – Section 2-2	1
OL-1-3	1	Cold Retention Basin North	1
OL-1-4	1	Cold Retention Basin South	1
OL-1-5	1	Cold Retention Basin East West Ramp	1
OL-1-6	1	Storm Drains Phase #1	1
OL-1-7	1	Storm Drains Phase 2, Section 1	1
OL-1-8	1	Storm Drains Phase 2, Section 2	1
OL-1-9	1	Storm Drains W, NW & N of SEB	1
OL-1-10	1	Storm Drains SE of PPH	1
OL-1-11	1	Phase 4, Section 1	1
OL-1-12	1	Storm Drains, Lateral D, North Section	1
OL-1-13	1	Storm Drains, Lateral D, North Section	1
OL-1-14	1	Storm Drains, South & East of SEB	1
OL-1-15	1	Storm Drains, Main Lateral, South of FH-110	1
OL-1-16	1	Storm Drains, Lateral A, East of Line 3 Road	1
OL-1-17	1	Storm Drains, Lateral D, South Section & STS46 Trench	1

Table 8, Storm Drains, Pipe Trenches and Sub-Surface Excavations Survey Unit Classification Comparison to FSSP

Survey Unit	Class	Description[1]	FSSP Classification[2]
OL-1-18	1	SANS Trenches South of HL Building	1
OL-1-19	1	RCRA Trenches South of SEB	1
OL-1-20	1	Northeast Corner of FH/WHB Footprint	1
OL-1-21	1	Southeast Corner of FH/WHB Footprint	1
OL-1-22	1	Western Sections of FH/WHB Footprint	1
OL-1-23	1	UST Excavations	1
OL-1-24	1	Evaporator Pit	1
OL-1-25	1	Phase 7 North of Haul Road, South of FH/WHB	1
OL-1-26	1	ERB Sump Drain Line Excavation	1
OL-1-33	1	Storm Drain Excavation- MacTec Crossover	1
OL-1-34	1	Storm Drain Excavation- Crossover south of SEB	1
OL-1-35	1	Storm Drain Excavation- Crossover at Line 3 Road/Driveway E	1
OL-1-36	1	Storm Drain Excavation- Line 3 Road North Crossover	1
OL-1-37	1	Storm Drain Excavation- Line 3 Road South Crossover	1
OL-1-38	1	Storm Drain Excavation- Haul Road Crossover	1
OL-1-39	1	Storm Drain Excavation - Trench South of Sludge Basins, East of SEB	1
OL-1-40	1	Storm Drain Excavation - CB-18 Excavation	1
OL-1-41	1	Storm Drain Excavation - CB-5A Excavation	1
OL-1-42	1	Resin Pits Excavation South of PPH	1
Ol-1-43	1	Storm Drain Excavation-Lateral C South Excavation	1
Ol-1-44	1	Storm Drain Excavation-Lateral C North Excavation	1
Ol-1-45	1	Excavations South of Waste Storage Pad	1

Table 8 Notes:

1. The data provided in the description are provided in the Survey Unit Log and the Survey Unit Release Records. See Figure 1 for a map of SDPTSSE that identifies the survey unit locations.
2. The FSSP Classifications are based on Table 2-2 of the FSSP which identifies Drainage Systems (Storm Sewers) as being Class 1.

Table 9 provides the survey unit breakdown, by MARSSIM classification [USNRC 2000].

Table 9, Storm Drains, Pipe Trenches and Other Sub-Surface Excavations 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	39	25268	100	100	648

4.2 Number of Measurements and Samples

The Final Status Survey for SDPTSSE was covered by several Survey Design and Survey Request (SR) documents. See Appendix B for specific sample locations within each survey unit. Table 10 identifies the Survey Design that was implemented for each SDPTSSE survey unit. The following Survey Requests (SRs) were used for SDPTSSE survey units: Survey Request Numbers 164, 165, 169, 176, 204, 237, 242, 244, 277 and 279.

The number of measurements and samples for each SDPTSSE survey unit was determined using the MARSSIM [USNRC 2000] 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 SDPTSSE.[20] When the Sign Test is selected, the VSP software uses MARSSIM [USNRC 2000] Equation 5-2 to calculate the number of measurements. Equation 3 of this report is Equation 5.2 from the MARSSIM and is shown below:

(Equation 3)

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

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,
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 $\beta = 0.1$),
Φ (Δ/σ) = value of cumulative standard normal distribution over the interval $-\infty$, Δ/σ,

[20] 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.

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 [PNL 2010] requires user inputs for the following parameters: α, β, Δ, σ and the $DCGL_W$. The number of measurements, N, for the 39 SDPTSSE survey units were calculated in six survey designs. Table 10 summarizes the survey design calculations and lists the values of the key VSP input parameters.

Table 10, Storm Drains, Pipe Trenches & Other Sub-Surface Excavations Survey Design Summary

Design No.[1][2][3]	Survey Units[4]	Class	DCGL[5]	LGBR[5]	LGBR/ DCGL	Δ [5]	σ [5]	Δ/σ	N
30	OL-1-1, OL-1-2 and OL-1-6	1	11.55	11.26	0.975	0.29	0.11	2.64	11
33	OL-1-3 and OL-1-4	1	11.55	11.26	0.975	0.29	0.15	1.93	11
37	OL-1-3 and OL-1-5	1	11.55	11.26	0.975	0.29	0.15	1.93	11
39	OL-1-10,	1	3.5[6]	3.05	0.87	0.45	0.15	3.0	11
	OL-1-42, and	1	3.5[6]	3.05	0.87	0.45	0.15	3.0	11
	OL-1-45	1	3.5[6]	3.05	0.87	0.45	0.15	3.0	11
44	OL-1-7, OL-1-8, OL-1-9, OL-1-11 through OL-1-25, OL-1-33 through OL-1-41, OL-1-43 and OL-1-44	1	11.55	11.26	0.975	0.29	0.10	2.90	11
46	OL-1-26	1	10.31	5.7	0.5	5.7	2.28	2.5	11

Table 10 Notes:

1. The data reported in Table 10 is taken from the Survey Design reports listed. They are maintained in the PBRF Document Control System.
2. Small differences in the values in this table and the values documented in the Survey Design reports are due to spreadsheet rounding and significant figures.
3. Values provided in the table are typical values for the survey units within that specific design.
4. Survey Units OL-1-27 through OL-1-32 are located in the ERB and are covered in the FSSR Att.10.
5. Units are in pCi/g.
6. Co-60 DCGL.

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 [PNL 2010] 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 [PNL 2010] report for survey unit OL-1-26 in Design No. 46 (with modifications). The sensitivity of N is explored by varying the standard deviation from 2.28 to 4.56 pCi/g (an increase of 100%), with the lower bound of gray region from ranging from 50 to 70 % 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 [PNL 2010] sensitivity analysis also varies the value of α, the sensitivity of N to changes in α is not evaluated here.

Table 11 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 70% of the DCGL. This range corresponds to Δ/σ ranging from 1.5 to 2.5. 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 100 % increase in σ increases N from 12 to 23. At this LBGR value, N is sensitive to measurement variability. With the LBGR set to 50% of the DCGL, the sensitivity of N to σ is decreased; a 100 % increase in σ increases N from 11 to 17.

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

Table 11, Sensitivity Analysis for OL-1-26 Design

Number of Samples							
DCGL = 11.55 [1]		α=0.05 [2]		α=0.10		α=0.15	
		σ = 4.56 [1] [3]	σ = 2.28	σ = 4.56	σ = 2.28	σ = 4.56	σ = 2.28
LBGR=70% [1] [4]	β=0.05	44	18	35	14	29	12
	β=0.10	35	14	27	11	22	9
	β=0.15	29	12	22	9	18	7
LBGR=60%	β=0.05	28	15	23	12	19	10
	β=0.10	23	12	17	9	14	8
	β=0.15	19	10	14	8	12	6
LBGR=50%	β=0.05	21	14	17	11	14	9
	β=0.10	17	11	13	9	11	7
	β=0.15	14	9	11	7	9	6

Table 11 Notes:

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

Visual Sample Plan was also used to determine the grid size, the random starting location coordinates (for Class 1 survey units) and to display the measurement locations on survey unit maps drawn to scale.

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 Comparison.[21]

4.3 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 [USNRC 2000] class of each survey unit.

Scan sensitivities for detectors used for walkover gamma scans of soil are determined using the method referenced in the PBRF FSS Plan and described in NUREG-1507 [NRC 1998]. Scan sensitivities for the Ludlum Model 44-10 NaI detectors used in FSS of soils at PBRF were developed in a technical basis document [PBRF 2009a]. The method is summarized and the key equations presented. The scan MDC is calculated using the following equations adapted from NUREG-1507 [USNRC 1998] for gamma scanning with NaI detectors:

$$MDCR_{SURV} = \frac{d'\sqrt{bi}}{\sqrt{p}}\left(\frac{60}{i}\right) \qquad \textbf{(Equation 4)}$$

$$MDCscan = \frac{MDCR_{surv}}{Conv * MS_O} \qquad \textbf{(Equation 5)}$$

Where:

MDC_{SURV} = the minimum detectable count rate in cpm that can be reliably detected by the "surveyor"
d' = index of sensitivity, unit less (MARSSIM default value of 1.38 is assigned),
b_i = background counts observed in the interval i,
i = observation interval (s),
p = surveyor efficiency, unit less (MARSSIM default value of 0.5 is assigned),
MDC_{scan} = the scan MDC, here in units of pCi/g,
Conv = instrument response conversion factor, units of cpm per μR/h,
MS_o = instrument response in units of μR/h per pCi/g (determined empirically or with a shielding algorithm).

Site-specific parameter values for the MDC_{scan} equation are obtained from the technical basis document [PBRF 2009a]. The most conservative instrument response conversion factor for detectors in the PBRF LMI 44-10 inventory is 232.39 cpm per

[21] As discussed in the next section, the scan sensitivities of instruments used in the FSS of the SDPTSSE were below the $DCGL_W$, and no increase in the number of measurements calculated using the Sign Test was required.

μR/h for Cs-137 and 262.21 for Co-60. The instrument response factors for Cs-137 and Co-60 respectively are 0.138 and 0.667 μR/h per pCi/g.

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 SDPTSSE is provided in Table 12. Measurement sensitivities provided in this section relate both to the gamma scan sensitivities and the static measurement sensitivities.

Table 12, Typical Detection Sensitivities of 44-10 for Co-60 and Cs-137

	Co-60[1]		Cs-137[4][5]	
Background (cpm)	MDCR[2] (ncpm)[3]	MDC_{scan} (pCi/g)	MDCR[2] (ncpm)[3]	MDC_{scan}[4] (pCi/g)
50	50.3	1.50	71.2	3.13
100	71.2	2.13	100.6	4.43
150	87.1	2.61	123.2	5.42
200	100.6	3.01	142.3	6.26
250	112.5	3.36	159.1	7.00

Table 12 Notes:

1. Per SR-39, the scan action level is 150 ncpm for Co-60. This value applies to survey units OL-1-10, OL-1-42, and OL-1-45.
2. MDCR = Minimum Detectable Count Rate.
3. ncpm = net counts per minute=gross counts per minute – background counts per minute.
4. Per SRs 30, 33, 37, and 44 the scan action level is 250 ncpm for Cs-137. This value applies to all remaining survey units contained within the SDPTSSE Attachment to the FSSR.
5. Per SR-46, the scan action level is 241 ncpm for Cs-137. This value applies to survey unit OL-1-26.

5.0 Storm Drains, Pipe Trenches & Other Sub-Surface Excavations Survey Results

Results of the SDPTSSE 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 SDPTSSE 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, soil sample number and location, statistical tests, and EMC tests).

5.1 Surveys and Investigations

5.1.1 Scan Surveys

Scan surveys were performed in accordance with the FSS requirements contained in the following Survey Requests:

- SR-164 (survey unit OL-1-1),
- SR-165 (survey unit OL-1-2),
- SR-169 (survey units OL-1-3 and OL-1-4),
- SR-176 (survey units OL-1-3 and OL-1-5),
- SR-204 (survey units OL-1-6),
- SR-237 (survey units OL-1-9, OL-1-11 through OL-1-25, OL-1-33 through OL-1-41, OL-1-43, and OL-1-44),
- SR-242 (survey units OL-1-9 through OL-1-25, and OL-1-33 through OL-1-45)
- SR-244 (survey units OL-1-10, OL-1-42, and OL-1-45),
- SR-277 (survey unit OL-1-26), and
- SR-279 (survey unit OL-1-26).

100% of all Class 1 survey units were scanned with the Ludlum 2350-1 with the 44-10 detector setup with a window for either Cs-137 or Co-60 energies. A scan action

level of 250 ncpm, for Cs-137, was established, per the SR (Except for those survey units covered by SR-244 which provided a scan action level of 150 ncpm, (for Co-60) and the survey unit covered by SR-277 (OL-1-26), which had an action level of 241 ncpm (for Cs-137). The scan action levels were determined by estimating a background count rate for the area and establishing an action level at a value less than the DCGL, typically 75% of the DCGL.

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 SDPTSSE scan surveys are compiled in Table 13. See Exhibits 7, 8 and 14 of Appendix A for a photograph of radiological surveys being conducted after SDS disassembly.

Table 13, Scan Survey Results

Survey Unit	Class	SR #	Surface Area of Survey Unit (in Square Meters)	Surface Area of Survey Unit (in Square Feet)	Scan Survey Coverage (%) [1]	QC Replicate Scan Coverage (%) [2]	Investigation Level Exceeded
OL-1-1	1	164	1323	14246	100	5.99	No
OL-1-2	1	165	1834	19738	100	5.7	Yes[3]
OL-1-3	1	169/176	1193	12843	100	5.5	Yes[3]
OL-1-4	1	169	1329	14306	100	7.0	No[3]
OL-1-5	1	176	190	2049	100	13.4	Yes[3]
OL-1-6	1	204	1166	12548	100	7.1	No
OL-1-7	1	237	801	8619	100	6.0	No
OL-1-8	1	237	537	5777	100	7.8	No
OL-1-9	1	237/242	1954	21036	100	5.7	No
OL-1-10	1	244	221	2380	100	8.4	No
OL-1-11	1	237/242	222	2385	100	6.3	No
OL-1-12	1	237/242	1175	12647	100	6.3	No
OL-1-13	1	237/242	1175	12653	100	7.6	No
OL-1-14	1	237/242	1377	14818	100	7.5	No
OL-1-15	1	237/242	1691	18199	100	5.8	No
OL-1-16	1	237/242	1332	14333	100	7.5	No
OL-1-17	1	237/242	805	8670	100	5.9	No
OL-1-18	1	237/242	362	3900	100	15.4	No
OL-1-19	1	237/242	202	2171	100	5.5	No
OL-1-20	1	237/242	885	9527	100	6.3	No
OL-1-21	1	237/242	895	9637	100	7.0	No
OL-1-22	1	237/242	549	5912	100	30.4	No
OL-1-23	1	237/242	255	2747	100	27.3	No
OL-1-24	1	237/242	222	2386	100	6.7	No
OL-1-25	1	237/242	956	10287	100	6.7	No

Table 13, Scan Survey Results

Survey Unit	Class	SR #	Surface Area of Survey Unit (in Square Meters)	Surface Area of Survey Unit (in Square Feet)	Scan Survey Coverage (%) [1]	QC Replicate Scan Coverage (%) [2]	Investigation Level Exceeded
OL-1-26	1	277/279	118	1268	100	6.3	No
OL-1-33	1	237/242	93	998	100	5.0	No
OL-1-34	1	237/242	61	660	100	5.3	No
OL-1-35	1	237/242	77	827	100	5.4	No
OL-1-36	1	237/242	97	1041	100	9.6	No
OL-1-37	1	237/242	82	879	100	5.7	No
OL-1-38	1	237/242	88	947	100	10.6	No
OL-1-39	1	237/242	267	2877	100	7.0	No
OL-1-40	1	237/242	74	796	100	21.1	No
OL-1-41	1	237/242	151	1622	100	6.8	No
OL-1-42	1	242/244	171	1844	100	5.4	No
OL-1-43	1	237/242	518	5579	100	5.4	No
OL-1-44	1	237/242	675	7268	100	5.2	No
OL-1-45	1	242/244	146	1571	100	15.3	No

Table 13 Notes:

1. The % scan coverage is given as the % of the area scanned in the initial survey. For Class 1 areas, 100% scan is required per Table 5-1 of the FSSP and Table 7 of this report.
2. Obtained from Survey Unit Release Records.
3. Refer to Section 5.1.2 of this report for an explanation of these survey unit investigation levels.

The results provided in Table 13 show that scan coverage requirements were satisfied for all survey units. Table 13 results also shows that scan investigation levels were exceeded in only 3 out of 39 survey units.

5.1.2 Investigative Measurements and Judgmental Soil Samples

As identified in Table 13, three survey units (OL-1-2, OL-1-3 and OL-1-5) were documented to have investigative measurements or judgmental soil samples collected within their boundaries. A description of the additional surveys and sampling conducted in each of the four survey units is as follows:

- Survey Unit OL-1-2 is located in the southern section of the protected area, north of Pentolite Road and East of Line 2 Road. During scanning of the survey unit, one area of elevated activity, > the scan investigation level, was identified in the far eastern portion of the survey unit. The area was identified as IM-1 and was approximately 1 ft^2 of surface area. The scan indicated 322 ncpm at location IM-1. Surface (0-6") and sub-surface (6"-12") sampling was performed at this location, under SR-165. The sample results indicated that the surface (0-6") soil sample contained measured Cs-137 activity of 4.22 pCi/g and no detectable Co-60 activity. The subsurface (6"-12") sample at location IM-1 indicated Cs-137 activity of 0.747 pCi/g and no detectable Co-60 activity. No further action was taken.

- Survey Unit OL-1-3 is located where the North Cold Retention Basin (CRB-1) resided. This survey unit originally encompassed the North CRB and the area between the North and South CRBs.

However, elevated activity was identified on the area between the North and South CRBs. FSS performed under Survey Design #33 indicated that the Survey Unit needed additional remediation. Surveys confirmed that broken piping in the south side of survey unit OL-1-3 was contaminated with activity levels > 50,000 dpm/100 cm^2, beta. All piping found was removed for disposal. Investigative surveys were performed after FSS was suspended on OL-1-3 and indicated that the area of elevated activity was limited to the ramp separating the North and South Retention Basins. Volumetric samples of the pipe scrapings/pieces yielded 622 pCi/g Cs-137 and 61 pCi/g Co-60 . The area of elevated activity was separated from OL-1-3 and a new survey unit was created, OL-1-5.

Four additional samples were collected within OL-1-3 and identified as IM-1 through IM-4. The samples were collected from the bottom of the North CRB excavation. The reason for the samples being collected was because during scanning, there was some standing water present and the FSS Lead Engineer requested soil samples to ensure that the scan results were representative of the conditions present in the excavation. The results of the soil sampling indicated no detectable Cs-137 or Co-60 activity was present in any of the four samples.

- Survey Unit OL-1-4 is located where the South Cold Retention Basin (CRB-2) resided. Four additional samples were collected within OL-1-4 and identified as IM-1 through IM-4. The samples were collected from the bottom of the South CRB excavation. The reason for the samples being collected was because during scanning, there was some standing water present and the FSS Lead Engineer requested soil samples to ensure that the scan results were representative of the conditions present in the excavation. The results of the soil sampling indicated no detectable Cs-137 or Co-60 activity was present in any of the four samples. No further action was taken.

- Survey Unit OL-1-5 is located between where the North and South CRBs resided. There were three areas prompting investigations in survey unit OL-1-5:

    - One area, that was 2.5' x 4', was located on the west side of OL-1-5 near a partially buried radioactive pipe. Three soil samples (SR-176-25 through SR-176-27) and three static measurements (IM-1 through IM-3) were obtained in this area.

    - The average Cs-137 and Co-60 activity of the soil samples taken in this area was 24.9 pCi/gm Cs-137 and 4.9 pCi/gm Co-60. These average values are well below the calculated $DCGL_{EMC}$ based on an area factor of 10.4 as found in Table 4, and utilizing the following equation from Procedure CS-09, step 4.5.2 where:

- $AF_i = 10.4$
- $DCGL_W = 11.82$ (Cs-137 $DCGL_{SUR}$ for Cs-137 and Sr-90)
- $DCGL_{EMC} = 122.9$

$$DCGL_{EMC} = AF_i \times DCGL_W$$

- Compliance with soil $DCGL_{EMC}$ was determined using the gamma spectroscopy results for SR-176-25 through SR-176-27 and a unity rule calculation performed utilizing the following equation from CS-09, step 4.5.3 where:
  - Cs-137 = 24.9 pCi/gm
  - Cs-137$DCGL_{EMC}$ = 122.9 pCi/gm
  - Co-60 = 4.9 pCi/gm
  - Co-60$DCGL_{EMC}$ = 39.52 pCi/gm

$$(\text{Cs-137} / \text{Cs-137}DCGL_{EMC}) + (\text{Co-60} / \text{Co-60}\ DCGL_{EMC})$$

  - The product of this calculation (unity fraction) is 0.327 and is ≤ 1.0.
- An elevated measurement test was performed utilizing the following equation from Procedure CS-09, Section 4.2 where:
  - δ = the average residual activity in the survey unit = 1.16 pCi/gm
  - $DCGL_W = 11.55$ (Cs-137 $DCGL_{SUR}$ for Cs-137, Sr-90 & Co-60)
  - average concentration in the elevated area – δ = 23.7 pCi/gm
  - Area Factor = 10.4

$$\frac{\delta}{DCGL_W} + \frac{(average \text{ concentration in elevated area} - \delta)}{(Area \text{ Factor})(DCGL_W)} \leq 1.0$$

  - The result of this calculation is 0.29 and is ≤ 1.0.

Since the calculated value is determined to be < 1.0, the area passes the EMC determination and no further action is required.

The other two elevated areas were both small in surface area, < 100 cm^2. The highest Cs-137 soil sample activity from these two elevated locations was 7.1

pCi/g, which is < the $DCGL_W$ value (for Cs-137, and all Co-60 activities were < MDA. Therefore, no further actions were taken on these areas.

5.1.3 Systematic Soil Sampling

5.1.3.1 Soil Sampling for Class 1 Areas

Systematic soil sampling was conducted within each of the 39 survey units that constitute **the SDPTSSE in accordance with the FSSP [NASA 2007] and the applicable Survey** Request.

Systematic soil samples were identified in each survey unit, by VSP, in accordance with procedure CS-08, Final Status Survey Design.

As stated in Table 4, the $DCGL_{SUR}$ for soil sampling is 11.82 pCi/g for Cs-137 and the $DCGL_W$ is 3.8 pCi/g for Co-60 in accordance with Survey Design #'s 30, 33, 37, and 44. The $DCGL_W$ for soil sampling is 14.7 pCi/g for Cs-137 and the $DCGL_{SUR}$ is 3.5 pCi/g for Co-60 in accordance with Survey Design # 39. The $DCGL_{SUR}$ for soil sampling is 11.4 pCi/g for Cs-137 and the $DCGL_W$ is 3.7 pCi/g for Co-60 in accordance with Survey Design # 46. Compliance with the DCGL is demonstrated through the use of the unity rule. The results are as follows:

- Four hundred and seventy-one (471) samples, including 40 QC samples, from 431 sample locations were processed and analyzed.
- Of the 471 original samples collected and analyzed, 48 were > MDA for Cs-137 and 1 sample was >MDA for Co-60.
- The highest Cs-137 activity was in Survey Unit OL-1-25 at location Sample Point (SP)-2. The Cs-137 activity at this location was 8.80E-01 pCi/g ± 2.22 E-01 pCi/g. The measured Co-60 activity at this location was <MDA. The highest Co-60 activity measured was in Survey Unit OL-1-4 at location SP-5. The Co-60 activity at this location was and 1.00E+00 pCi/g ± 1.76E-01 pCi/g. This is the only sample result > the Co-60 MDA. The Cs-137 activity measured at this location was 5.83E-01 pCi/g ± 1.76E-01 pCi/g.
- The average activity for all systematic soil samples, collected within Class 1 areas, was 1.06E-01 pCi/g for Cs-137 and 1.14E-01 pCi/g for Co-60.[22]

Refer to Table 14 of this report for a summary, by survey unit, of the average and maximum Cs-137 and Co-60 systematic soil sample results. Additionally, refer to Appendix B of this report for systematic soil sample locations, by survey unit. Also, refer to Appendix C of this report for all systematic soil sample results, by survey unit.

[22] The average activity was determined by using the MDA value if the activity was determined by quantitative analysis to be at or below the MDA.

5.1.3.2 Quality Control Sample Analysis

The SRs required splitting 5% of samples for QC purposes. Forty (40) of the 431 samples, or 9.3 %, were split for QC analysis.

Forty Quality Control (QC) samples were collected and analyzed in Class 1 areas. All 40 samples were analyzed and the results compared to the original sample results. The comparison was in accord with the method in the FSS Plan, Section 12.7.2 [NASA 2007]. In this method the sample resolution is calculated as the quotient of the original sample one-sigma uncertainty and the sample result. Then the ratios of QC to original sample results are compared to acceptance values specified for each range of resolution given in FSS Plan Table 12.2. The ratios were all within the acceptable range provided in Table 12.2. See Appendix C for QC Comparison results.

Table 14, Storm Drains, Pipe Trenches & Other Sub-Surface Excavations Systematic Soil Sample Results By Survey Unit

Survey Unit ID	No. of Measurements	Cs-137, $DCGL_w$ = 11.82 pCi/g[1]				Co-60, $DCGL_w$ = 3.80 pCi/g[1]				Average Unity Fraction [2]
		Maximum (pCi/g)	Test Result: Maximum < $DCGL_w$	Average (pCi/g) [2]	Test Result: Average < $DCGL_w$	Maximum (pCi/g)	Test Result: Maximum < $DCGL_w$	Average (pCi/g) [2]	Test Result: Average < $DCGL_w$	
OL-1-1	11	0.162	Yes	0.060	Yes	0.076	Yes	0.060	Yes	0.021
OL-1-2	11	0.428	Yes	0.428	Yes	0.076	Yes	0.054	Yes	0.050
OL-1-3	11	0.190	Yes	0.077	Yes	0.134	Yes	0.119	Yes	0.038
OL-1-4	11	0.583	Yes	0.125	Yes	1.000	Yes	0.191	Yes	0.061
OL-1-5	11	0.303	Yes	0.100	Yes	0.129	Yes	0.114	Yes	0.039
OL-1-6	11	0.102	Yes	0.080	Yes	0.137	Yes	0.117	Yes	0.038
OL-1-7	11	0.112	Yes	0.070	Yes	0.128	Yes	0.104	Yes	0.033
OL-1-8	11	0.087	Yes	0.073	Yes	0.120	Yes	0.110	Yes	0.035
OL-1-9	11	0.112	Yes	0.077	Yes	0.141	Yes	0.120	Yes	0.038
OL-1-10[3]	11	0.205	Yes	0.085	Yes	0.136	Yes	0.116	Yes	0.039
OL-1-11	11	0.150	Yes	0.080	Yes	0.133	Yes	0.120	Yes	0.038
OL-1-12	12	0.179	Yes	0.085	Yes	0.138	Yes	0.115	Yes	0.038
OL-1-13	11	0.209	Yes	0.082	Yes	0.117	Yes	0.108	Yes	0.035
OL-1-14	11	0.275	Yes	0.115	Yes	0.139	Yes	0.118	Yes	0.041
OL-1-15	11	0.293	Yes	0.110	Yes	0.130	Yes	0.110	Yes	0.038
OL-1-16	11	0.369	Yes	0.113	Yes	0.122	Yes	0.113	Yes	0.039
OL-1-17	11	0.262	Yes	0.122	Yes	0.149	Yes	0.117	Yes	0.041
OL-1-18	11	0.111	Yes	0.076	Yes	0.131	Yes	0.114	Yes	0.037
OL-1-19	11	0.183	Yes	0.107	Yes	0.119	Yes	0.105	Yes	0.037
OL-1-20	11	0.092	Yes	0.077	Yes	0.145	Yes	0.122	Yes	0.039
OL-1-21	11	0.236	Yes	0.075	Yes	0.137	Yes	0.116	Yes	0.037
OL-1-22	11	0.116	Yes	0.085	Yes	0.143	Yes	0.128	Yes	0.041
OL-1-23	11	0.183	Yes	0.077	Yes	0.135	Yes	0.108	Yes	0.035
OL-1-24	11	0.295	Yes	0.095	Yes	0.125	Yes	0.118	Yes	0.039

Table 14, Storm Drains, Pipe Trenches & Other Sub-Surface Excavations Systematic Soil Sample Results By Survey Unit

Survey Unit ID	No. of Measurements	Cs-137, $DCGL_w$ = 11.82 pCi/g[1]				Co-60, $DCGL_w$ = 3.80 pCi/g[1]				Average Unity Fraction [2]
		Maximum (pCi/g)	Test Result: Maximum < $DCGL_w$	Average (pCi/g) [2]	Test Result: Average < $DCGL_w$	Maximum (pCi/g)	Test Result: Maximum < $DCGL_w$	Average (pCi/g) [2]	Test Result: Average < $DCGL_w$	
OL-1-25	11	0.880	Yes	0.204	Yes	0.144	Yes	0.130	Yes	0.052
OL-1-26[4]	12	0.112	Yes	0.079	Yes	0.140	Yes	0.118	Yes	0.039
OL-1-33	11	0.167	Yes	0.084	Yes	0.136	Yes	0.115	Yes	0.037
OL-1-34	11	0.191	Yes	0.072	Yes	0.137	Yes	0.115	Yes	0.036
OL-1-35	11	0.159	Yes	0.088	Yes	0.146	Yes	0.123	Yes	0.040
OL-1-36	11	0.310	Yes	0.105	Yes	0.150	Yes	0.127	Yes	0.042
OL-1-37	11	0.130	Yes	0.089	Yes	0.143	Yes	0.116	Yes	0.039
OL-1-38	11	0.676	Yes	0.164	Yes	0.140	Yes	0.112	Yes	0.043
OL-1-39	11	0.271	Yes	0.124	Yes	0.137	Yes	0.124	Yes	0.043
OL-1-40	11	0.133	Yes	0.085	Yes	0.133	Yes	0.115	Yes	0.037
OL-1-41	11	0.126	Yes	0.091	Yes	0.146	Yes	0.117	Yes	0.039
OL-1-42[3]	11	0.105	Yes	0.082	Yes	0.139	Yes	0.112	Yes	0.038
OL-1-43	11	0.392	Yes	0.112	Yes	0.129	Yes	0.106	Yes	0.037
OL-1-44	11	0.816	Yes	0.155	Yes	0.150	Yes	0.109	Yes	0.042
OL-1-45[3]	11	0.395	Yes	0.128	Yes	0.133	Yes	0.108	Yes	0.040
Total	**431**	-	-	-	-	-	-	-	-	-
Maximum	-	**0.880**	-	**0.428**	-	**1.000**	-	**0.191**	-	**0.061**
Grand Mean	-	-	-	**0.106**	-	-	-	**0.114**	-	**0.039**

Table 14 Notes:

1. The soil sample DCGLs for survey units covered by Survey Designs 30, 33, 37 and 44 was 11.82 pCi/g for Cs-137 and 3.80 pCi/g for Co-60.
2. Calculation of average values and unity fractions substitution of MDA values in sample results reported as <MDA.
3. The soil sample DCGLs for survey units covered by Survey Design 39 was 3.50 pCi/g for Co-60 and 14.7 pCi/g for Cs-137.
4. The soil sample DCGLs for survey units covered by Survey Design 46 is 11.40 pCi/g for Cs-137 and 3.7 pCi/g for Co-60.

5.2 ALARA Evaluation

It is shown that residual contamination in the SDPTSSE 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."[23]

Applicable NRC surface soil screening values are: Co-60, 3.8; Sr-90, 1.7 and Cs-137, 11 (all in pCi/g)[24]. From Appendix C, the highest Cs-137 activity was in Survey Unit OL-1-25 at location SP-2. The activity at this location was 8.80E-01 ± 2.22E-01 pCi/g and <MDA for Co-60. The highest Co-60 activity measured was in Survey Unit OL-1-4 at location SP-5. The activity at this location was 1.00E+00 ± 1.76E-01 pCi/g. The Cs-137 activity at this location was 5.83E-01 ± 1.76E-01 pCi/g. 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 0.081/0.912=0.089[25], the activity concentration of Sr-90 is also well below the screening level. The average activity for all systematic soil samples collected within all Class 1 areas, was 1.06E-01 pCi/g for Cs-137 and 1.14E-01 pCi/g 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:

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[23] This guidance was initially published in Draft Regulatory Guide DG-4006, but has been reissued in NUREG-1757 Volume 2[USNRC 2006].

[24] Soil Screening Levels from NUREG-1757 Volume 2, Appendix H, Table H-2 [USNRC 2006].

[25] The Sr-90:Cs-137 activity ratio for Survey Units OL-1-10, OL-1-42 and OL-1-45 is 0.085/0.201=0.423, per Survey Design 39 and Table 5-2 of the PBRF-TBD-09-001 [PBRF 2009].

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

As reported in Section 5.1.3.1 above, the average and maximum activity values for all systematic soil samples collected are as follows:

- 1.06E-01 pCi/g (average value for Cs-137),
- 8.80E-01 pCi/g (maximum value for Cs-137),
- 1.14E-01 pCi/g (average value for Co-60), and
- 1.00E+00 pCi/g (maximum value for Co-60).

Therefore, all systematic soil sample results are below the EPA Trigger Levels 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 trigger level.

5.4 Conclusions

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

- Scan surveys were performed in all 39 survey units with scan coverage equal to (100% for Class 1 areas) the percentage requirements stated in the FSSP.
- While standing water was present in the two CRB survey units (OL-1-3 & OL-1-4) during scanning activities, the presence of water in the survey units did not adversely impact the performance of required 100% scan surveys. Furthermore, additional sampling conducted within these survey units indicated that no detectable Cs-137 or Co-60 activity was present in the samples.
- Residual surface soil contamination above scan investigation levels was detected in only three survey units. Soil sample results indicated that the activity present was well below the $DCGL_W$ or $DCGL_{EMC}$, as applicable (in one survey unit).
- All 431 systematic soil sample results were less than the applicable $DCGL_W$ values for Cs-137 and Co-60.
- Forty (40) QC soil sample (split samples) results were less than the applicable $DCGL_W$ values for Cs-137 and Co-60.
- Residual surface activity and 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 units were compared to, and found to be less than EPA trigger levels.
- No changes in area classification from what was proposed in the FSS Plan were made and any area not identified in the FSS Plan was given a classification of 1.

- There were no changes from initial assumptions (in the FSS Plan) regarding the extent of residual activity in the SDPTSSE.

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7.0 Appendices

Appendix A – Exhibits

Appendix B – Survey Unit Maps and Tables Showing Measurement Locations

Appendix C – Final Status Survey Soil Sample Results

Plum Brook Reactor Facility

Final Status Survey Report

Attachment 7

Storm Drains, Pipe Trenches & Other Sub-Surface Excavations

Revision 0

Appendix A

Exhibits

List of Exhibits

Exhibit 1, Storm Drain, Pipe Trenches & Other Sub-Surface Excavations Survey Unit Breakdown

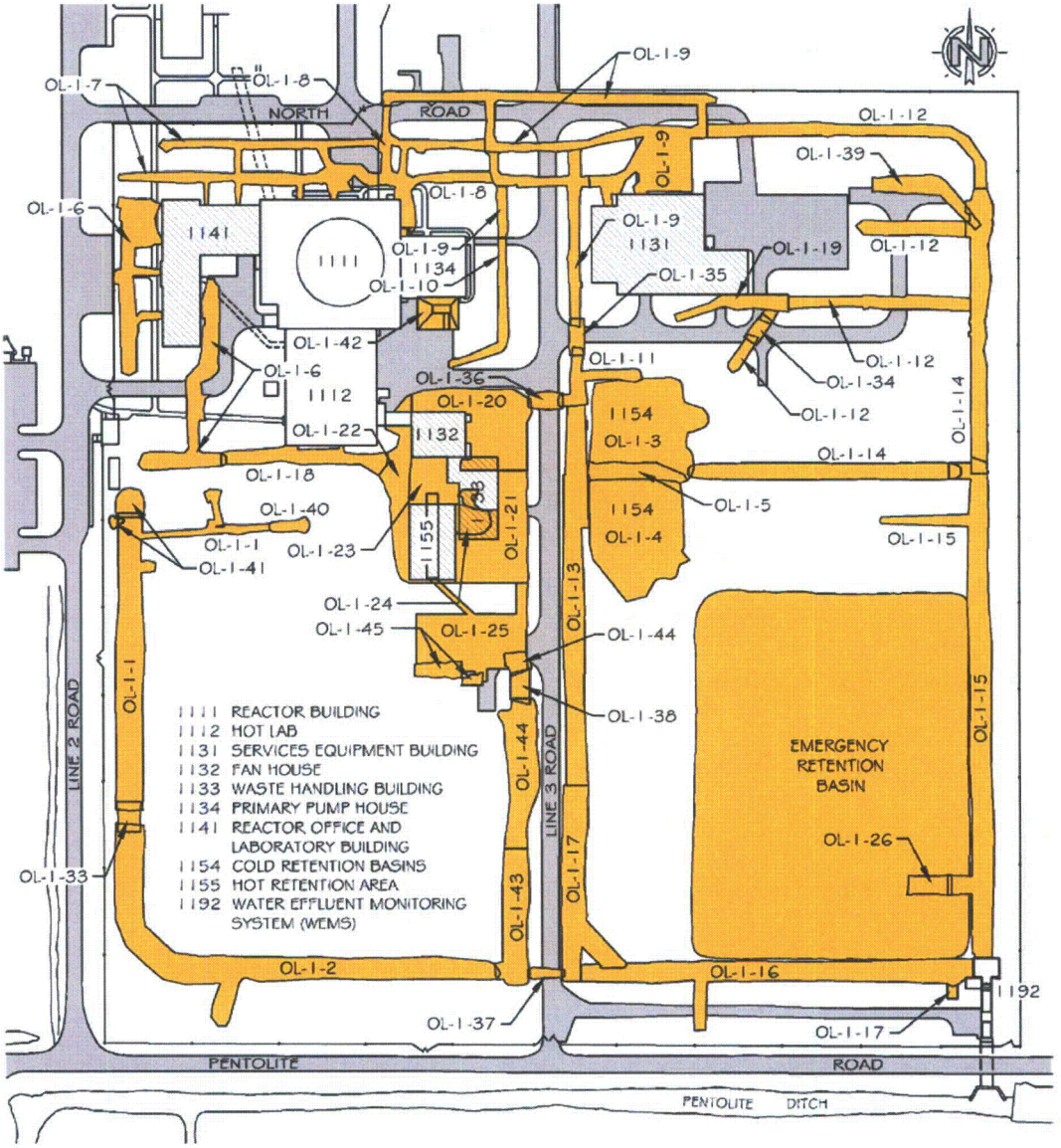


Exhibit 2, Storm Drain System Laterals

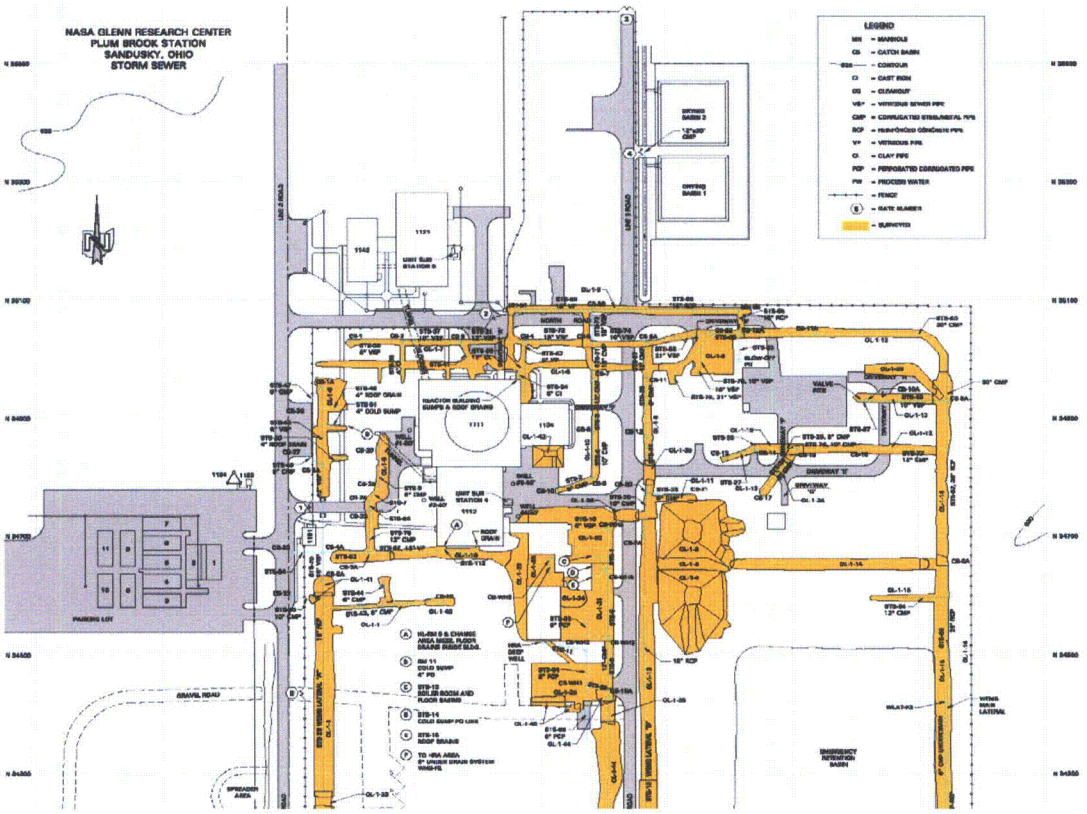


Exhibit 3, Sanitary System Piping Location Map

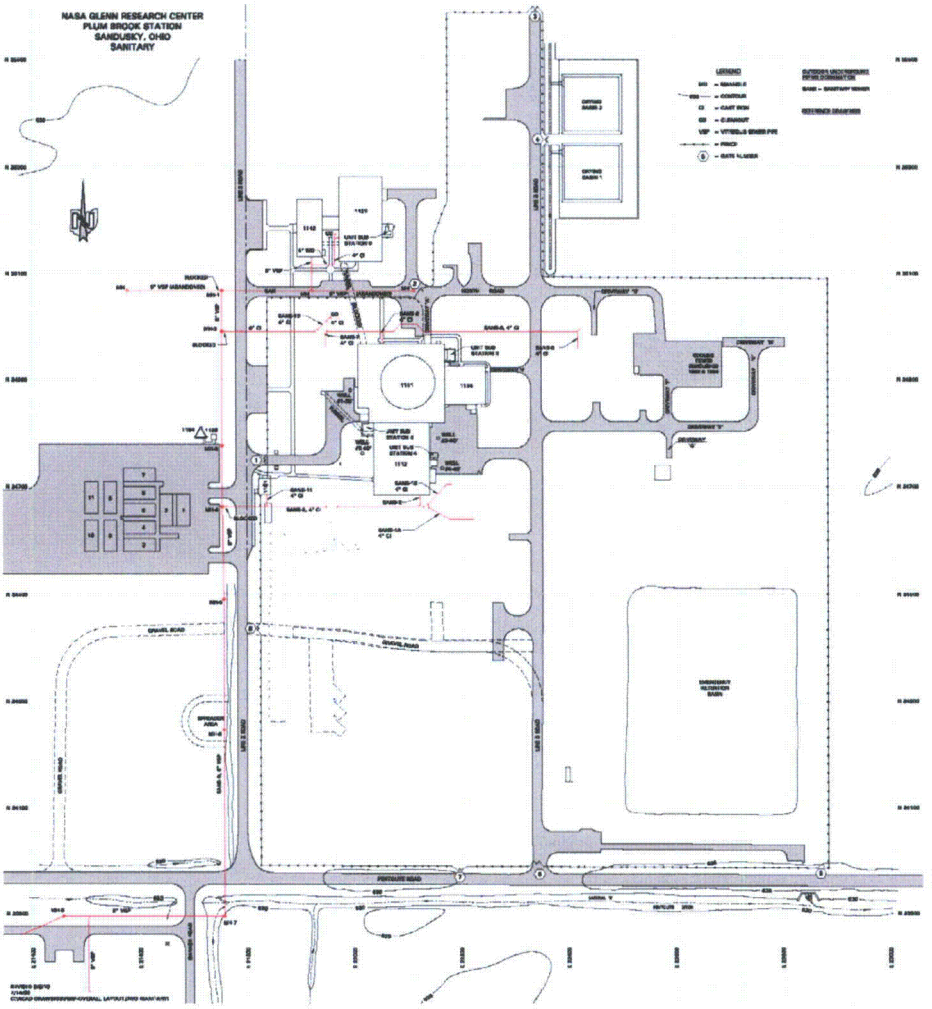


Exhibit 4, Excavation of SDS Piping in Phase 4
SDS West of CRB and East of Line 3 Road

SDS piping removal

Exhibit 5, Excavation of SDS Piping in Phase 4

Excavation of Lateral "D" South and West of CRB-2

SDS Piping Removal

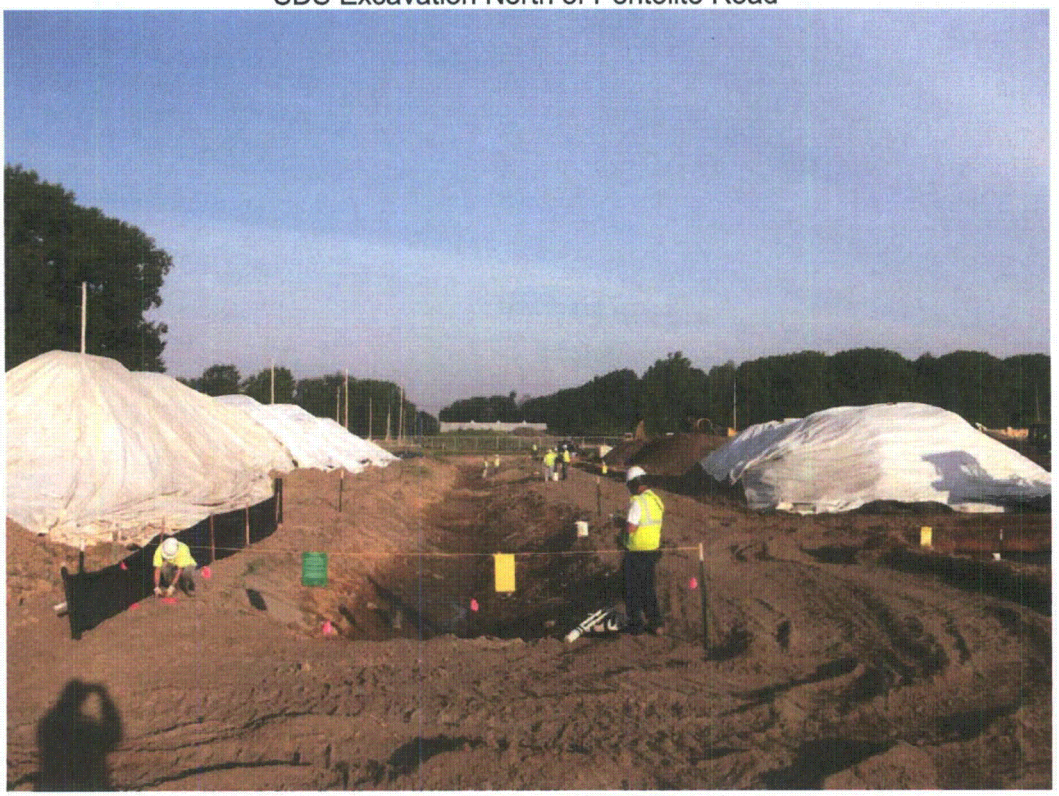
Exhibit 6, Phase 6 of SDS Dismantlement

Radiological Survey of East SDS

Backfill of SDS trench after FSS Survey

Exhibit 7, Phase 7 of SDS Dismantlement

SDS Excavation North of Pentolite Road



Radiological Survey of SDS Trench

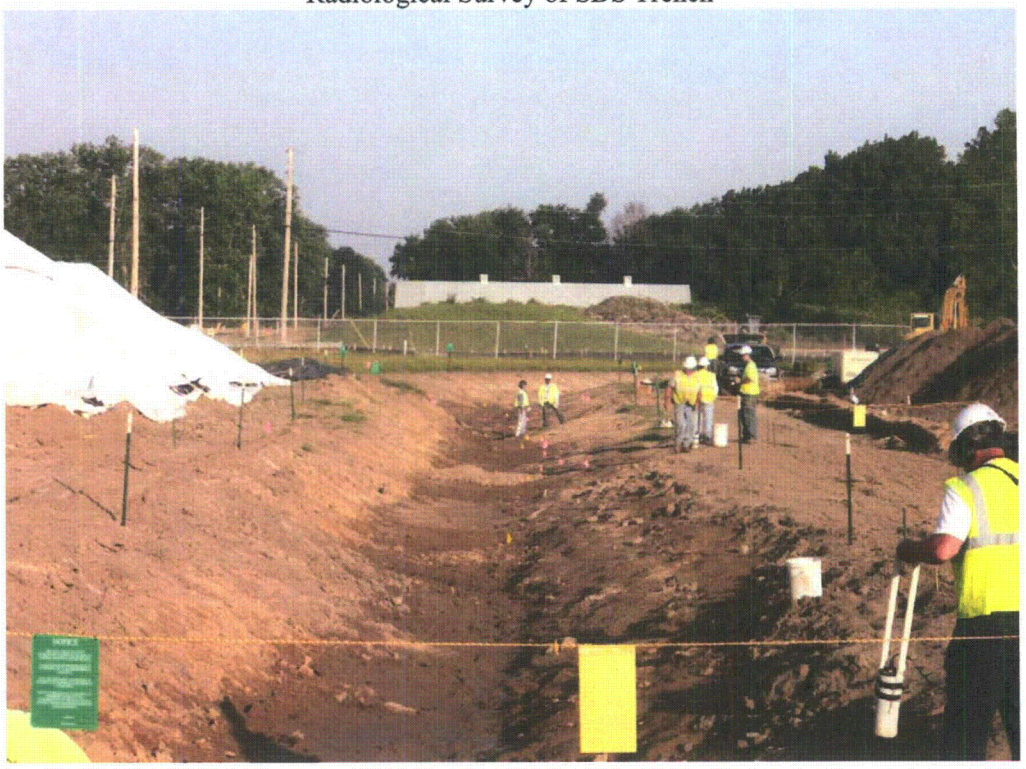


Exhibit 8, Radiological Survey of Storm Drain Trenching

Trench Located Inside Protected Area Fence near Intersection of Pentolite and Line 2 Roads

Radiological Survey of Lateral A

Exhibit 9, Excavation of SDS Piping

SDS piping located west of ERB

Removal of Piping from ERB

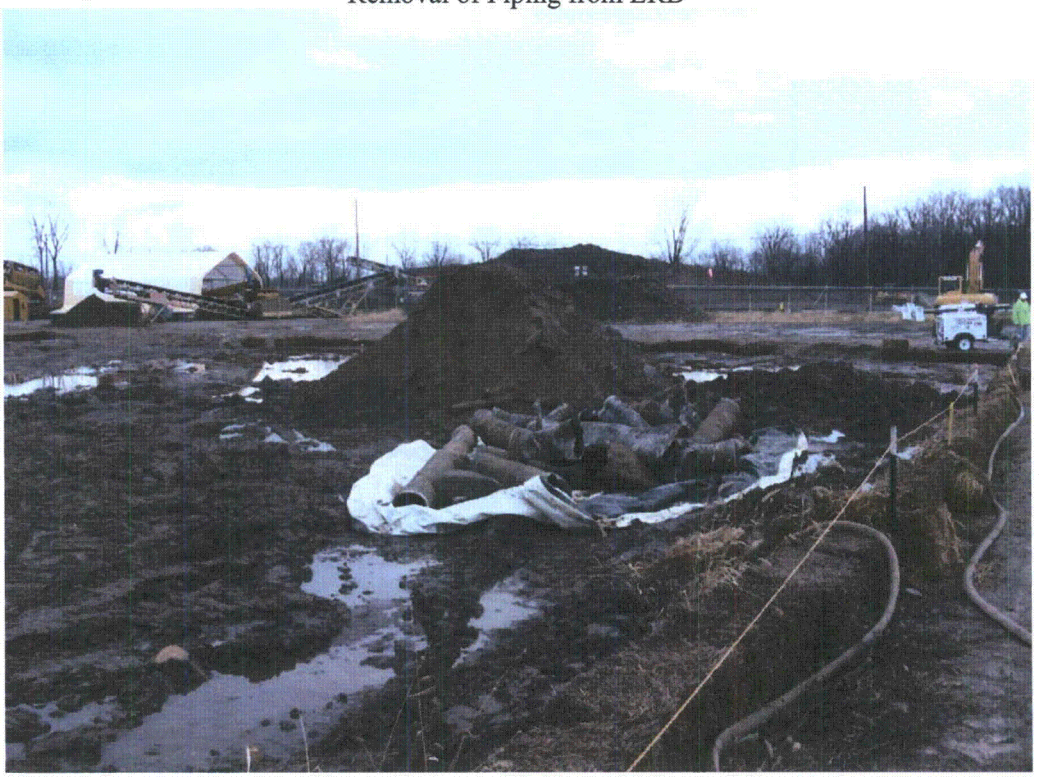


Exhibit 10, CRB Dismantlement
Removal of Roof Structure on North CRB

South CRB Concrete Demolition

Exhibit 11, CRB Disassembly

Contaminated CRB Piping Removal

Excavation of North CRB

Exhibit 12, CRB Excavations
North and South Excavations

Exhibit 13, Excavations of Piping

Pipe # FH-103 and Sleeve from West Wall of WHB

Piping Discovered during FPR walk-down of Trenches North of SEB prior to FSS

Exhibit 14, Excavation South of WHB
Concrete Pad Removal

Radiological Survey during Excavation Activities

Exhibit 15, Spill Area Excavation
Concrete Pad South of WHB and West of Line 3 Road

Load-out of Material

Exhibit 16, Lateral "A" Disassembly

Excavation of SDS Piping

Trench after SDS Piping Removal

Exhibit 17, Hot Lab Drain Line Excavation
West of Hot Lab and South of Reactor Security Building

Drain Line Piping Removal

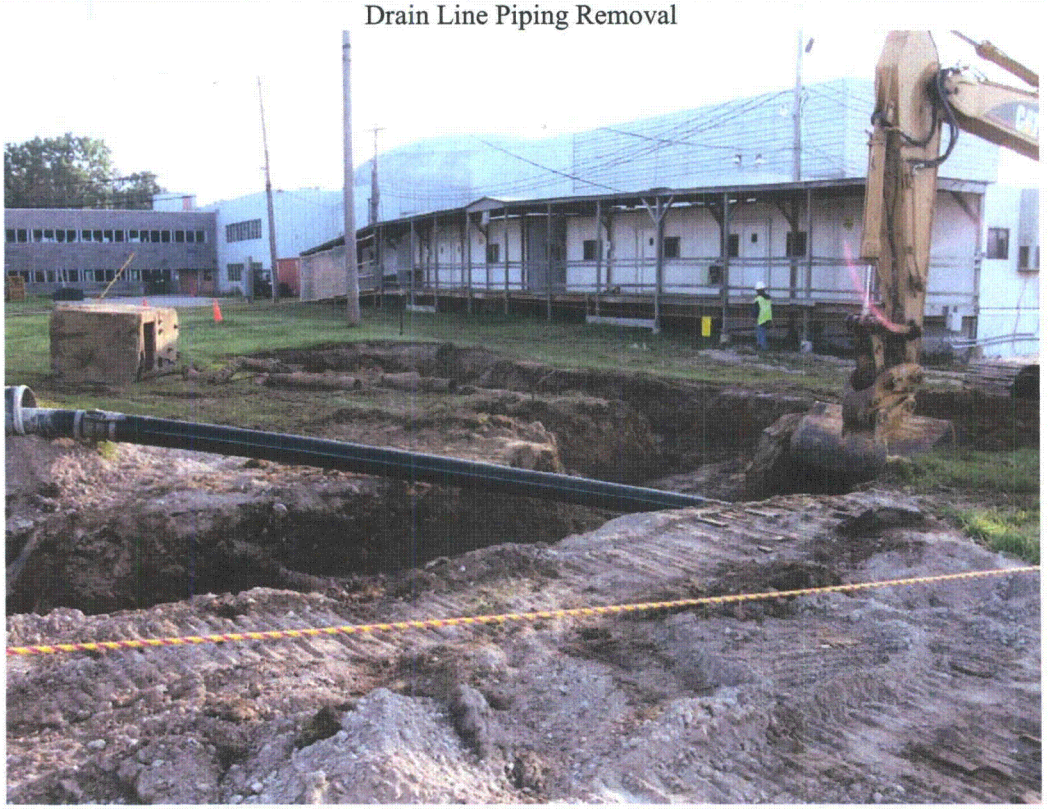


Exhibit 18, Backfill after SDS Disassembly
Lateral "A"

Lateral "A" Looking from North to South

Exhibit 19, Excavation of RCRA Soil

South of SEB

Discolored Soil in RCRA Excavation

Exhibit 20, Soil Staging

RCRA Area Soil being staged

Soil from SDS Excavations

Plum Brook Reactor Facility

Final Status Survey Report

Attachment 7

Storm Drains, Pipe Trenches & Other Sub-Surface Excavations

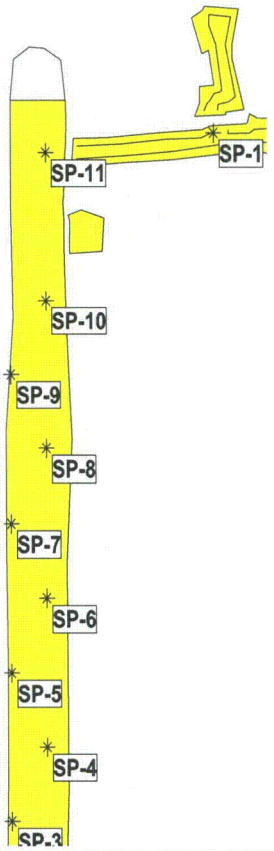
Revision 0

Appendix B

Survey Unit Maps and Tables Showing Measurement Locations

Index of Storm Drains, Pipe Trenches and Other Sub-Surface Excavations (OL-1) Survey Unit Maps and Tables of Coordinates

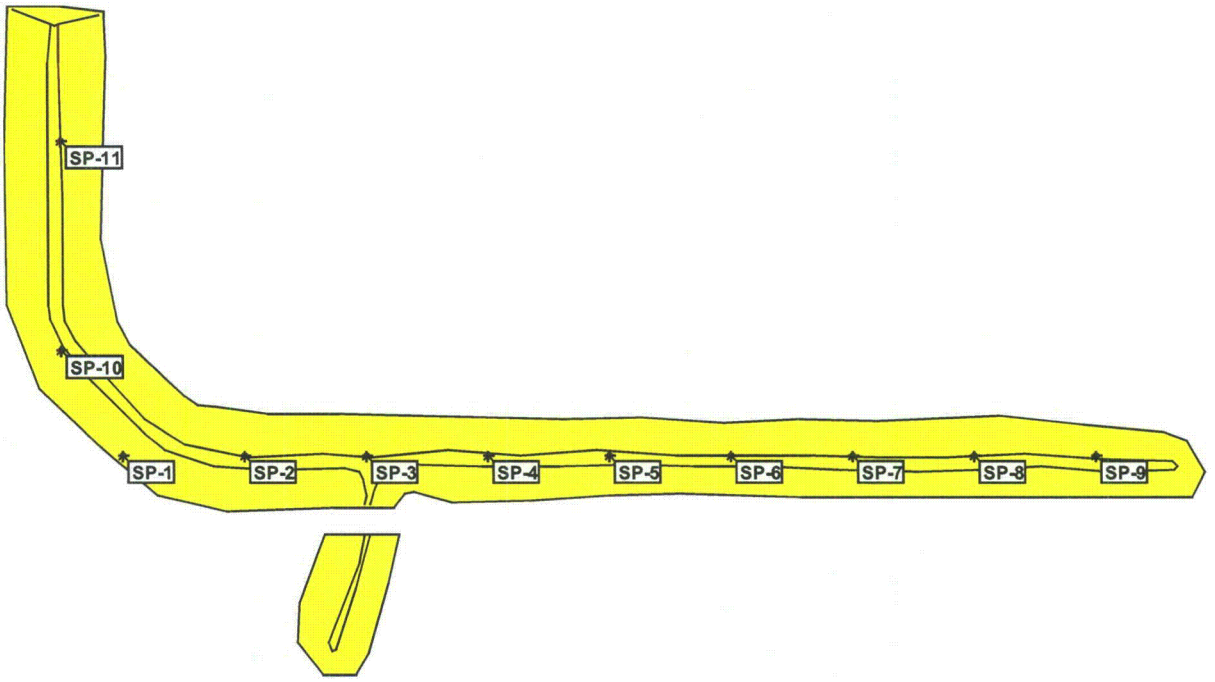
Survey Unit OL-1-1



Survey Unit OL-1-1 Area: North/South Storm Drain & East/West Lateral Trenches, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
79	9.8	SP-1	Systematic
117	9.2	SP-2	Systematic
2.5	16.5	SP-3	Systematic
21.2	50.0	SP-4	Systematic
2.2	83.5	SP-5	Systematic
21.9	117	SP-6	Systematic
2.8	150.5	SP-7	Systematic
22.2	184	SP-8	Systematic
0.7	217.4	SP-9	Systematic
18.4	250.9	SP-10	Systematic
19.5	317.9	SP-11	Systematic

The Y coordinate for samples SP-1 & SP-2 are from the south edge of the east west lateral excavation. The X coordinate is from the southwest corner of the east west dogleg excavation.
The Y coordinate for samples SP-3 to SP-11 are from the southwest corner of the trench south of CB-5A excavation. The X coordinate is from the west edge of the trench south of CB-5A excavation.

Survey Unit OL-1-2

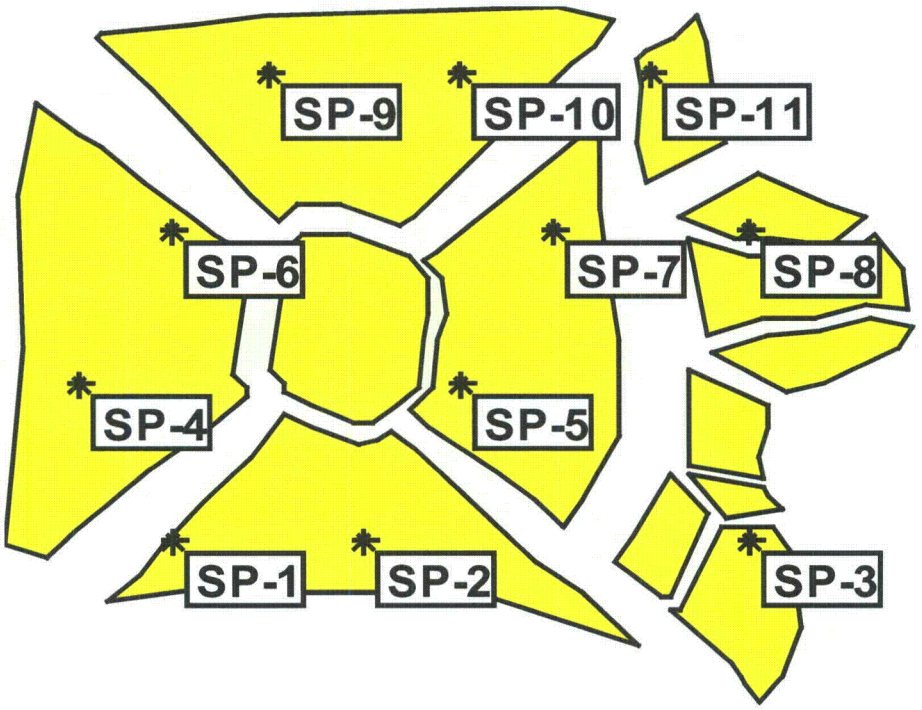


Survey Unit OL-1-2 Area: East/West Storm Drain, North/South Lateral, & West/North Bend Trenches, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
-93.4	-13.2	SP-1	Systematic
-49.8	2.7	SP-2	Systematic
-4.1	3.6	SP-3	Systematic
41.3	1.9	SP-4	Systematic
86.7	1.0	SP-5	Systematic
132.1	1.9	SP-6	Systematic
177.5	2.8	SP-7	Systematic
222.9	3.1	SP-8	Systematic
268.3	3.5	SP-9	Systematic
-136	-3.1	SP-10	Systematic
-214	2.3	SP-11	Systematic

The sample Y coordinates are measured from the centerline of the bottom of the excavation, which is shown by the inner lines on the map. Positive measurements are to the north/east of the bottom, while negative values are measured to the south/west of the bottom.

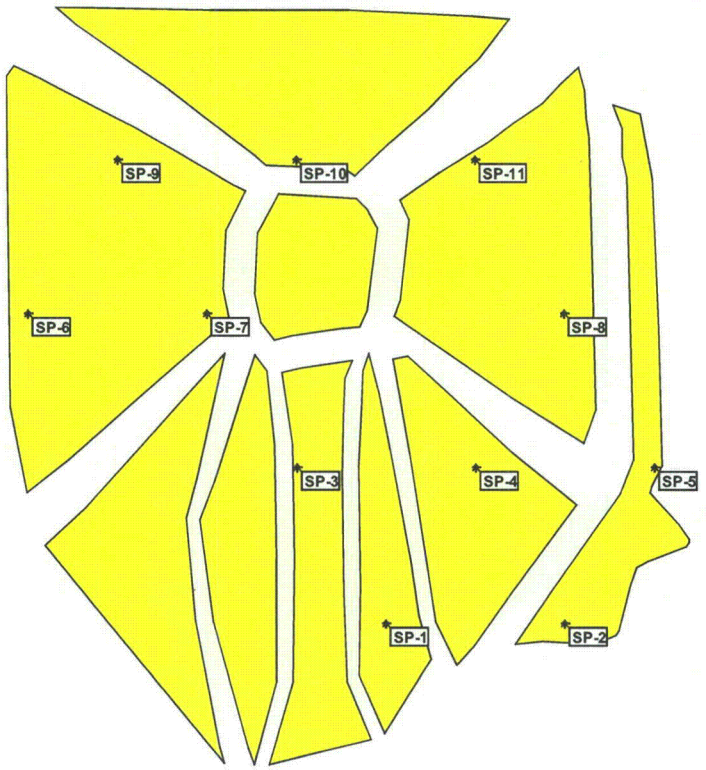
The X coordinates are measured from a point that is the intersection of 2 lines drawn from:
(1) the center of the bottom of the east-west excavation and
(2) the center of the bottom of the small north-south excavation that extends from the southern edge of the east-west trench

Survey Unit OL-1-3



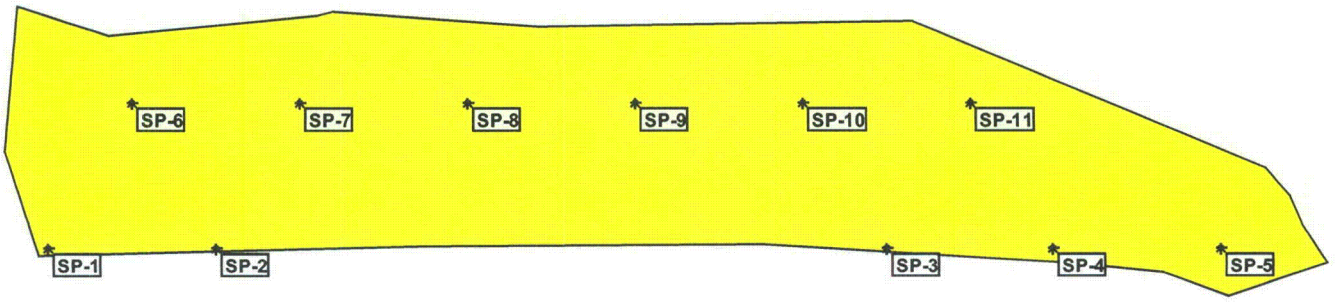
Survey Unit OL-1-3 Area: North Cold Retention Basin, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
0.0	-0.0	SP-1	Systematic
37	-0.0	SP-2	Systematic
110	-0.0	SP-3	Systematic
-18	32	SP-4	Systematic
55	32	SP-5	Systematic
0.0	63	SP-6	Systematic
74	63	SP-7	Systematic
110	63	SP-8	Systematic
19	95	SP-9	Systematic
55	95	SP-10	Systematic
92	95	SP-11	Systematic
All measurements are taken from the closest adjacent surface.			

Survey Unit OL-1-4



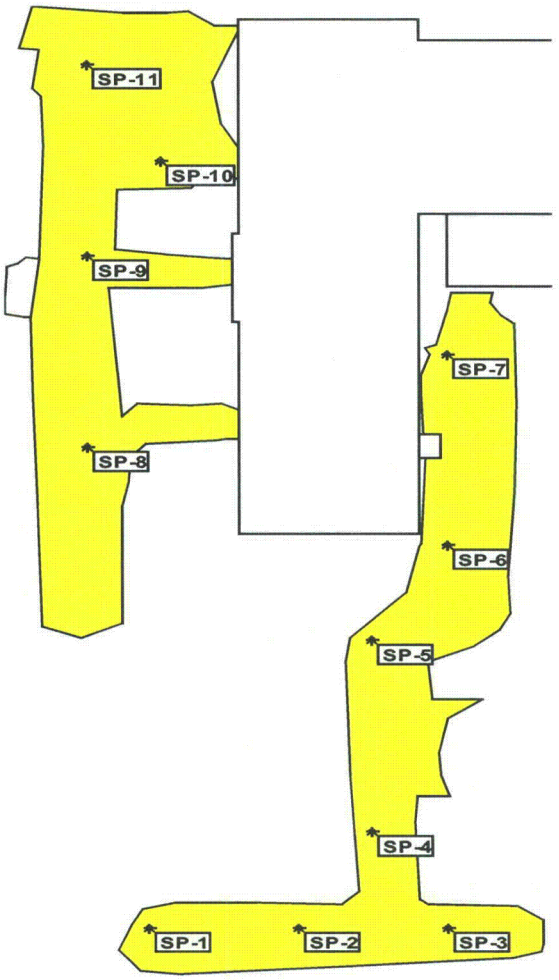
Survey Unit OL-1-4 Area: South Cold Retention Basin, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
6	13	SP-1	Systematic
4	5	SP-2	Systematic
1	21	SP-3	Systematic
8	22	SP-4	Systematic
5	1	SP-5	Systematic
29	5	SP-6	Systematic
4	4	SP-7	Systematic
22	6	SP-8	Systematic
8	24	SP-9	Systematic
9	2	SP-10	Systematic
2	18	SP-11	Systematic
All measurements are taken from the closest adjacent surface.			

Survey Unit OL-1-5



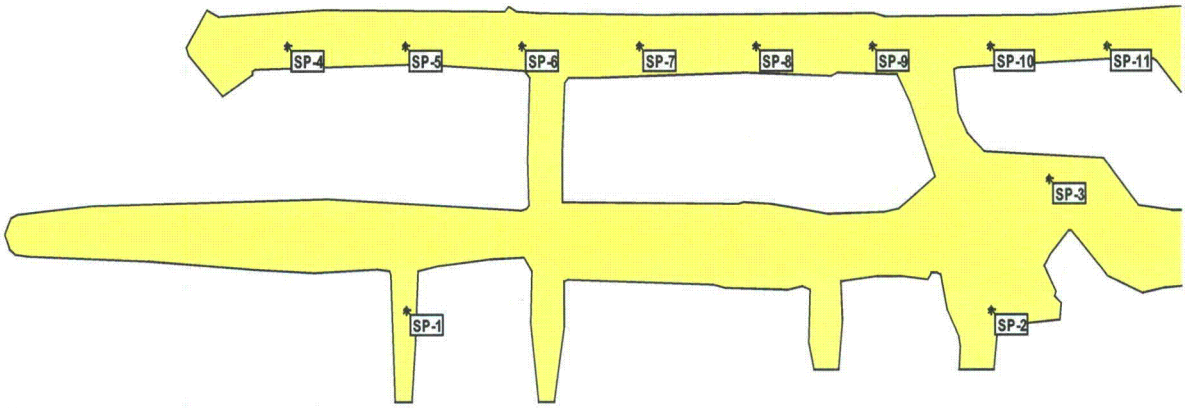
OL 1-5 Area: Cold Retention Basin Center Area, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
0.0	-0.0	SP-1	Systematic
15	-0.0	SP-2	Systematic
74	-0.0	SP-3	Systematic
89	-0.0	SP-4	Systematic
103	-0.0	SP-5	Systematic
8	12	SP-6	Systematic
23	12	SP-7	Systematic
37	12	SP-8	Systematic
52	12	SP-9	Systematic
67	12	SP-10	Systematic
81	12	SP-11	Systematic
The X-Y coordinates for samples SP-2 thru SP-11 are from SP-1, placement of SP-1 is in the southwest corner of the survey unit.			

Survey Unit OL-1-6



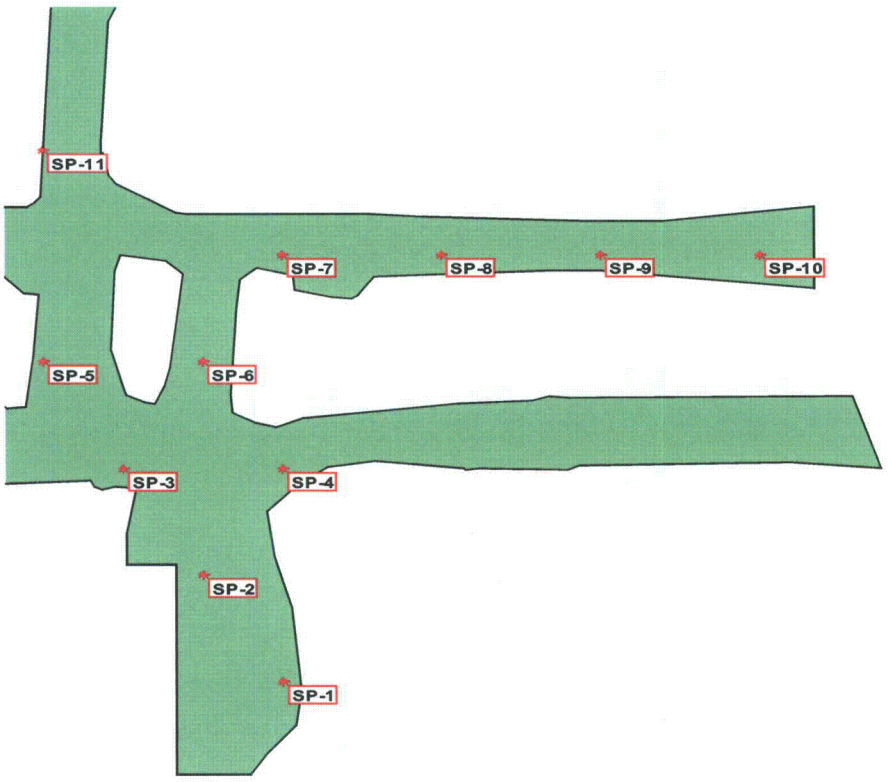
OL 1-6 Area: Storm Drains Phase #1, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
4' east of west trench edge	7' south of north trench edge	SP-1	Systematic
40' east of west trench edge	9' south of north trench edge	SP-2	Systematic
76' east of west trench edge	9' south of north trench edge	SP-3	Systematic
4' east of west trench edge	44' north of south trench edge	SP-4	Systematic
4' east of west trench edge	106' north of south trench edge	SP-5	Systematic
15' west of east trench edge	83' south of north trench edge	SP-6	Systematic
14' west of east trench edge	20' south of north trench edge	SP-7	Systematic
14' east of west trench edge	143' south of north trench edge	SP-8	Systematic
10' east of west trench edge	81' south of north trench edge	SP-9	Systematic
29' east of west trench edge	48' south of north trench edge	SP-10	Systematic
12' east of west trench edge	18' south of north trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed			

Survey Unit OL-1-7



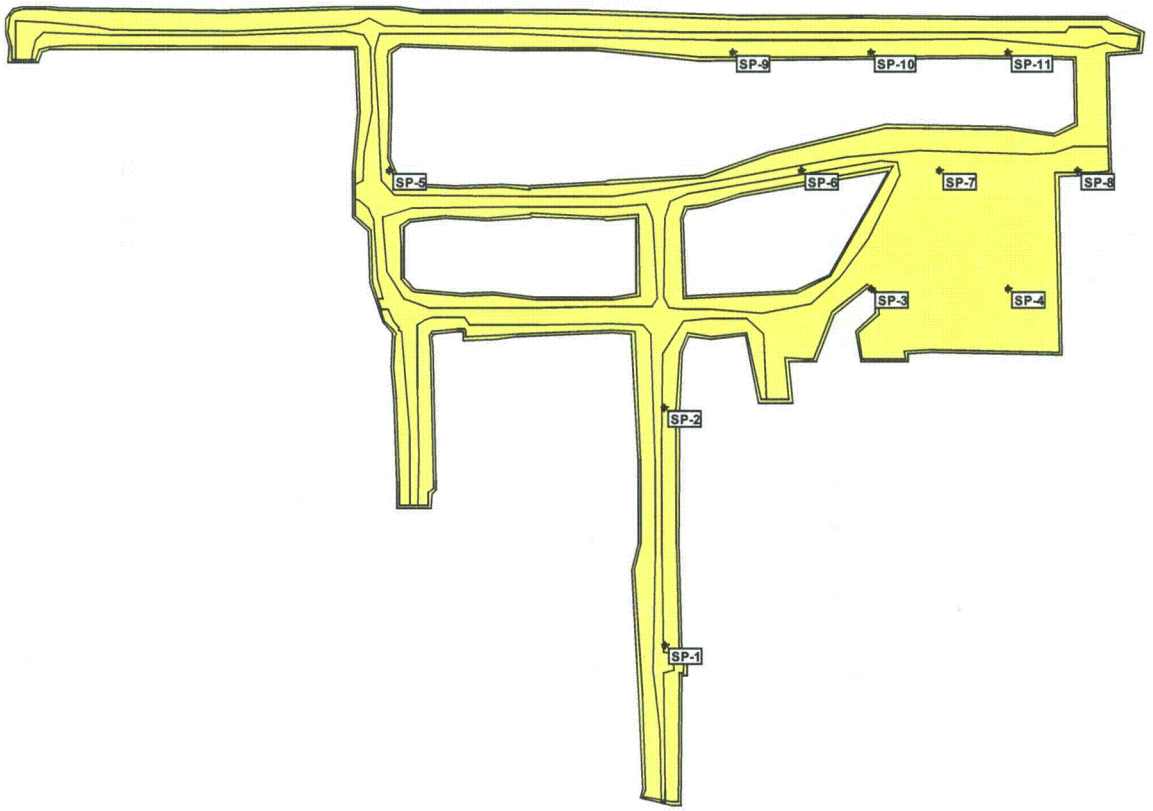
OL 1-7 Area: Storm Drains Phase 2, Section 1, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
3' east of west trench edge	19' north of south trench edge	SP-1	Systematic
12' east of west trench edge	12' north of south trench edge	SP-2	Systematic
29' east of west trench edge	5' south of north trench edge	SP-3	Systematic
26' east of west trench edge	7' north of south trench edge	SP-4	Systematic
56' east of west trench edge	7' north of south trench edge	SP-5	Systematic
86' west of east trench edge	7' south of north trench edge	SP-6	Systematic
116' west of east trench edge	5' south of north trench edge	SP-7	Systematic
146' east of west trench edge	5' south of north trench edge	SP-8	Systematic
176' east of west trench edge	6' south of north trench edge	SP-9	Systematic
206' east of west trench edge	5' south of north trench edge	SP-10	Systematic
236' east of west trench edge	7' south of north trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed			

Survey Unit OL-1-8



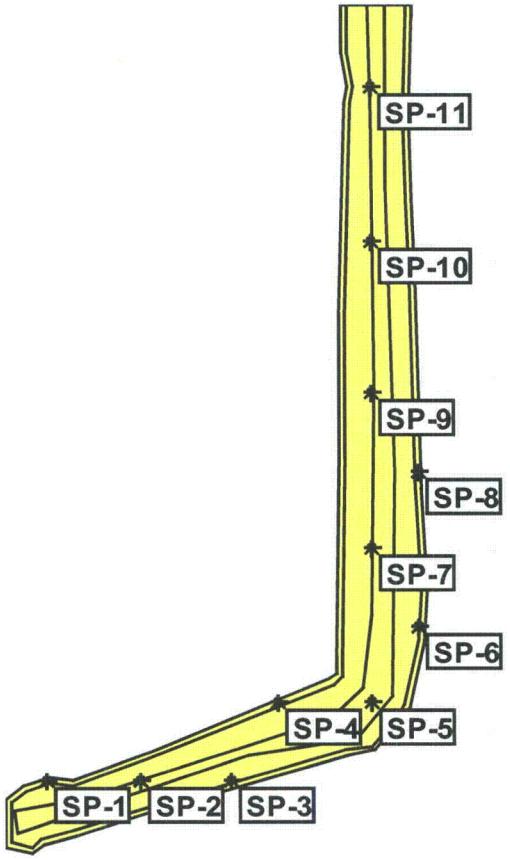
OL 1-8 Area: Storm Drains Phase 2, Section 2, Class 1 Measurement Locations and results			
X Coord	**Y Coord**	**Label**	**Type**
16' east of west trench edge	10' north of south trench edge	SP-1	Systematic
4' east of west trench edge	40' north of south trench edge	SP-2	Systematic
12' west of SP-2	3' north of south trench edge	SP-3	Systematic
24' east of SP-3	5' north of south trench edge	SP-4	Systematic
2' east of west trench edge	23' north of south trench edge	SP-5	Systematic
4' west of east trench edge	82' north of south trench edge	SP-6	Systematic
24' east of SP-3	4' north of south trench edge	SP-7	Systematic
12' east of SP-7	4' north of south trench edge	SP-8	Systematic
12' east of SP-8	3' north of south trench edge	SP-9	Systematic
12' east of SP-9	6' north of south trench edge	SP-10	Systematic
1' east of west trench edge	65' north of south trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed			

Survey Unit OL-1-9



OL 1-9 Area: Storm Drains West, Northwest, and North of SEB, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
5' west of east trench edge	55' north of south trench edge	SP-1	Systematic
5' west of east trench edge	135' north of south trench edge	SP-2	Systematic
64' west of east trench edge	1' north of southwest trench edge	SP-3	Systematic
17' west of east trench edge	20' north of south trench edge	SP-4	Systematic
3' west of east trench edge	117' north of south trench edge	SP-5	Systematic
105' west of east trench edge	5' north of south trench edge	SP-6	Systematic
58' west of east trench edge	62' north of south trench edge	SP-7	Systematic
11' west of east trench edge	2' north of south trench edge	SP-8	Systematic
138' west of east trench edge	2' north of south trench edge	SP-9	Systematic
92' west of east trench edge	2' north of south trench edge	SP-10	Systematic
46' west of east trench edge	2' north of south trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed			

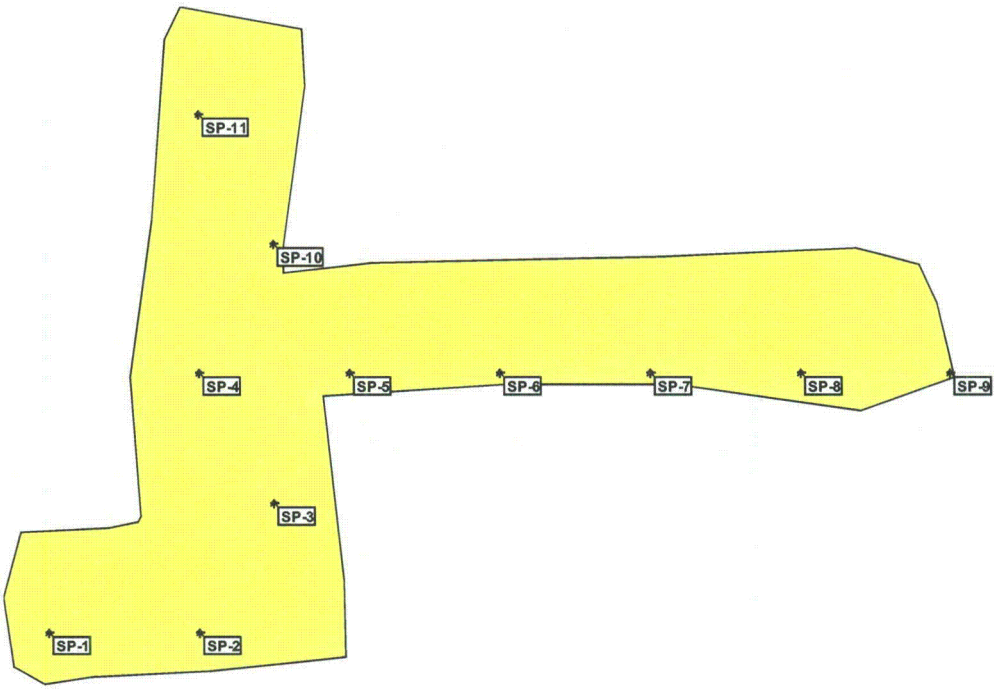
Survey Unit OL-1-10



OL 1-10 Area: Storm Drains Southeast of PPH, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
7' from west edge of trench (A)	1' south of trench edge	SP-1	Systematic
22' from west edge of trench (A)	4' south of trench edge	SP-2	Systematic
37' from west edge of trench (A)	11' south of trench edge	SP-3	Systematic
44' from west edge of trench (A)	1' south of trench edge	SP-4	Systematic
7' from east edge of trench	8' north of trench edge	SP-5	Systematic
1' from east edge of trench	14' north of SP-5	SP-6	Systematic
4' from west edge of trench	28' north of SP-5	SP-7	Systematic
1' from east edge of trench	42' north of SP-5	SP-8	Systematic
4' from west edge of trench	56' north of SP-5	SP-9	Systematic
3' from west edge of trench	84' north of SP-5	SP-10	Systematic
2' from west edge of trench	112' north of SP-5	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed			

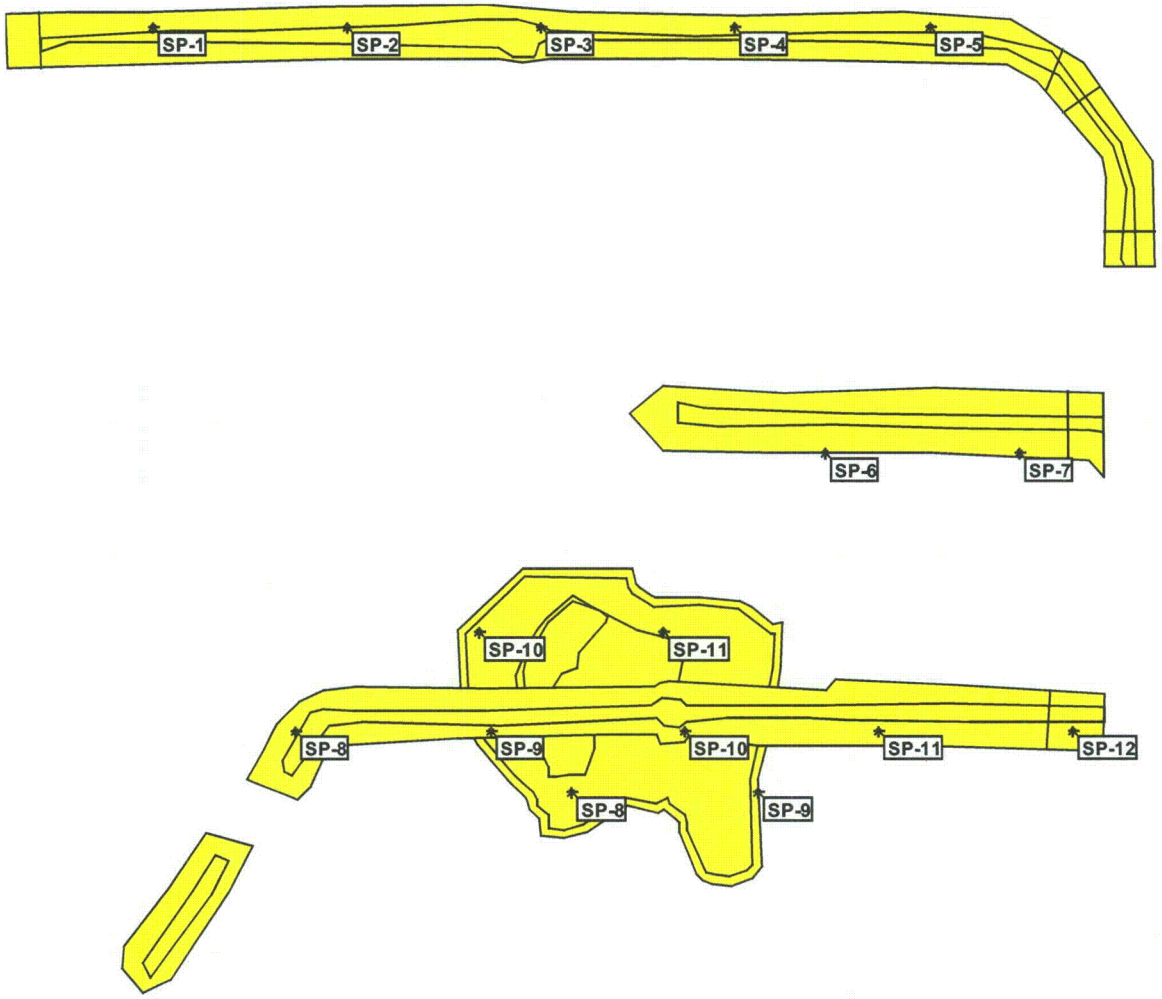
Survey Unit OL-1-11

u



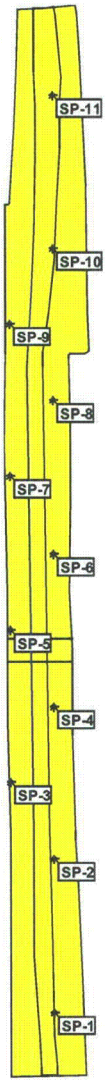
OL 1-11 Area: Phase 4, Section 1, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
30' west of east trench edge	5' north of south trench edge	SP-1	Systematic
15' west of east trench edge	4' north of south trench edge	SP-2	Systematic
6' west of east trench edge	17' north of south trench edge	SP-3	Systematic
6' east of west trench edge	31' north of south trench edge	SP-4	Systematic
22' east of west trench edge	2' north of south trench edge	SP-5	Systematic
38' east of west trench edge	1' north of south trench edge	SP-6	Systematic
54' east of west trench edge	1' north of south trench edge	SP-7	Systematic
70' east of west trench edge	3' north of south trench edge	SP-8	Systematic
86' east of west trench edge	1' north of south trench edge	SP-9	Systematic
1' west of east trench edge	44' north of south trench edge	SP-10	Systematic
10' west of east trench edge	59' north of south trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed			

Survey Unit OL-1-12



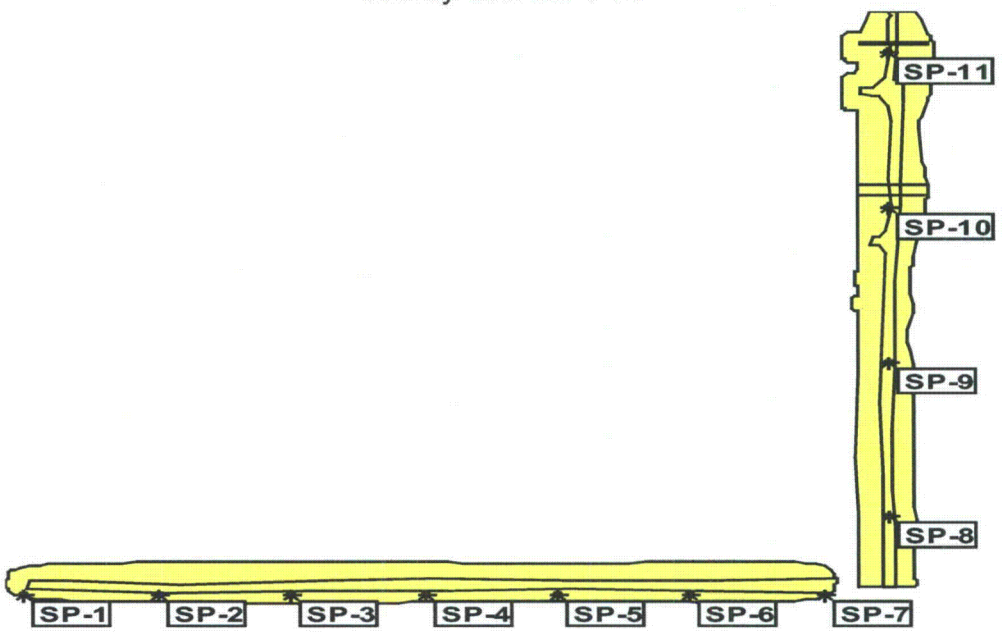
OL 1-12 Area: Storm Drains, Lateral D, North Section, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
42 ft from west end of trench	4.6 ft from north bank of trench	SP-1	Systematic
57 ft from SP-1	5.7 ft from north bank of trench	SP-2	Systematic
57 ft from SP-2	4.6 ft from north bank of trench	SP-3	Systematic
57 ft from SP-3	2.9 ft from north bank of trench	SP-4	Systematic
57 ft from SP-4	3.3 ft from north bank of trench	SP-5	Systematic
56 ft from west end of trench	0.5 ft from south bank of trench	SP-6	Systematic
57 ft from SP-6	1 ft from south bank of trench	SP-7	Systematic
6 ft from west end of trench	8 ft from north bank of trench	SP-8	Systematic
56 ft from SP-8	2 ft from south bank of trench	SP-9	Systematic
56 ft from SP-9	3 ft from south bank of trench	SP-10	Systematic
56 ft from SP-10	5 ft from south bank of trench	SP-11	Systematic
56 ft from SP-11	6 ft from south bank of trench	SP-12	Systematic
The X, Y coordinates for samples SP-1 thru SP-12 are as listed			

Survey Unit OL-1-13



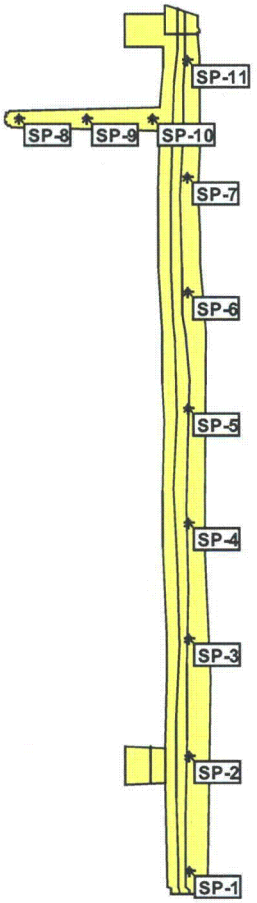
OL 1-13 Area: Storm Drains, Lateral D, North Section, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
12 ft from east edge of trench	26	SP-1	Systematic
9 ft from east edge of trench	89	SP-2	Systematic
0.4 ft from west edge of trench	121	SP-3	Systematic
8 ft from east edge of trench	153	SP-4	Systematic
1.4 ft from west edge of trench	184	SP-5	Systematic
7 ft from east edge of trench	216	SP-6	Systematic
2.4 ft from west edge of trench	247	SP-7	Systematic
7 ft from east edge of trench	279	SP-8	Systematic
1.7 ft from west edge of trench	310	SP-9	Systematic
14 ft from east edge of trench	342	SP-10	Systematic
12 ft from east edge of trench	405	SP-11	Systematic
The X coordinates for samples SP-1 thru SP-11 are as listed. The Y coordinate is measured from the center of the southern-most point of the survey unit.			

Survey Unit OL-1-14



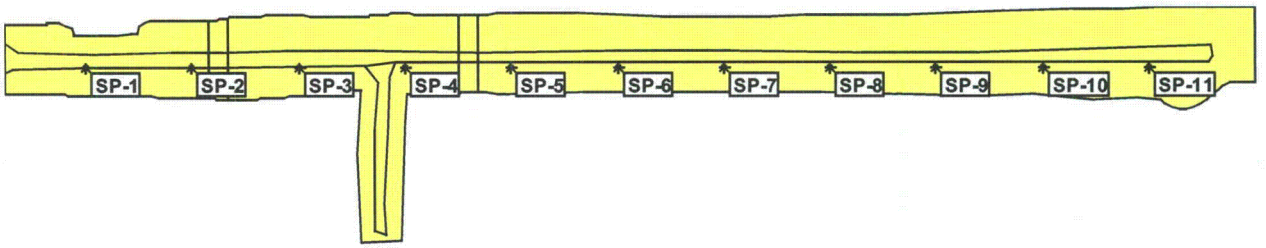
OL 1-14 Area: Storm Drains, South & East of SEB, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
5' east of west trench edge	1' north of south trench edge	SP-1	Systematic
55' east of west trench edge	5' north of south trench edge	SP-2	Systematic
105' east of west trench edge	6' north of south trench edge	SP-3	Systematic
155' east of west trench edge	3' north of south trench edge	SP-4	Systematic
205' east of west trench edge	3' north of south trench edge	SP-5	Systematic
255' east of west trench edge	4' north of south trench edge	SP-6	Systematic
305' east of west trench edge	1' north of south trench edge	SP-7	Systematic
11' east of west trench edge	270' south of concrete wall edge	SP-8	Systematic
12' east of dam edge edge	182' south of concrete wall edge	SP-9	Systematic
11' east of west trench edge	94' south of concrete wall edge	SP-10	Systematic
17' east of west trench edge	6' south of concrete wall edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			

Survey Unit OL-1-15



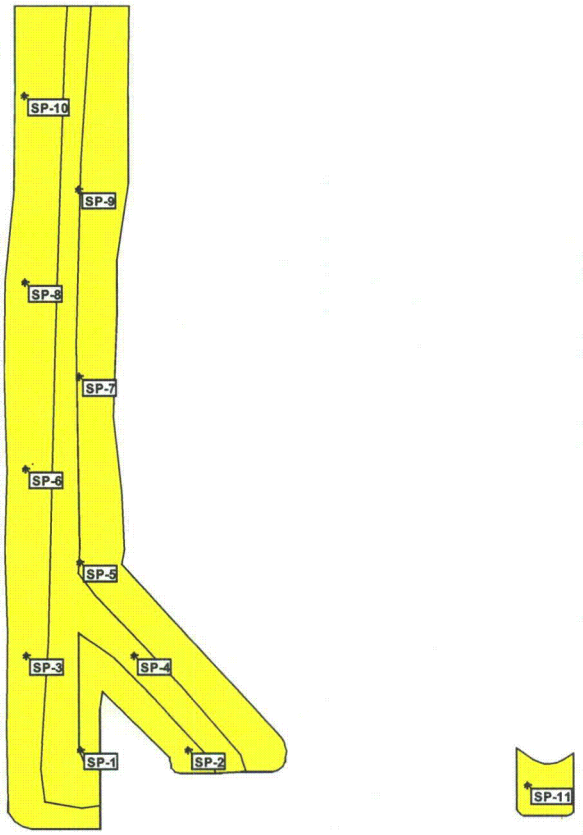
OL 1-15 Area: Storm Drains, Main Lateral, South of FH-110, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
12' west of east trench edge	10' north of south trench edge (WEMS wall)	SP-1	Systematic
13' west of east trench edge	85' north of south trench edge (WEMS wall)	SP-2	Systematic
14' west of east trench edge	160' north of south trench edge (WEMS wall)	SP-3	Systematic
12' west of east trench edge	235' north of south trench edge (WEMS wall)	SP-4	Systematic
13' west of east trench edge	310' north of south trench edge (WEMS wall)	SP-5	Systematic
12' west of east trench edge	385' north of south trench edge (WEMS wall)	SP-6	Systematic
12' west of east trench edge	460' north of south trench edge (WEMS wall)	SP-7	Systematic
8' east of west trench edge	6' south of north trench edge	SP-8	Systematic
50' east of west trench edge	7' south of north trench edge	SP-9	Systematic
92' east of west trench edge	8' south of north trench edge	SP-10	Systematic
11' west of east trench edge	535' north of south trench edge (WEMS wall)	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			

Survey Unit OL-1-16



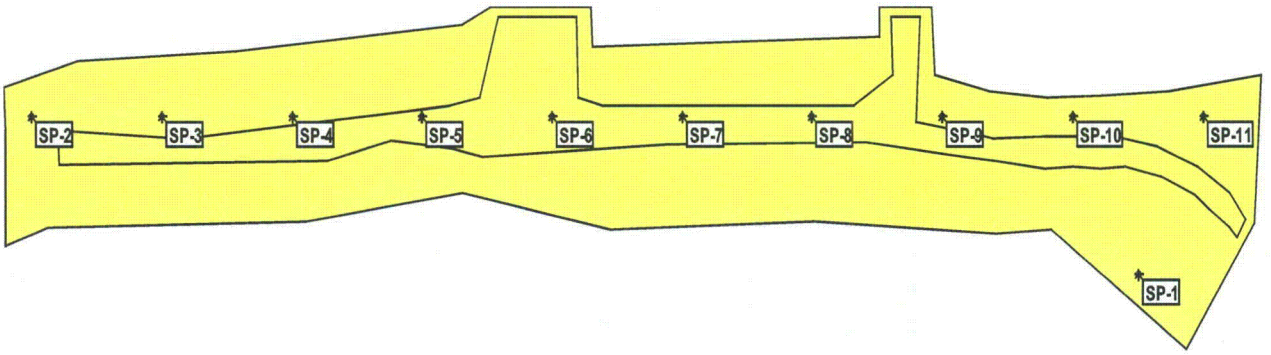
OL 1-16 Area: Storm Drains, Lateral A, East of Line 3 Road, Class1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
28' east of west trench edge	10' north of south trench edge	SP-1	Systematic
66' east of west trench edge	11' north of south trench edge	SP-2	Systematic
104' east of west trench edge	10' north of south trench edge	SP-3	Systematic
142' east of west trench edge	10' north of south trench edge	SP-4	Systematic
181' east of west trench edge	10' north of south trench edge	SP-5	Systematic
220' east of west trench edge	11' north of south trench edge	SP-6	Systematic
259' east of west trench edge	11' north of south trench edge	SP-7	Systematic
298' east of west trench edge	11' north of south trench edge	SP-8	Systematic
337' east of west trench edge	12' north of south trench edge	SP-9	Systematic
376' east of west trench edge	12' north of south trench edge	SP-10	Systematic
415' east of west trench edge	12' north of south trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			

Survey Unit OL-1-17



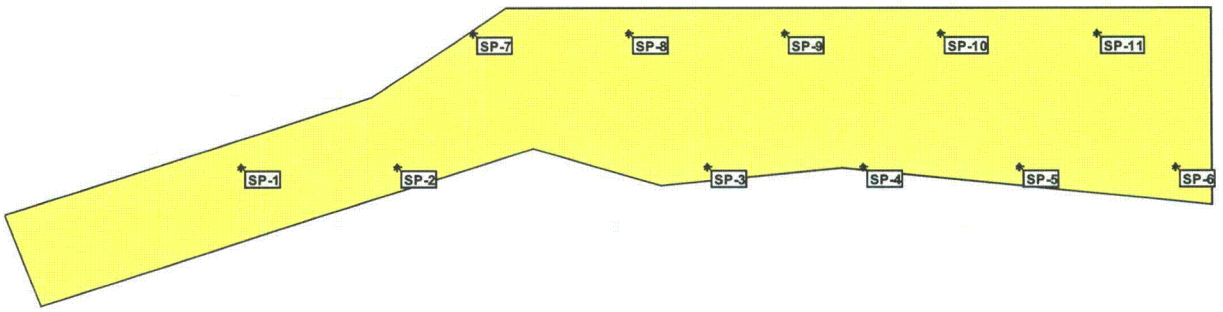
OL 1-17 Area: Storm Drains, Lateral D, South Section & STS Trench, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
5 ft from east side of trench	23 ft from the southern end of the trench	SP-1	Systematic
5.7 ft from southwest side of trench	7 ft from the southern end of the trench	SP-2	Systematic
5.2 ft from west side of trench	49 ft from the southern end of the trench	SP-3	Systematic
Center of trench	34 ft from the southern end of the trench	SP-4	Systematic
12 ft from east side of trench	75 ft from the southern end of the trench	SP-5	Systematic
5.1 ft from west side of trench	101 ft from the southern end of the trench	SP-6	Systematic
10 ft from east side of trench	127 ft from the southern end of the trench	SP-7	Systematic
5.2 ft from west side of trench	153 ft from the southern end of the trench	SP-8	Systematic
13 ft from east side of trench	179 ft from the southern end of the trench	SP-9	Systematic
2.6 ft from west side of trench	205 ft from the southern end of the trench	SP-10	Systematic
3 ft from west side of trench	9 ft from the southern end of the trench	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			

Survey Unit OL-1-18



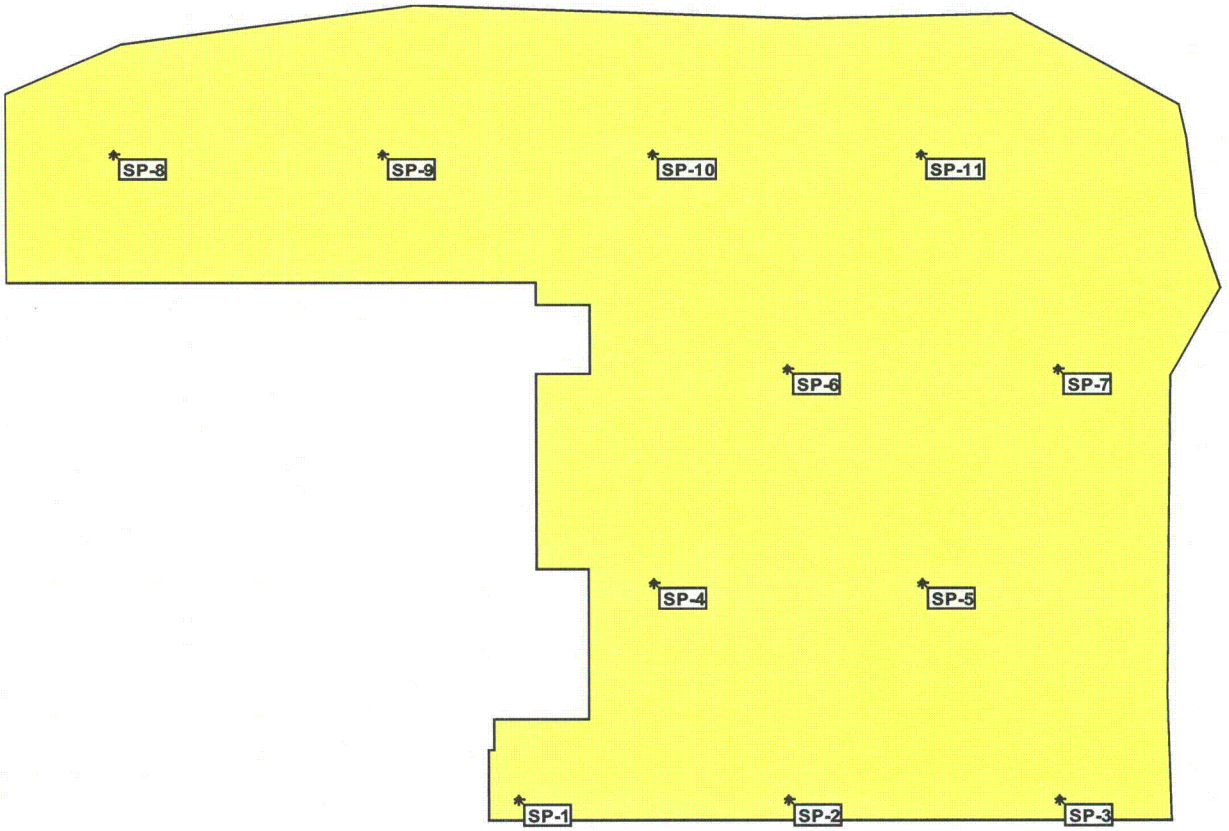
OL 1-18 Area: SANS Trenches South of HL Building, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
176' east of west trench edge	4' north of south trench edge	SP-1	Systematic
4' east of west trench edge	13' north of south trench edge	SP-2	Systematic
24' east of west trench edge	12' north of south trench edge	SP-3	Systematic
44' east of west trench edge	11' north of south trench edge	SP-4	Systematic
64' east of west trench edge	9' north of south trench edge	SP-5	Systematic
84' east of west trench edge	11' north of south trench edge	SP-6	Systematic
104' east of west trench edge	12' north of south trench edge	SP-7	Systematic
124' east of west trench edge	11' north of south trench edge	SP-8	Systematic
144' east of west trench edge	12' north of south trench edge	SP-9	Systematic
164' east of west trench edge	14' north of south trench edge	SP-10	Systematic
184' east of west trench edge	14' north of south trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			

Survey Unit OL-1-19



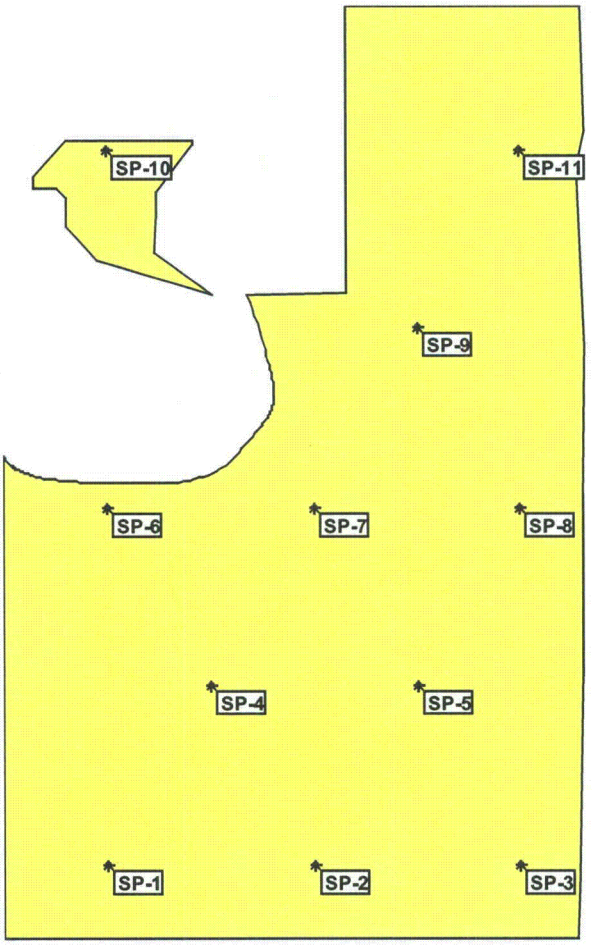
OL 1-19 Area: RCRA Trenches South of SEB, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
105' west of east trench edge	17' south of north trench edge	SP-1	Systematic
88' west of east trench edge	17' south of north trench edge	SP-2	Systematic
54' west of east trench edge	17' south of north trench edge	SP-3	Systematic
37' west of east trench edge	17' south of north trench edge	SP-4	Systematic
20' west of east trench edge	17' south of north trench edge	SP-5	Systematic
3' west of east trench edge	17' south of north trench edge	SP-6	Systematic
85' west of east trench edge	3' south of north trench edge	SP-7	Systematic
68' west of east trench edge	3' south of north trench edge	SP-8	Systematic
51' west of east trench edge	3' south of north trench edge	SP-9	Systematic
34' west of east trench edge	3' south of north trench edge	SP-10	Systematic
17' west of east trench edge	3' south of north trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			

Survey Unit OL-1-20



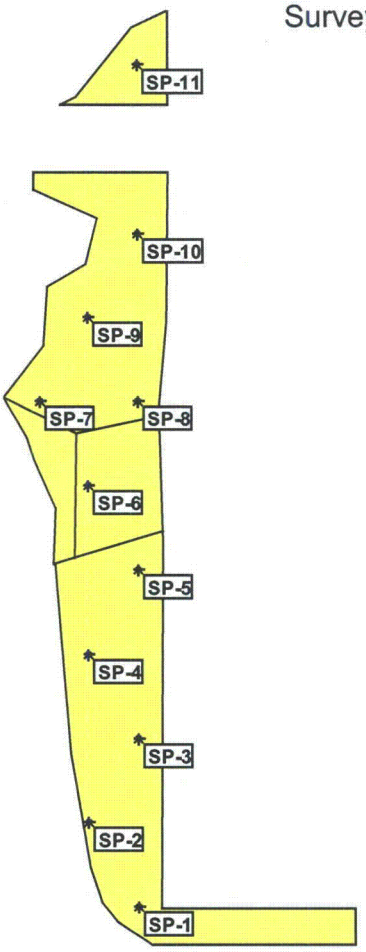
OL 1-20 Area: Northeast Corner of FH/WHB Footprint, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
3' east of west trench edge	2' north of south trench edge	SP-1	Systematic
34' east of west trench edge	2' north of south trench edge	SP-2	Systematic
65' east of west trench edge	2' north of south trench edge	SP-3	Systematic
7' east of west trench edge	30' north of south trench edge	SP-4	Systematic
48' east of west trench edge	30' north of south trench edge	SP-5	Systematic
23' east of west trench edge	57' north of south trench edge	SP-6	Systematic
54' east of west trench edge	57' north of south trench edge	SP-7	Systematic
13' east of west trench edge	16' north of south trench edge	SP-8	Systematic
44' east of west trench edge	16' north of south trench edge	SP-9	Systematic
75' east of west trench edge	85' north of south trench edge	SP-10	Systematic
106' east of west trench edge	85' north of south trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			

Survey Unit OL-1-21



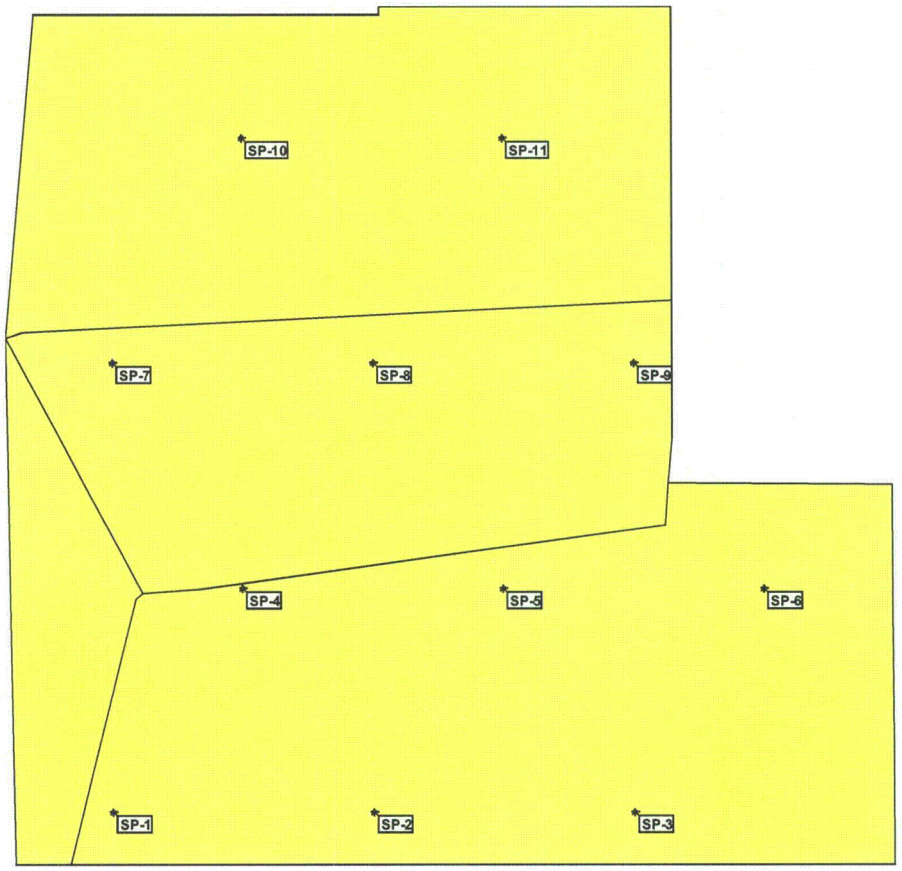
OL 1-21 Area: Southeast Corner of FH/WHB Footprint, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
16' east of west trench edge	12' north of south trench edge	SP-1	Systematic
48' east of west trench edge	12' north of south trench edge	SP-2	Systematic
80' east of west trench edge	12' north of south trench edge	SP-3	Systematic
32' east of west trench edge	38' north of south trench edge	SP-4	Systematic
64' east of west trench edge	38' north of south trench edge	SP-5	Systematic
16' east of west trench edge	66' north of south trench edge	SP-6	Systematic
48' east of west trench edge	66' north of south trench edge	SP-7	Systematic
80' east of west trench edge	66' north of south trench edge	SP-8	Systematic
25' east of west trench edge	94' north of south trench edge	SP-9	Systematic
8' east of west trench edge	2' south of north trench edge	SP-10	Systematic
26' east of west trench edge	120' north of south trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			

Survey Unit OL-1-22



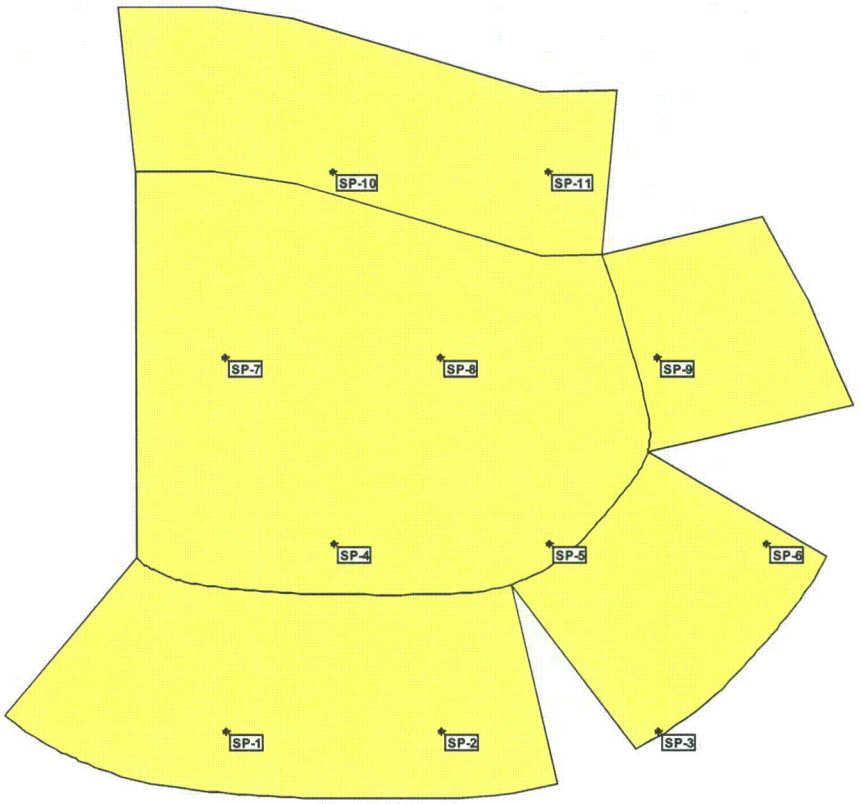
OL 1-22 Area: Western Sections of FH/WHB Footprint, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
4' west of east trench edge	188' south of north trench edge	SP-1	Systematic
16' west of east trench edge	167' south of north trench edge	SP-2	Systematic
4' west of east trench edge	145' south of north trench edge	SP-3	Systematic
17' west of east trench edge	124' south of north trench edge	SP-4	Systematic
4' west of east trench edge	102' south of north trench edge	SP-5	Systematic
17' west of east trench edge	80' south of north trench edge	SP-6	Systematic
30' west of east trench edge	58' south of north trench edge	SP-7	Systematic
4' west of east trench edge	58' south of north trench edge	SP-8	Systematic
18' west of east trench edge	37' south of north trench edge	SP-9	Systematic
6' west of east trench edge	16' south of north trench edge	SP-10	Systematic
7' west of east trench edge	10' north of south trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			

Survey Unit OL-1-23



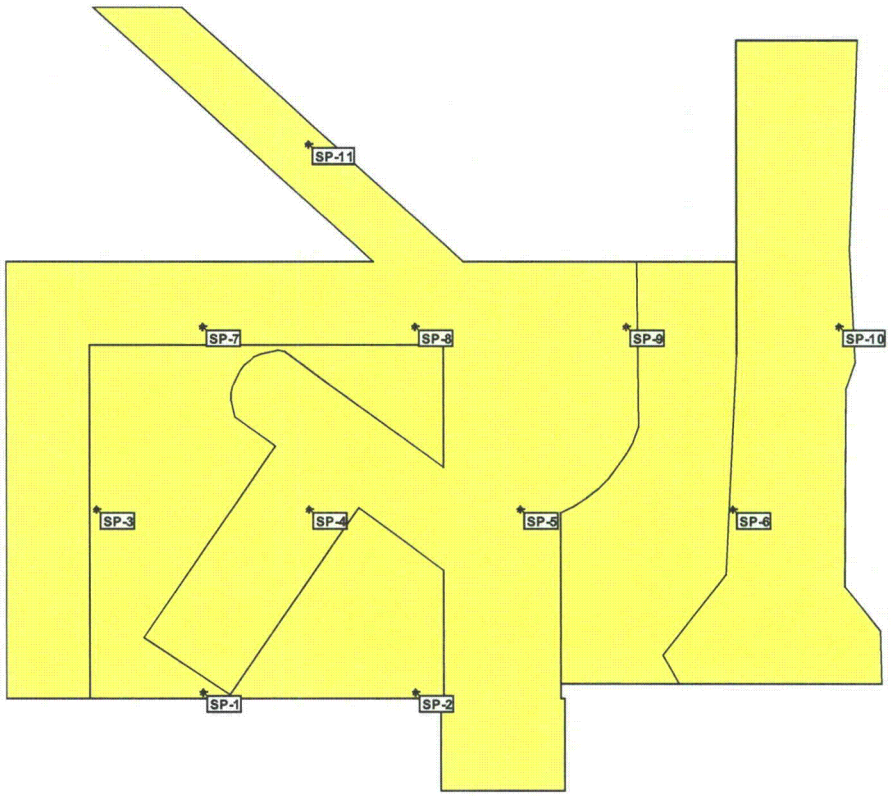
OL 1-23 Area: UST Excavations, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
6' east of southwest corner	3' north of south trench edge	SP-1	Systematic
23' east of southwest corner	3' north of south trench edge	SP-2	Systematic
40' east of southwest corner	3' north of south trench edge	SP-3	Systematic
15' east of southwest corner	18' north of south trench edge	SP-4	Systematic
32' east of southwest corner	18' north of south trench edge	SP-5	Systematic
49' east of southwest corner	18' north of south trench edge	SP-6	Systematic
6' east of southwest corner	33' north of south trench edge	SP-7	Systematic
23' east of southwest corner	33' north of south trench edge	SP-8	Systematic
40' east of southwest corner	33' north of south trench edge	SP-9	Systematic
15' east of southwest corner	47' north of south trench edge	SP-10	Systematic
32' east of southwest corner	47' north of south trench edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are measured from the survey unit's southwest corner.			

Survey Unit OL-1-24



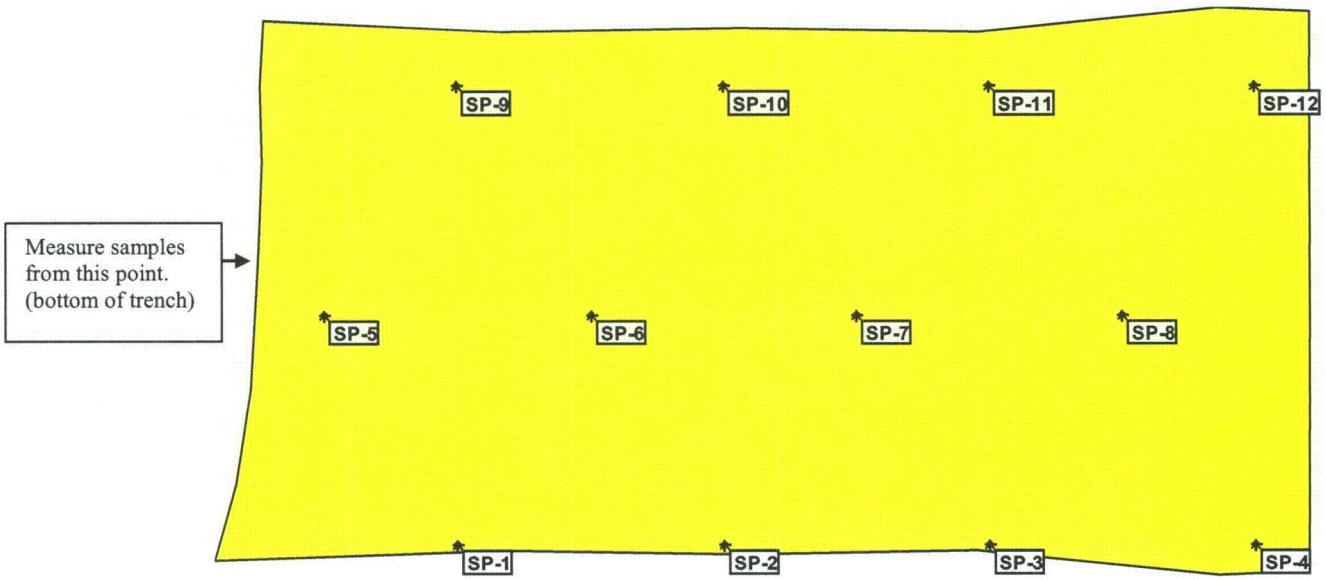
OL 1-24 Area: Evaporator Pit, Class 1 Measurement Locations and results			
X Coord	**Y Coord**	**Label**	**Type**
15' east from southwest wall	5' down from top of pit	SP-1	Systematic
30' east from southwest wall	5' down from top of pit	SP-2	Systematic
44' east from southwest wall	1' down from top of pit	SP-3	Systematic
15' east of west wall	19' down from top of pit	SP-4	Systematic
30' east of west wall	16' down from top of pit	SP-5	Systematic
54' east from southwest wall	5' down from top of pit	SP-6	Systematic
6' east of west wall	25' down from top of pit	SP-7	Systematic
16' east of west wall	21' down from top of pit	SP-8	Systematic
44' east from northwest wall	11' down from top of pit	SP-9	Systematic
15' east from northwest wall	10' down from top of pit	SP-10	Systematic
30' east from northwest wall	6' down from top of pit	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are measured from the survey unit's identified wall edge and the top of the evaporator pit.			

Survey Unit OL-1-25



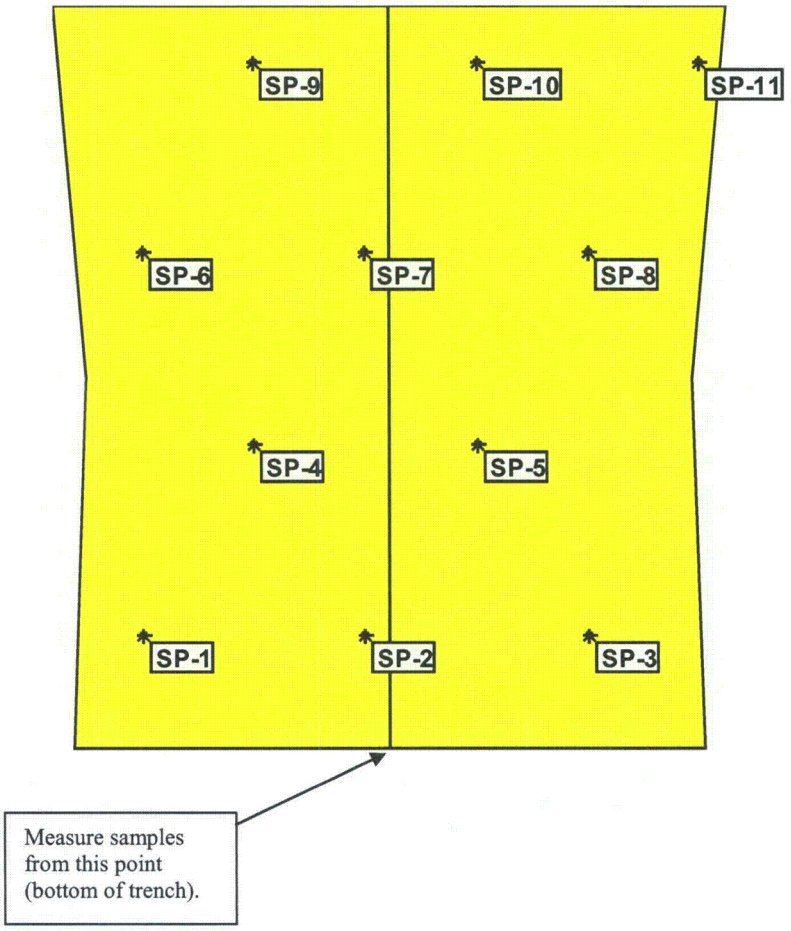
OL 1-25 Area: Phase 7 North of Haul Road, South of FH/WHB, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
30'	1.0'	SP-1	Systematic
63'	1.0'	SP-2	Systematic
14'	29'	SP-3	Systematic
47'	29'	SP-4	Systematic
80'	29'	SP-5	Systematic
113'	29'	SP-6	Systematic
30'	58'	SP-7	Systematic
63'	58'	SP-8	Systematic
96'	58'	SP-9	Systematic
129'	58'	SP-10	Systematic
47' east of survey units west edge	4' south of trenches north edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-10 are measured from the survey unit's southwest corner. The X, Y coordinates for sample SP-11 are as delineated			

Survey Unit OL-1-26



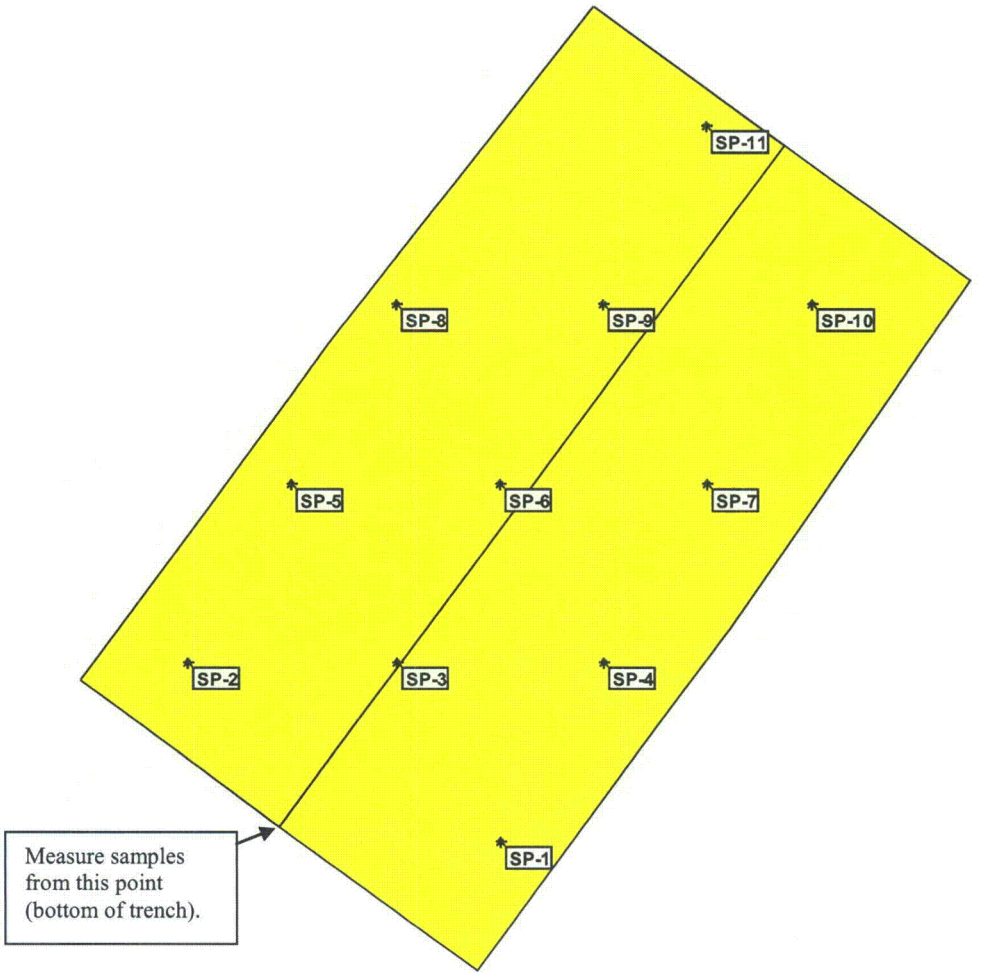
OL 1-26 Area: ERB Sump Drain Line Excavation, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
9.5	-12.2	SP-1	Systematic
22.1	-12.2	SP-2	Systematic
34.7	-12.2	SP-3	Systematic
47.3	-12.2	SP-4	Systematic
3.2	-1.3	SP-5	Systematic
15.8	-1.3	SP-6	Systematic
28.4	-1.3	SP-7	Systematic
41.0	-1.3	SP-8	Systematic
9.5	9.6	SP-9	Systematic
22.1	9.6	SP-10	Systematic
34.7	9.6	SP-11	Systematic
All sample points are measured from the point shown on the map			

Survey Unit OL-1-33



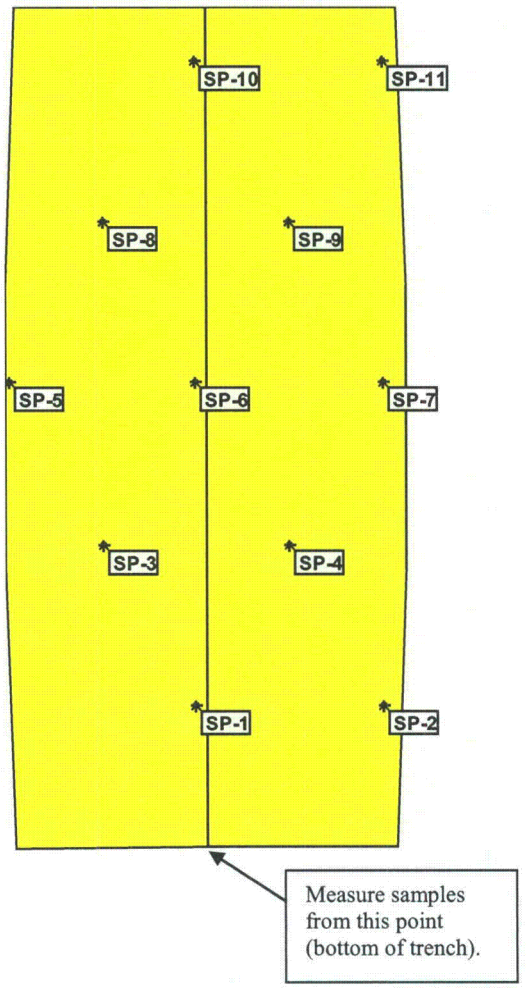
OL 1-33 Area: Storm Drain Excavation-MacTec Crossover, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
-11.3	5.2	SP-1	Systematic
-1.1	5.2	SP-2	Systematic
9.1	5.2	SP-3	Systematic
-6.2	14.0	SP-4	Systematic
4.0	14.0	SP-5	Systematic
-11.3	22.9	SP-6	Systematic
-1.1	22.9	SP-7	Systematic
9.1	22.9	SP-8	Systematic
-6.2	31.7	SP-9	Systematic
4.0	31.7	SP-10	Systematic
14.3	31.7	SP-11	Systematic
All sample points are measured from the point shown on the map.			

Survey Unit OL-1-34



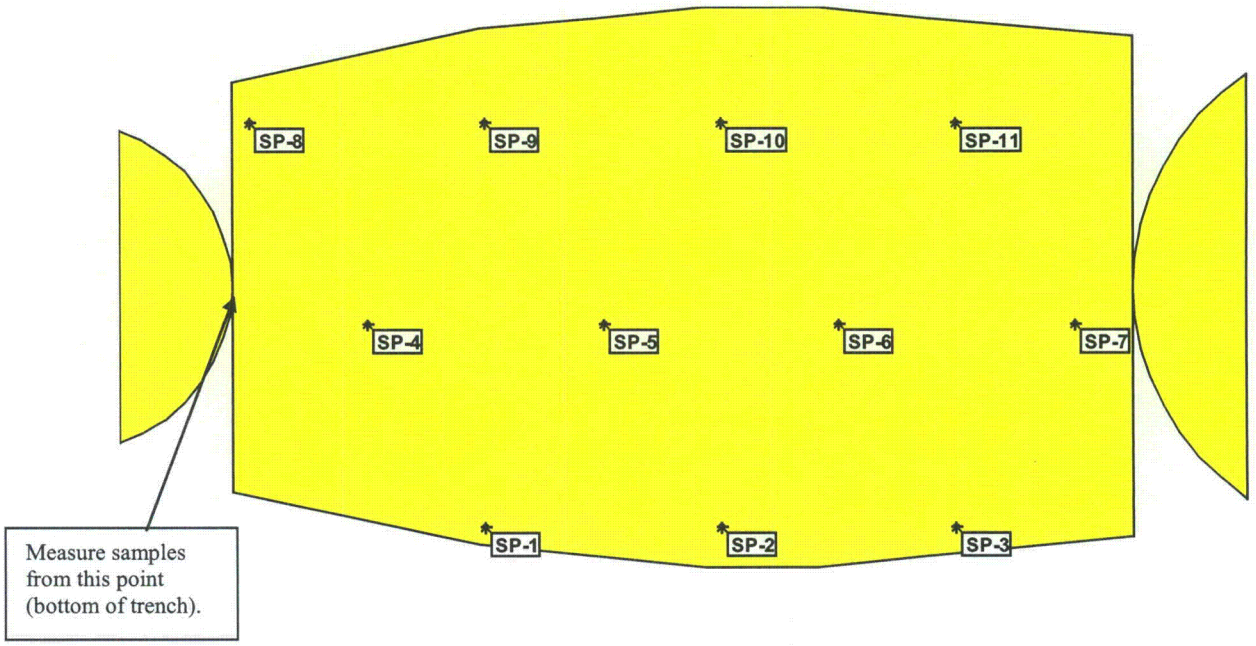
OL 1-34 Area: Storm Drain Excavations-Crossover South of SEB, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
4.8	-7.4	SP-1	Systematic
3.2	6.7	SP-2	Systematic
8.1	0	SP-3	Systematic
13.2	-6.6	SP-4	Systematic
11.4	8.0	SP-5	Systematic
16.4	1.1	SP-6	Systematic
21.2	-5.5	SP-7	Systematic
19.8	8.8	SP-8	Systematic
24.7	1.9	SP-9	Systematic
29.7	-4.5	SP-10	Systematic
32.9	3.0	SP-11	Systematic
All sample points are measured from the point shown on the map.			

Survey Unit OL-1-35



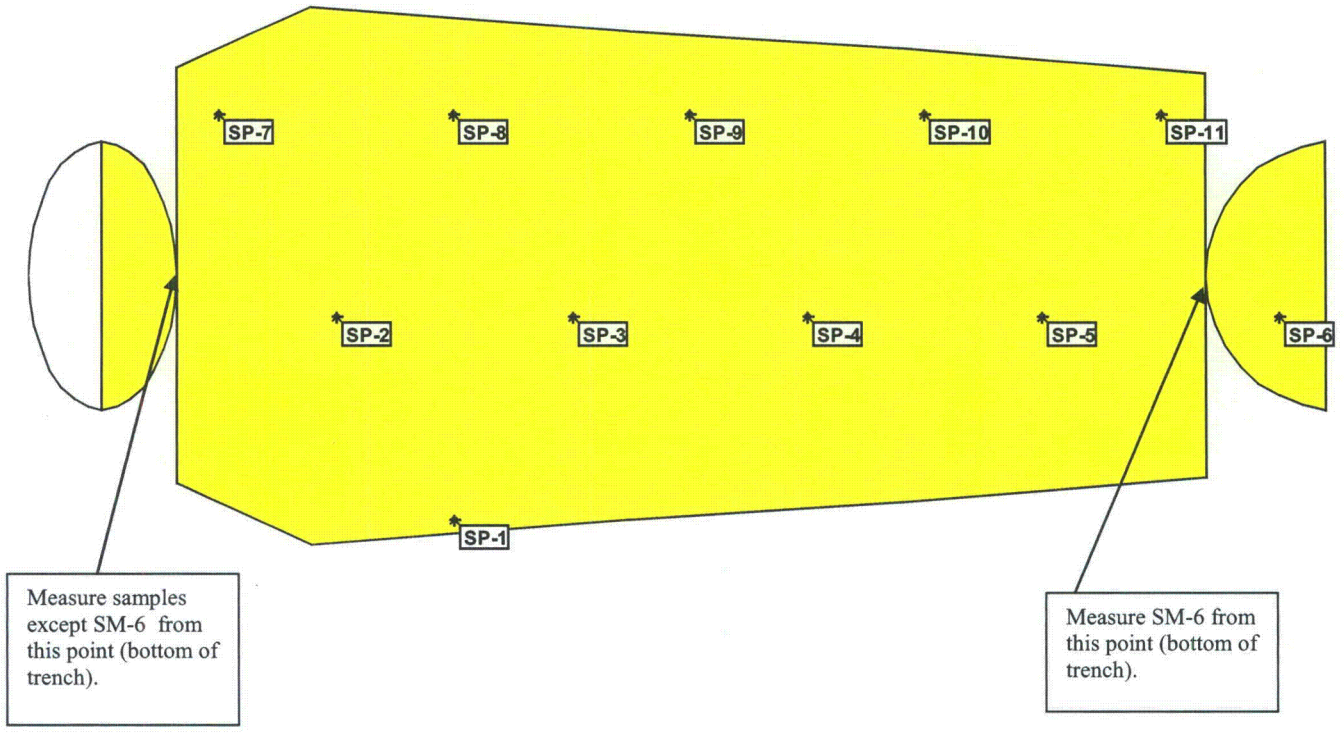
OL 1-35 Area: : Storm Drain Excavations-Crossover at Line 3 Road/Driveway E, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
-0.5	7.1	SP-1	Systematic
8.8	7.1	SP-2	Systematic
-5.2	15.2	SP-3	Systematic
4.1	15.2	SP-4	Systematic
-9.8	23.3	SP-5	Systematic
-0.5	23.3	SP-6	Systematic
8.8	23.3	SP-7	Systematic
-5.2	31.3	SP-8	Systematic
4.1	31.3	SP-9	Systematic
-0.5	39.4	SP-10	Systematic
8.8	39.4	SP-11	Systematic
All sample points are measured from the point shown on the map.			

Survey Unit OL-1-36



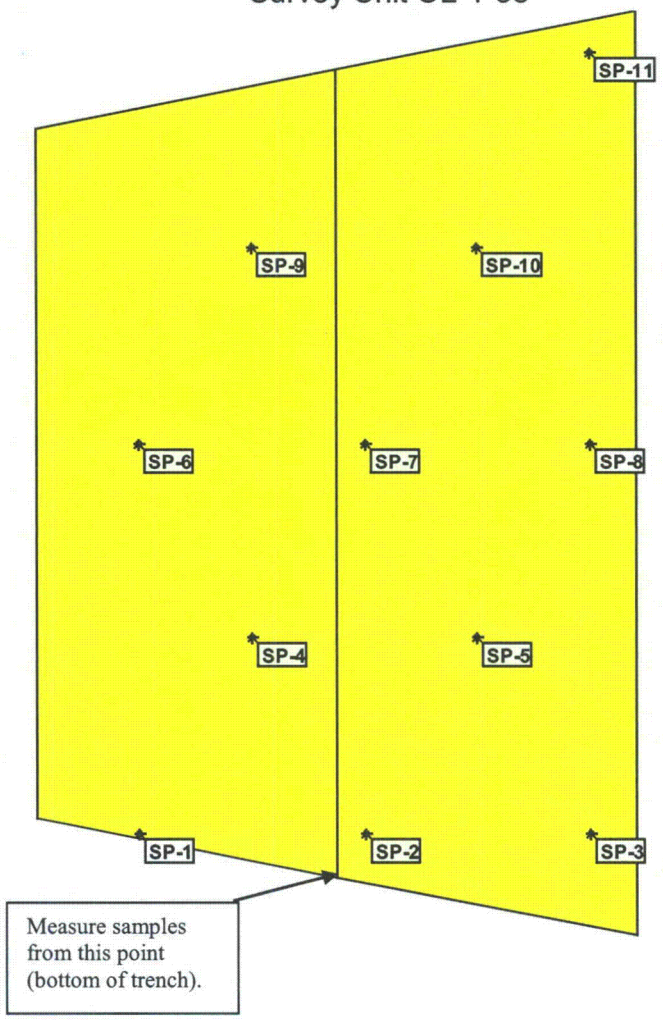
OL 1-36 Area: Storm Drain Excavation- Line 3 Road North Crossover, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
11.2	-10.8	SP-1	Systematic
21.7	-10.8	SP-2	Systematic
32.1	-10.8	SP-3	Systematic
6.0	-1.7	SP-4	Systematic
16.5	-1.7	SP-5	Systematic
26.9	-1.7	SP-6	Systematic
37.4	-1.7	SP-7	Systematic
0.8	7.3	SP-8	Systematic
11.2	7.3	SP-9	Systematic
21.7	7.3	SP-10	Systematic
32.1	7.3	SP-11	Systematic
All sample points are measured from the point shown on the map.			

Survey Unit OL-1-37



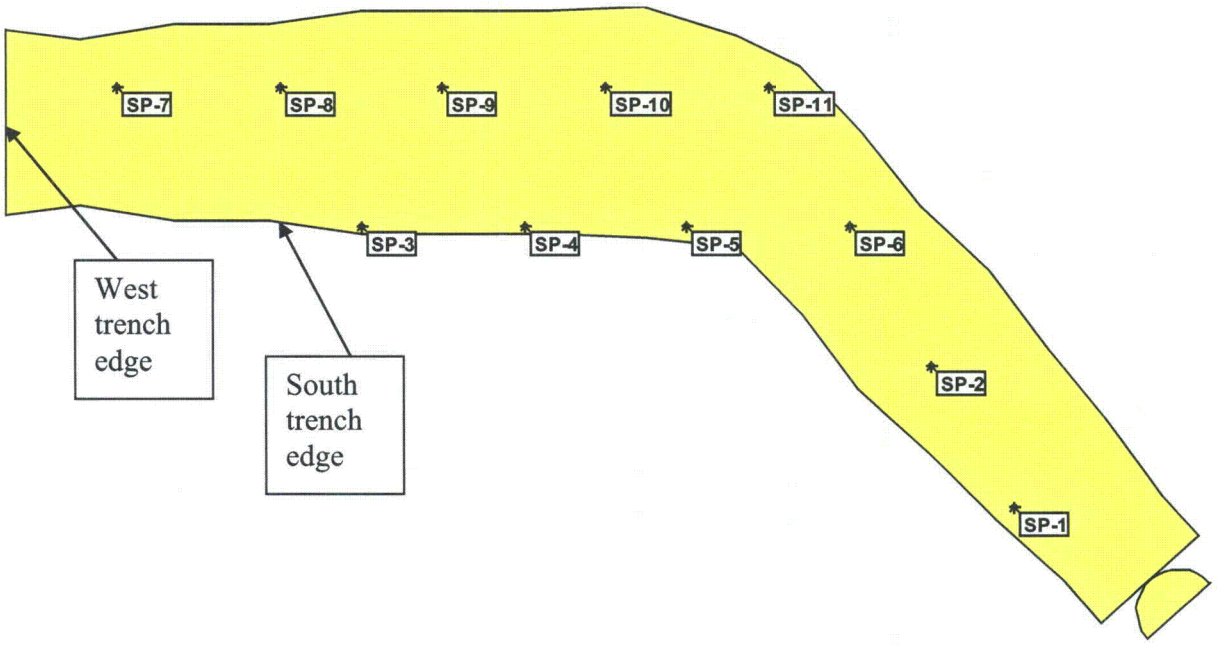
OL 1-37 Area: Storm Drain Excavation-Line 3 Road South Crossover, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
11.4	-10	SP-1	Systematic
6.6	-1.7	SP-2	Systematic
16.2	-1.7	SP-3	Systematic
25.8	-1.7	SP-4	Systematic
35.4	-1.7	SP-5	Systematic
1.6	2.9	SP-6	Systematic
1.7	6.7	SP-7	Systematic
11.4	6.7	SP-8	Systematic
21.0	6.7	SP-9	Systematic
30.6	6.7	SP-10	Systematic
40.2	6.7	SP-11	Systematic
All sample points are measured from the point shown on the map.			

Survey Unit OL-1-38



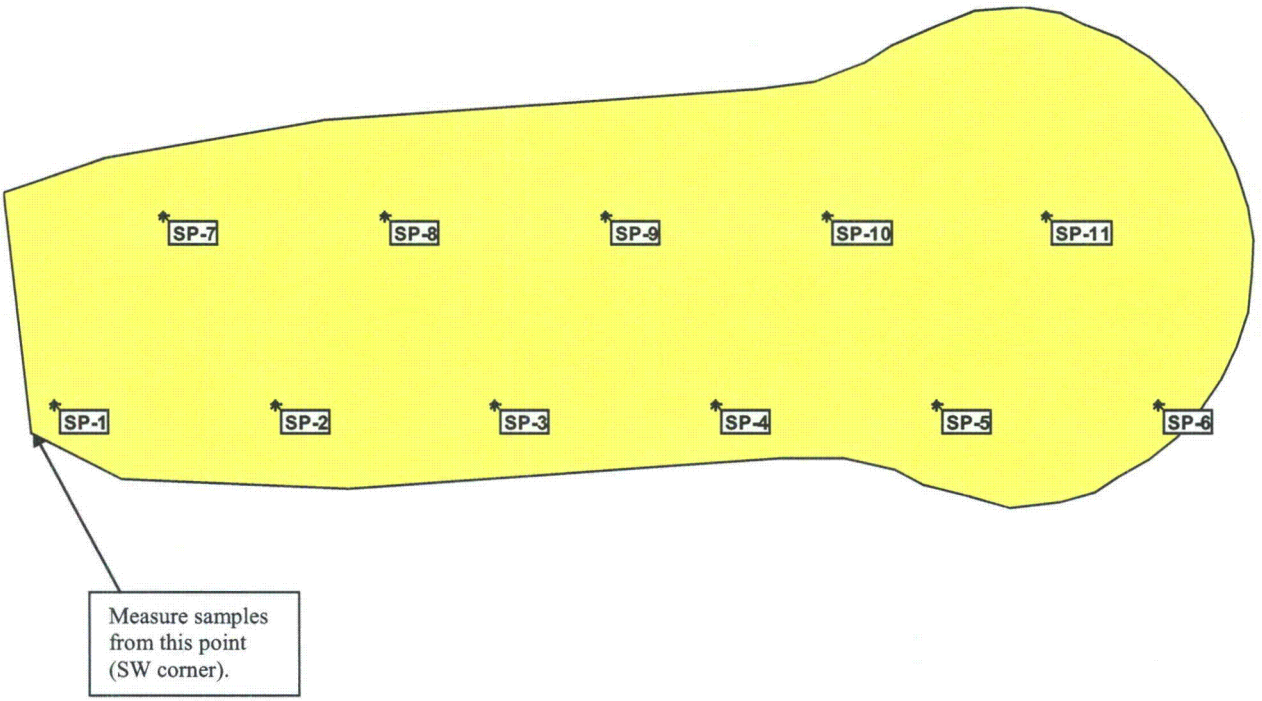
OL 1-38 Area: Storm Drain Excavation-Haul Road Crossover, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
-8.8	1.9	SP-1	Systematic
1.2	1.9	SP-2	Systematic
11.2	1.9	SP-3	Systematic
-3.8	10.6	SP-4	Systematic
6.2	10.6	SP-5	Systematic
-8.8	19.2	SP-6	Systematic
1.2	19.2	SP-7	Systematic
11.2	19.2	SP-8	Systematic
-3.8	27.8	SP-9	Systematic
6.2	27.8	SP-10	Systematic
11.2	36.5	SP-11	Systematic
All sample points are measured from the point shown on the map.			

Survey Unit OL-1-39



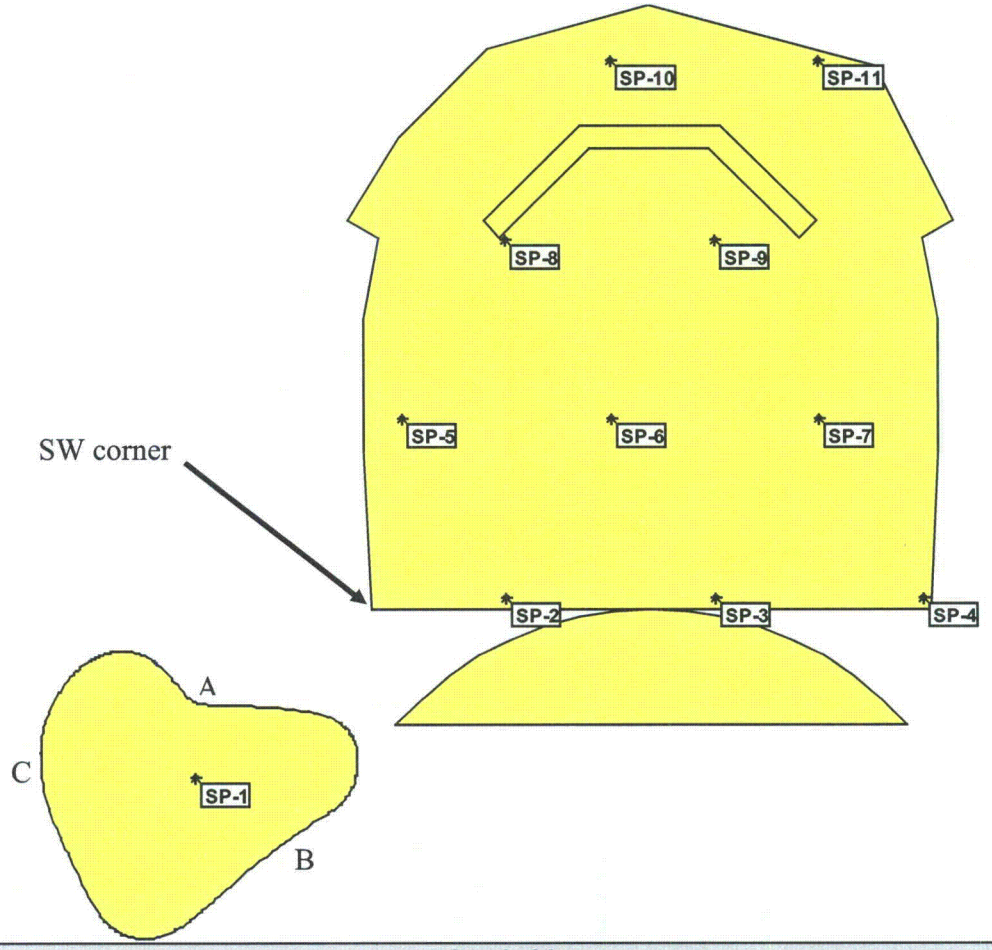
OL 1-39 Area: Storm Drain Excavation-Trench South of Sludge Basins, East of SEB, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
7' east of SP-2	15' south SP-2	SP-1	Systematic
100' east of west trench edge	15' south of SP-6	SP-2	Systematic
40' east of west trench edge	2' north of south trench edge	SP-3	Systematic
57' east of west trench edge	2' north of south trench edge	SP-4	Systematic
74' east of west trench edge	4' north of south trench edge	SP-5	Systematic
91' east of west trench edge	20' north of south trench edge	SP-6	Systematic
15' east of west trench edge	14' north of south trench edge	SP-7	Systematic
32' east of west trench edge	17' north of south trench edge	SP-8	Systematic
49' east of west trench edge	17' north of south trench edge	SP-9	Systematic
66' east of west trench edge	19' north of south trench edge	SP-10	Systematic
83' east of west trench edge	15' north of SP-5	SP-11	Systematic
All sample points are measured from the point shown on the map.			

Survey Unit OL-1-40



OL 1-40 Area: Storm Drain Excavation - CB-18 Excavation, Class 1 Measurement Locations and results			
X Coord	**Y Coord**	**Label**	**Type**
1.0	1.0	SP-1	Systematic
10	1.0	SP-2	Systematic
19	1.0	SP-3	Systematic
28	1.0	SP-4	Systematic
38	1.0	SP-5	Systematic
47	1.0	SP-6	Systematic
6	9.0	SP-7	Systematic
15	9.0	SP-8	Systematic
24	9.0	SP-9	Systematic
33	9.0	SP-10	Systematic
42	9.0	SP-11	Systematic
All sample points are measured from the point shown on the map.			

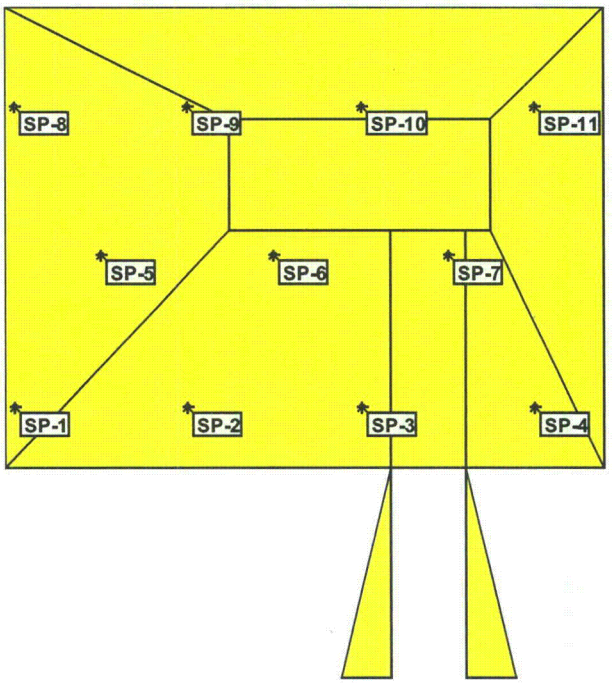
Survey Unit OL-1-41



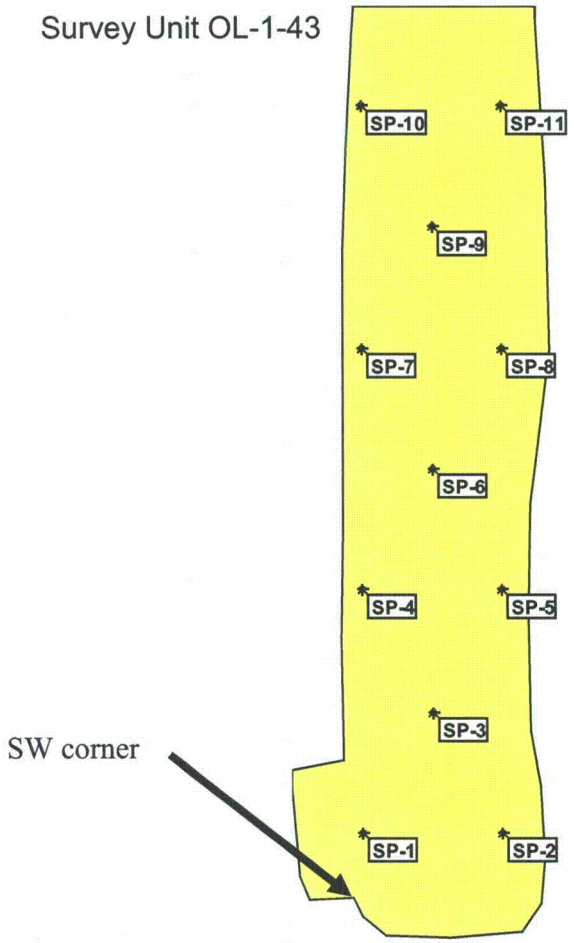
OL-1-41 Area: Storm Drain Excavation – CB-5A Excavation, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
as per note b	as per note b	SP-1	Systematic
9	0.6	SP-2	Systematic
22	0.6	SP-3	Systematic
35	0.6	SP-4	Systematic
2	12	SP-5	Systematic
15	12	SP-6	Systematic
28	12	SP-7	Systematic
9	23	SP-8	Systematic
22	23	SP-9	Systematic
15	34	SP-10	Systematic
28	34	SP-11	Systematic

[a] The X, Y coordinates for samples SP-2 thru SP-11 are measured from the designated SW corner of the excavation.
[b] The coordinates for sample SP-1 are 5' south of north edge A, 6' NW of SE edge B, and 9.5' east of west edge C.

Survey Unit OL-1-42

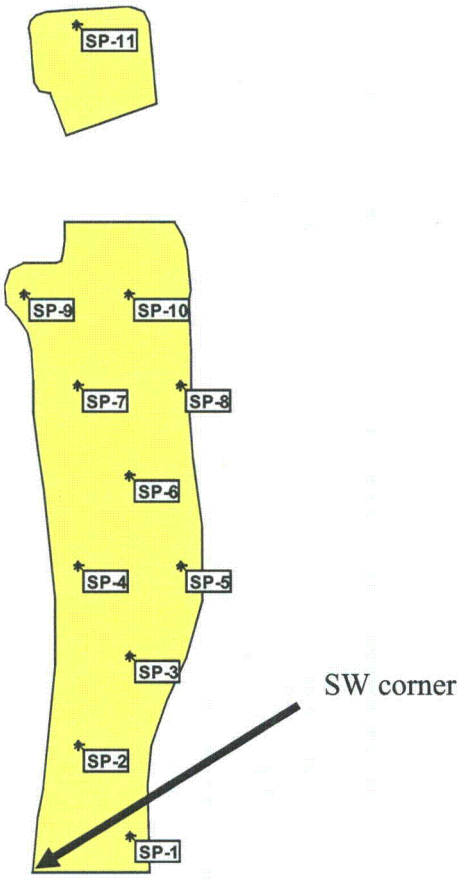


OL 1-42 Area: Resin Pits Excavation South of PPH, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
1' down from top of pit	4' north of SW pit corner	SP-1	Systematic
4' down from top of pit	10' east of SW pit corner	SP-2	Systematic
4' down from top of pit	24' east of SW pit corner	SP-3	Systematic
4' down from top of pit	4' west of SE pit corner	SP-4	Systematic
7' down from top of pit	16' south of NW pit corner	SP-5	Systematic
2' up from bottom of pit	5' east of SW pit corner	SP-6	Systematic
2' up from bottom of pit	4' west of SE pit corner	SP-7	Systematic
1' down from top of pit	7' south of NW pit corner	SP-8	Systematic
4' up from bottom of pit	1' south of NW pit corner	SP-9	Systematic
1' up from bottom of pit	11' west of NE pit corner	SP-10	Systematic
4' up from bottom of pit	2' south of NE pit corner	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP-11 are as listed.			



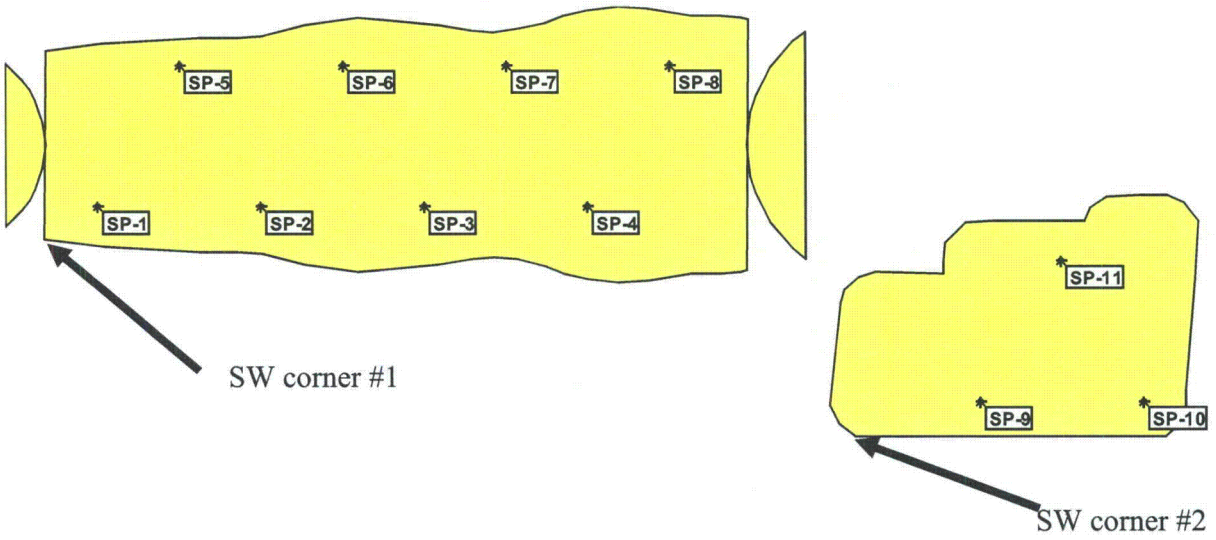
OL-1-43 Area: Storm Drain Excavations – Lateral C South Excavation, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
2	11	SP-1	Systematic
26	11	SP-2	Systematic
14	32	SP-3	Systematic
2	53	SP-4	Systematic
26	53	SP-5	Systematic
14	74	SP-6	Systematic
2	95	SP-7	Systematic
26	95	SP-8	Systematic
14	115	SP-9	Systematic
2	136	SP-10	Systematic
26	136	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP -11 are measured from the designated SW corner of the excavation.			

Survey Unit OL-1-44



OL-1-44 Area: Storm Drain Excavation-Lateral C North Excavation, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
26	9	SP-1	Systematic
12	33	SP-2	Systematic
26	57	SP-3	Systematic
12	81	SP-4	Systematic
40	81	SP-5	Systematic
26	105	SP-6	Systematic
12	129	SP-7	Systematic
40	129	SP-8	Systematic
-1	153	SP-9	Systematic
26	153	SP-10	Systematic
19' west of excavation east edge	5' south of excavation north edge	SP-11	Systematic
The X, Y coordinates for samples SP-1 thru SP -10 are measured from the designated SW corner of the excavation (unit of measurement = feet). The X, Y coordinates for sample SP-11 are as described below (unit of measurement = feet).			

Survey Unit OL-1-45



[a] The X, Y coordinates for samples SP-1 thru SP-8 are measured from SW corner #1.
[b] The X, Y coordinates for samples SP-1 thru SP-11 are measured from SW corner #2.
[c] unit of measurement = feet

OL-1-45 Area: Excavations South of Waste Storage Pad, Class 1 Measurement Locations			
X Coord	**Y Coord**	**Label**	**Type**
4	3	SP-1	Systematic
17	3	SP-2	Systematic
30	3	SP-3	Systematic
43	3	SP-4	Systematic
11	14	SP-5	Systematic
24	14	SP-6	Systematic
36	14	SP-7	Systematic
50	14	SP-8	Systematic
10	3	SP-9	Systematic
22	3	SP-10	Systematic
16	13	SP-11	Systematic

Plum Brook Reactor Facility

Final Status Survey Report

Attachment 7

Storm Drains, Pipe Trenches & Other Sub-Surface Excavations

Revision 0

Appendix C

Soil Sample Results

Table of Contents

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-1 SP-1	PB09-00998	SR-164-1	363.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.93E-02	5.98E-02
OL-1-1 SP-2	PB09-00999	SR-164-2	364.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.91E-02	5.96E-02
OL-1-1 SP-3	PB09-01001	SR-164-3	387.0	1.10E-01	4.70E-02	<MDA	<MDA	1%	N/A		5.62E-02
OL-1-1 SP-4	PB09-01002	SR-164-4	382.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.92E-02	6.14E-02
OL-1-1 SP-5	PB09-01003	SR-164-5	349.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	4.08E-02	6.22E-02
OL-1-1 SP-6	PB09-01004	SR-164-6	384.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	5.59E-02	6.10E-02
OL-1-1 SP-7	PB09-01005	SR-164-7	371.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	4.99E-02	5.86E-02
OL-1-1 SP-8	PB09-01006	SR-164-8	390.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	5.85E-02	6.01E-02
OL-1-1 SP-9	PB09-01007	SR-164-9	382.9	1.62E-01	5.74E-02	<MDA	<MDA	1%	N/A		5.68E-02
OL-1-1 SP-10	PB09-01008	SR-164-10	454.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.14E-02	7.56E-02
OL-1-1 SP-11	PB09-01009	SR-164-11	507.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.83E-02	4.62E-02
OL-1-2 SP-1	PB09-01116	SR-165-1	406.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	5.05E-02	5.78E-02
OL-1-2 SP-2	PB09-01117	SR-165-2	398.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	5.80E-02	5.65E-02
OL-1-2 SP-3	PB09-01118	SR-165-3	390.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.65E-02	5.57E-02
OL-1-2 SP-4	PB09-01119	SR-165-4	488.2	9.59E-02	4.01E-02	<MDA	<MDA	1%	N/A		4.81E-02
OL-1-2 SP-5	PB09-01120	SR-165-5	503.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	4.37E-02	4.48E-02
OL-1-2 SP-6	PB09-01122	SR-165-6	459.6	4.28E-01	1.05E-01	<MDA	<MDA	4%	N/A		4.73E-02
OL-1-2 SP-7	PB09-01123	SR-165-7	412.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.64E-02	5.69E-02
OL-1-2 SP-8	PB09-01124	SR-165-8	404.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	4.43E-02	5.57E-02
OL-1-2 SP-9	PB09-01125	SR-165-9	388.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.67E-02	5.59E-02
OL-1-2 SP-10	PB09-01126	SR-165-10	482.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.11E-02	4.86E-02
OL-1-2 SP-11	PB09-01127	SR-165-11	461.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	5.10E-02	4.86E-02
OL-1-3 SP-1	PB09-02115	SR-176-196	350.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.57E-02	1.34E-01
OL-1-3 SP-2	PB09-02116	SR-176-197	408.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.95E-02	1.10E-01
OL-1-3 SP-3	PB09-02117	SR-176-198	379.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.91E-02	1.24E-01
OL-1-3 SP-4	PB09-02118	SR-176-199	393.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.21E-02	1.15E-01
OL-1-3 SP-5	PB09-02119	SR-176-200	376.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.96E-02	1.25E-01
OL-1-3 SP-6	PB09-02120	SR-176-201	426.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.66E-02	1.08E-01
OL-1-3 SP-7	PB09-02122	SR-176-203	384.8	1.90E-01	8.99E-02	<MDA	<MDA	2%	N/A		1.22E-01
OL-1-3 SP-8	PB09-02123	SR-176-204	428.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.99E-02	1.09E-01
OL-1-3 SP-9	PB09-02124	SR-176-205	397.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.13E-02	1.33E-01
OL-1-3 SP-10	PB09-02125	SR-176-206	375.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.76E-02	1.25E-01
OL-1-3 SP-11	PB09-02126	SR-176-207	363.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.59E-02	1.24E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-4 SP-1	PB09-01376	SR-169-13	369.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.82E-02	6.36E-02
OL-1-4 SP-2	PB09-01377	SR-169-14	376.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.57E-02	1.15E-01
OL-1-4 SP-3	PB09-01379	SR-169-16	374.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.62E-02	1.16E-01
OL-1-4 SP-4	PB09-01380	SR-169-17	410.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.66E-02	1.14E-01
OL-1-4 SP-5	PB09-01382	SR-169-18	375.1	5.83E-01	1.76E-01	1.00E+00	1.76E-01	31%	N/A		
OL-1-4 SP-6	PB09-01383	SR-169-19	396.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.01E-01	1.18E-01
OL-1-4 SP-7	PB09-01384	SR-169-20	387.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.36E-02	1.12E-01
OL-1-4 SP-8	PB09-01385	SR-169-21	402.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.46E-02	1.17E-01
OL-1-4 SP-9	PB09-01386	SR-169-22	400.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.12E-02	1.09E-01
OL-1-4 SP-10	PB09-01387	SR-169-23	381.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.64E-02	1.23E-01
OL-1-4 SP-11	PB09-01388	SR-169-24	390.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.31E-02	1.12E-01
OL-1-5 SP-1	PB09-02057	SR-176-1	402.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.09E-02	1.08E-01
OL-1-5 SP-2	PB09-02058	SR-176-2	363.0	3.03E-01	1.17E-01	<MDA	<MDA	3%	N/A		1.29E-01
OL-1-5 SP-3	PB09-02059	SR-176-3	399.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.79E-02	1.13E-01
OL-1-5 SP-4	PB09-02060	SR-176-4	380.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.99E-02	1.14E-01
OL-1-5 SP-5	PB09-02062	SR-176-5	397.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.13E-01	1.18E-01
OL-1-5 SP-6	PB09-02063	SR-176-6	405.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.00E-02	1.11E-01
OL-1-5 SP-7	PB09-02064	SR-176-7	436.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.87E-02	1.07E-01
OL-1-5 SP-8	PB09-02065	SR-176-8	383.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.43E-02	1.13E-01
OL-1-5 SP-9	PB09-02066	SR-176-9	366.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.78E-02	1.19E-01
OL-1-5 SP-10	PB09-02067	SR-176-10	404.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.42E-02	1.16E-01
OL-1-5 SP-11	PB09-02068	SR-176-11	415.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.82E-02	1.08E-01
OL-1-6 SP-1	PB09-04922	SR-204-1	427.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.67E-02	1.02E-01
OL-1-6 SP-2	PB09-04923	SR-204-2	345.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.27E-02	1.26E-01
OL-1-6 SP-3	PB09-04924	SR-204-3	441.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.47E-02	9.86E-02
OL-1-6 SP-4	PB09-04925	SR-204-4	312.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.09E-02	1.44E-01
OL-1-6 SP-5	PB09-04926	SR-204-5	375.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.59E-02	1.16E-01
OL-1-6 SP-6	PB09-04927	SR-204-6	341.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.78E-02	1.37E-01
OL-1-6 SP-7	PB09-04928	SR-204-7	424.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.02E-01	1.02E-01
OL-1-6 SP-8	PB09-04929	SR-204-8	457.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.20E-02	1.03E-01
OL-1-6 SP-9	PB09-04930	SR-204-9	384.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.41E-02	1.13E-01
OL-1-6 SP-10	PB09-04931	SR-204-10	357.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.39E-02	1.31E-01
OL-1-6 SP-11	PB09-04932	SR-204-11	378.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.55E-02	1.15E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-7 SP-1	PB10-01504	SR-237-1	380.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.46E-02	1.19E-01
OL-1-7 SP-2	PB10-01505	SR-237-2	456.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.03E-02	9.67E-02
OL-1-7 SP-3	PB10-01506	SR-237-3	458.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.19E-02	9.83E-02
OL-1-7 SP-4	PB10-01507	SR-237-4	383.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.17E-02	1.15E-01
OL-1-7 SP-5	PB10-01508	SR-237-5	427.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.64E-02	1.06E-01
OL-1-7 SP-6	PB10-01509	SR-237-6	450.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	4.27E-02	4.89E-02
OL-1-7 SP-7	PB10-01510	SR-237-7	433.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.54E-02	1.04E-01
OL-1-7 SP-8	PB10-01511	SR-237-8	451.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.09E-02	9.77E-02
OL-1-7 SP-9	PB10-01512	SR-237-9	352.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.06E-02	1.28E-01
OL-1-7 SP-10	PB10-01513	SR-237-10	380.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.12E-01	1.16E-01
OL-1-7 SP-11	PB10-01514	SR-237-11	398.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.12E-02	1.13E-01
OL-1-8 SP-1	PB10-01519	SR-237-13	403.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.81E-02	1.09E-01
OL-1-8 SP-2	PB10-01522	SR-237-15	440.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.74E-02	1.00E-01
OL-1-8 SP-3	PB10-01523	SR-237-16	439.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.15E-02	1.03E-01
OL-1-8 SP-4	PB10-01524	SR-237-17	380.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.23E-02	1.16E-01
OL-1-8 SP-5	PB10-01525	SR-237-18	464.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.11E-02	9.71E-02
OL-1-8 SP-6	PB10-01526	SR-237-19	375.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.32E-02	1.17E-01
OL-1-8 SP-7	PB10-01527	SR-237-20	422.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.71E-02	1.07E-01
OL-1-8 SP-8	PB10-01528	SR-237-21	398.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.90E-02	1.11E-01
OL-1-8 SP-9	PB10-01529	SR-237-22	375.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.57E-02	1.20E-01
OL-1-8 SP-10	PB10-01530	SR-237-23	378.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.28E-02	1.17E-01
OL-1-8 SP-11	PB10-01531	SR-237-24	411.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.90E-02	1.10E-01
OL-1-9 SP-1	PB10-01576	SR-237-25	329.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.60E-02	1.37E-01
OL-1-9 SP-2	PB10-01577	SR-237-26	339.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.10E-02	1.30E-01
OL-1-9 SP-3	PB10-01579	SR-237-28	336.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.18E-02	1.31E-01
OL-1-9 SP-4	PB10-01580	SR-237-29	319.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.12E-01	1.41E-01
OL-1-9 SP-5	PB10-01582	SR-237-30	420.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.54E-02	1.05E-01
OL-1-9 SP-6	PB10-01583	SR-237-31	345.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.20E-02	1.30E-01
OL-1-9 SP-7	PB10-01584	SR-237-32	325.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.45E-02	1.35E-01
OL-1-9 SP-8	PB10-01585	SR-237-33	464.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.10E-02	9.71E-02
OL-1-9 SP-9	PB10-01586	SR-237-34	420.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.55E-02	1.05E-01
OL-1-9 SP-10	PB10-01587	SR-237-35	420.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.76E-02	1.07E-01
OL-1-9 SP-11	PB10-01588	SR-237-36	444.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.19E-02	9.93E-02

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

Location	Sample Log #	Sample #	Weight (g)	Cs-137 DCGL[1] 11.4 DCGL[2] 14.7 DCGL[3] 11.82 pCi/g	Cs-137 2σ	Co-60 DCGL 3.7 DCGL 3.5 DCGL 3.8 pCi/g	Co-60 2σ	% Unity	Cs:Co	Cs-137 MDA pCi/g	Co-60 MDA pCi/g
OL-1-10 SP-1	PB10-01869	SR-244	363.8	2.05E-01	9.19E-02	<MDA	<MDA	1%	N/A		1.21E-01
OL-1-10 SP-2	PB10-01870	SR-244	384.2	1.80E-01	8.74E-02	<MDA	<MDA	1%	N/A		1.23E-01
OL-1-10 SP-3	PB10-01871	SR-244	331.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.56E-02	1.36E-01
OL-1-10 SP-4	PB10-01872	SR-244	430.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.39E-02	1.02E-01
OL-1-10 SP-5	PB10-01873	SR-244	367.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.16E-02	1.28E-01
OL-1-10 SP-6	PB10-01874	SR-244	380.6	1.62E-01	8.10E-02	<MDA	<MDA	1%	N/A		1.18E-01
OL-1-10 SP-7	PB10-01875	SR-244	401.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.86E-02	1.10E-01
OL-1-10 SP-8	PB10-01876	SR-244	412.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.26E-02	1.14E-01
OL-1-10 SP-9	PB10-01877	SR-244	457.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.21E-02	9.86E-02
OL-1-10 SP-10	PB10-01878	SR-244	396.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.94E-02	1.11E-01
OL-1-10 SP-11	PB10-01879	SR-244	421.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.11E-02	1.12E-01
OL-1-11 SP-1	PB10-01925	SR-237-37	425.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.47E-02	1.04E-01
OL-1-11 SP-2	PB10-01926	SR-237-38	432.6	1.50E-01	7.53E-02	<MDA	<MDA	1%	N/A		1.09E-01
OL-1-11 SP-3	PB10-01927	SR-237-39	407.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.97E-02	1.11E-01
OL-1-11 SP-4	PB10-01928	SR-237-40	375.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.33E-02	1.18E-01
OL-1-11 SP-5	PB10-01929	SR-237-41	373.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.03E-02	1.27E-01
OL-1-11 SP-6	PB10-01930	SR-237-42	387.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.32E-02	1.16E-01
OL-1-11 SP-7	PB10-01931	SR-237-43	331.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.42E-01	1.33E-01
OL-1-11 SP-8	PB10-01932	SR-237-44	376.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.97E-02	1.26E-01
OL-1-11 SP-9	PB10-01933	SR-237-45	354.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.01E-02	1.27E-01
OL-1-11 SP-10	PB10-01934	SR-237-46	382.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.19E-02	1.15E-01
OL-1-11 SP-11	PB10-01935	SR-237-47	372.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.05E-02	1.27E-01
OL-1-12 SP-1	PB10-01977	SR-237-49	400.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.92E-02	1.13E-01
OL-1-12 SP-2	PB10-01979	SR-237-51	433.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.55E-02	1.04E-01
OL-1-12 SP-3	PB10-01980	SR-237-52	448.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.33E-02	1.05E-01
OL-1-12 SP-4	PB10-01982	SR-237-53	390.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.63E-02	1.15E-01
OL-1-12 SP-5	PB10-01983	SR-237-54	420.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.12E-02	1.12E-01
OL-1-12 SP-6	PB10-01984	SR-237-55	402.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.18E-02	1.17E-01
OL-1-12 SP-7	PB10-01985	SR-237-56	440.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.44E-02	1.02E-01
OL-1-12 SP-8	PB10-01986	SR-237-57	420.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.12E-02	1.12E-01
OL-1-12 SP-9	PB10-01987	SR-237-58	366.6	1.79E-01	8.67E-02	<MDA	<MDA	2%	N/A		1.23E-01
OL-1-12 SP-10	PB10-01988	SR-237-59	393.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.61E-02	1.20E-01
OL-1-12 SP-11	PB10-01989	SR-237-60	377.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.52E-02	1.19E-01
OL-1-12 SP-12	PB10-01990	SR-237-61	342.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.74E-02	1.38E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-13 SP-1	PB10-02052	SR-237-62	436.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.31E-02	1.01E-01
OL-1-13 SP-2	PB10-02053	SR-237-63	402.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.44E-02	1.17E-01
OL-1-13 SP-3	PB10-02054	SR-237-64	386.1	2.09E-01	9.15E-02	<MDA	<MDA	2%	N/A		1.17E-01
OL-1-13 SP-4	PB10-02055	SR-237-65	418.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.58E-02	1.05E-01
OL-1-13 SP-5	PB10-02056	SR-237-66	454.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.60E-02	1.04E-01
OL-1-13 SP-6	PB10-02057	SR-237-67	403.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.04E-02	1.12E-01
OL-1-13 SP-7	PB10-02059	SR-237-69	440.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.80E-02	1.07E-01
OL-1-13 SP-8	PB10-02060	SR-237-70	405.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.99E-02	1.11E-01
OL-1-13 SP-9	PB10-02062	SR-237-71	414.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.23E-02	1.14E-01
OL-1-13 SP-10	PB10-02063	SR-237-72	446.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.36E-02	1.01E-01
OL-1-13 SP-11	PB10-02064	SR-237-73	445.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.31E-02	9.89E-02
OL-1-14 SP-1	PB10-02151	SR-237-74	360.8	2.65E-01	1.28E-01	<MDA	<MDA	2%	N/A		1.31E-01
OL-1-14 SP-2	PB10-02152	SR-237-75	420.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.04E-01	1.12E-01
OL-1-14 SP-3	PB10-02154	SR-237-77	440.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.47E-02	1.07E-01
OL-1-14 SP-4	PB10-02155	SR-237-78	397.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.55E-02	1.19E-01
OL-1-14 SP-5	PB10-02156	SR-237-79	350.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.56E-02	1.35E-01
OL-1-14 SP-6	PB10-02157	SR-237-80	410.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.31E-02	1.15E-01
OL-1-14 SP-7	PB10-02158	SR-237-81	339.8	2.75E-01	1.15E-01	<MDA	<MDA	2%	N/A		1.39E-01
OL-1-14 SP-8	PB10-02136	SR-237-82	427.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.01E-02	1.11E-01
OL-1-14 SP-9	PB10-02137	SR-237-83	447.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.60E-02	1.06E-01
OL-1-14 SP-10	PB10-02138	SR-237-84	428.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.00E-02	1.10E-01
OL-1-14 SP-11	PB10-02140	SR-237-85	405.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.39E-02	1.17E-01
OL-1-15 SP-1	PB10-02185	SR-237-86	368.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.49E-01	1.20E-01
OL-1-15 SP-2	PB10-02186	SR-237-87	418.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.09E-02	1.09E-01
OL-1-15 SP-3	PB10-02187	SR-237-88	448.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.68E-02	1.05E-01
OL-1-15 SP-4	PB10-02188	SR-237-89	411.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.95E-02	1.11E-01
OL-1-15 SP-5	PB10-02189	SR-237-90	433.5	2.93E-01	1.01E-01	<MDA	<MDA	2%	N/A		1.02E-01
OL-1-15 SP-6	PB10-02190	SR-237-91	380.9	1.92E-01	9.07E-02	<MDA	<MDA	2%	N/A		1.24E-01
OL-1-15 SP-7	PB10-02191	SR-237-92	401.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.13E-02	1.14E-01
OL-1-15 SP-8	PB10-02192	SR-237-93	340.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.07E-02	1.29E-01
OL-1-15 SP-9	PB10-02193	SR-237-94	362.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.27E-02	1.30E-01
OL-1-15 SP-10	PB10-02194	SR-237-95	377.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	5.05E-02	6.03E-02
OL-1-15, SP-11	PB10-02196	SR-237-97	430.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.97E-02	1.10E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-16 SP-1	PB10-02371	SR-237-98	391.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.65E-02	1.20E-01
OL-1-16 SP-2	PB10-02372	SR-237-99	419.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.82E-02	1.09E-01
OL-1-16 SP-3	PB10-02373	SR-237-100	410.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.96E-02	1.11E-01
OL-1-16 SP-4	PB10-02374	SR-237-101	378.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.56E-02	1.21E-01
OL-1-16 SP-5	PB10-02375	SR-237-102	449.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.37E-02	1.02E-01
OL-1-16 SP-6	PB10-02376	SR-237-103	401.0	2.45E-01	1.20E-01	<MDA	<MDA	2%	N/A		1.18E-01
OL-1-16 SP-7	PB10-02377	SR-237-104	453.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.31E-02	1.01E-01
OL-1-16 SP-8	PB10-02378	SR-237-105	438.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.84E-02	1.08E-01
OL-1-16 SP-9	PB10-02379	SR-237-106	431.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.63E-02	1.06E-01
OL-1-16 SP-10	PB10-02380	SR-237-107	385.7	3.69E-01	1.25E-01	<MDA	<MDA	3%	N/A		1.22E-01
OL-1-16 SP-11	PB10-02382	SR-237-108	379.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.53E-02	1.20E-01
OL-1-17 SP-1	PB10-02826	SR-237-110	399.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.51E-02	1.18E-01
OL-1-17 SP-2	PB10-02828	SR-237-112	407.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.36E-02	1.16E-01
OL-1-17 SP-3	PB10-02829	SR-237-113	316.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.47E-02	1.49E-01
OL-1-17 SP-4	PB10-02830	SR-237-114	385.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.02E-01	1.19E-01
OL-1-17 SP-5	PB10-02831	SR-237-115	390.2	2.40E-01	1.00E-01	<MDA	<MDA	2%	N/A		1.21E-01
OL-1-17 SP-6	PB10-02832	SR-237-116	360.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.94E-02	1.27E-01
OL-1-17 SP-7	PB10-02833	SR-237-117	450.0	2.62E-01	9.76E-02	<MDA	<MDA	2%	N/A		1.05E-01
OL-1-17 SP-8	PB10-02834	SR-237-118	314.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.21E-01	1.45E-01
OL-1-17 SP-9	PB10-02835	SR-237-119	445.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.73E-02	1.06E-01
OL-1-17 SP-10	PB10-02836	SR-237-120	394.9	1.87E-01	8.58E-02	<MDA	<MDA	2%	N/A		1.16E-01
OL-1-17 SP-11	PB10-02837	SR-237-121	398.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.76E-02	5.93E-02
OL-1-18 SP-1	PB10-03300	SR-237-146	399.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.50E-02	1.18E-01
OL-1-18 SP-2	PB10-03302	SR-237-147	439.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.50E-02	1.04E-01
OL-1-18 SP-3	PB10-03304	SR-237-149	414.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.90E-02	1.10E-01
OL-1-18 SP-4	PB10-03305	SR-237-150	424.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.06E-02	1.11E-01
OL-1-18 SP-5	PB10-03306	SR-237-151	429.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.66E-02	1.06E-01
OL-1-18 SP-6	PB10-03307	SR-237-152	418.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.11E-01	1.13E-01
OL-1-18 SP-7	PB10-03308	SR-237-153	402.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.10E-02	1.13E-01
OL-1-18 SP-8	PB10-03309	SR-237-154	349.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.18E-02	1.31E-01
OL-1-18 SP-9	PB10-03310	SR-237-155	381.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.86E-02	1.24E-01
OL-1-18 SP-10	PB10-03311	SR-237-156	377.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.58E-02	1.21E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-18 SP-11	PB10-03312	SR-237-157	442.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.77E-02	1.07E-01
OL-1-19 SP-1	PB10-03106	SR-237-122	402.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.36E-01	1.17E-01
OL-1-19 SP-2	PB10-03107	SR-237-123	429.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.67E-02	1.06E-01
OL-1-19 SP-3	PB10-03109	SR-237-125	441.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.48E-02	1.03E-01
OL-1-19 SP-4	PB10-03110	SR-237-126	432.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.94E-02	1.09E-01
OL-1-19 SP-5	PB10-03111	SR-237-127	422.8	1.56E-01	7.58E-02	<MDA	<MDA	1%	N/A		1.08E-01
OL-1-19 SP-6	PB10-03112	SR-237-128	415.8	1.66E-01	8.08E-02	<MDA	<MDA	1%	N/A		1.14E-01
OL-1-19 SP-7	PB10-03113	SR-237-129	383.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.33E-01	1.19E-01
OL-1-19 SP-8	PB10-03114	SR-237-130	434.4	1.83E-01	5.87E-02	<MDA	<MDA	2%	N/A		5.44E-02
OL-1-19 SP-9	PB10-03115	SR-237-131	429.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.66E-02	1.06E-01
OL-1-19 SP-10	PB10-03116	SR-237-132	428.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.68E-02	1.07E-01
OL-1-19 SP-11	PB10-03117	SR-237-133	440.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.81E-02	1.07E-01
OL-1-20 SP-1	PB10-03259	SR-237-134	377.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.29E-02	1.17E-01
OL-1-20 SP-2	PB10-03260	SR-237-135	348.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.61E-02	1.36E-01
OL-1-20 SP-3	PB10-03263	SR-237-137	320.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.58E-02	1.37E-01
OL-1-20 SP-4	PB10-03264	SR-237-138	405.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.39E-02	1.16E-01
OL-1-20 SP-5	PB10-03265	SR-237-139	388.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	3.68E-02	5.87E-02
OL-1-20 SP-6	PB10-03266	SR-237-140	380.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.23E-02	1.16E-01
OL-1-20 SP-7	PB10-03267	SR-237-141	326.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.19E-02	1.45E-01
OL-1-20 SP-8	PB10-03268	SR-237-142	423.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.07E-02	1.11E-01
OL-1-20 SP-9	PB10-03269	SR-237-143	359.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.34E-02	1.31E-01
OL-1-20 SP-10	PB10-03270	SR-237-144	345.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.68E-02	1.37E-01
OL-1-20 SP-11	PB10-03271	SR-237-145	339.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.83E-02	1.39E-01
OL-1-21 SP-1	PB10-03511	SR-237-158	436.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.54E-02	1.04E-01
OL-1-21 SP-2	PB10-03512	SR-237-159	353.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.55E-02	1.25E-01
OL-1-21 SP-3	PB10-03514	SR-237-161	348.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.34E-02	1.26E-01
OL-1-21 SP-4	PB10-03515	SR-237-162	396.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.21E-02	1.15E-01
OL-1-21 SP-5	PB10-03516	SR-237-163	438.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.28E-02	1.01E-01
OL-1-21 SP-6	PB10-03517	SR-237-164	360.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.93E-02	1.26E-01
OL-1-21 SP-7	PB10-03518	SR-237-165	393.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.00E-02	1.12E-01
OL-1-21 SP-8	PB10-03519	SR-237-166	331.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.62E-02	1.37E-01
OL-1-21 SP-9	PB10-03520	SR-237-167	395.3	2.36E-01	9.46E-02	<MDA	<MDA	2%	N/A		1.11E-01
OL-1-21 SP-10	PB10-03522	SR-237-168	450.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.34E-02	1.01E-01
OL-1-21 SP-11	PB10-03523	SR-237-169	368.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.46E-02	1.19E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-22 SP-1	PB10-03700	SR-237-194	329.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.10E-02	1.43E-01
OL-1-22 SP-2	PB10-03711	SR-237-195	332.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.59E-02	1.37E-01
OL-1-22 SP-3	PB10-03712	SR-237-196	381.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.51E-02	1.20E-01
OL-1-22 SP-4	PB10-03713	SR-237-197	404.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.08E-02	1.13E-01
OL-1-22 SP-5	PB10-03715	SR-237-199	392.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.64E-02	1.20E-01
OL-1-22 SP-6	PB10-03716	SR-237-200	353.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.09E-02	1.29E-01
OL-1-22 SP-7	PB10-03717	SR-237-201	372.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.04E-02	1.27E-01
OL-1-22 SP-8	PB10-03718	SR-237-202	355.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.06E-02	1.28E-01
OL-1-22 SP-9	PB10-03719	SR-237-203	376.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.16E-01	1.25E-01
OL-1-22 SP-10	PB10-03720	SR-237-204	322.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.01E-01	1.41E-01
OL-1-22 SP-11	PB10-03722	SR-237-205	347.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.92E-02	1.27E-01
OL-1-23, SP-1	PB10-03609	SR-237-170	446.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.16E-02	9.88E-02
OL-1-23, SP-2	PB10-03610	SR-237-171	399.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.50E-02	1.18E-01
OL-1-23, SP-3	PB10-03611	SR-237-172	337.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.83E-01	1.35E-01
OL-1-23, SP-4	PB10-03612	SR-237-173	452.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.08E-02	9.75E-02
OL-1-23, SP-5	PB10-03613	SR-237-174	419.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.14E-02	1.13E-01
OL-1-23, SP-6	PB10-03614	SR-237-175	415.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.89E-02	1.10E-01
OL-1-23, SP-7	PB10-03615	SR-237-176	434.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.33E-02	1.01E-01
OL-1-23, SP-8	PB10-03616	SR-237-177	463.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.46E-02	1.02E-01
OL-1-23, SP-9	PB10-03617	SR-237-178	392.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.29E-02	1.16E-01
OL-1-23, SP-10	PB10-03618	SR-237-179	436.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.31E-02	1.01E-01
OL-1-23, SP-11	PB10-03620	SR-237-181	441.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.23E-02	9.98E-02
OL-1-24-SP-1	PB10-03675	SR-237-182	389.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.69E-02	1.21E-01
OL-1-24-SP-2	PB10-03676	SR-237-183	391.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.31E-02	1.17E-01
OL-1-24-SP-3	PB10-03678	SR-237-185	392.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.29E-02	1.16E-01
OL-1-24-SP-4	PB10-03679	SR-237-186	380.1	1.71E-01	8.57E-02	<MDA	<MDA	1%	N/A		1.24E-01
OL-1-24-SP-5	PB10-03680	SR-237-187	421.4	2.95E-01	1.30E-01	<MDA	<MDA	2%	N/A		1.08E-01
OL-1-24-SP-6	PB10-03682	SR-237-188	386.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.76E-02	1.22E-01
OL-1-24-SP-7	PB10-03683	SR-237-189	450.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.35E-02	1.01E-01
OL-1-24-SP-8	PB10-03684	SR-237-190	379.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.91E-02	1.25E-01
OL-1-24-SP-9	PB10-03685	SR-237-191	366.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.79E-02	1.24E-01
OL-1-24-SP-10	PB10-03686	SR-237-192	390.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.68E-02	1.21E-01
OL-1-24-SP-11	PB10-03687	SR-237-193	383.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.46E-02	1.19E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-25 SP-1	PB10-03800	SR-237-206	322.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.51E-01	1.41E-01
OL-1-25 SP-2	PB10-03802	SR-237-207	341.1	8.80E-01	2.22E-01	<MDA	<MDA	7%	N/A		1.34E-01
OL-1-25 SP-3	PB10-03803	SR-237-208	332.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.60E-02	1.37E-01
OL-1-25 SP-4	PB10-03804	SR-237-209	325.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.77E-02	1.40E-01
OL-1-25 SP-5	PB10-03806	SR-237-211	425.6	4.01E-01	1.24E-01	<MDA	<MDA	3%	N/A		1.11E-01
OL-1-25 SP-6	PB10-03807	SR-237-212	317.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.90E-02	1.44E-01
OL-1-25 SP-7	PB10-03808	SR-237-213	355.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.42E-02	1.33E-01
OL-1-25 SP-8	PB10-03809	SR-237-214	348.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.20E-02	1.31E-01
OL-1-25 SP-9	PB10-03810	SR-237-215	349.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.58E-02	1.35E-01
OL-1-25 SP-10	PB10-03811	SR-237-216	368.7	2.21E-01	9.66E-02	<MDA	<MDA	2%	N/A		1.24E-01
OL-1-25 SP-11	PB10-03812	SR-237-217	453.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.60E-02	1.04E-01
OL-1-26 SP-1	PB10-04146	SR-279-1	375.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.33E-02	1.17E-01
OL-1-26 SP-2	PB10-04147	SR-279-2	382.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.83E-02	1.23E-01
OL-1-26 SP-3	PB10-04149	SR-279-4	384.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.80E-02	1.23E-01
OL-1-26 SP-4	PB10-04150	SR-279-5	400.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.68E-02	1.10E-01
OL-1-26 SP-5	PB10-04151	SR-279-6	461.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.49E-02	1.02E-01
OL-1-26 SP-6	PB10-04152	SR-279-7	417.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.59E-02	1.06E-01
OL-1-26 SP-7	PB10-04153	SR-279-8	424.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.07E-02	1.11E-01
OL-1-26 SP-8	PB10-04154	SR-279-9	447.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.15E-02	9.85E-02
OL-1-26 SP-9	PB10-04155	SR-279-10	383.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.82E-02	1.23E-01
OL-1-26 SP-10	PB10-04156	SR-279-11	340.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.39E-02	1.34E-01
OL-1-26 SP-11	PB10-04157	SR-279-12	342.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.52E-02	1.29E-01
OL-1-26 SP-12	PB10-04158	SR-279-13	338.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.12E-01	1.40E-01
OL-1-33 SP-1	PB10-04193	SR-237-230	399.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.88E-02	1.10E-01
OL-1-33 SP-2	PB10-04194	SR-237-231	391.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.65E-02	1.21E-01
OL-1-33 SP-3	PB10-04195	SR-237-232	336.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.51E-02	1.36E-01
OL-1-33 SP-4	PB10-04196	SR-237-233	384.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.03E-02	1.15E-01
OL-1-33 SP-5	PB10-04197	SR-237-234	368.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.13E-02	1.28E-01
OL-1-33 SP-6	PB10-04198	SR-237-235	460.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.21E-02	9.90E-02
OL-1-33 SP-7	PB10-04199	SR-237-236	460.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.51E-02	1.03E-01
OL-1-33 SP-8	PB10-04200	SR-237-237	367.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.49E-02	1.20E-01
OL-1-33 SP-9	PB10-04202	SR-237-238	416.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.53E-02	1.09E-01
OL-1-33 SP-10	PB10-04203	SR-237-239	424.0	1.67E-01	7.69E-02	<MDA	<MDA	1%	N/A		1.04E-01
OL-1-33 SP-11	PB10-04204	SR-237-240	387.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.74E-02	1.22E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

Location	Sample Log #	Sample #	Weight (g)	Cs-137 DCGL[1]	Cs-137 11.4	Co-60 DCGL	Co-60 3.7	% Unity	Cs:Co	Cs-137 MDA	Co-60 MDA
				Cs-137 DCGL[2]	Cs-137 14.7	Co-60 DCGL	Co-60 3.5				
				Cs-137 DCGL[3]	Cs-137 11.82	Co-60 DCGL	Co-60 3.8				
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-1-34 SP-1	PB10-04168	SR-237-218	352.7	1.91E-01	8.99E-02	<MDA	<MDA	2%	N/A		1.25E-01
OL-1-34 SP-2	PB10-04169	SR-237-219	335.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.53E-02	1.36E-01
OL-1-34 SP-3	PB10-04171	SR-237-221	453.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.30E-02	1.00E-01
OL-1-34 SP-4	PB10-04172	SR-237-222	321.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.56E-02	1.37E-01
OL-1-34 SP-5	PB10-04173	SR-237-223	406.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.03E-02	1.12E-01
OL-1-34 SP-6	PB10-04174	SR-237-224	462.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	5.95E-02	9.54E-02
OL-1-34 SP-7	PB10-04175	SR-237-225	388.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.37E-02	1.17E-01
OL-1-34 SP-8	PB10-04176	SR-237-226	332.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.28E-02	1.33E-01
OL-1-34 SP-9	PB10-04177	SR-237-227	453.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.30E-02	1.00E-01
OL-1-34 SP-10	PB10-04178	SR-237-228	422.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.52E-02	1.04E-01
OL-1-34 SP-11	PB10-04179	SR-237-229	456.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.26E-02	9.99E-02
OL-1-35 SP-1	PB10-04180	SR-237-242	394.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.98E-02	1.12E-01
OL-1-35 SP-2	PB10-04182	SR-237-243	343.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.33E-01	1.38E-01
OL-1-35 SP-3	PB10-04183	SR-237-244	447.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.38E-02	1.02E-01
OL-1-35 SP-4	PB10-04184	SR-237-245	395.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.96E-02	1.11E-01
OL-1-35 SP-5	PB10-04185	SR-237-246	354.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.46E-02	1.33E-01
OL-1-35 SP-6	PB10-04186	SR-237-247	364.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.84E-02	1.25E-01
OL-1-35 SP-7	PB10-04187	SR-237-248	386.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.13E-02	1.14E-01
OL-1-35 SP-8	PB10-04188	SR-237-249	397.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.54E-02	1.19E-01
OL-1-35 SP-9	PB10-04189	SR-237-250	366.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.81E-02	1.24E-01
OL-1-35 SP-10	PB10-04190	SR-237-251	339.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.09E-02	1.30E-01
OL-1-35 SP-11	PB10-04191	SR-237-252	322.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.59E-01	1.46E-01
OL-1-36 SP-1	PB10-04235	SR-237-254	317.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.67E-02	1.39E-01
OL-1-36 SP-2	PB10-04236	SR-237-255	330.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.07E-02	1.43E-01
OL-1-36 SP-3	PB10-04237	SR-237-256	337.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.14E-02	1.31E-01
OL-1-36 SP-4	PB10-04238	SR-237-257	392.6	1.76E-01	8.55E-02	<MDA	<MDA	1%	N/A		1.20E-01
OL-1-36 SP-5	PB10-04239	SR-237-258	456.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.15E-01	9.65E-02
OL-1-36 SP-6	PB10-04240	SR-237-259	391.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.66E-02	1.21E-01
OL-1-36 SP-7	PB10-04242	SR-237-260	389.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.06E-02	1.13E-01
OL-1-36 SP-8	PB10-04243	SR-237-261	314.4	3.10E-01	1.27E-01	<MDA	<MDA	3%	N/A		1.50E-01
OL-1-36 SP-9	PB10-04244	SR-237-262	420.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.13E-02	1.12E-01
OL-1-36 SP-10	PB10-04245	SR-237-263	338.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.85E-02	1.39E-01
OL-1-36 SP-11	PB10-04246	SR-237-264	357.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.39E-02	1.32E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-37 SP-1	PB10-04248	SR-237-266	358.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.12E-01	1.23E-01
OL-1-37 SP-2	PB10-04249	SR-237-267	438.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.37E-02	1.01E-01
OL-1-37 SP-3	PB10-04251	SR-237-269	464.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	5.92E-02	9.49E-02
OL-1-37 SP-4	PB10-04252	SR-237-270	436.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.96E-02	1.01E-01
OL-1-37 SP-5	PB10-04253	SR-237-271	444.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.33E-02	9.93E-02
OL-1-37 SP-6	PB10-04254	SR-237-272	349.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.94E-02	1.26E-01
OL-1-37 SP-7	PB10-04255	SR-237-273	309.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.30E-01	1.43E-01
OL-1-37 SP-8	PB10-04256	SR-237-274	329.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.00E-01	1.08E-01
OL-1-37 SP-9	PB10-04257	SR-237-275	351.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.58E-02	1.25E-01
OL-1-37 SP-10	PB10-04258	SR-237-276	363.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.25E-02	1.30E-01
OL-1-37 SP-11	PB10-04259	SR-237-277	357.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.70E-02	1.23E-01
OL-1-38 SP-1	PB10-04260	SR-237-278	377.1	1.88E-01	8.64E-02	<MDA	<MDA	2%	N/A		1.17E-01
OL-1-38 SP-2	PB10-04262	SR-237-279	445.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.74E-02	1.06E-01
OL-1-38 SP-3	PB10-04263	SR-237-280	371.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.35E-01	1.19E-01
OL-1-38 SP-4	PB10-04264	SR-237-281	378.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.91E-02	1.25E-01
OL-1-38 SP-5	PB10-04266	SR-237-283	406.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.38E-02	1.16E-01
OL-1-38 SP-6	PB10-04267	SR-237-284	454.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.05E-02	9.70E-02
OL-1-38 SP-7	PB10-04268	SR-237-285	428.9	6.76E-01	1.72E-01	<MDA	<MDA	6%	N/A		1.10E-01
OL-1-38 SP-8	PB10-04269	SR-237-286	315.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.72E-02	1.40E-01
OL-1-38 SP-9	PB10-04270	SR-237-287	430.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.97E-02	1.10E-01
OL-1-38 SP-10	PB10-04271	SR-237-288	465.0	2.81E-01	9.53E-02	<MDA	<MDA	2%	N/A		9.49E-02
OL-1-38 SP-11	PB10-04272	SR-237-289	456.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.82E-02	9.67E-02
OL-1-39 SP-1	PB10-04426	SR-237-290	361.1	2.07E-01	9.26E-02	<MDA	<MDA	2%	N/A		1.22E-01
OL-1-39 SP-2	PB10-04427	SR-237-291	345.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.67E-02	1.37E-01
OL-1-39 SP-3	PB10-04429	SR-237-293	418.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.16E-02	1.13E-01
OL-1-39 SP-4	PB10-04430	SR-237-294	382.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.47E-02	1.19E-01
OL-1-39 SP-5	PB10-04431	SR-237-295	353.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.78E-02	1.25E-01
OL-1-39 SP-6	PB10-04432	SR-237-296	436.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.87E-02	1.08E-01
OL-1-39 SP-7	PB10-04433	SR-237-297	371.9	2.71E-01	1.07E-01	<MDA	<MDA	2%	N/A		1.23E-01
OL-1-39 SP-8	PB10-04434	SR-237-298	357.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.10E-01	1.23E-01
OL-1-39 SP-9	PB10-04435	SR-237-299	351.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.25E-01	1.34E-01
OL-1-39 SP-10	PB10-04436	SR-237-300	352.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.92E-01	1.30E-01
OL-1-39 SP-11	PB10-04437	SR-237-301	349.2	1.82E-01	8.83E-02	<MDA	<MDA	2%	N/A		1.26E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS											
				Cs-137		Co-60					
				DCGL[1]	11.4	DCGL	3.7				
				DCGL[2]	14.7	DCGL	3.5			Cs-137	Co-60
				DCGL[3]	11.82	DCGL	3.8			MDA	MDA
Location	Sample Log #	Sample #	Weight (g)	pCi/g	2σ	pCi/g	2σ	% Unity	Cs:Co	pCi/g	pCi/g
OL-1-40 SP-1	PB10-04520	SR-237-302	451.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.09E-02	9.75E-02
OL-1-40 SP-2	PB10-04523	SR-237-303	344.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.52E-02	1.03E-01
OL-1-40 SP-3	PB10-04524	SR-237-304	377.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.57E-02	1.21E-01
OL-1-40 SP-4	PB10-04525	SR-237-305	358.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.68E-02	1.23E-01
OL-1-40 SP-5	PB10-04526	SR-237-306	356.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.33E-01	1.33E-01
OL-1-40 SP-6	PB10-04527	SR-237-307	384.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.06E-01	1.19E-01
OL-1-40 SP-7	PB10-04528	SR-237-308	410.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.64E-02	8.05E-02
OL-1-40 SP-8	PB10-04529	SR-237-309	376.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.96E-02	1.25E-01
OL-1-40 SP-9	PB10-04530	SR-237-310	382.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.47E-02	1.19E-01
OL-1-40 SP-10	PB10-04531	SR-237-311	393.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.28E-02	1.12E-01
OL-1-40 SP-11	PB10-04532	SR-237-312	352.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.12E-02	1.29E-01
OL-1-41, SP-1	PB10-04650	SR-237-314	401.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.26E-02	1.10E-01
OL-1-41, SP-2	PB10-04651	SR-237-315	402.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.45E-02	1.17E-01
OL-1-41, SP-3	PB10-04652	SR-237-316	425.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.82E-02	1.07E-01
OL-1-41, SP-4	PB10-04654	SR-237-318	373.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.13E-01	1.26E-01
OL-1-41, SP-5	PB10-04655	SR-237-319	400.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.97E-02	1.14E-01
OL-1-41, SP-6	PB10-04656	SR-237-320	414.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.52E-02	1.06E-01
OL-1-41, SP-7	PB10-04657	SR-237-321	324.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.25E-02	1.46E-01
OL-1-41, SP-8	PB10-04658	SR-237-322	403.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.62E-02	1.13E-01
OL-1-41, SP-9	PB10-04659	SR-237-323	401.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.26E-01	1.10E-01
OL-1-41, SP-10	PB10-04660	SR-237-324	375.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.02E-01	1.26E-01
OL-1-41, SP-11	PB10-04662	SR-237-325	411.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.95E-02	1.11E-01
OL-1-42, SP-1	PB11-00002	SR-244-13	387.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.11E-02	1.14E-01
OL-1-42, SP-2	PB11-00004	SR-244-15	423.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.26E-02	1.04E-01
OL-1-42, SP-3	PB11-00005	SR-244-16	422.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.09E-02	1.12E-01
OL-1-42, SP-4	PB11-00006	SR-244-17	434.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.33E-02	1.01E-01
OL-1-42, SP-5	PB11-00007	SR-244-18	340.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.81E-02	1.39E-01
OL-1-42, SP-6	PB11-00008	SR-244-19	422.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.52E-02	1.04E-01
OL-1-42, SP-7	PB11-00009	SR-244-20	444.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.74E-02	1.06E-01
OL-1-42, SP-8	PB11-00010	SR-244-21	393.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.00E-02	1.12E-01
OL-1-42, SP-9	PB11-00011	SR-244-22	380.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.03E-01	1.24E-01
OL-1-42, SP-10	PB11-00012	SR-244-23	424.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.33E-02	1.04E-01
OL-1-42, SP-11	PB11-00013	SR-244-24	419.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.05E-01	1.13E-01

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE RESULTS

CLASS 1 SOIL SAMPLE RESULTS

Location	Sample Log #	Sample #	Weight (g)	Cs-137 DCGL[1] pCi/g	Cs-137 11.4 2σ	Co-60 DCGL 3.7 pCi/g	Co-60 3.7 2σ	% Unity	Cs:Co	Cs-137 MDA pCi/g	Co-60 MDA pCi/g
				Cs-137 DCGL[2]	14.7	Co-60 DCGL	3.5				
				Cs-137 DCGL[3]	11.82	Co-60 DCGL	3.8				
OL-1-43, SP-1	PB11-00071	SR-237-326	382.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.74E-02	1.15E-01
OL-1-43, SP-2	PB11-00072	SR-237-327	365.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.05E-01	1.29E-01
OL-1-43, SP-3	PB11-00073	SR-237-328	380.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.23E-02	1.16E-01
OL-1-43, SP-4	PB11-00075	SR-237-330	392.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.01E-02	1.12E-01
OL-1-43, SP-5	PB11-00076	SR-237-331	423.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.30E-01	1.11E-01
OL-1-43, SP-6	PB11-00077	SR-237-332	402.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.84E-02	1.10E-01
OL-1-43, SP-7	PB11-00078	SR-237-333	439.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.83E-02	1.08E-01
OL-1-43, SP-8	PB11-00079	SR-237-334	436.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.55E-02	1.04E-01
OL-1-43, SP-9	PB11-00080	SR-237-335	454.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.68E-02	9.69E-02
OL-1-43, SP-10	PB11-00082	SR-237-336	438.2	3.92E-01	1.03E-01	<MDA	<MDA	3%	N/A		5.39E-02
OL-1-43, SP-11	PB11-00083	SR-237-337	386.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.24E-02	1.09E-01
OL-1-44, SP-1	PB11-00084	SR-237-338	389.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.44E-02	1.29E-01
OL-1-44, SP-2	PB11-00085	SR-237-339	423.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.07E-02	1.11E-01
OL-1-44, SP-3	PB11-00087	SR-237-341	428.3	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.57E-02	1.17E-01
OL-1-44, SP-4	PB11-00088	SR-237-342	457.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.69E-02	1.03E-01
OL-1-44, SP-5	PB11-00089	SR-237-343	415.7	1.52E-01	6.94E-02	<MDA	<MDA	1%	N/A		4.70E-02
OL-1-44, SP-6	PB11-00090	SR-237-344	437.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.13E-01	1.15E-01
OL-1-44, SP-7	PB11-00091	SR-237-345	448.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.68E-02	1.05E-01
OL-1-44, SP-8	PB11-00092	SR-237-346	427.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.09E-02	1.07E-01
OL-1-44, SP-9	PB11-00093	SR-237-347	383.7	8.16E-01	1.88E-01	<MDA	<MDA	7%	N/A		1.50E-01
OL-1-44, SP-10	PB11-00094	SR-237-348	451.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.70E-02	1.04E-01
OL-1-44, SP-11	PB11-00095	SR-237-349	433.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.15E-02	1.05E-01
OL-1-45, SP-1	PB11-00106	SR-244-25	408.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.95E-02	1.08E-01
OL-1-45, SP-2	PB11-00107	SR-244-26	431.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.02E-01	1.17E-01
OL-1-45, SP-3	PB11-00108	SR-244-27	377.3	3.95E-01	1.29E-01	<MDA	<MDA	3%	N/A		1.33E-01
OL-1-45, SP-4	PB11-00109	SR-244-28	374.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.08E-02	8.00E-02
OL-1-45, SP-5	PB11-00110	SR-244-29	400.4	2.03E-01	6.11E-02	<MDA	<MDA	1%	N/A		7.46E-02
OL-1-45, SP-6	PB11-00111	SR-244-30	403.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.97E-02	1.25E-01
OL-1-45, SP-7	PB11-00112	SR-244-31	411.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.07E-01	1.22E-01
OL-1-45, SP-8	PB11-00113	SR-244-32	415.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	5.31E-02	6.05E-02
OL-1-45, SP-9	PB11-00114	SR-244-33	392.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.17E-02	1.28E-01
OL-1-45, SP-10	PB11-00115	SR-244-34	433.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.27E-01	1.16E-01
OL-1-45, SP-11	PB11-00117	SR-244-36	393.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.94E-02	1.28E-01
Total Number			431	46	46	1	1	431	N/A	385	430
Maximum Value			507.9	8.80E-01	2.22E-01	1.00E+00	1.76E-01	31%	N/A	1.92E-01	1.50E-01
Average Value			395.8	2.74E-01	1.01E-01	1.00E+00	1.76E-01	0%	N/A	7.84E-02	1.12E-01
Standard Deviation			38.71	1.68E-01	3.52E-02	N/A	N/A	2%	N/A	2.00E-02	1.99E-02

Notes:
1. Denotes DCGLs used for Survey Unit OL-1-26, per Survey Design #46
2. Denotes DCGLs used for Survey Units OL-1-10, OL-1-42, and OL-1-45, per Survey Design #39
3. Denotes DCGLs used for all remaining Suvey Units within SDPTSSE, per Survey Designs #30, 33, 37, and 44

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE
QC COMPARISON

QC SOIL SAMPLE SUMMARYDATA											
Location	HPGe Log #	Sample #	Weight (g)	Cs-137		Co-60		% Unity	Cs:Co	Cs-137 MDA	Co-60 MDA
				pCi/g	2σ	pCi/g	2σ			pCi/g	pCi/g
OL-1-35 SP-11 QC	PB10-04192	SR-237-253	381.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.49E-02	1.19E-01
OL-1-36 SP-11 QC	PB10-04247	SR-237-265	378.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.93E-02	1.25E-01
OL-1-37 SP-2 QC	PB10-04250	SR-237-268	422.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.21E-01	1.04E-01
OL-1-38 SP-4 QC	PB10-04265	SR-237-282	383.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.17E-02	1.15E-01
OL-1-33 SP-11 QC	PB10-04205	SR-237-241	424.5	1.67E-01	7.68E-02	<MDA	<MDA	1%	N/A		1.04E-01
OL-1-34 SP-2 QC	PB10-04170	SR-237-220	406.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.77E-02	1.08E-01
OL-1-26 SP-2 QC	PB10-04148	SR-279-3	429.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.41E-02	1.03E-01
OL-1-19 SP-2 QC	PB10-03108	SR-237-124	443.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.76E-02	1.06E-01
OL-1-25 SP-4 QC	PB10-03805	SR-237-210	360.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.93E-02	1.26E-01
OL-1-22 SP-4 QC	PB10-03714	SR-237-198	431	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.63E-02	1.06E-01
OL-1-21 SP-2 QC	PB10-03513	SR-237-160	423.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.75E-02	1.08E-01
OL-1-24 SP-2 QC	PB10-03677	SR-237-184	387.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.74E-02	1.22E-01
OL-1-7 SP-11 QC	PB10-01515	SR-237-12	312.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.81E-02	1.41E-01
OL-1-8 SP-1 QC	PB10-01520	SR-237-14	433.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.54E-02	1.04E-01
OL-1-9 SP-2 QC	PB10-01578	SR-237-27	356.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.95E-02	1.26E-01
OL-1-12 SP-3 QC	PB10-01981	SR-237-52	448.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.49E-02	1.00E-01
OL-1-10 SP-11 QC	PB10-01881	SR-244	396.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.55E-02	1.19E-01
OL-1-15 SP-1 QC	PB10-02127	SR-242-4	375.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.97E-02	1.25E-01
OL-1-13 SP-6 QC	PB10-02058	SR-237-68	387.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.10E-02	1.14E-01
OL-1-15 SP-10 QC	PB10-02195	SR-237-96	366.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.24E-02	1.20E-01
OL-1-17 SP-1 QC	PB10-02827	SR-237-111	397	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.55E-02	1.19E-01
OL-1-20 SP-2 QC	PB10-03262	SR-237-136	395.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.24E-02	1.15E-01
OL-1-18 SP-2 QC	PB10-03303	SR-237-148	397.2	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.54E-02	1.19E-01
OL-1-39 SP-2 QC	PB10-04428	SR-237-292	368.1	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.48E-02	1.29E-01
OL-1-40 SP-11 QC	PB10-04533	SR-237-313	404.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.79E-02	1.09E-01
OL-1-41, SP-3 QC	PB10-04653	SR-237-317	403.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.81E-02	1.09E-01
OL-1-43, SP-3 QC	PB11-00074	SR-237-329	389.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.89E-02	1.21E-01
OL-1-44, SP-2 QC	PB11-00086	SR-237-340	447.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.38E-02	1.02E-01
OL-1-11 SP-11 QC	PB10-01936	SR-237-48	394.7	<MDA	<MDA	<MDA	<MDA	0%	N/A	9.30E-02	1.12E-01
OL-1-16, SP-11 QC	PB10-02383	SR-237-109	399.6	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.12E-01	1.18E-01
OL-1-14, SP-2 QC	PB10-02153	SR-237-76	427.0	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.40E-01	1.11E-01
OL-1-23, SP-10 QC	PB10-03619	SR-237-180	437.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	6.85E-02	1.08E-01
OL-1-42, SP-1 QC	PB11-00003	SR-244-14	341.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	8.77E-02	1.38E-01
OL-1-45, SP-10 QC	PB11-00116	SR-244-35	423.9	<MDA	<MDA	<MDA	<MDA	0%	N/A	1.35E-01	1.19E-01
OL-1-2, SP-11 QC	PB09-01128	SR-165-12	430.0	1.11E-01	5.13E-02	<MDA	<MDA	1%	N/A		5.06E-02
OL-1-3, SP-11 QC	PB09-02127	SR-176-24	412.4	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.27E-02	1.14E-01
OL-1-4 SP-2, QC	PB09-01378	SR-169-15	394.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.61E-02	1.19E-01
OL-1-1, SP-11, QC	PB09-01010	SR-164-12	494.5	<MDA	<MDA	<MDA	<MDA	0%	N/A	4.71E-02	4.40E-02
OL-1-5, SP-11, QC	PB09-02069	SR-176-12	401.8	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.84E-02	1.17E-01
OL-1-6, SP-11, QC	PB09-04933	SR-204-12	384	<MDA	<MDA	<MDA	<MDA	0%	N/A	7.81E-02	1.22E-01
Total Number			40	2	2	0	0	40	0	38	40
Maximum Value			494.5	1.67E-01	7.68E-02	<MDA	<MDA	1%	N/A	1.4E-01	1.4E-01
Average Value			402.4	1.39E-01	6.41E-02	<MDA	<MDA	0%	N/A	8.0E-02	1.1E-01
Standard Deviation			33.14	3.96E-02	1.80E-02	N/A	N/A	0%	N/A	1.90E-02	1.78E-02

APPENDIX C
FINAL STATUS SURVEY
SOIL SAMPLE
QC COMPARISON

QC Comparison (FSSP Section 12.7.2)								
Location	HPGe Log #	Sample #	Original Result	Replicate Result	Original 2 Sigma Uncertainty	Resolution	Ratio	Pass
OL-1-35 SP-11 QC	PB10-04192	SR-237-253	<MDA	<MDA				YES
OL-1-36 SP-11 QC	PB10-04247	SR-237-265	<MDA	<MDA				YES
OL-1-37 SP-2 QC	PB10-04250	SR-237-268	<MDA	<MDA				YES
OL-1-38 SP-4 QC	PB10-04265	SR-237-282	<MDA	<MDA				YES
OL-1-33 SP-11 QC	PB10-04205	SR-237-241	1.67E-01	7.74E-02	7.68E-02	4	0.5	YES
OL-1-34 SP-2 QC	PB10-04170	SR-237-220	<MDA	<MDA				YES
OL-1-26 SP-2 QC	PB10-04148	SR-279-3	<MDA	<MDA				YES
OL-1-19 SP-2 QC	PB10-03108	SR-237-124	<MDA	<MDA				YES
OL-1-25 SP-4 QC	PB10-03805	SR-237-210	<MDA	<MDA				YES
OL-1-22 SP-4 QC	PB10-03714	SR-237-198	<MDA	<MDA				YES
OL-1-21 SP-2 QC	PB10-03513	SR-237-160	<MDA	<MDA				YES
OL-1-24 SP-2 QC	PB10-03677	SR-237-184	<MDA	<MDA				YES
OL-1-7 SP-11 QC	PB10-01515	SR-237-12	<MDA	<MDA				YES
OL-1-8 SP-1 QC	PB10-01520	SR-237-14	<MDA	<MDA				YES
OL-1-9 SP-2 QC	PB10-01578	SR-237-27	<MDA	<MDA				YES
OL-1-12 SP-3 QC	PB10-01981	SR-237-52	<MDA	<MDA				YES
OL-1-10 SP-11 QC	PB10-01881	SR-244	<MDA	<MDA				YES
OL-1-15 SP-1 QC	PB10-02127	SR-242-4	<MDA	<MDA				YES
OL-1-13 SP-6 QC	PB10-02058	SR-237-68	<MDA	<MDA				YES
OL-1-15 SP-10 QC	PB10-02195	SR-237-96	<MDA	<MDA				YES
OL-1-17 SP-1 QC	PB10-02827	SR-237-111	<MDA	<MDA				YES
OL-1-20 SP-2 QC	PB10-03262	SR-237-136	<MDA	<MDA				YES
OL-1-18 SP-2 QC	PB10-03303	SR-237-148	<MDA	<MDA				YES
OL-1-39 SP-2 QC	PB10-04428	SR-237-292	<MDA	<MDA				YES
OL-1-40 SP-11 QC	PB10-04533	SR-237-313	<MDA	<MDA				YES
OL-1-41, SP-3 QC	PB10-04653	SR-237-317	<MDA	<MDA				YES
OL-1-43, SP-3 QC	PB11-00074	SR-237-329	<MDA	<MDA				YES
OL-1-44, SP-2 QC	PB11-00086	SR-237-340	<MDA	<MDA				YES
OL-1-11 SP-11 QC	PB10-01936	SR-237-48	<MDA	<MDA				YES
OL-1-16, SP-11 QC	PB10-02383	SR-237-109	<MDA	<MDA				YES
OL-1-14, SP-2 QC	PB10-02153	SR-237-76	<MDA	<MDA				YES
OL-1-23, SP-10 QC	PB10-03619	SR-237-180	<MDA	<MDA				YES
OL-1-42, SP-1 QC	PB11-00003	SR-244-14	<MDA	<MDA				YES
OL-1-45, SP-10 QC	PB11-00116	SR-244-35	<MDA	<MDA				YES
OL-1-2, SP-11 QC	PB09-01128	SR-165-12	1.11E-01	5.10E-02	5.13E-02	4	0.5	YES
OL-1-3, SP-11 QC	PB09-02127	SR-176-24	<MDA	<MDA				YES
OL-1-4 SP-2, QC	PB09-01378	SR-169-15	<MDA	<MDA				YES
OL-1-1, SP-11, QC	PB09-01010	SR-164-12	<MDA	<MDA				YES
OL-1-5, SP-11, QC	PB09-02069	SR-176-12	<MDA	<MDA				YES
OL-1-6, SP-11, QC	PB09-04933	SR-204-12	<MDA	<MDA				YES
Total Number			2	2	2	2	2	N/A
Total Number "YES"								40
Total Number "NO"								0

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.