590108-0605090007

CH2M HILL Mound, Inc.
1075 Mound Road
P.O. Box 750
Miamisburg, OH 45343-0750

CH2MHILL

SMO-216/06
March 28, 2006

Mr. Don Pfister, Director
Miamisburg Closure Project
U. S. Department of Energy
175 Tri-County Parkway
Springdale, OH 45246

ATTENTION: Paul Lucas

SUBJECT: **Contract No. DE-AC24-03OH20152:** Deliverable #36 Building Data Package; Section C.2.1.1 Facility Demolition; Deliverable #39 Potential release site and removal action documentation; Section C.2.3.1.3 Remaining Response Actions; UGL Partial III OSC Report, Final

Dear Mr. Pfister:

Attached is the following Final document for your records:

- UGL Partial III OSC Report, Final

If you or members of your staff have any questions regarding the document, or if additional support is needed, please contact Dave Rakel at 937-865-4203.

Sincerely,

Michael D. Ebben
Site Manager

ME/jg

Enclosures

cc: T. Fischer, USEPA, (1) w/attachments
B. Nickel, OEPA, (1) w/attachments
S.Helmer, ODH, (1) w/attachments
J. Colleli, ODH, (1) w/attachments
M. Wojciechowski, Tetra Tech, (1) w/attach
G. Gorsuch, DOE/MCP, (1) w/attachments
R. Tormey, DOE/OH, (1) w/attachments
G. Desai, DOE/HQ, (1) w/attachments
C. Kline, CH2M Hill, (1) w/attachments
F. Bullock, MMCIC (2) w/attachments
Public Reading Room (1) w/attachments
Admin Records, CH2M Hill, (2) w/attachs
ER Records, CH2M Hill, (1) w/attachs
DCC (1) w/attachments
M. Ebben, CH2M Hill, w/o attachments
K. Armstrong, CH2M Hill, w/o attachments
D. Rakel, CH2M Hill, w/o attachments
D. Kramer, CH2M Hill, w/o attachments
J. Fontaine, CH2M Hill, w/o attachments
MOAT Coordinator, CH2M Hill, w/o attachs
S. Barr, CH2M Hill, w/o attachments
M. McDougal, CH2M Hill, w/o attachments
file, CH2M Hill, w/o attachments

590108-0605090007

UGL PARTIAL III
REMOVAL ACTION
OSC REPORT

This Report Closes HH Footprint and PRSs 151 & 413

March 2006

Final

Department of Energy
Miamisburg Closure Project

CH2MHILL

K:\SHARED\ER\All UGLs\Partial III HH\OSC REPORT\HH OSC Final.doc
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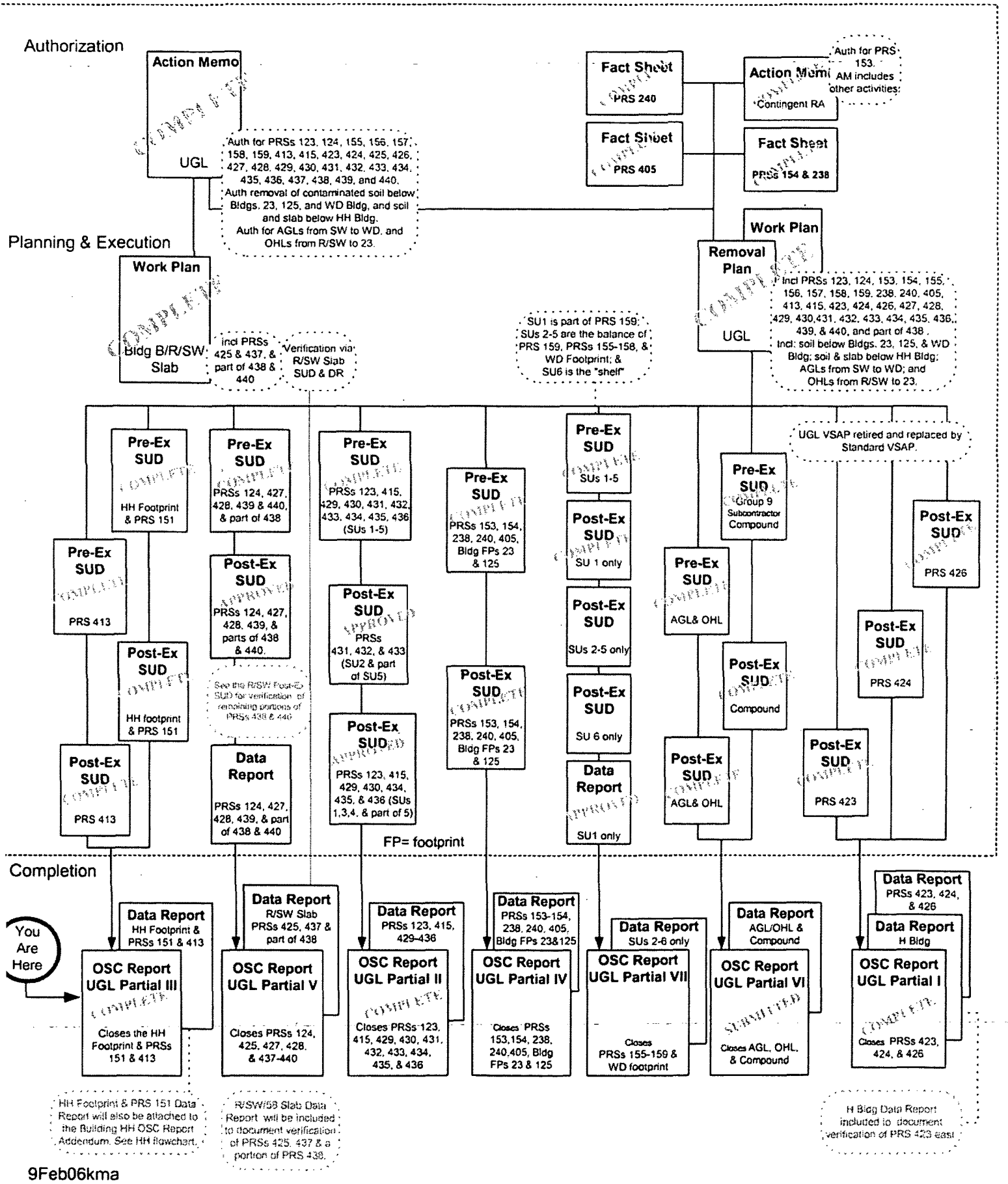
UGL (Underground Waste Transfer Lines) (AKA Group 9):

PRSs 123, 124, 153, 154, 155, 156, 157, 158, 159, 238, 240, 405, 413, 415, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, and 440

Includes soil below Bldgs 23, 125, HH, and WD.



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Acronyms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CO	cleanup objective
COC	contaminant of concern
CRA	Contingent Removal Action
cy	cubic yards
DOE	Department of Energy
HS	hot spot
MCP	Miamisburg Closure Project
mg/kg	milligram per kilogram
OEPA	Ohio Environmental Protection Agency
OSC	On-Scene Coordinator
pCi/g	picoCuries per gram
ppm	parts per million
PRP	Potentially Responsible Parties
PRS	Potential Release Site
RA	Removal Action
RASS	Remedial Action Survey Sample
SUD	Survey Unit Design
UCL	upper confidence limit
UGL	underground line
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
VSAP	Verification Sampling and Analysis Plan

RECOMMENDATION: HH Footprint & PRSs 151 & 413

The HH Footprint and Potential Release Site (PRS) 413 Removal Actions (RAs) were authorized via the underground line (UGL) Action Memo, Final, September 2003. The PRS 151 RA was authorized via the Building HH Removal Action Action Memo, Final, August 2002. The HH Footprint and PRS 151 RAs were based on historical processes, and radiological surveys and soil sample results which showed elevated levels of Ac-227, Ag-108m, Bi-207, Bi-210m, Bi-214, Cs-137, Co-60, Pa-231, Pb-214, Ra-226, tritium, Th-230, and Th-232. The PRS 413 RA was based on historic elevated results of ethylbenzene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, ideno(1,2,3-cd)pyrene, and dibenz(a,h)anthracene.

Contaminated soil at HH Footprint and PRS 151 was excavated per the associated Action Memo and UGLs Removal Plan, Final, April 2004. Verification sampling and analysis was performed in accordance with the Standard Soils Verification Sampling & Analysis Plan (VSAP), Final, August 2004 to demonstrate that the remaining soil meets the cleanup criteria. This removal action was successfully completed and resulted in the excavation and disposal of approximately 4,791 cubic yards (cy) of radioactively contaminated soil (for disposal at Envirocare).

Contaminated soil at PRS 413 was previously remediated and verification samples were collected at that time.

The cleanup criteria established in the Standard VSAP are satisfied if all verification sample results are below cleanup objectives (COs) or all sample results are below hot spot (HS) criteria <u>and</u> the 95% UCL (upper confidence limit) for the area of interest is less than the CO and the data set passes the Sign test.

The contaminants of concern (COCs) are identified above. All results for HH Footprint and PRS 151 are below COs documenting that the cleanup criteria were met. All results for PRS 413 were below concentrations that could leach to groundwater at unacceptable levels.

After a thorough review of this On-Scene Coordinator (OSC) Report, the Core Team agrees that the RAs associated with HH Footprint and PRSs 151 & 413 are complete, and that all previously existing environmental issues associated with them have been resolved.

Paul L 3/23/06

Paul Lucas, OSC
U.S. Department of Energy
Springdale, Ohio

Timothy J. F 3/21/06

Timothy J. Fischer, Remedial Project Manager
USEPA
Chicago, Illinois

Brian Nickel 3/23/06

Brian Nickel, Project Manager
OEPA
Dayton, Ohio

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1.0 SUMMARY OF EVENTS

This section describes the site background and events leading up to the removal action (RA), parties involved in responding to the RA, cleanup objective (CO) determination, chronological narrative of the RA, and resources committed to complete the projects.

1.1 Site Conditions and Background

Background. The locations of the HH Footprint and Potential Release Sites (PRSs) 151 and 413 are highlighted on Figure 1 (on page A7/99). Other PRSs not closed by this partial On-Scene Coordinator (OSC) Report, but associated with the underground line (UGL) RA, are shown, but not highlighted. The descriptions of the RAs closed via this OSC Report are bolded in Table 1 (on page 2 of 6). Other PRSs not closed by this partial OSC Report, but associated with the UGL RA, are shown, but not bolded.

The UGL RA was authorized by the Core Team (August 11, 2003), as documented in the associated Action Memo (UGL Action Memo, Removal Action of Soil & Underground Waste Transfer Lines Leading to WD Building, Final, September 2003). The RA for PRS 153 was authorized by the associated Action Memo (Action Memorandum/Engineering Evaluation/Cost Analysis, Contingent Removal Action (CRA) for Contaminated Soil, June 2002, Final). The RA for PRSs 154 and 238 was authorized by Fact Sheet (PRS 154 and 238: Area 23 and Potential Hot Spot S1092, Final, October 2003). The RA for PRS 240 was authorized by Fact Sheet (PRS 240: Potential Hot Spot Location S0472, Final, October 2003). The RA for PRS 405 was authorized by Fact Sheet (PRS 405: Soil Contamination – Building 23, Final, March 2004). The PRS 151 RA was authorized by the HH Building Action Memo, Final, August 2002.

The level of soil radiological and volatile organic compound (VOC) contamination present warranted a RA under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act). This OSC Report documents the completion of the HH Footprint and PRSs 151 and 413 RA activities authorized via the Action Memos, including removal of soil contaminated above the CO. Verification sampling and analysis was performed in accordance with the Standard VSAP, Soils Verification Sampling & Analysis Plan, Final, August 2004 and Post-Excavation Survey Unit Designs (SUDs). Excerpts of the associated SUDs are included in Appendix C of Attachment A to this OSC Report. Verification results demonstrate that the remaining soil meets the CO.

Removal Action. The UGLs were used to connect sumps and process lines from within T, R, SW, and H Buildings to the WD process treatment facility for treatment of generated radiologically contaminated liquid and sediment waste. See Table 1 (on page 2 of 6) for a listing of PRSs associated with these lines.

PRS 413 was remediated and sampled in 1996/1997 as documented in the PRS 413 Package dated 16 June 1997. The area that includes PRS 413 was recently excavated as part of the UGL RA. Because the excavation went five feet below the depth of the 1996 PRS 413 remediation, the Core Team determined that no additional sampling for

PRS 413 was necessary. Therefore, PRS 413 is identified herein as requiring no further assessment. For HH Footprint and PRS 151, soil was remediated, and the surface verified, as required. HH Footprint and PRSs 151 and 413 are closed by this OSC Report.

This OSC Report documents removal of contaminated soil from HH Footprint and PRSs 151 and 413, which are shown on Figure 1 (A7/99). Contaminated soil was excavated per the Action Memos and UGLs (Including Grp 9 PRS's 123-124, 153-159, 238, 240, 405, 413, 415, 423-430, 433-440; Grp 17 PRSs 431-432; Grp 21 PRS 131; Bldg HH Soil & Slab; Bldgs 23, 125, and WD Soil; SW-WD AGLs; and R/SW-23 OHLs.) Removal Plan, Final, April, 2004. Verification sampling and analysis was performed in accordance with the Standard VSAP, Soils Verification Sampling & Analysis Plan, Final, August 2004 to demonstrate that the remaining soil meets the cleanup criteria.

Since the Department of Energy (DOE) is the sole responsible party for cleanup of HH Footprint and PRSs 151 and 413 soil contamination, no Potentially Responsible Parties (PRPs) were sought to clean up the site. Monsanto Research Corporation, EG&G Mound Applied Technologies, and BWXT of Ohio, Inc were the operating contractors at the site from 1948 to 30 September 1988, from 1 October 1988 until 30 September 1997, and from 1 October 1997 until 31 December 2002 respectively. CH2M Hill Mound, Inc. became the site contractor for the Miamisburg Closure Project (MCP) effective January 1, 2003.

Table 1: UGL RA PRSs

(bold PRSs closed via this OSC Report)

PRS	Description/Comment
123	Area 5, radioactive waste line break
124	Building 48 Hillside
153	Area 20, Radioactive waste line break
154	Area 23, Th contaminated soils
155	Old sanitary disposal (SD) plant (aka Old sanitary waste treatment plant) / removed 1997
156	Old SD Plant Tank (tank 205) / removed 1997
157	Old SD Plant Tank (tank 206) / removed 1997
158	Old SD Plant Tank (tank 207) / removed 1997
159	Area 4A, Sewage Sludge Drying Pits / removed 1997
238	Potential hot spot location S1092
405	Building 23 Oil Contaminated Soil
413	**Soil contamination – creosote / removed 1996**
415	Soil contamination – Radiological SCR307
423	Hot waste line, segment 1A
424	Hot waste line, segment 1B
425	Hot waste line, segment 2
426	Hot waste line, segment 5
427	Hot waste line, segment 6
428	Hot waste line, segment 7
429	Hot waste line, segment 9
430	Hot waste line, segment 9b

PRS	Description/Comment
431	Hot waste line, segment 10
432	Hot waste line, segment 11
433	Hot waste line, segment 12
434	Hot waste line, segment 13A
435	Hot waste line, segment 13B
436	Hot waste line, segment 14
437	Hot waste line, segment 3
438	Hot waste line, segment 4
439	Hot waste line, segment 4A
440	Hot waste line, segment 8

Additional RAs not listed above but closed via this OSC Report include:

NA	**HH Footprint**
151	**Room HH-6 Alpha Wastewater Sump (Tank 237)**

1.2 Organization of the Removal Actions

Table 2 lists the parties responding to the removal actions, and their responsibilities.

Table 2: Organization of the Removal Action

US Environmental Protection Agency (USEPA) SFR-5J 77 W. Jackson Street Chicago, IL 60604 312-353-2000	Timothy J. Fischer	Federal agency responsible for oversight
Ohio Environmental Protection Agency (OEPA) 401 E. Fifth Street Dayton, OH 45402-2911 937-285-6357	Brian K. Nickel	State agency responsible for oversight
US Dept. of Energy Miamisburg Closure Project 175 Tri-County Parkway Springdale, OH 45246 513-246-0071	Paul Lucas	On-scene Coordinator responsible for oversight and success
CH2M HILL Environmental Restoration Project 1075 Mound Road Miamisburg, OH 45343-3030 937-608-8220	Jim Fontaine	Provide OSC with technical assistance, administrative support, field oversight, sample management, site safety, photo, site documentation, and preparation of the OSC Report

1.3 Objectives

Documentation Objective. The objectives of this OSC Report are to describe the RA fieldwork and document successful completion of the project. Material quantities and disposition locations are presented in Table 3. Because this is a partial OSC Report, complete costs are not available to report. Total project cost for the UGL Removal Action will be reported in the last of the OSC Reports associated with the UGL Removal Action.

Table 3: Materials and Disposition

Type of Material	Quantity (cy)	Disposal Method	Disposal Location
Contaminated soil	4,791	Rail transport	Envirocare of Utah

Cleanup Objective. Contaminants and COs for HH Footprint and PRS 151 realized during historic and/or Remedial Action Survey Sample (RASS) sampling that were included in the Post-Ex SUD for HH Footprint and PRS 151 are:

Table 4: Soil Cleanup Objectives (pCi/g unless otherwise specified)

Contaminant	Cleanup Objective	Hot Spot	PRSs
Thorium-230 +D	2.8	4.6	PRS 151
Thorium-232 +D	2.1	3.5	HH Footprint & PRS 151
Tritium	avg.<328*	na	HH Footprint
Actinium-227	4.6	13.61	151 area
Silver-108m	1.22	3.66	151 area
Bismuth-207	1.2	3.6	151 area
Bismuth-210m	8.3	24.9	151 area
Bismuth-214	1.17	3.51	151 area
Cobalt-60	0.7	2.1	151 area
Cesium-137	3.8	10.62	151 area
Protactinium-231	4.0	11.81	151 area
Lead-214	8.9	26.8	151 area
Radium-226	2.9	4.7	151 area

* based on location-specific calculations, the CO for tritium requires the average result to be less than 328 pCi/g.

The cleanup criteria are satisfied if all verification sample results are below CO or all sample results are below hot spot (HS) criteria and the 95% UCL (upper confidence limit) for the area of interest is less than the CO and the data set passes the Sign test.

Cleanup Objective. All final verification results for HH Footprint and PRS 151 were below their respective COs. Verification results are identified in the Data Report, Table 1 (A14/99 – A22/99). All historic verification results for PRS 413 were below concentrations that could leach to groundwater at unacceptable levels.

Hot Spot Criteria. The Hot Spot criteria for the COCs are presented in Table 4. There were no sample results that exceeded the hot spot criteria for any analyte.

1.4 Chronological Narrative of the Removal Actions

Table 5 presents a chronological narrative of events surrounding the RAs. Individual excavation dates are not listed due to the duration of the project and concurrent RA activities.

Table 5: Chronology of RA

Timeframe	Activity
1996	PRS 413 contaminated soil RA activities, and verification sampling & analysis.
August 2002	HH Building Action Memo approved.
August 2003	UGL RA authorized.
April 2004	UGL Removal Plan approved.
December 2004-September 2005	HH Footprint and PRS 151 contaminated soil RA activities, and verification sampling & analysis.
January 2006	OSC Report prepared.

2.0 EFFECTIVENESS OF THE REMOVAL ACTIONS

The HH Footprint and PRSs 151 and 413 removal actions are complete, and the objectives of the Action Memoranda have been met. The limits of excavation and verification are identified on Figures 3-6 (see A9/99 – A12/99). Results of verification sampling and analysis are provided in Appendix A, and photographs of the site remediation are provided in Appendix C.

2.1 Actions Taken by Mound Personnel

CH2M Hill Mound, Inc. personnel planned and performed removal action oversight, and performed the excavation, monitoring, sampling and analyses, documentation, and transportation of contaminated soil and debris to the designated onsite soil staging area. Photographic documentation is presented in Appendix C. The project met the removal action objectives (Section 1.3), as outlined in the Action Memoranda. CH2M Hill Mound, Inc. personnel prepared this OSC Report, which shows that the Removal Action objectives were achieved.

2.2 Actions Taken by Local, State, and Federal Agencies

The DOE/MCP was the lead agency for the RA and provided the funding. DOE, USEPA, and OEPA had oversight responsibility for the RA and review of the Action Memorandum and OSC Report to ensure that the objectives were met.

2.3 Actions Taken by Subcontractors

Subcontractors involved in the project included:

- Earthline Inc. of Ohio – performed excavation and transportation of soil to the soil staging area.
- Terran of Ohio - performed site soil sampling, data management, and validation.
- Envirocare of Utah - disposal of radiologically contaminated waste via rail transport.

3.0 DIFFICULTIES ENCOUNTERED

3.1 Items that Affect the Removal Actions

No difficulties were encountered during the removals.

3.2 Issues of Intergovernmental Coordination

All DOE/OEPA/USEPA interactions were good. The agencies were updated informally on a regular basis, and formally at monthly Core Team meetings. The Mound 2000 Process worked well.

4.0 RECOMMENDATIONS

4.1 Means to Prevent a Recurrence

The contaminated soil was removed. Mound Removal Actions have regulator approved work plans, each of which has a section that addresses runon/runoff controls. In addition, the site Storm Water Pollution Prevention Plan applies to the entire site and is monitored by the Environmental Compliance and Analytical Services group. As a result of the removal and runon/runoff protection, spread of contamination is prevented. After the removal action and the CERCLA process for the parcel are complete, the area will be transferred from Federal to private ownership. All State and Federal disposal rules will apply.

ATTACHMENT A

DATA REPORT

UGL Partial III DATA REPORT

HH Footprint and PRSs 151 & 413

January 2006

Rev. 0

Department of Energy

Miamisburg Closure Project

CH2MHILL

A1/108

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Acronyms

Ex	Excavation
pCi/g	picoCuries per gram
PRS	Potential Release Site
QC	quality control
RA	removal action
R&V	review and validation
SUD	Survey Unit Design
UGL	underground line
VSAP	Verification Sampling and Analysis Plan

1.0 PURPOSE

This Data Report provides documentation of sampling activities conducted in accordance with the Standard VSAP, Soils Verification Sampling and Analysis Plan, Final, August 2004; required to close out HH Footprint and Potential Release Site (PRS) 151. Per the approved Post-Excavation (Ex) Survey Unit Design (SUD), sampling was not required to close out PRS 413. The location of HH Footprint and PRSs 151 and 413 are shown on Figure 1.

The purposes of this Data Report are to:

- document any variances to the VSAP/Post-Ex SUDs,
- present statistical and bias data (separately),
- present summary statistics and statistical analyses of the applicable data, including retrospective power curve, and
- provide documentation of data review and validation.

2.0 DOCUMENT ORGANIZATION / SUMMARY

The Underground Line (UGL) removal action (RA) consists of multiple sample events, each known as a "UGL Partial". This Data Report is for UGL Partial III, which covers two areas (HH Footprint/PRS 151 and PRS 413 as described below).

Unless otherwise specified as a variance, sampling and analyses were conducted in accordance with the VSAP and Post-Ex SUDs.

3.0 FIELD ACTIVITIES

3.1 HH FOOTPRINT / PRS 151

Verification sampling activities occurred in July, August, and September 2005. The investigation was conducted in accordance with the Soils Verification Sampling and Analysis Plan, Final August 2004.

Surface soil samples were collected in accordance with the procedures presented in the Mound Methods Compendiums S-001, S-002, S-020, S-028, S-029, and Q-002. Samples were collected and composited in-situ using the stainless steel trowels and placed in ½ liter plastic containers with lids. In some cases, a rock hammer or spud bar

was used to loosen the soil prior to sample collection. Several locations were submerged within standing pools of water or located within an area deemed physically hazardous for sampling personnel to enter. Samples from these locations were collected using a trackhoe and composited using stainless steel trowels and bowls. All equipment was thoroughly decontaminated using non-phosphate detergent and distilled water between sample locations. The samples were field-screened by a radiological control technician at the site and screened by the Mound Soil Screening Laboratory prior to shipment to the contract laboratory.

3.2 PRS 413

Per the Post-Ex SUD (excerpt in Appendix C) PRS 413 was previously verified and additional verification was not required.

4.0 DATA REVIEW / VALIDATION

All data were reviewed and 10% of offsite data were validated.

Field and laboratory QC (quality control) were assessed as part of the data review and validation (R&V) process.

Documentation of review and validation (and related variances) is provided in Appendix E. Review and validation supports that the data are usable.

APPENDIX A

FIGURES

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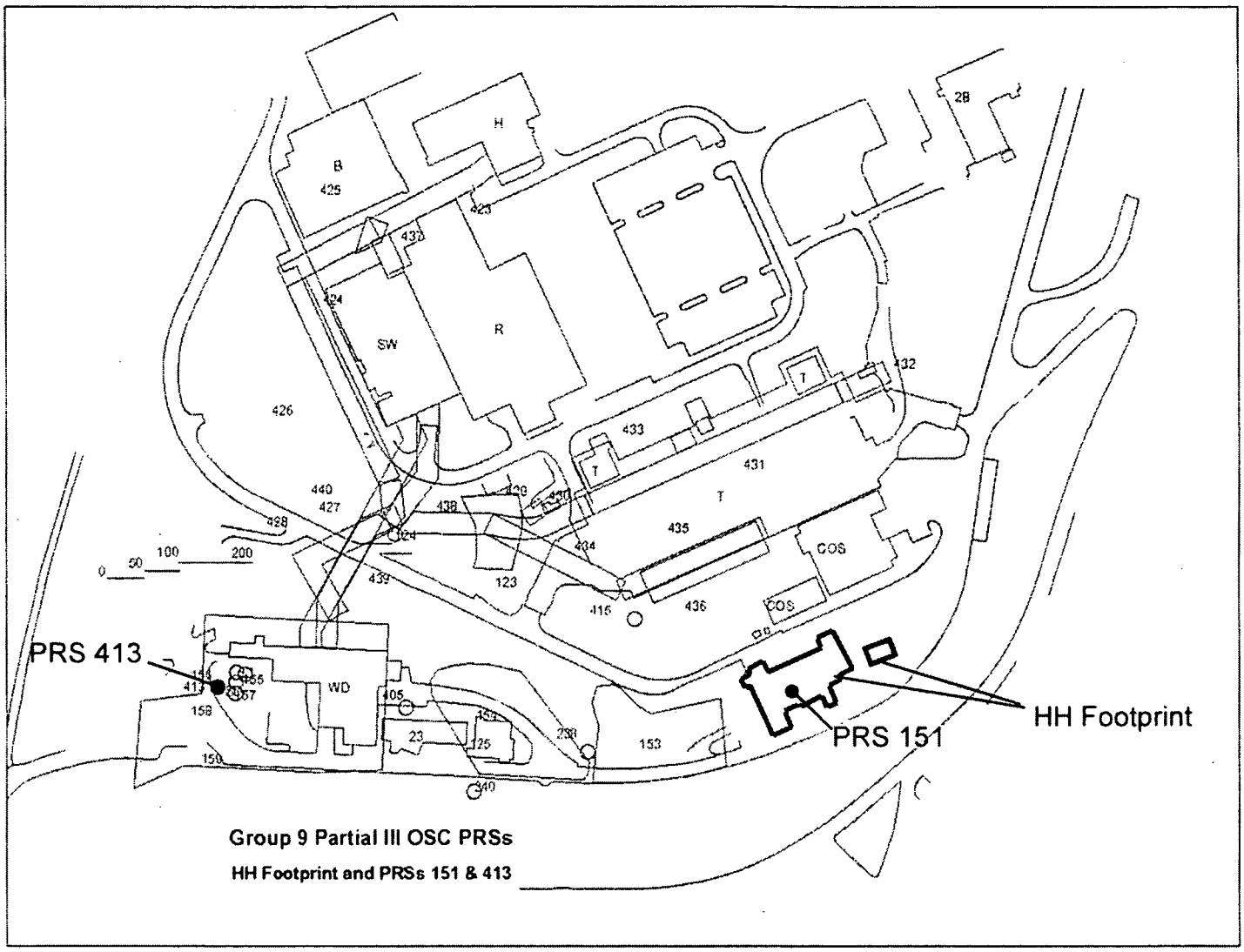

Figure 1: Location of HH Footprint and PRSs 151 & 413

A7/108

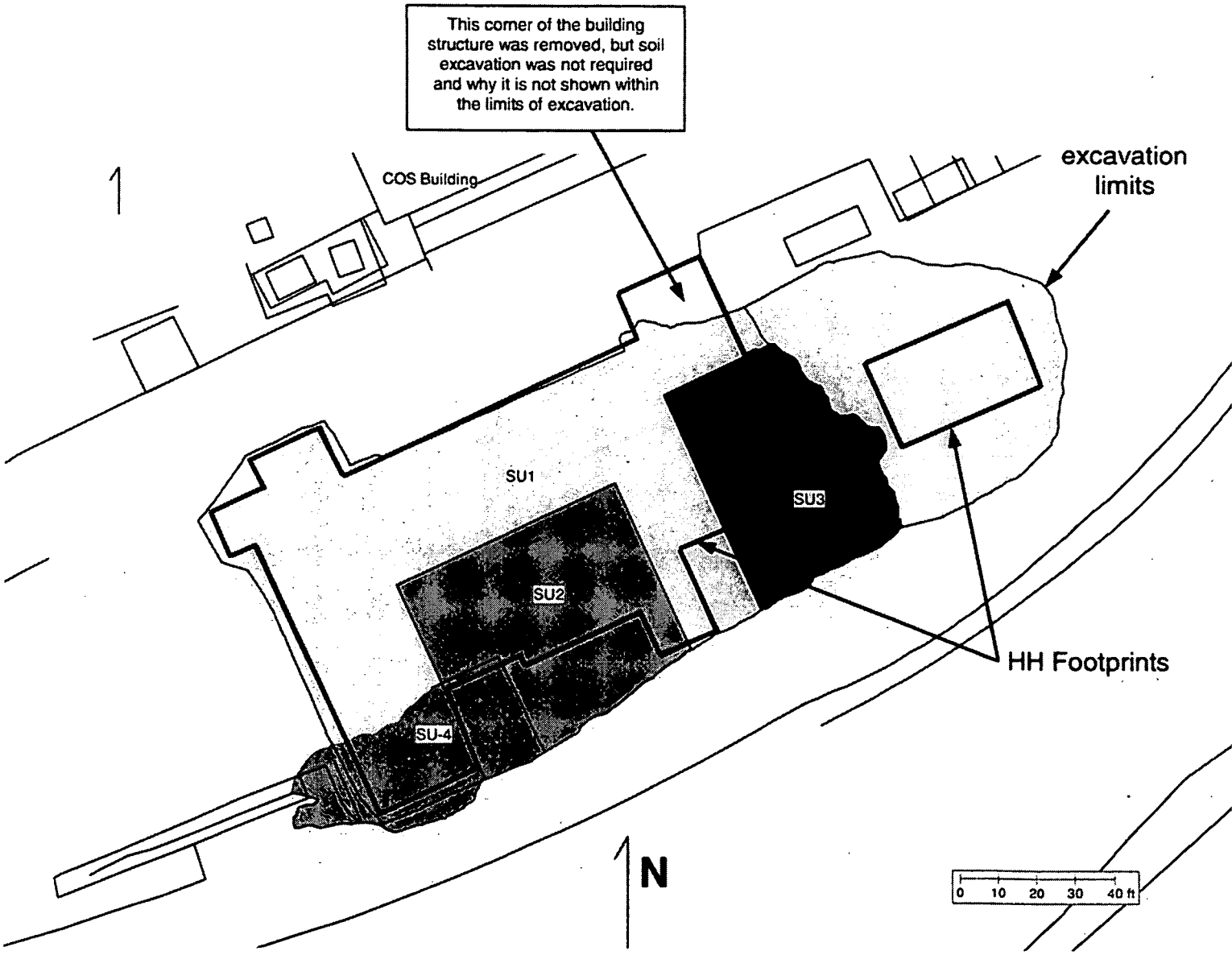

Figure 2: Location of SUs 1-4

A8/108

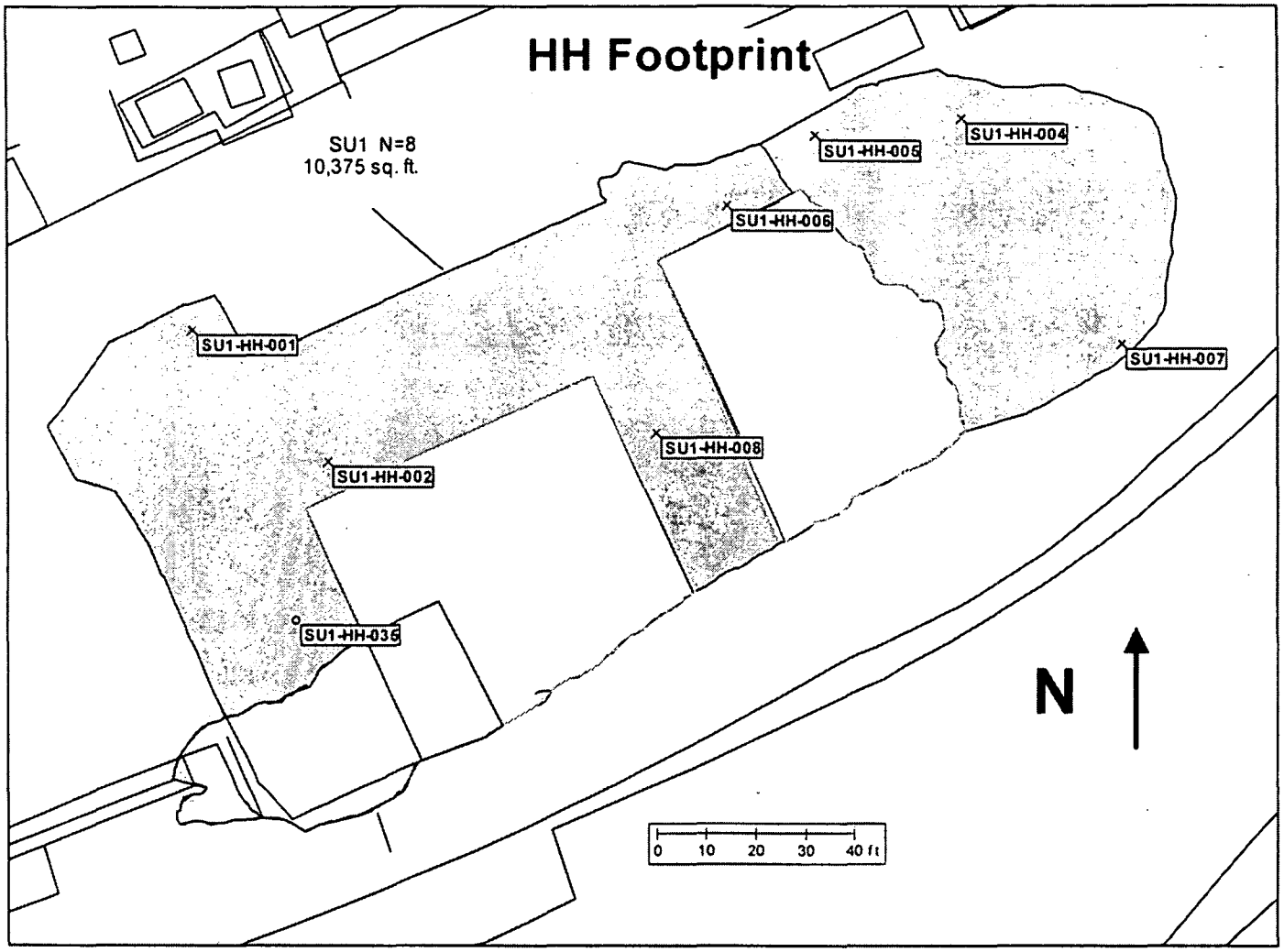

Figure 3: SU1 Verification Locations

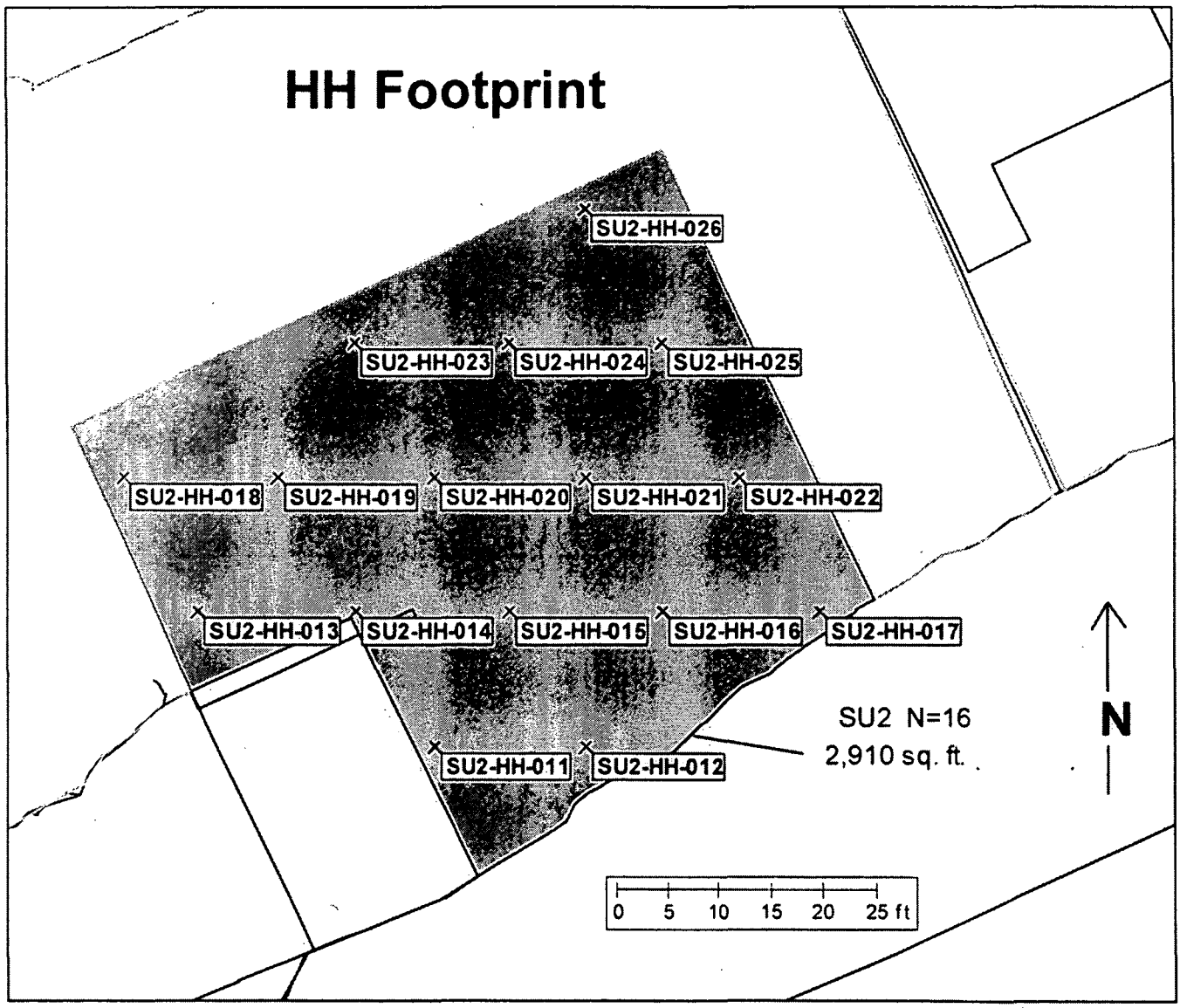

Figure 4: SU2 Verification Locations
(PRS 151 area)

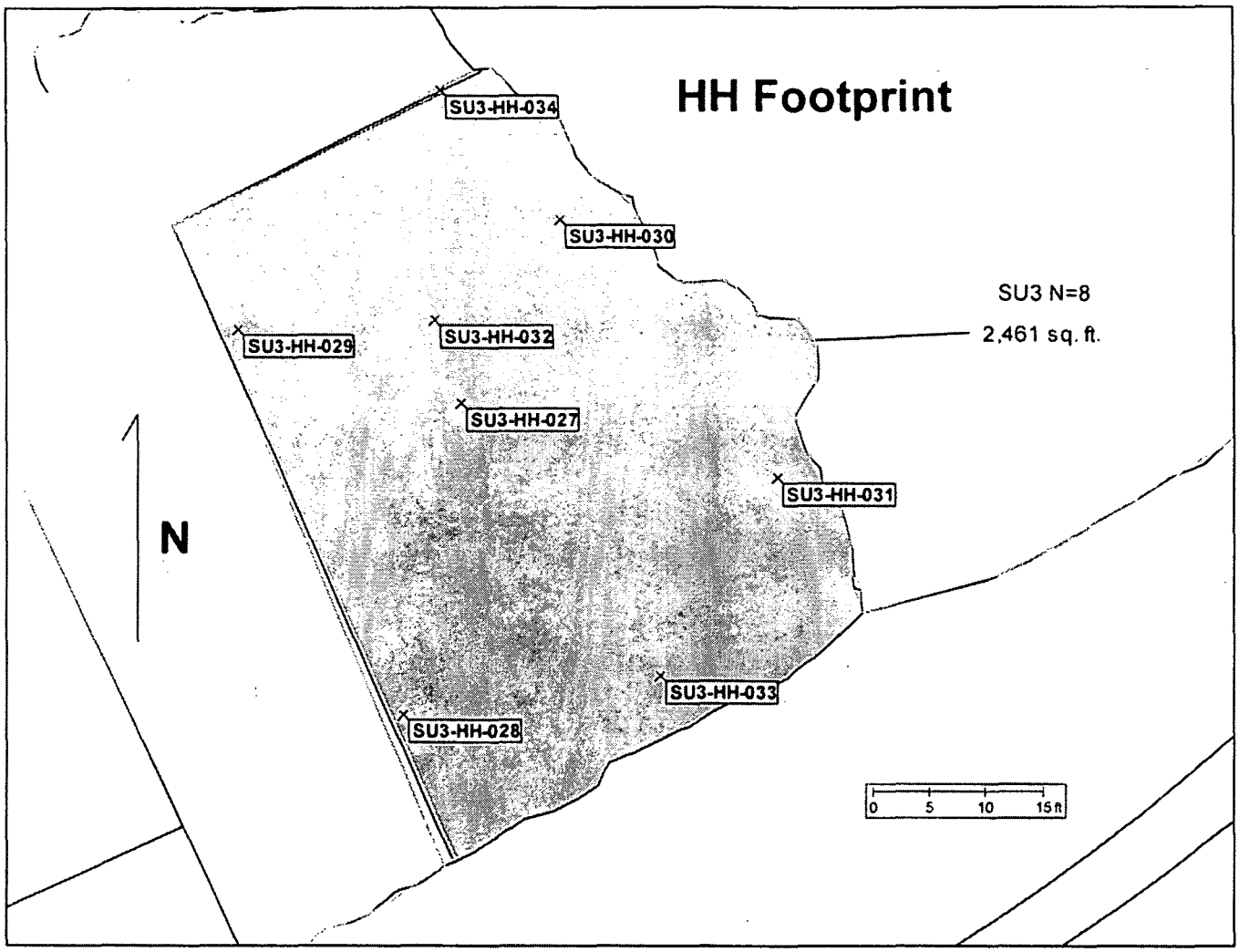

Figure 5: SU3 Verification Locations

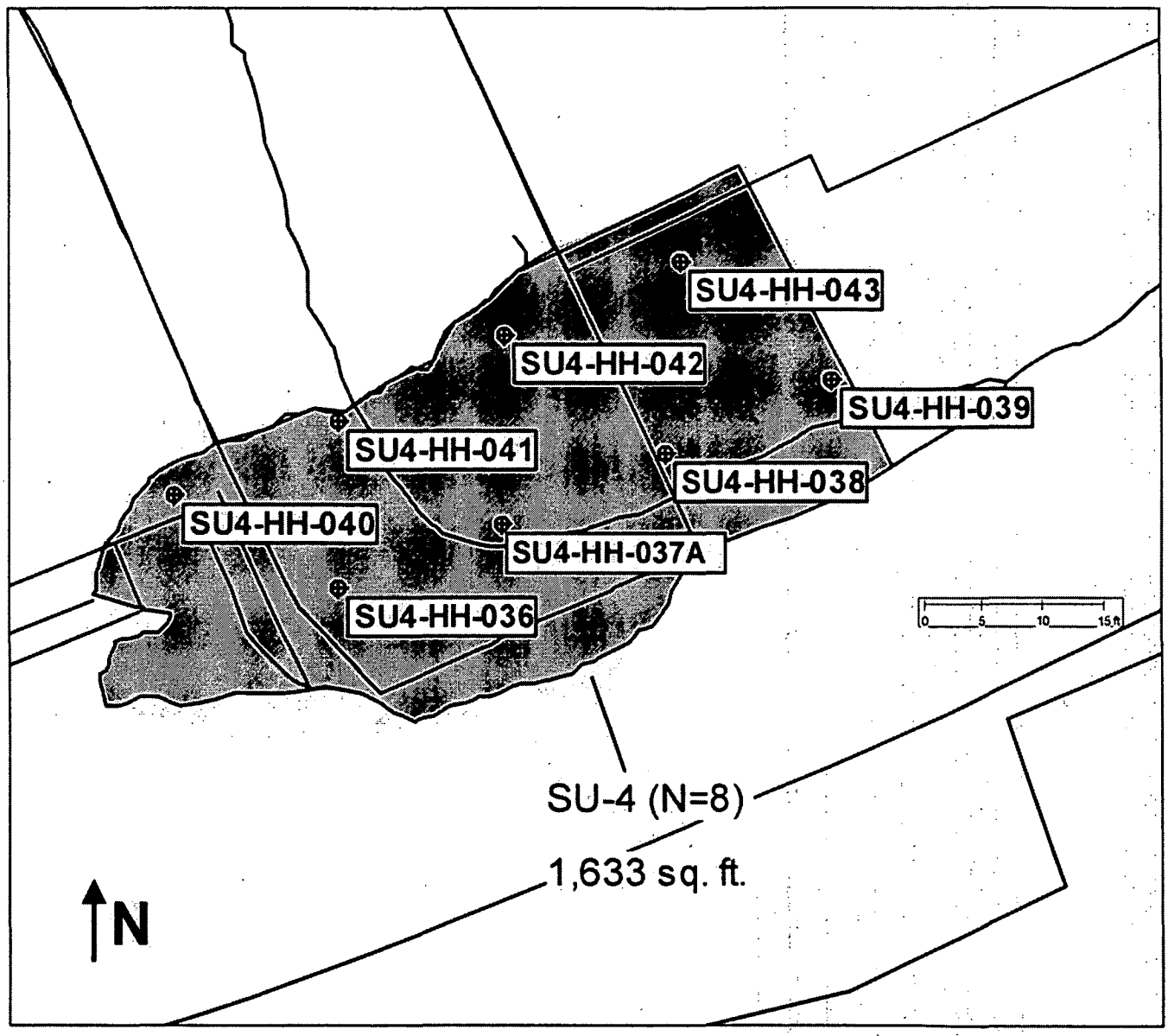

Figure 6: SU4 Verification Locations

A12/108

APPENDIX B

TABLES

A13/108

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Table 1: Verification Results (SUs 1-4) [pCi/g]

Location	Date	Analyte	CO	Result	DL	DQ	LQ	Easting	Northing
SU1-HH-001	20050721	Thorium-228	2.6	0.5	0.04			1465215	598498.3
SU1-HH-001	20050721	Thorium-230	2.8	1.08	0.03			1465215	598498.3
SU1-HH-001	20050721	Thorium-232	2.1	0.55	0.03			1465215	598498.3
SU1-HH-002	20050721	Thorium-228	2.6	0.82	0.04			1465242	598472.1
SU1-HH-002	20050721	Thorium-230	2.8	1.61	0.03			1465242	598472.1
SU1-HH-002	20050721	Thorium-232	2.1	0.77	0.02			1465242	598472.1
SU1-HH-004	20050722	Thorium-228	2.6	0.58	0.05			1465369	598540.4
SU1-HH-004	20050722	Thorium-230	2.8	1.43	0.03			1465369	598540.4
SU1-HH-004	20050722	Thorium-232	2.1	0.56	0.03			1465369	598540.4
SU1-HH-005	20050722	Thorium-228	2.6	0.38	0.02			1465340	598537
SU1-HH-005	20050722	Thorium-230	2.8	0.72	0.02			1465340	598537
SU1-HH-005	20050722	Thorium-232	2.1	0.41	0.02			1465340	598537
SU1-HH-006	20050721	Thorium-228	2.6	1.1	0.02			1465322	598523.3
SU1-HH-006	20050721	Thorium-230	2.8	0.94	0.02			1465322	598523.3
SU1-HH-006	20050721	Thorium-232	2.1	1.15	0.02			1465322	598523.3
SU1-HH-007	20050721	Thorium-228	2.6	0.6	0.04			1465401	598495.5
SU1-HH-007	20050721	Thorium-230	2.8	0.74	0.03			1465401	598495.5
SU1-HH-007	20050721	Thorium-232	2.1	0.58	0.02			1465401	598495.5
SU1-HH-008	20050721	Thorium-228	2.6	0.87	0.02			1465308	598477.8
SU1-HH-008	20050721	Thorium-230	2.8	1.32	0.02			1465308	598477.8
SU1-HH-008	20050721	Thorium-232	2.1	0.79	0.02			1465308	598477.8
SU1-HH-035	20050824	Thorium-228	2.6	0.64	0.14			1465235	598440.5
SU1-HH-035	20050824	Thorium-230	2.8	1.86	0.08			1465235	598440.5
SU1-HH-035	20050824	Thorium-232	2.1	0.59	0.06			1465235	598440.5
SU2-HH-011	20050721	Actinium-227	4.6	0.54	0.54	UJ	U	1465273	598431.6
SU2-HH-011	20050721	Actinium-228	1.9	0.79	0.49			1465273	598431.6
SU2-HH-011	20050721	Americium-241	63	0.19	0.19	UJ	U	1465273	598431.6
SU2-HH-011	20050721	Bismuth-207	1.2	0.086	0.086	UJ	U	1465273	598431.6
SU2-HH-011	20050721	Bismuth-210M	8.3	0.12	0.12	UJ	U	1465273	598431.6
SU2-HH-011	20050721	Bismuth-212	9.87	1.04	0.88			1465273	598431.6
SU2-HH-011	20050721	Bismuth-214	1.17	0.82	0.18			1465273	598431.6
SU2-HH-011	20050721	Cesium-137	3.8	0.13	0.13	UJ	U	1465273	598431.6
SU2-HH-011	20050721	Cobalt-60	0.7	0.12	0.12	UJ	U	1465273	598431.6
SU2-HH-011	20050721	Lead-210	7.4	2.5	2.5	U	U	1465273	598431.6
SU2-HH-011	20050721	Lead-212	16.6	0.98	0.19			1465273	598431.6
SU2-HH-011	20050721	Lead-214	8.9	0.76	0.17			1465273	598431.6
SU2-HH-011	20050721	Potassium-40	47.8	26.3	1.1			1465273	598431.6
SU2-HH-011	20050721	Protactinium-231	4	3	3	U	U	1465273	598431.6
SU2-HH-011	20050721	Radium-226	2.9	0.82	0.18	J		1465273	598431.6
SU2-HH-011	20050721	Radium-228	2.1	0.79	0.49			1465273	598431.6
SU2-HH-011	20050721	Silver-108M	1.2	0.07	0.07		U	1465273	598431.6
SU2-HH-011	20050721	Thallium-208	0.5	0.28	0.11			1465273	598431.6
SU2-HH-011	20050721	Thorium-228	2.6	1.18	0.08			1465273	598431.6
SU2-HH-011	20050721	Thorium-230	2.8	1.35	0.04			1465273	598431.6
SU2-HH-011	20050721	Thorium-232	2.1	1.1	0.03			1465273	598431.6
SU2-HH-011	20050721	Thorium-232	2.1	0.79	0.49			1465273	598431.6
SU2-HH-012	20050722	Actinium-227	4.6	0.5	0.5	UJ	U	1465288	598431.6
SU2-HH-012	20050722	Americium-241	63	0.2	0.2	UJ	U	1465288	598431.6
SU2-HH-012	20050722	Bismuth-207	1.2	0.095	0.095	UJ	U	1465288	598431.6
SU2-HH-012	20050722	Bismuth-210M	8.3	0.11	0.11	UJ	U	1465288	598431.6
SU2-HH-012	20050722	Bismuth-214	1.17	0.53	0.25			1465288	598431.6

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Table 1: Verification Results (SUs 1-4) [pCi/g]

Location	Date	Analyte	CO	Result	DL	DQ	LQ	Easting	Northing
SU2-HH-012	20050722	Cesium-137	3.8	0.1	0.1	UJ	U	1465288	598431.6
SU2-HH-012	20050722	Cobalt-60	0.7	0.1	0.1	UJ	U	1465288	598431.6
SU2-HH-012	20050722	Lead-210	7.4	3	3	U	U	1465288	598431.6
SU2-HH-012	20050722	Lead-212	16.6	0.73	0.17			1465288	598431.6
SU2-HH-012	20050722	Lead-214	8.9	0.5	0.18			1465288	598431.6
SU2-HH-012	20050722	Potassium-40	47.8	22.7	1.2			1465288	598431.6
SU2-HH-012	20050722	Protactinium-231	4	3.4	3.4	U	U	1465288	598431.6
SU2-HH-012	20050722	Radium-226	2.9	0.53	0.25	J		1465288	598431.6
SU2-HH-012	20050722	Radium-228	2.1	0.72	0.72	U	U	1465288	598431.6
SU2-HH-012	20050722	Silver-108M	1.2	0.082	0.082		U	1465288	598431.6
SU2-HH-012	20050722	Thallium-208	0.5	0.27	0.1			1465288	598431.6
SU2-HH-012	20050722	Thorium-228	2.6	1.04	0.05			1465288	598431.6
SU2-HH-012	20050722	Thorium-230	2.8	1.11	0.03			1465288	598431.6
SU2-HH-012	20050722	Thorium-232	2.1	1.08	0.03			1465288	598431.6
SU2-HH-013	20050721	Actinium-227	4.6	0.27	0.27	UJ	U	1465250	598444.6
SU2-HH-013	20050721	Americium-241	63	0.11	0.11	UJ	U	1465250	598444.6
SU2-HH-013	20050721	Bismuth-207	1.2	0.06	0.06	UJ	U	1465250	598444.6
SU2-HH-013	20050721	Bismuth-210M	8.3	0.075	0.075	UJ	U	1465250	598444.6
SU2-HH-013	20050721	Bismuth-214	1.17	0.35	0.1			1465250	598444.6
SU2-HH-013	20050721	Cesium-137	3.8	0.054	0.054	UJ	U	1465250	598444.6
SU2-HH-013	20050721	Cobalt-60	0.7	0.072	0.072	UJ	U	1465250	598444.6
SU2-HH-013	20050721	Lead-210	7.4	1.4	1.4	UJ	U	1465250	598444.6
SU2-HH-013	20050721	Lead-212	16.6	0.182	0.11			1465250	598444.6
SU2-HH-013	20050721	Lead-214	8.9	0.35	0.1			1465250	598444.6
SU2-HH-013	20050721	Potassium-40	47.8	9.7	0.5			1465250	598444.6
SU2-HH-013	20050721	Protactinium-231	4	1.5	1.5	UJ	U	1465250	598444.6
SU2-HH-013	20050721	Radium-226	2.9	0.35	0.1	J		1465250	598444.6
SU2-HH-013	20050721	Radium-228	2.1	0.4	0.4	U	U	1465250	598444.6
SU2-HH-013	20050721	Silver-108M	1.2	0.039	0.039		U	1465250	598444.6
SU2-HH-013	20050721	Thallium-208	0.5	0.127	0.07			1465250	598444.6
SU2-HH-013	20050721	Thorium-228	2.6	0.094	0.032	J	J	1465250	598444.6
SU2-HH-013	20050721	Thorium-230	2.8	0.49	0.02			1465250	598444.6
SU2-HH-013	20050721	Thorium-232	2.1	0.21	0.018			1465250	598444.6
SU2-HH-014	20050721	Actinium-227	4.6	0.56	0.56	U	U	1465265	598444.6
SU2-HH-014	20050721	Actinium-228	1.9	1.59	0.37			1465265	598444.6
SU2-HH-014	20050721	Americium-241	63	0.18	0.18	U	U	1465265	598444.6
SU2-HH-014	20050721	Bismuth-207	1.2	0.1	0.1	U	U	1465265	598444.6
SU2-HH-014	20050721	Bismuth-210M	8.3	0.12	0.12	UJ	U	1465265	598444.6
SU2-HH-014	20050721	Bismuth-212	9.87	1.3	0.85			1465265	598444.6
SU2-HH-014	20050721	Bismuth-214	1.17	0.88	0.23			1465265	598444.6
SU2-HH-014	20050721	Cesium-137	3.8	0.13	0.13	UJ	U	1465265	598444.6
SU2-HH-014	20050721	Cobalt-60	0.7	0.17	0.17	UJ	U	1465265	598444.6
SU2-HH-014	20050721	Lead-210	7.4	2.5	2.5	UJ	U	1465265	598444.6
SU2-HH-014	20050721	Lead-212	16.6	0.81	0.19			1465265	598444.6
SU2-HH-014	20050721	Lead-214	8.9	0.78	0.17			1465265	598444.6
SU2-HH-014	20050721	Potassium-40	47.8	25.4	0.8			1465265	598444.6
SU2-HH-014	20050721	Protactinium-231	4	2.9	2.9	UJ	U	1465265	598444.6
SU2-HH-014	20050721	Radium-226	2.9	0.88	0.23	J		1465265	598444.6
SU2-HH-014	20050721	Radium-228	2.1	1.59	0.37			1465265	598444.6
SU2-HH-014	20050721	Silver-108M	1.2	0.082	0.082		U	1465265	598444.6
SU2-HH-014	20050721	Thallium-208	0.5	0.37	0.11			1465265	598444.6

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Table 1: Verification Results (SUs 1-4) [pCi/g]

Location	Date	Analyte	CO	Result	DL	DQ	LQ	Easting	Northing
SU2-HH-014	20050721	Thorium-228	2.6	0.91	0.01			1465265	598444.6
SU2-HH-014	20050721	Thorium-230	2.8	0.94	0.02			1465265	598444.6
SU2-HH-014	20050721	Thorium-232	2.1	1.59	0.37			1465265	598444.6
SU2-HH-014	20050721	Thorium-232	2.1	0.88	0.01			1465265	598444.6
SU2-HH-015	20050721	Actinium-227	4.6	0.56	0.56	UJ	U	1465280	598444.6
SU2-HH-015	20050721	Americium-241	63	0.24	0.24	UJ	U	1465280	598444.6
SU2-HH-015	20050721	Bismuth-207	1.2	0.12	0.12	UJ	U	1465280	598444.6
SU2-HH-015	20050721	Bismuth-210M	8.3	0.16	0.16	UJ	U	1465280	598444.6
SU2-HH-015	20050721	Bismuth-214	1.17	0.82	0.24			1465280	598444.6
SU2-HH-015	20050721	Cesium-137	3.8	0.15	0.15	UJ	U	1465280	598444.6
SU2-HH-015	20050721	Cobalt-60	0.7	0.18	0.18	U	U	1465280	598444.6
SU2-HH-015	20050721	Lead-210	7.4	3	3	UJ	U	1465280	598444.6
SU2-HH-015	20050721	Lead-212	16.6	1.11	0.2			1465280	598444.6
SU2-HH-015	20050721	Lead-214	8.9	0.67	0.17			1465280	598444.6
SU2-HH-015	20050721	Potassium-40	47.8	32.8	1.6			1465280	598444.6
SU2-HH-015	20050721	Protactinium-231	4	3.7	3.7	UJ	U	1465280	598444.6
SU2-HH-015	20050721	Radium-226	2.9	0.82	0.24	J		1465280	598444.6
SU2-HH-015	20050721	Radium-228	2.1	0.87	0.87	U	U	1465280	598444.6
SU2-HH-015	20050721	Silver-108M	1.2	0.109	0.109		U	1465280	598444.6
SU2-HH-015	20050721	Thallium-208	0.5	0.38	0.13			1465280	598444.6
SU2-HH-015	20050721	Thorium-228	2.6	1.1	0.07			1465280	598444.6
SU2-HH-015	20050721	Thorium-230	2.8	1.36	0.05			1465280	598444.6
SU2-HH-015	20050721	Thorium-232	2.1	1.08	0.03			1465280	598444.6
SU2-HH-016	20050721	Actinium-227	4.6	0.5	0.5	UJ	U	1465295	598444.6
SU2-HH-016	20050721	Americium-241	63	0.2	0.2	UJ	U	1465295	598444.6
SU2-HH-016	20050721	Bismuth-207	1.2	0.094	0.094	UJ	U	1465295	598444.6
SU2-HH-016	20050721	Bismuth-210M	8.3	0.14	0.11			1465295	598444.6
SU2-HH-016	20050721	Bismuth-214	1.17	0.49	0.19			1465295	598444.6
SU2-HH-016	20050721	Cesium-137	3.8	0.094	0.094	UJ	U	1465295	598444.6
SU2-HH-016	20050721	Cobalt-60	0.7	0.12	0.12	UJ	U	1465295	598444.6
SU2-HH-016	20050721	Lead-210	7.4	2.4	2.4	UJ	U	1465295	598444.6
SU2-HH-016	20050721	Lead-212	16.6	0.62	0.15			1465295	598444.6
SU2-HH-016	20050721	Lead-214	8.9	0.55	0.16			1465295	598444.6
SU2-HH-016	20050721	Potassium-40	47.8	22.6	1.1			1465295	598444.6
SU2-HH-016	20050721	Protactinium-231	4	2.4	2.4	UJ	U	1465295	598444.6
SU2-HH-016	20050721	Radium-226	2.9	0.49	0.19	J		1465295	598444.6
SU2-HH-016	20050721	Radium-228	2.1	0.77	0.68			1465295	598444.6
SU2-HH-016	20050721	Silver-108M	1.2	0.068	0.068		U	1465295	598444.6
SU2-HH-016	20050721	Thallium-208	0.5	0.338	0.1			1465295	598444.6
SU2-HH-016	20050721	Thorium-228	2.6	0.92	0.09			1465295	598444.6
SU2-HH-016	20050721	Thorium-230	2.8	1.41	0.03			1465295	598444.6
SU2-HH-016	20050721	Thorium-232	2.1	0.91	0.04			1465295	598444.6
SU2-HH-017	20050722	Actinium-227	4.6	0.41	0.41	UJ	U	1465310	598444.6
SU2-HH-017	20050722	Americium-241	63	0.14	0.14	UJ	U	1465310	598444.6
SU2-HH-017	20050722	Bismuth-207	1.2	0.063	0.063	UJ	U	1465310	598444.6
SU2-HH-017	20050722	Bismuth-210M	8.3	0.078	0.078	UJ	U	1465310	598444.6
SU2-HH-017	20050722	Bismuth-214	1.17	0.41	0.13			1465310	598444.6
SU2-HH-017	20050722	Cesium-137	3.8	0.09	0.09	UJ	U	1465310	598444.6
SU2-HH-017	20050722	Cobalt-60	0.7	0.1	0.1	UJ	U	1465310	598444.6
SU2-HH-017	20050722	Lead-210	7.4	1.6	1.6	UJ	U	1465310	598444.6
SU2-HH-017	20050722	Lead-212	16.6	0.27	0.13			1465310	598444.6

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Table 1: Verification Results (SUs 1-4) [pCi/g]

Location	Date	Analyte	CO	Result	DL	DQ	LQ	Easting	Northing
SU2-HH-017	20050722	Lead-214	8.9	0.52	0.13			1465310	598444.6
SU2-HH-017	20050722	Potassium-40	47.8	8.6	1			1465310	598444.6
SU2-HH-017	20050722	Protactinium-231	4	1.7	1.7	UJ	U	1465310	598444.6
SU2-HH-017	20050722	Radium-226	2.9	0.41	0.13	J		1465310	598444.6
SU2-HH-017	20050722	Radium-228	2.1	0.43	0.43	U	U	1465310	598444.6
SU2-HH-017	20050722	Silver-108M	1.2	0.053	0.053		U	1465310	598444.6
SU2-HH-017	20050722	Thallium-208	0.5	0.119	0.077			1465310	598444.6
SU2-HH-017	20050722	Thorium-228	2.6	0.43	0.06			1465310	598444.6
SU2-HH-017	20050722	Thorium-230	2.8	1.46	0.04			1465310	598444.6
SU2-HH-017	20050722	Thorium-232	2.1	0.46	0.04			1465310	598444.6
SU2-HH-018	20050721	Actinium-227	4.6	0.26	0.26	UJ	U	1465243	598457.6
SU2-HH-018	20050721	Americium-241	63	0.098	0.098	UJ	U	1465243	598457.6
SU2-HH-018	20050721	Bismuth-207	1.2	0.025	0.025	UJ	U	1465243	598457.6
SU2-HH-018	20050721	Bismuth-210M	8.3	0.056	0.056	UJ	U	1465243	598457.6
SU2-HH-018	20050721	Bismuth-214	1.17	0.31	0.11			1465243	598457.6
SU2-HH-018	20050721	Cesium-137	3.8	0.08	0.08	UJ	U	1465243	598457.6
SU2-HH-018	20050721	Cobalt-60	0.7	0.071	0.071	UJ	U	1465243	598457.6
SU2-HH-018	20050721	Lead-210	7.4	1.2	1.2	UJ	U	1465243	598457.6
SU2-HH-018	20050721	Lead-212	16.6	0.243	0.089			1465243	598457.6
SU2-HH-018	20050721	Lead-214	8.9	0.39	0.09			1465243	598457.6
SU2-HH-018	20050721	Potassium-40	47.8	9.4	0.1			1465243	598457.6
SU2-HH-018	20050721	Protactinium-231	4	1.4	1.4	UJ	U	1465243	598457.6
SU2-HH-018	20050721	Radium-226	2.9	0.31	0.11	J		1465243	598457.6
SU2-HH-018	20050721	Radium-228	2.1	0.36	0.36	U	U	1465243	598457.6
SU2-HH-018	20050721	Silver-108M	1.2	0.04	0.04		U	1465243	598457.6
SU2-HH-018	20050721	Thallium-208	0.5	0.095	0.052			1465243	598457.6
SU2-HH-018	20050721	Thorium-228	2.6	0.36	0.05			1465243	598457.6
SU2-HH-018	20050721	Thorium-230	2.8	0.59	0.03			1465243	598457.6
SU2-HH-018	20050721	Thorium-232	2.1	0.34	0.03			1465243	598457.6
SU2-HH-019	20050721	Actinium-227	4.6	0.33	0.33	UJ	U	1465258	598457.6
SU2-HH-019	20050721	Actinium-228	1.9	0.47	0.29			1465258	598457.6
SU2-HH-019	20050721	Americium-241	63	0.16	0.16	UJ	U	1465258	598457.6
SU2-HH-019	20050721	Bismuth-207	1.2	0.081	0.081	UJ	U	1465258	598457.6
SU2-HH-019	20050721	Bismuth-210M	8.3	0.12	0.12	UJ	U	1465258	598457.6
SU2-HH-019	20050721	Bismuth-214	1.17	0.5	0.16			1465258	598457.6
SU2-HH-019	20050721	Cesium-137	3.8	0.098	0.098	UJ	U	1465258	598457.6
SU2-HH-019	20050721	Cobalt-60	0.7	0.12	0.12	UJ	U	1465258	598457.6
SU2-HH-019	20050721	Lead-210	7.4	1.9	1.9	UJ	U	1465258	598457.6
SU2-HH-019	20050721	Lead-212	16.6	0.56	0.12			1465258	598457.6
SU2-HH-019	20050721	Lead-214	8.9	0.31	0.17			1465258	598457.6
SU2-HH-019	20050721	Potassium-40	47.8	16	0.7			1465258	598457.6
SU2-HH-019	20050721	Protactinium-231	4	2.3	2.3	UJ	U	1465258	598457.6
SU2-HH-019	20050721	Radium-226	2.9	0.5	0.16	J		1465258	598457.6
SU2-HH-019	20050721	Radium-228	2.1	0.47	0.29			1465258	598457.6
SU2-HH-019	20050721	Silver-108M	1.2	0.078	0.078		U	1465258	598457.6
SU2-HH-019	20050721	Thallium-208	0.5	0.169	0.083			1465258	598457.6
SU2-HH-019	20050721	Thorium-228	2.6	0.66	0.04			1465258	598457.6
SU2-HH-019	20050721	Thorium-230	2.8	0.74	0.01			1465258	598457.6
SU2-HH-019	20050721	Thorium-232	2.1	0.6	0.02			1465258	598457.6
SU2-HH-019	20050721	Thorium-232	2.1	0.47	0.29			1465258	598457.6
SU2-HH-020	20050721	Actinium-227	4.6	0.41	0.41	U	U	1465273	598457.6

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Table 1: Verification Results (SUs 1-4) [pCi/g]

Location	Date	Analyte	CO	Result	DL	DQ	LQ	Easting	Northing
SU2-HH-020	20050721	Actinium-228	1.9	0.65	0.29			1465273	598457.6
SU2-HH-020	20050721	Americium-241	63	0.14	0.14	UJ	U	1465273	598457.6
SU2-HH-020	20050721	Bismuth-207	1.2	0.077	0.077	UJ	U	1465273	598457.6
SU2-HH-020	20050721	Bismuth-210M	8.3	0.178	0.13			1465273	598457.6
SU2-HH-020	20050721	Bismuth-214	1.17	0.35	0.16			1465273	598457.6
SU2-HH-020	20050721	Cesium-137	3.8	0.082	0.082	UJ	U	1465273	598457.6
SU2-HH-020	20050721	Cobalt-60	0.7	0.14	0.14	UJ	U	1465273	598457.6
SU2-HH-020	20050721	Lead-210	7.4	2	2	UJ	U	1465273	598457.6
SU2-HH-020	20050721	Lead-212	16.6	0.52	0.16			1465273	598457.6
SU2-HH-020	20050721	Lead-214	8.9	0.54	0.12			1465273	598457.6
SU2-HH-020	20050721	Potassium-40	47.8	15.4	0.8			1465273	598457.6
SU2-HH-020	20050721	Protactinium-231	4	1.9	1.9	UJ	U	1465273	598457.6
SU2-HH-020	20050721	Radium-226	2.9	0.35	0.16	J		1465273	598457.6
SU2-HH-020	20050721	Radium-228	2.1	0.65	0.29			1465273	598457.6
SU2-HH-020	20050721	Silver-108M	1.2	0.058	0.058		U	1465273	598457.6
SU2-HH-020	20050721	Thallium-208	0.5	0.147	0.057			1465273	598457.6
SU2-HH-020	20050721	Thorium-228	2.6	0.77	0.05			1465273	598457.6
SU2-HH-020	20050721	Thorium-230	2.8	1.4	0.04			1465273	598457.6
SU2-HH-020	20050721	Thorium-232	2.1	0.82	0.04			1465273	598457.6
SU2-HH-020	20050721	Thorium-232	2.1	0.65	0.29			1465273	598457.6
SU2-HH-021	20050721	Actinium-227	4.6	0.42	0.42	UJ	U	1465288	598457.6
SU2-HH-021	20050721	Americium-241	63	0.16	0.16	UJ	U	1465288	598457.6
SU2-HH-021	20050721	Bismuth-207	1.2	0.065	0.065	UJ	U	1465288	598457.6
SU2-HH-021	20050721	Bismuth-210M	8.3	0.11	0.11	UJ	U	1465288	598457.6
SU2-HH-021	20050721	Bismuth-214	1.17	0.59	0.13			1465288	598457.6
SU2-HH-021	20050721	Cesium-137	3.8	0.11	0.11	UJ	U	1465288	598457.6
SU2-HH-021	20050721	Cobalt-60	0.7	0.12	0.12	UJ	U	1465288	598457.6
SU2-HH-021	20050721	Lead-210	7.4	2.2	2.2	UJ	U	1465288	598457.6
SU2-HH-021	20050721	Lead-212	16.6	0.48	0.16			1465288	598457.6
SU2-HH-021	20050721	Lead-214	8.9	0.554	0.308		U	1465288	598457.6
SU2-HH-021	20050721	Potassium-40	47.8	20.4	0.6			1465288	598457.6
SU2-HH-021	20050721	Protactinium-231	4	2.7	2.7	UJ	U	1465288	598457.6
SU2-HH-021	20050721	Radium-226	2.9	0.59	0.13	J		1465288	598457.6
SU2-HH-021	20050721	Radium-228	2.1	0.59	0.59	U	U	1465288	598457.6
SU2-HH-021	20050721	Silver-108M	1.2	0.061	0.061		U	1465288	598457.6
SU2-HH-021	20050721	Thallium-208	0.5	0.335	0.083			1465288	598457.6
SU2-HH-021	20050721	Thorium-228	2.6	0.69	0.04			1465288	598457.6
SU2-HH-021	20050721	Thorium-230	2.8	0.71	0.03			1465288	598457.6
SU2-HH-021	20050721	Thorium-232	2.1	0.77	0.03			1465288	598457.6
SU2-HH-022	20050721	Actinium-227	4.6	0.38	0.38	UJ	U	1465303	598457.6
SU2-HH-022	20050721	Americium-241	63	0.14	0.14	UJ	U	1465303	598457.6
SU2-HH-022	20050721	Bismuth-207	1.2	0.059	0.059	UJ	U	1465303	598457.6
SU2-HH-022	20050721	Bismuth-210M	8.3	0.089	0.089	UJ	U	1465303	598457.6
SU2-HH-022	20050721	Bismuth-214	1.17	0.32	0.13			1465303	598457.6
SU2-HH-022	20050721	Cesium-137	3.8	0.085	0.085	UJ	U	1465303	598457.6
SU2-HH-022	20050721	Cobalt-60	0.7	0.11	0.11	UJ	U	1465303	598457.6
SU2-HH-022	20050721	Lead-210	7.4	1.7	1.7	UJ	U	1465303	598457.6
SU2-HH-022	20050721	Lead-212	16.6	0.53	0.14			1465303	598457.6
SU2-HH-022	20050721	Lead-214	8.9	0.34	0.14			1465303	598457.6
SU2-HH-022	20050721	Potassium-40	47.8	17.3	0.6			1465303	598457.6
SU2-HH-022	20050721	Protactinium-231	4	2.2	2.2	U	U	1465303	598457.6

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Table 1: Verification Results (SUs 1-4) [pCi/g]

Location	Date	Analyte	CO	Result	DL	DQ	LQ	Easting	Northing
SU2-HH-022	20050721	Radium-226	2.9	0.32	0.13	J		1465303	598457.6
SU2-HH-022	20050721	Radium-228	2.1	0.58	0.55			1465303	598457.6
SU2-HH-022	20050721	Silver-108M	1.2	0.045	0.045		U	1465303	598457.6
SU2-HH-022	20050721	Thallium-208	0.5	0.156	0.07			1465303	598457.6
SU2-HH-022	20050721	Thorium-228	2.6	0.87	0.06			1465303	598457.6
SU2-HH-022	20050721	Thorium-230	2.8	1.11	0.05			1465303	598457.6
SU2-HH-022	20050721	Thorium-232	2.1	0.87	0.03			1465303	598457.6
SU2-HH-023	20050721	Actinium-227	4.6	0.4	0.4	UJ	U	1465265	598470.6
SU2-HH-023	20050721	Americium-241	63	0.15	0.15	UJ	U	1465265	598470.6
SU2-HH-023	20050721	Bismuth-207	1.2	0.086	0.086	UJ	U	1465265	598470.6
SU2-HH-023	20050721	Bismuth-210M	8.3	0.44	0.1			1465265	598470.6
SU2-HH-023	20050721	Bismuth-214	1.17	0.32	0.19			1465265	598470.6
SU2-HH-023	20050721	Cesium-137	3.8	0.068	0.068	UJ	U	1465265	598470.6
SU2-HH-023	20050721	Cobalt-60	0.7	0.1	0.1	UJ	U	1465265	598470.6
SU2-HH-023	20050721	Lead-210	7.4	2.1	2.1	UJ	U	1465265	598470.6
SU2-HH-023	20050721	Lead-212	16.6	0.38	0.1			1465265	598470.6
SU2-HH-023	20050721	Lead-214	8.9	0.237	0.237		U	1465265	598470.6
SU2-HH-023	20050721	Potassium-40	47.8	11.2	0.7			1465265	598470.6
SU2-HH-023	20050721	Protactinium-231	4	1.9	1.9	UJ	U	1465265	598470.6
SU2-HH-023	20050721	Radium-226	2.9	0.32	0.19	J		1465265	598470.6
SU2-HH-023	20050721	Radium-228	2.1	0.52	0.52	U	U	1465265	598470.6
SU2-HH-023	20050721	Silver-108M	1.2	0.076	0.076		U	1465265	598470.6
SU2-HH-023	20050721	Thallium-208	0.5	0.108	0.08			1465265	598470.6
SU2-HH-023	20050721	Thorium-228	2.6	0.66	0.04			1465265	598470.6
SU2-HH-023	20050721	Thorium-230	2.8	0.83	0.04			1465265	598470.6
SU2-HH-023	20050721	Thorium-232	2.1	0.48	0.03			1465265	598470.6
SU2-HH-024	20050721	Actinium-227	4.6	0.4	0.4	U	U	1465280	598470.6
SU2-HH-024	20050721	Americium-241	63	0.14	0.14	UJ	U	1465280	598470.6
SU2-HH-024	20050721	Bismuth-207	1.2	0.072	0.072	U	U	1465280	598470.6
SU2-HH-024	20050721	Bismuth-210M	8.3	0.079	0.079	UJ	U	1465280	598470.6
SU2-HH-024	20050721	Bismuth-214	1.17	0.35	0.13			1465280	598470.6
SU2-HH-024	20050721	Cesium-137	3.8	0.074	0.074	UJ	U	1465280	598470.6
SU2-HH-024	20050721	Cobalt-60	0.7	0.088	0.088	UJ	U	1465280	598470.6
SU2-HH-024	20050721	Lead-210	7.4	1.7	1.7	UJ	U	1465280	598470.6
SU2-HH-024	20050721	Lead-212	16.6	0.446	0.092			1465280	598470.6
SU2-HH-024	20050721	Lead-214	8.9	0.34	0.12			1465280	598470.6
SU2-HH-024	20050721	Potassium-40	47.8	13.3	0.9			1465280	598470.6
SU2-HH-024	20050721	Protactinium-231	4	1.8	1.8	UJ	U	1465280	598470.6
SU2-HH-024	20050721	Radium-226	2.9	0.35	0.13	J		1465280	598470.6
SU2-HH-024	20050721	Radium-228	2.1	0.43	0.43	U	U	1465280	598470.6
SU2-HH-024	20050721	Silver-108M	1.2	0.052	0.052		U	1465280	598470.6
SU2-HH-024	20050721	Thallium-208	0.5	0.138	0.066			1465280	598470.6
SU2-HH-024	20050721	Thorium-228	2.6	0.71	0.06			1465280	598470.6
SU2-HH-024	20050721	Thorium-230	2.8	0.62	0.04			1465280	598470.6
SU2-HH-024	20050721	Thorium-232	2.1	0.63	0.03			1465280	598470.6
SU2-HH-025	20050721	Actinium-227	4.6	0.51	0.51	UJ	U	1465295	598470.6
SU2-HH-025	20050721	Actinium-228	1.9	0.84	0.36			1465295	598470.6
SU2-HH-025	20050721	Americium-241	63	0.23	0.23	UJ	U	1465295	598470.6
SU2-HH-025	20050721	Bismuth-207	1.2	0.091	0.091	UJ	U	1465295	598470.6
SU2-HH-025	20050721	Bismuth-210M	8.3	0.14	0.14	UJ	U	1465295	598470.6
SU2-HH-025	20050721	Bismuth-214	1.17	0.64	0.24			1465295	598470.6

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Table 1: Verification Results (SUs 1-4) [pCi/g]

Location	Date	Analyte	CO	Result	DL	DQ	LQ	Easting	Northing
SU2-HH-025	20050721	Cesium-137	3.8	0.11	0.11	UJ	U	1465295	598470.6
SU2-HH-025	20050721	Cobalt-60	0.7	0.16	0.16	UJ	U	1465295	598470.6
SU2-HH-025	20050721	Lead-210	7.4	2.6	2.6	UJ	U	1465295	598470.6
SU2-HH-025	20050721	Lead-212	16.6	0.73	0.18			1465295	598470.6
SU2-HH-025	20050721	Lead-214	8.9	0.79	0.19			1465295	598470.6
SU2-HH-025	20050721	Potassium-40	47.8	24.4	0.9			1465295	598470.6
SU2-HH-025	20050721	Protactinium-231	4	2.6	2.6	UJ	U	1465295	598470.6
SU2-HH-025	20050721	Radium-226	2.9	0.64	0.24	J		1465295	598470.6
SU2-HH-025	20050721	Radium-228	2.1	0.84	0.36			1465295	598470.6
SU2-HH-025	20050721	Silver-108M	1.2	0.08	0.08		U	1465295	598470.6
SU2-HH-025	20050721	Thallium-208	0.5	0.27	0.1			1465295	598470.6
SU2-HH-025	20050721	Thorium-228	2.6	0.81	0.08			1465295	598470.6
SU2-HH-025	20050721	Thorium-230	2.8	1.32	0.03			1465295	598470.6
SU2-HH-025	20050721	Thorium-232	2.1	0.84	0.36			1465295	598470.6
SU2-HH-025	20050721	Thorium-232	2.1	0.82	0.04			1465295	598470.6
SU2-HH-026D	20050721	Actinium-227	4.6	0.46	0.46	UJ	U	1465288	598483.6
SU2-HH-026	20050721	Actinium-227	4.6	0.38	0.38	UJ	U	1465288	598483.6
SU2-HH-026	20050721	Actinium-228	1.9	0.66	0.3			1465288	598483.6
SU2-HH-026D	20050721	Americium-241	63	0.17	0.17	UJ	U	1465288	598483.6
SU2-HH-026	20050721	Americium-241	63	0.15	0.15	UJ	U	1465288	598483.6
SU2-HH-026D	20050721	Bismuth-207	1.2	0.094	0.094	U	U	1465288	598483.6
SU2-HH-026	20050721	Bismuth-207	1.2	0.074	0.074	UJ	U	1465288	598483.6
SU2-HH-026D	20050721	Bismuth-210M	8.3	0.11	0.11	UJ	U	1465288	598483.6
SU2-HH-026	20050721	Bismuth-210M	8.3	0.1	0.1	UJ	U	1465288	598483.6
SU2-HH-026	20050721	Bismuth-214	1.17	0.59	0.15			1465288	598483.6
SU2-HH-026D	20050721	Bismuth-214	1.17	0.48	0.22			1465288	598483.6
SU2-HH-026	20050721	Cesium-137	3.8	0.099	0.099	UJ	U	1465288	598483.6
SU2-HH-026D	20050721	Cesium-137	3.8	0.095	0.095	UJ	U	1465288	598483.6
SU2-HH-026D	20050721	Cobalt-60	0.7	0.13	0.13	UJ	U	1465288	598483.6
SU2-HH-026	20050721	Cobalt-60	0.7	0.12	0.12	UJ	U	1465288	598483.6
SU2-HH-026D	20050721	Lead-210	7.4	2.3	2.3	UJ	U	1465288	598483.6
SU2-HH-026	20050721	Lead-210	7.4	1.9	1.9	U	U	1465288	598483.6
SU2-HH-026D	20050721	Lead-212	16.6	0.63	0.16			1465288	598483.6
SU2-HH-026	20050721	Lead-212	16.6	0.54	0.13			1465288	598483.6
SU2-HH-026D	20050721	Lead-214	8.9	0.55	0.15			1465288	598483.6
SU2-HH-026	20050721	Lead-214	8.9	0.39	0.13			1465288	598483.6
SU2-HH-026D	20050721	Potassium-40	47.8	18.4	1.1			1465288	598483.6
SU2-HH-026	20050721	Potassium-40	47.8	16.1	0.8			1465288	598483.6
SU2-HH-026D	20050721	Protactinium-231	4	2.7	2.7	UJ	U	1465288	598483.6
SU2-HH-026	20050721	Protactinium-231	4	2.3	2.3	UJ	U	1465288	598483.6
SU2-HH-026	20050721	Radium-226	2.9	0.59	0.15	J		1465288	598483.6
SU2-HH-026D	20050721	Radium-226	2.9	0.48	0.22	J		1465288	598483.6
SU2-HH-026D	20050721	Radium-228	2.1	0.76	0.73			1465288	598483.6
SU2-HH-026	20050721	Radium-228	2.1	0.66	0.3			1465288	598483.6
SU2-HH-026D	20050721	Silver-108M	1.2	0.068	0.068		U	1465288	598483.6
SU2-HH-026	20050721	Silver-108M	1.2	0.066	0.066		U	1465288	598483.6
SU2-HH-026	20050721	Thallium-208	0.5	0.204	0.078			1465288	598483.6
SU2-HH-026D	20050721	Thallium-208	0.5	0.146	0.096			1465288	598483.6
SU2-HH-026D	20050721	Thorium-228	2.6	0.69	0.04			1465288	598483.6
SU2-HH-026	20050721	Thorium-228	2.6	0.6	0.04			1465288	598483.6
SU2-HH-026	20050721	Thorium-230	2.8	1.12	0.02			1465288	598483.6

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Table 1: Verification Results (SUs 1-4) [pCi/g]

Location	Date	Analyte	CO	Result	DL	DQ	LQ	Easting	Northing
SU2-HH-026D	20050721	Thorium-230	2.8	0.91	0.02			1465288	598483.6
SU2-HH-026D	20050721	Thorium-232	2.1	0.86	0.03			1465288	598483.6
SU2-HH-026	20050721	Thorium-232	2.1	0.68	0.02			1465288	598483.6
SU3-HH-027	20050721	Thorium-228	2.6	1.07	0.05			1465334	598496.6
SU3-HH-027	20050721	Thorium-230	2.8	1.19	0.03			1465334	598496.6
SU3-HH-027	20050721	Thorium-232	2.1	0.82	0.03			1465334	598496.6
SU3-HH-027	20050721	Tritium	328	160	0.6			1465334	598496.6
SU3-HH-028	20050721	Thorium-228	2.6	0.84	0.1			1465329	598469.2
SU3-HH-028	20050721	Thorium-230	2.8	1.07	0.04			1465329	598469.2
SU3-HH-028	20050721	Thorium-232	2.1	0.81	0.04			1465329	598469.2
SU3-HH-028	20050721	Tritium	328	187	0.6			1465329	598469.2
SU3-HH-029	20050721	Thorium-228	2.6	0.49	0.04			1465314	598503.2
SU3-HH-029	20050721	Thorium-230	2.8	0.78	0.02			1465314	598503.2
SU3-HH-029	20050721	Thorium-232	2.1	0.58	0.03			1465314	598503.2
SU3-HH-029	20050721	Tritium	328	19.4	0.6			1465314	598503.2
SU3-HH-030	20050721	Thorium-228	2.6	1.05	0.03			1465343	598512.9
SU3-HH-030	20050721	Thorium-230	2.8	1.01	0.03			1465343	598512.9
SU3-HH-030	20050721	Thorium-232	2.1	0.91	0.02			1465343	598512.9
SU3-HH-030	20050721	Tritium	328	1.75	0.58	J	J	1465343	598512.9
SU3-HH-031	20050721	Thorium-228	2.6	0.47	0.04			1465362	598490
SU3-HH-031	20050721	Thorium-230	2.8	1.13	0.03			1465362	598490
SU3-HH-031	20050721	Thorium-232	2.1	0.51	0.03			1465362	598490
SU3-HH-031	20050721	Tritium	328	8	0.6			1465362	598490
SU3-HH-032D	20050721	Thorium-228	2.6	0.44	0.03			1465332	598504.1
SU3-HH-032	20050721	Thorium-228	2.6	0.42	0.03			1465332	598504.1
SU3-HH-032	20050721	Thorium-230	2.8	0.92	0.02			1465332	598504.1
SU3-HH-032D	20050721	Thorium-230	2.8	0.84	0.02			1465332	598504.1
SU3-HH-032	20050721	Thorium-232	2.1	0.41	0.03			1465332	598504.1
SU3-HH-032D	20050721	Thorium-232	2.1	0.39	0.03			1465332	598504.1
SU3-HH-032	20050721	Tritium	328	36.8	0.6			1465332	598504.1
SU3-HH-032D	20050721	Tritium	328	32.9	0.6			1465332	598504.1
SU3-HH-033	20050721	Thorium-228	2.6	1.1	0.04			1465352	598472.6
SU3-HH-033	20050721	Thorium-230	2.8	1.09	0.04			1465352	598472.6
SU3-HH-033	20050721	Thorium-232	2.1	0.96	0.04			1465352	598472.6
SU3-HH-033	20050721	Tritium	328	29.3	0.6			1465352	598472.6
SU3-HH-034	20050721	Thorium-228	2.6	0.85	0.03			1465332	598524.3
SU3-HH-034	20050721	Thorium-230	2.8	0.79	0.02			1465332	598524.3
SU3-HH-034	20050721	Thorium-232	2.1	0.85	0.01			1465332	598524.3
SU4-HH-036	20050824	Thorium-228	2.6	0.37	0.07			1465231	598409.2
SU4-HH-036	20050824	Thorium-230	2.8	1.08	0.04			1465231	598409.2
SU4-HH-036	20050824	Thorium-232	2.1	0.25	0.045			1465231	598409.2
SU4HH-037AD	20050920	Thorium-228	2.6	1.28	0.03			1465245	598414.4
SU4HH-037A	20050920	Thorium-228	2.6	1.11	0.04			1465245	598414.4
SU4HH-037AD	20050920	Thorium-230	2.8	1.17	0.02			1465245	598414.4
SU4HH-037A	20050920	Thorium-230	2.8	0.99	0.03			1465245	598414.4
SU4HH-037A	20050920	Thorium-232	2.1	1.18	0.02			1465245	598414.4
SU4HH-037AD	20050920	Thorium-232	2.1	1.16	0.03			1465245	598414.4
SU4-HH-038	20050824	Thorium-228	2.6	0.72	0.13			1465258	598420.2
SU4-HH-038	20050824	Thorium-230	2.8	0.88	0.08			1465258	598420.2
SU4-HH-038	20050824	Thorium-232	2.1	0.67	0.08			1465258	598420.2
SU4-HH-039	20050824	Thorium-228	2.6	0.59	0.09			1465272	598426.3

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Table 1: Verification Results (SUs 1-4) [pCi/g]

Location	Date	Analyte	CO	Result	DL	DQ	LQ	Easting	Northing
SU4-HH-039	20050824	Thorium-230	2.8	1.31	0.05			1465272	598426.3
SU4-HH-039	20050824	Thorium-232	2.1	0.5	0.05			1465272	598426.3
SU4-HH-040	20050824	Thorium-228	2.6	0.93	0.08			1465217	598416.9
SU4-HH-040	20050824	Thorium-230	2.8	1.39	0.03			1465217	598416.9
SU4-HH-040	20050824	Thorium-232	2.1	1	0.05			1465217	598416.9
SU4-HH-041	20050824	Thorium-228	2.6	0.51	0.08			1465231	598422.8
SU4-HH-041	20050824	Thorium-230	2.8	1.31	0.06			1465231	598422.8
SU4-HH-041	20050824	Thorium-232	2.1	0.68	0.05			1465231	598422.8
SU4-HH-042D	20050824	Thorium-228	2.6	0.67	0.07			1465245	598430.2
SU4-HH-042	20050824	Thorium-228	2.6	0.46	0.07			1465245	598430.2
SU4-HH-042D	20050824	Thorium-230	2.8	1.02	0.04			1465245	598430.2
SU4-HH-042	20050824	Thorium-230	2.8	0.83	0.04			1465245	598430.2
SU4-HH-042D	20050824	Thorium-232	2.1	0.61	0.04			1465245	598430.2
SU4-HH-042	20050824	Thorium-232	2.1	0.45	0.05			1465245	598430.2
SU4-HH-043	20050824	Thorium-228	2.6	0.52	0.06			1465260	598436.1
SU4-HH-043	20050824	Thorium-230	2.8	0.79	0.04			1465260	598436.1
SU4-HH-043	20050824	Thorium-232	2.1	0.4	0.05			1465260	598436.1

CO: cleanup objective
DL: detection limit
DQ: data qualifier
LQ: lab qualifiier

U: not detected
J: estimated
D: duplicate
A: resample

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APPENDIX C

POST-EX SUD EXCERPTS

Post-Ex SUD for HH Footprint & PRS 151 ..... A24/99
Appendix III for HH Footprint & PRS 151 ..... A31/99
Post-Ex SUD for PRS 413 ..... A41/99

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Survey Unit Design (SUD)

Project: HH Footprint & PRS151

Review & Approval

Project Engineer: Denny Lammlein _____

Reviewer: James Fontaine _____

Reviewer: _____

Document	Title
Action Memo	UGL Action Memorandum, Final, September 2003
Action Memo	Building HH Removal Action ~~(for PRS 151)~~, August 2002
RP	UGLs Removal Plan, Final, April ~~2004~~
WP	Soil Removal, ELT-MND-105-00, April 2004
VSAP	Standard Verification Sampling & Analysis Plan, Final, August 2004

☐ **Pre-Excavation** or ☒ **Post-Excavation**?

Summary of Changes (for Post-Excavation SUDs ONLY) (see following pages for details)	YES	NO
1. Did the COC(s) change?	X	
2. Did the grid size or N change?	X	
3. Did the classification change?		X
4. Were bias/judgmental samples collected?		X
5. Other significant change?	X	

A24/03

SUD Worksheet

Acronyms

AGL	Above Ground Line
AM	Action Memo
BGS	Below Ground Surface
CO	Cleanup Objective
COC	Contaminant of Concern
DCGL	Derived Concentration Guideline Level
Delta	Delta (change)
EPA	Environmental Protection Agency
FSS	Final Status Survey
HH	Hydrolysis House (HH) building
HS	Hot Spot
LBGR	Lower Bound of the Gray Region
MARSSIM	Multi – Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MEIMS	Mound Environmental Information Management System
ml	milliliter
N	Number of Samples
NA or N/A	Non-applicable
NaI	Sodium Iodide
OHL	Overhead Line
PCi/g	Pico Curies per Gram
PRS	Potential Release Site
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RadCon	Radiological Control
RASS	Remedial Action Support Survey
Rel Shft	Relative Shift
RP	Removal Plan
RSDS	Radiological Survey Data Sheet
SD	Sanitary Disposal (SD) Building
R/SW	Research/Special Works (R/SW) Complex
SSL	Soil Screening Level
SU	Survey Unit
SUD	Survey Unit Design
TBD	To Be Determined
UGL	Underground Lines
SVSAP	Standard Verification Sampling and Analysis Plan
WD	Waste Disposal (WD) Building
WDA	Waste Disposal Annex (WDA) Building
WP	Work Package

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Item 1

Summary of historic information relevant to this SUD:

HH Building was originally constructed to treat polonium mission effluents generated in T Building. This involved neutralizing process acid solutions and removing bismuth and other elements before sending effluents to WD Building for further processing. Wastes included those generated from Protactinium and Ionium programs in the mid-1950s when a pilot plant was operated in HH Building. The process was moved to SW Building, and by late in the 1950s, HH Building underwent modifications for a change in mission to a research and development and rare/stable gas production facility.

In the 1980s, a pipe rupture released several thousands of gallons of water in the connecting tunnel between T and HH Buildings. Although the source was non-process water, the large quantity resulted in flooding in HH basement, which washed radiological contamination from at least one walk-in fume hood and contaminated large portions of basement floor surfaces. HH Building (with the exception of the slab and north wall) was demolished in the Spring of 2004.

The slab, north wall, PRS 151 (Room HH-6 alpha wastewater sump – tank 237), & utilities/structures to 3' below grade will be removed, after which, verification sampling will be performed.

Item 2

Summary of historic **data** relevant to SU:

No COCs are listed in the UGL AM. Of the limited data available within the HH footprint, only Th-232 was found, and only at one location, SCR383, above CO (2.4 pCi/g). All other data were below respective COs. It is therefore a Class 1 area based on the isolated removal and the COC is Th-232.

Only two sample locations within the HH footprint have data suitable for standard deviation calculations. Due to the larger volume of data and likely similar Th-232 levels between the two areas (see note below), the spreadsheet calculations (Attachment B) for HH footprint were based on the dataset for the adjacent WD/HH hillsides (Attachment A). This data should mimic the "as-left" condition after HH soil and slab is removed. Figure 1 shows the location of HH relative to the HH-WD hillside.

RASS samples will be collected during the slab, wall, soil, and utility removals. The use of waste management samples, guide dig samples, etc., will also be used to determine final COCs. COCs will be adjusted as appropriate in the Post-Excavation SUD.

Note: Figure 1 shows a former rad waste line that conveyed wastes from HH to WD. This line leaked several times in the 1950s. Since the effluent was from HH and leaked on the hillside, and the majority of samples near the rad waste line were Th232, the conclusion was reached that the levels might be similar.

Item 3a

COC	BASIS	CO (pCi/g)	HS (pCi/g)	MAX (pCi/g)	Offsite Analysis & Compendium Method: gamma (A-015)	Iso Pu (A-012)	Iso Th (A-012)	Iso U (A-012)
Th-232	Historic results > CO.	2.1	3.5	2.4			X	

Analyses are to be performed per Mound Methods Compendium and COs (for surface samples/analysis i.e., bedrock, asphalt, concrete) as applicable. Compendium Method A-012 is Isotopic Uranium, Isotopic Plutonium, and Isotopic Thorium by Alpha Spectrometry, Compendium Method A-014 is for Tritium, and Compendium Method A-015 is Gamma Spectrometry. Surface samples/analysis are to be in accordance with MD-80036: OP 10001, 10002, 30005, 30007, and 30040. Hard surfaces will be swiped and gross alpha and beta measurements will be performed and compared to the most restrictive COC in Mound 2000 Work Plan Appendix A Table 1 (NUREG 1.86 Regulatory Guide). If the location fails to meet the most restrictive criteria then it will be sent to alpha spec for determination of the COC so the applicable, instead of the most restrictive, criteria can be applied.

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Changes if any, from Pre-ex SUD: Two additional survey units have been added to the SUD based on RASS data (Reference Alpha Spec RASS Data [SUs #2 and #3] included in Appendix II - Alpha spec analysis provides a definitive radiological analysis for certain analytes such as Th230 and Tritium, which could not be seen by gamma spectroscopy). Survey Unit #2 is at the location of PRS 151, the Room HH-6 alpha wastewater sump and includes the soil load-out area for the sump. After removal of the sump, RASS sampling indicated 11 additional COCs at this location. The list of COCs, as well as all new information relative to this Post-Ex SUD, is provided in Appendix II. Survey Unit #3 was also added to this SUD because of Tritium contamination found at the east end of the former HH building as a result of RASS sampling. New information regarding this Survey Unit will also be found in Appendix II. COCs for SU#3 are Th232 and Tritium. Soil Screening Level (SSL) for Tritium is 328 pCi/g. (See Appendix II – HH Survey Unit #3 – "Development of a Conservative Soil Screening Level for Tritium for Group 9, HH Footprint, Pathway: Migration to Groundwater")

Item 3b	Chem basis for std dev, AM COCs/New COCs NA

Item 4	Classify Areas & provide justification	Selection	Class	Scan Coverage guidelines
	The Survey Unit is Class 1 because soil > CO is being remediated.	X	1	100%
			2	10-90%
			3	Judgmental

Changes if any, from Pre-ex SUD: Both new Survey Units (#2 and #3) will also be Class 1.

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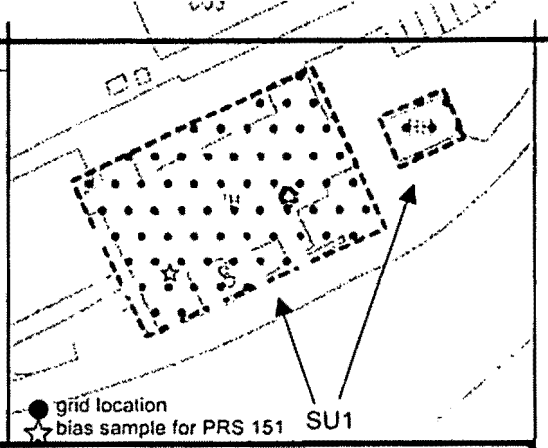
Item 5	Subdivide areas into SUs See Attachment A for Historical Sample Data – Standard Deviations for COCs. The data set is historical data without results that exceed COs in order to mimic the "as-left" condition. See Attachment B for MARRSIM SU Spreadsheet	This SUD consists of one survey unit. (see figure at right) SU1 covers the entire HH Building Footprint including the nearby former HH chiller building footprint. The approximate size of SU1 is 16,200 sf (~1500 m2). Samples located on 30' tri grid = 17	

Changes if any from Pre-Ex SUD: Survey Unit #1 covers the bulk of the building footprint and adjoining areas. The new area is 11,265 sq. ft., smaller than stated above due to subtracting out the areas for Survey Units 2 and 3.

Survey Unit #2 covers the PRS 151 wastewater sump area and adjoining load-out area. This SU is 3,406 sq. ft.

Survey Unit #3 is located at the eastern end of the original HH footprint. This SU is 2,344 sq. ft.

See Appendix II for the new Survey Unit Map for the HH Footprint as well as revised COCs.

Item 6a

Calculations / Rad

1. Calculate the (s) for each COC listed above: See Attachment B.

2. Number of Samples (N): See Attachment B.

Spreadsheet-Calculated Numbers of Samples: SU1 = 15 samples (30' tri grid).

SU1 Scanning MDC (Area Factor) corrected = n/a.

30' foot triangular grid = 17 samples

The determination of the number of samples is consistent with section 3.7 of the standard VSAP, which provides for a default grid spacing.

Sample locations were selected by overlaying onto the SU a 30-foot triangular grid with a random starting point.

A total of 17 sample locations will be assessed.

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	Changes if any, from Pre-Ex SUD: Actual extent of excavation shown in HH Footprint Survey Units Plan, Appendix II. Number of samples changed as a result. SU#1 now has eight samples because of the lower standard deviation for Th232. SU#2 has 18 samples using a 15-foot grid per the MARSSIM spreadsheet calculation; excavation area is 3,406 sq. ft. SU#3 has eight samples based on the MARSSIM calculation; area is 2,344 sq. ft. A total of 32 samples will be assessed.
Item 6b	Calculations/Chem, Std dev, Number of Samples N/A
	Changes if any, from Pre-ex SUD: None
Item 7	Grid spacing Triangular 30 foot grid..
	Changes if any, from Pre-ex SUD: As noted in Item 6a above, Survey Unit #1 will not use a grid: eight random samples will be selected as calculated by the MARSSIMS spreadsheet and mapped using the Visual Sampling Plan. SU#2 will use a 15-foot grid based on paragraph 3.7 of the SVSAP (default 15' grid.) SU#3 does not use a grid; eight random samples are selected based on the MARSSIM spreadsheet calculation and mapped using the Visual Sampling Plan.
Item 8	**QA/QC:** Collection of QA/QC samples shall be in accordance with the Standard VSAP, Final, August 2004. Q-002 Chain-of-Custody Procedures — S-001 General Instructions for Field Personnel Q-003 Documentation Requirements — S-002 Soil Sampling With a Spade and Scoop Q-004 Laboratory Data Reduction — S-028 Sample Control and Documentation Q-006 Validation of Laboratory Data Packages — S-029 Guide to Handling, Packaging, and Shipping of Samples and Method Q-002 Q-007 Data Assessment Q-008 Data Integrity Verification Q-010 Electronic Data Deliverable Format Specifications – MEIMS Std. ...
Item 9	Bias/judgment samples Verification of PRS 151 will be accomplished by collection of one sample at the base of sump excavation. COCs will be based on RASS data. If no COCs are found, analyses will be consistent with that of HH footprint samples. (Additional bias samples are always within the discretion of the EPA.)
	Changes if any, from Pre-ex SUD: COCs are listed in Appendix II. Survey Unit #3 has eight random samples. No bias samples are planned by CH2M HILL.

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Item 10	Not otherwise covered.../ comments
	Potentially impacted work areas, where excavated materials are expected to be loaded into haulers, will be combined with existing survey units or added as new survey units in the Post Excavation SUD. Site policy requires performance of onsite soil screening (NaI or germanium) on verification samples slated for offsite analysis and evaluation of the results prior to shipment. This analysis will generally be performed on a split of the verification sample containerized in an EPA dish (approximately 500 mL) but may be performed on the actual verification sample as long as containerization requirements are maintained for the offsite lab. Count time of the analysis will be sufficient to meet the cleanup objectives (COs) of the contaminants of concern (COCs) requiring verification. In-process sampling events (Characterization and Remedial Action Support Survey (RASS) samples) will be conducted during the entire PRS remediation. Those samples will undergo gamma spectrometry analysis to guide actions. RASS sampling of the remediated areas will be used to determine if the FSS (verification) sampling can be conducted. These samples will undergo gamma spectroscopy analysis If there is an insufficient volume of soil to fill an EPA dish within a 1 m x 1 m square centered on the proposed sample location, due to bedrock or obstruction (such as a structure, foundation, or utility bank which is not to be removed), then the soil analysis will not be performed. In lieu of a soil analysis, RadCon will survey the surface per COs and provide documentation thereof in an RSDS. The RSDS(s) will be included as documentation. Any final sample location that does not meet the surface release criteria will be submitted to the Core Team for concurrence prior to the area being back-filled. Removal of the HH north wall presents a safety hazard and potential loss of the roadway should backfill not be accomplished in a timely manner. With core team concurrence and favorable on-site sampling results, backfill will be accomplished at risk to the extent necessary to preserve the upper roadway. Geotextile membrane will be placed at the removal interface.
	Changes if any, from Pre-ex SUD: Load out area occurred either on the paved roadway and was released by radcon procedures or within the remediated area to be sampled.

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Development of a Conservative Soil Screening Level for Tritium at Group 9, HH Footprint, Pathway: Migration to Groundwater

The memo serves as documentation describing the development of a conservative soil screening level at the Group 9, HH Footprint, for tritium via the migration to groundwater pathway.

The discussion below outlines a general procedure based on application of soil screening equations for determining potential impacts to groundwater from soils contaminated with tritium. The discussion is followed by an outline of the details associated with the calculation for determining the tritium soil screening level for the Group 9, HH Footprint.

INTRODUCTION

This guidance outlines a procedure for determining a threshold level of tritium that can remain in soils without causing an adverse impact to the underlying groundwater system. The methodology is identical to that outlined in Attachment D4 of Mound Environmental Restoration's Guidance Document titled: "*Potential Release Site Packages, Reading and Understanding, Volume II, Preliminary, August 7, 1996.* Specific information regarding the calculation of soil screening levels for tritium for the migration to groundwater pathway was obtained from the United States Environmental Protection Agency document titled: *"Soil Screening Level Guidance for Radionuclides, Technical Background Document, October, 2000."*

TECHNICAL DISCUSSION

The soil matrix can be compartmentalized to include a contaminant inventory distributed within the solid soil materials (sorbed contamination), the soil water (dissolved contamination) and soil air (vapor phase). This methodology is intended to be utilized only for the quantity of tritium that exists within the soil matrix moisture, (i.e. the amount of tritium bound within the water molecule). As a result, the soil equilibrium partition equation reduces to an expression that accounts strictly for the soil moisture compartment (i.e. K_d for tritium = 0 and tritium vapor phase concentration is negligible). These assumptions are consistent with the United States Environmental Protection Agency document titled: *"Soil Screening Level Guidance for Radionuclides, Technical Background Document, October, 2000,"* (see Table 5.3 of Part 5 and equations 18 and 19 of Part 2).

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The resulting soil screening level equation for migration of tritium to groundwater is therefore:

$$SSL = C_w \ (1 \times 10^{-3}) \{ \phi_w / \rho_b \}$$

Where:

SSL = soil screening level (pCi/g)
C_w = target soil leachate concentration (pCi/L)
ϕ_w = water filled porosity
ρ_b = dry bulk density (kg/L)
(1×10^{-3}) = conversion factor (kg/g)

Mound's Environmental Laboratory provides analytical techniques for determining the amount of tritium associated with the soil moisture. The analytical process is found in Mound's Analytical procedure MD 80030. Tritium soil sample results are reported as pCi/gram and solely reflect the amount of tritium bound within the soil water. Any site-specific soil screening level that is calculated for a location at the Mound facility can be compared to the analytical results obtained from Mound's Environmental lab. If the comparison reveals that soil analytical results are less than the calculated soil screening level it can be assumed that the tritium bound within the overlying soil water will not negatively impact the underlying groundwater system.

TRITIUM SOIL SCREENING LEVEL FOR GROUP 9 HH FOOTPRINT

The following calculation is developed for a soil contamination area located at the Group 9, HH Footprint.

The first step in calculating a soil screening level is development of a physical model depicting the contaminated area. The parameters required for the model include the following:

- The technical basis for selecting this dimension is a combination of the physical dimensions of HH building and the soil sample results from a characterization effort conducted in June, 2005. Twelve characterization samples were taken across the HH Footprint with only two detections located in the southeast portion of the footprint (sample HH-3H-03 and HH-3H-04 at 10.8 and 89.6 pCi/g respectively). This is the area historically associated with Tritium processing. The characterization data supports the use of a source length parallel to groundwater flow limited to soils in this southeast portion of the HH Building footprint). **The source length parallel to groundwater flow is therefore modeled at 10 meters.**

- Horizontal distance to a receptor (for the Group 9 HH Footprint this was taken to be the direction parallel to groundwater flow to the edge of the BVA or about 130 meters)

- Hydraulic gradient (this was calculated from the slope of the topographic surface which mimics the underlying topographic slope of the bedrock surface and in the vicinity of Group 9 HH Footprint is approximately 0.20 ft/ft.

- Saturated porosity of contaminated soil (Ow) is estimated to equal approximately 25%. This is based on observation of the soils in the group 9 area around HH Building. It is the opinion of the Mound hydrogeologist that the soils predominantly represent a mixture of sandy/gravely glacial till that has been heavily disturbed by construction activity. The disturbance generally results in an increase in material porosity as gravel backfill is brought in for placement around foundations and utility trenches. The following table provides some estimates of ranges of porosity for various materials. The soil in the group 9 area is a disturbed glacial till with mixed sand and gravel.

Porosity Ranges for Sediments

Material	Porosity (%)
well-sorted sand or gravel	25-50
sand and gravel, mixed	20-35
glacial till	10-20
Silt	35-50
Clay	33-60
(Based on Meinzer (1923a); Davis (1969); Cohen (1965); and MacCary and Lambert (1962) as quoted by C.W. Fetter [2])	

The remaining input parameters are characteristic of the Mound site and bedrock system and do not vary (for modeling purposes) from location to location. They include:

Aquifer thickness: 15 meters
Hydraulic conductivity: 52 meters/yr
Infiltration rate: 0.15 meters/yr
Dry soil bulk density: 1.6 Kg/L

The input parameters are then input into a spreadsheet model that in turn calculates a mixing zone depth and dilution factor that allows for a conservative reduction of the leachate concentration based upon the physical characteristics of the aquifer and the soil contaminate dimensions. The methodology is described in detail in a Mound document titled "*Potential Release Site Packages, Reading and Understanding, VolumeII, Preliminary, August 7, 1996.*

The table below shows the input parameter and resulting model generated mixing zone depth and dilution factor.

Input Parameters and Resulting Dilution Attenuation Factor for Example Soil Screening Level Calculation for Tritium at WD Building

Parameters for soil leaching calculation:			
Definition	**Parameter**	**Main Hilltop soil**	**Units**
source length parallel to ground water flow	L	10	m
aquifer thickness (DOE 1994)	da	15	m
hydraulic conductivity (DOE 1994)	K	52	m/y
hydraulic gradient at the source	i	0.20	m/m
horizontal distance to receptor	xr	130	m
infiltration rate (Schairbaum & Frost 1988)	in	0.15	m/y
soil-water partition coefficient (Koc * foc for organic chemicals)	Kd	chemical specific	L/kg
saturated porosity	Ow	0.25	

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air filled porosity	Oa	0.28	
Henry's Law constant * 41 (0 for metals and radionuclides)	H	chemical specific	
dry soil bulk density	B	1.6	kg/L
soil organic carbon/water partition coefficient	Koc	chemical specific	L/kg
fraction organic carbon in soil (DOE Mound Plant Data Base)	foc	0.02	
mixing zone depth	d	15	m
dilution factor (used to multiply the target concentration)	df=	105	

The calculated dilution attenuation factor = 105

The dilution factor is subsequently used to determine a target soil leachate concentration that is a function of either the Federal Maximum Contaminant Level (MCL) or some risk based guideline value for groundwater. The target soil leachate concentration is determined by multiplying the dilution attenuation factor by the allowable groundwater concentration (i.e. MCL or risk based guideline value).

For tritium, the allowable groundwater concentration was selected to correspond to the tritium MCL of 20,000 pCi/L.

The resulting target soil leachate concentration is therefore (20,000 pCi/L)(105)

Target Soil Leachate Concentration = 2,100,000 pCi/L

Taking into consideration the equilibrium soil relationships described in the earlier the soil screening level or SSL is calculated via the following equation:

$$SSL = C_w \ (1 \times 10^{-3})\{ \phi_w / \rho_b \}$$

Where:

SSL = soil screening level (pCi/g)
C_w = target soil leachate concentration (pCi/L)
ϕ_w = water filled porosity
ρ_b = dry bulk density (kg/L)
(1×10^{-3}) = conversion factor (kg/g)

For soils underling the Group 9 PRS:

ρ_b dry bulk density is assumed to be 1.6 Kg/L

ϕ_w water filled porosity of fill soils underlying the Group 9 PRS is assumed to be 0.25

therefore:

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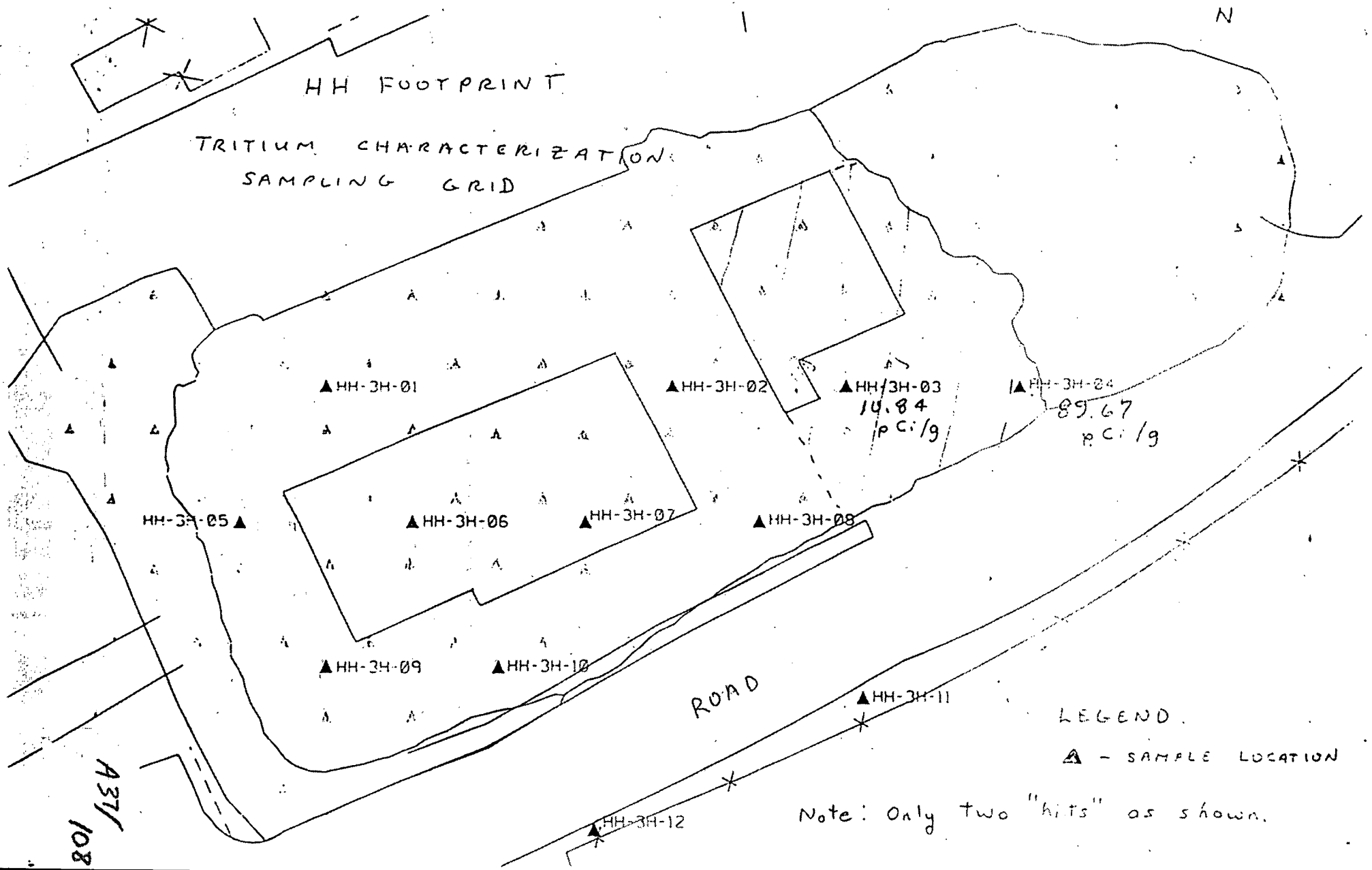
SSL = 2,100,000 pCi/L (1×10^{-3}) { 0.25/1.6 }

SSL ≅ 328 pCi/gram


N
HH FOOTPRINT
TRITIUM CHARACTERIZATION
SAMPLING GRID
HH-3H-01
HH-3H-02
HH-3H-03
14.84
pCi/g
HH-3H-04
89.67
pCi/g
HH-3H-05
HH-3H-06
HH-3H-07
HH-3H-08
HH-3H-09
HH-3H-10
HH-3H-11
HH-3H-12
ROAD
LEGEND.
▲ - SAMPLE LOCATION
Note: Only two "hits" as shown.

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Laboratory ID#:	0503671 - 0503682	
Project/function:	HH Building	
Submitted:	Jun 16, 2005	
Submitted by:	J. Jendrek	
Point of Contact:	J. Jendrek	x3691
RSDS#:	N/A	
Date:	Jun 16, 2005	

TRITIUM CHARACTERIZATION SAMPLING, CONDUCTED AT THE REQUEST OF THE CORE TEAM ON 2 JUN 05.

SAMPLING DATE: JUN 14, 2005

Lab ID 0503671
Sample Location HH-3H-01

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

Lab ID 0503672
Sample Location HH-3H-02

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

Lab ID 0503673
Sample Location HH-3H-03

Isotope	pCi/g	Uncertainty +/-	LDL
3H	10.84	3.02	3.71

Lab ID 0503674
Sample Location HH-3H-04

Isotope	pCi/g	Uncertainty +/-	LDL
3H	89.67	3.40	3.71

Lab ID 0503675
Sample Location HH-3H-05

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

Lab ID 0503676
Sample Location HH-3H-06

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

Lab ID 0503677
Sample Location HH-3H-07

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

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Lab ID 0503678
Sample Location HH-3H-08

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

Lab ID 0503679
Sample Location HH-3H-09

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

Lab ID 0503680
Sample Location HH-3H-10

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

Lab ID 0503681
Sample Location HH-3H-11

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

Lab ID 0503682
Sample Location HH-3H-12

Isotope	pCi/g	Uncertainty +/-	LDL
3H	<LDL	<LDL	3.71

[redacted]

1585 6-16-05
HP # Date

7783
Dat[redacted] HP # Date

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Project: HH Footprint & PRS151

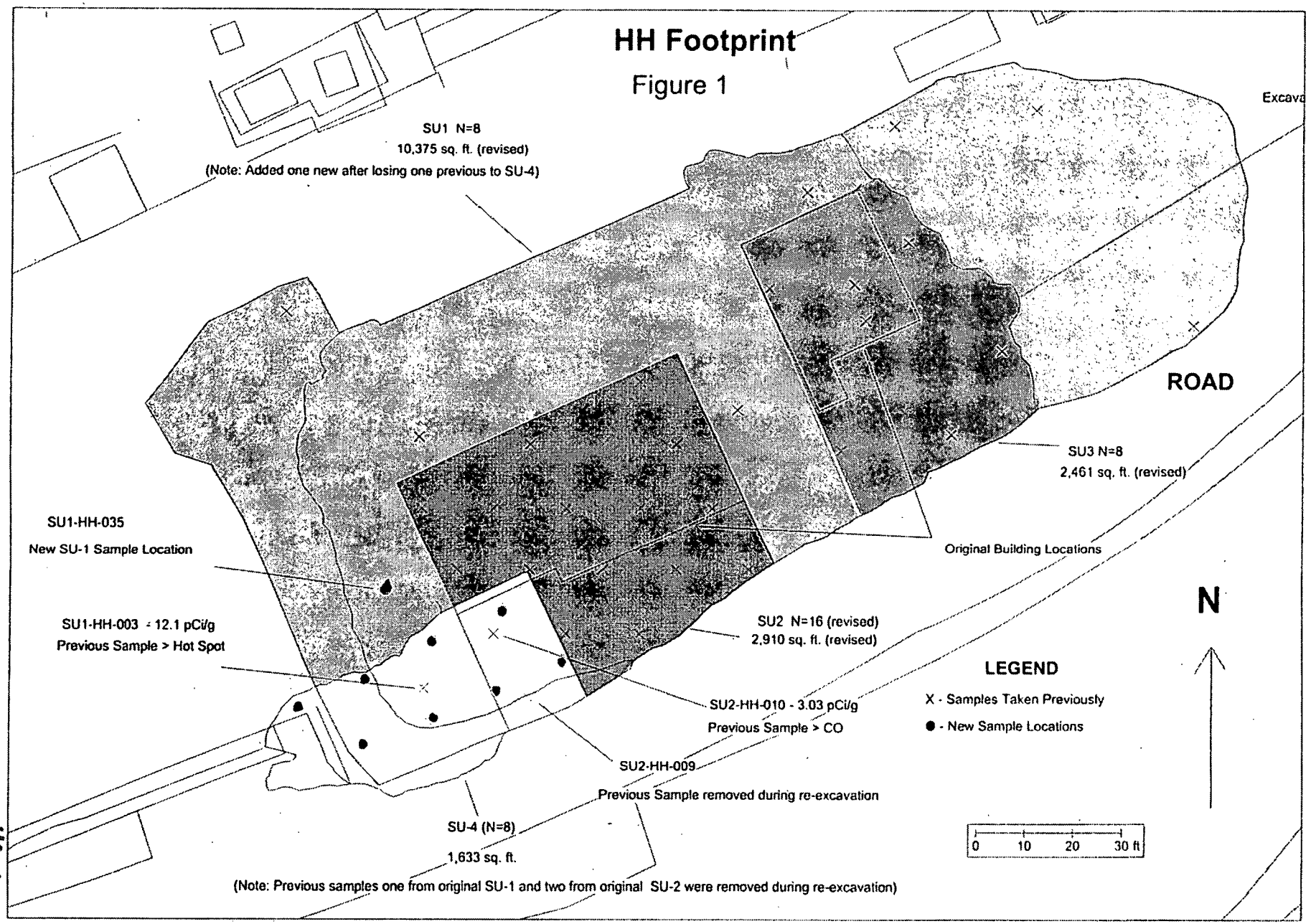
Appendix III

Revision to Approved Post-Ex SUD

- Creation of SU-4
- Sample Map and Locations
- SU-4 MARSSIM Spreadsheet

HH Footprint

Figure 1



A-HH/108

Background for Revision: During final verification sampling of the HH footprint, the following results were found:

Sample	Isotope	Result pCi/g	MDA pCi/g	Cleanup Objective (CO) pCi/g	Hot Spot Criteria (HS) pCi/g
SU1-HH-003	Th-230	12.1	0.03	2.8	4.66
SU2-HH-009	Th-230			2.8	4.66
SU2-HH-010	Th-230	3.03	0.02	2.8	4.66

The SU2-HH-010 result that exceeded CO could have remained, but the SU1-HH-003 result required removal because it exceeded HS. Because Th-230 was not one of the original Contaminants of Concern (COC), it was decided to resample on a 15-foot grid. In addition, a storm drain lay below the elevated sample location, so it was decided to take the whole storm drain out.

COCs for SU-4 (Note: COCs and standard deviations from the adjacent SU-2 were used for SU-4):

COC	(pCi/g)		Offsite Analysis & Compendium Method		Onsite Analysis
	CO	HS	gamma (A-015)	Isc Th (A-012)	Long Count Gamma
Ac-227	4.64	13.7			X
Ag-108m	1.22	3.66			X
Cs-137	3.84	10.7			X
Co-60	0.76	2.12			X
Pb-214	7.45	19.9			X
Pa-231	4.00	11.8			X
Ra-226	2.93	4.79			X
Bi-207	1.24	3.6			X
Bi-210m	8.34	24.9			X
Bi-214	1.17	3.51			X
Th-230	2.8	4.66		X	
Th-232	2.1	3.39		X	

This re-excavation removed sample locations SU1-HH-003, SU2-HH-009, and SU2-HH-010. The creation of SU-4 reduced the area of SU-1 from 11,265 sq. ft. to. 10,375 sq. ft. and SU-2 from 3,405 sq. ft. to 2,910 sq. ft. By removing SU1-HH-003 from the SU-1 area, the number of samples did not meet the 8 calculated in the MARSSIM spreadsheet. Therefore, sample location SU1-HH-035 was added to increase the number of samples in SU-1 back to the required 8.

MARSSIM Spreadsheet-Calculated Numbers of Samples: SU4 = 8 samples

SU4 Scanning MDC (Area Factor) corrected = 56.

15' foot triangular grid = 8 samples

The determination of the number of samples is consistent with section 3.7 of the standard VSAP, which provides for a default grid spacing.

Sample locations were selected by overlaying onto the SU a 15-foot triangular grid with a random starting point.

A total of 8 sample locations will be assessed.

The revised SU1, SU2, and SU3 MARSSIM spreadsheets are due to a change in area.
Revised Scanning MDC (Area Factors) corrected are:
SU1 – n/a
SU2 – 100
SU3 – n/a

HH Footprint Sample Locations

Area: SU-1

X Coord	Y Coord	Label	Value	Type	Status*
1465215	598498.3	SU1-HH-001	0	Random	Previous
1465242	598472.1	SU1-HH-002	0	Random	Previous
1465369	598540.4	SU1-HH-004	0	Random	Previous
1465340	598537	SU1-HH-005	0	Random	Previous
1465322	598523.3	SU1-HH-006	0	Random	Previous
1465401	598495.5	SU1-HH-007	0	Random	Previous
1465308	598477.8	SU1-HH-008	0	Random	Previous
1465235	598440.5	SU1-HH-035	0	Systematic	New

Area: SU-2

X Coord	Y Coord	Label	Value	Type	Status*
1465273	598431.6	SU2-HH-011	0	Hotspot	Previous
1465288	598431.6	SU2-HH-012	0	Hotspot	Previous
1465250	598444.6	SU2-HH-013	0	Hotspot	Previous
1465265	598444.6	SU2-HH-014	0	Hotspot	Previous
1465280	598444.6	SU2-HH-015	0	Hotspot	Previous
1465295	598444.6	SU2-HH-016	0	Hotspot	Previous
1465310	598444.6	SU2-HH-017	0	Hotspot	Previous
1465243	598457.6	SU2-HH-018	0	Hotspot	Previous
1465258	598457.6	SU2-HH-019	0	Hotspot	Previous
1465273	598457.6	SU2-HH-020	0	Hotspot	Previous
1465288	598457.6	SU2-HH-021	0	Hotspot	Previous
1465303	598457.6	SU2-HH-022	0	Hotspot	Previous
1465265	598470.6	SU2-HH-023	0	Hotspot	Previous
1465280	598470.6	SU2-HH-024	0	Hotspot	Previous
1465295	598470.6	SU2-HH-025	0	Hotspot	Previous
1465288	598483.6	SU2-HH-026	0	Hotspot	Previous

Area: SU-3

X Coord	Y Coord	Label	Value	Type	Status*
1465334	598496.6	SU3-HH-027	0	Random	Previous
1465329	598469.2	SU3-HH-028	0	Random	Previous
1465314	598503.2	SU3-HH-029	0	Random	Previous
1465343	598512.9	SU3-HH-030	0	Random	Previous
1465362	598490	SU3-HH-031	0	Random	Previous
1465332	598504.1	SU3-HH-032	0	Random	Previous
1465352	598472.6	SU3-HH-033	0	Random	Previous
1465332	598524.3	SU3-HH-034	0	Random	Previous

Area: SU-4

X Coord	Y Coord	Label	Value	Type	Status*
1465243	598420.8	SU1-HH-003	0	Random	Previous
1465265	598418.7	SU2-HH-009	0	Hotspot	Previous
1465258	598431.6	SU2-HH-010	0	Hotspot	Previous
1465231	598409.2	SU4-HH-036	0	Systematic	New
1465245	598414.4	SU4-HH-037	0	Systematic	New
1465258	598420.2	SU4-HH-038	0	Systematic	New
1465272	598426.3	SU4-HH-039	0	Systematic	New

1465217	598416.9	SU4-HH-040	0	Systematic	New
1465231	598422.8	SU4-HH-041	0	Systematic	New
1465245	598430.2	SU4-HH-042	0	Systematic	New
1465260	598436.1	SU4-HH-043	0	Systematic	New

* Samples marked "Previous" will not be resampled

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Sample Standard Deviation (s)	Radionuclide	Cleanup Objective	Units
	Ac-227+D	4.6	(pCi/g)
	Am-241	63	(pCi/g)
	Ce-141	38	(pCi/g)
	Cs-137+D	3.8	(pCi/g)
	Co-60	0.7	(pCi/g)
	Cu-244	92	(pCi/g)
	Pb-210+D	7.4	(pCi/g)
	Np-237+D	10.4	(pCi/g)
	Ni-95	2.5	(pCi/g)
	Pu-238	55	(pCi/g)
	Pu-239/240	62	(pCi/g)
	Pa-231+D	4	(pCi/g)
	Ra-226+D	2.9	(pCi/g)
	Ra-228	2.1	(pCi/g)
	Th-228+D	2.6	(pCi/g)
	Th-230+D	2.8	(pCi/g)
0.177	Th-232+D	2.1	(pCi/g)
	U-233+D	4.8	(pCi/g)
	U-234	106.1	(pCi/g)
	U-234+D	2	(pCi/g)
	U-235	16.11	(pCi/g)
	U-235+D	3.2	(pCi/g)
	U-238	121.2	(pCi/g)
	U-238+D	2.2	(pCi/g)
	Bi-207	1.2	(pCi/g)
	Bi-210m	8.3	(pCi/g)
	Tc-99	2140	(pCi/g)
	Sr-90	94.72	(pCi/g)

Type I Error	0.05		
$Z_{1-alpha}$	1.645		
Type II Error	0.2		
Z_{1-beta}	0.842		
Effective	0.18	*(s)*	
Sign p	0.993790		

Estimate (N) - Sign Test

DCGL	1
LBGR	0.50
Delta	0.50
(s)	0.18
Rel Shift	2.825
(N)	8.00

Pu-238 Area Factor (N) na

Calculate the Total Effective (s)

Sample Grid Spacing

SU Area	964.88	m^2
Grid Length	10.2	m
Grid Height	8.9	m

Sample Grid Spacing

SU Area	10375	ft^2
Grid Length	33.5	ft
Grid Height	29.0	ft

PRS: HH Footprint

Survey Unit: SU1

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Sample Standard Deviation (s)	Radionuclide	Cleanup Objective	Units
0.264	Ac-227+D	4.6	(pCi/g)
0.004	Ag-108m	1.22	(pCi/g)
	Am-241	63	(pCi/g)
	Ce-141	38	(pCi/g)
0.008	Cs-137+D	3.8	(pCi/g)
0.049	Co-60	0.7	(pCi/g)
	Cu-244	92	(pCi/g)
	Pb-210+D	7.4	(pCi/g)
0.055	Pb-214	7.4	(pCi/g)
	Np-237+D	10.4	(pCi/g)
	Ni-95	2.5	(pCi/g)
	Pu-238	55	(pCi/g)
	Pu-239/240	62	(pCi/g)
0.212	Pa-231+D	4	(pCi/g)
0.234	Ra-226+D	2.9	(pCi/g)
	Ra-228	2.1	(pCi/g)
	Th-228+D	2.6	(pCi/g)
0.5	Th-230+D	2.8	(pCi/g)
0.193	Th-232+D	2.1	(pCi/g)
	U-233+D	4.8	(pCi/g)
	U-234	106.1	(pCi/g)
	U-234+D	2	(pCi/g)
	U-235	16.11	(pCi/g)
	U-235+D	3.2	(pCi/g)
	U-238	121.2	(pCi/g)
	U-238+D	2.2	(pCi/g)
0.057	Bi-207	1.2	(pCi/g)
0.564	Bi-210m	8.3	(pCi/g)
0.063	Bi-214	11.7	(pCi/g)
	Tc-99	2140	(pCi/g)
	Sr-90	94.72	(pCi/g)

Type I Error	0.05		
$Z_{1\text{-alpha}}$	1.645		
Type II Error	0.2		
$Z_{1\text{-beta}}$	0.842		
Effective	0.25	(s)	
Sign p	0.971284		

Estimate (N) - Sign Test

DCGL	1
LBGR	0.50
Delta	0.50
(s)	0.25
Rel Shift	1.964
(N)	9.00

Area Factor Adjusted (N) 100

Calculate the Total Effective (s)

Sample Grid Spacing

SU Area	270.63	m^2
Grid Length	5.1	m
Grid Height	4.4	m

Sample Grid Spacing

SU Area	2910	ft^2
Grid Length	16.7	ft
Grid Height	14.5	ft

PRS: HH Footprint

Survey Unit: SU2

Notes:
Th-230 was identified as the COC of concern with respect to Scan MDC and no table is available in the SVSAP Appendix D.
The table for Pu-238 was used due to being more conservative (Pu-238 Area Factor = 6.4 vs Th-230 Area Factor = 5.51)

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Sample Standard Deviation (s)	Radionuclide	Cleanup Objective	Units
	Ac-227+D	4.6	(pCi/g)
	Am-241	63	(pCi/g)
	Ce-141	38	(pCi/g)
	Cs-137+D	3.8	(pCi/g)
	Co-60	0.7	(pCi/g)
	Cu-244	92	(pCi/g)
	Pb-210+D	7.4	(pCi/g)
	Np-237+D	10.4	(pCi/g)
	Ni-95	2.5	(pCi/g)
	Pu-238	55	(pCi/g)
	Pu-239/240	62	(pCi/g)
	Pa-231+D	4	(pCi/g)
	Ra-226+D	2.9	(pCi/g)
	Ra-228	2.1	(pCi/g)
25.8	Tritium	328	(pCi/g)
	Th-228+D	2.6	(pCi/g)
	Th-230+D	2.8	(pCi/g)
0.177	Th-232+D	2.1	(pCi/g)
	U-233+D	4.8	(pCi/g)
	U-234	106.1	(pCi/g)
	U-234+D	2	(pCi/g)
	U-235	16.11	(pCi/g)
	U-235+D	3.2	(pCi/g)
	U-238	121.2	(pCi/g)
	U-238+D	2.2	(pCi/g)
	Bi-207	1.2	(pCi/g)
	Bi-210m	8.3	(pCi/g)
	Tc-99	2140	(pCi/g)
	Sr-90	94.72	(pCi/g)

Type I Error	0.05		
$Z_{1\text{-alpha}}$	1.645		
Type II Error	0.2		
$Z_{1\text{-beta}}$	0.842		
Effective	0.12	(s)	
Sign p	0.993790		

Estimate (N) - Sign Test

DCGL	1
LBGR	0.66
Delta	0.34
(s)	0.12
Rel Shift	2.949
(N)	8.00

Pu-238 Area Factor (N) na

Calculate the Total Effective (s)

Sample Grid Spacing

SU Area	228.87	m^2
Grid Length	5.0	m
Grid Height	4.3	m

Sample Grid Spacing

SU Area	2461	ft^2
Grid Length	16.3	ft
Grid Height	14.1	ft

PRS: HH Footprint

Survey Unit: SU3

A48/108

Sample Standard Deviation (s)	Radionuclide	Cleanup Objective	Units
0.264	Ac-227+D	4.6	(pCi/g)
0.004	Ag-108m	1.22	(pCi/g)
	Am-241	63	(pCi/g)
	Ce-141	38	(pCi/g)
0.008	Cs-137+D	3.8	(pCi/g)
0.049	Co-60	0.7	(pCi/g)
	Cu-244	92	(pCi/g)
	Pb-210+D	7.4	(pCi/g)
0.055	Pb-214	7.4	(pCi/g)
	Np-237+D	10.4	(pCi/g)
	Ni-95	2.5	(pCi/g)
	Pu-238	55	(pCi/g)
	Pu-239/240	62	(pCi/g)
0.212	Pa-231+D	4	(pCi/g)
0.234	Ra-226+D	2.9	(pCi/g)
	Ra-228	2.1	(pCi/g)
	Th-228+D	2.6	(pCi/g)
0.5	Th-230+D	2.8	(pCi/g)
0.193	Th-232+D	2.1	(pCi/g)
	U-233+D	4.8	(pCi/g)
	U-234	106.1	(pCi/g)
	U-234+D	2	(pCi/g)
	U-235	16.11	(pCi/g)
	U-235+D	3.2	(pCi/g)
	U-238	121.2	(pCi/g)
	U-238+D	2.2	(pCi/g)
0.057	Bi-207	1.2	(pCi/g)
0.564	Bi-210m	8.3	(pCi/g)
0.063	Bi-214	11.7	(pCi/g)
	Tc-99	2140	(pCi/g)
	Sr-90	94.72	(pCi/g)

Type I Error	0.05		
$Z_{1\text{-alpha}}$	1.645		
Type II Error	0.2		
$Z_{1\text{-beta}}$	0.842		
Effective	0.25 (s)		
Sign p	0.993790		

Estimate (N) - Sign Test

DCGL	1
LBGR	0.35
Delta	0.65
(s)	0.25
Rel Shift	2.553
(N)	8.00

Area Factor Adjusted (N) 56

Calculate the Total Effective (s)

Sample Grid Spacing

SU Area	151.87	m^2
Grid Length	4.1	m
Grid Height	3.5	m

Sample Grid Spacing

SU Area	1633	ft^2
Grid Length	13.3	ft
Grid Height	11.5	ft

PRS: HH Footprint

Survey Unit: SU4

Notes:

1) Th-230 was identified as the COC of concern with respect to Scan MDC and no table is available in the SVSAP Appendix D. The table for Pu-238 was used due to being more conservative (Pu-238 Area Factor = 6.4 vs Th-230 Area Factor = 5.51)

2) COCs and standard deviations from the adjacent SU-2 were used for SU-4

A49/168

Survey Unit Design (SUD)

Project: PRS 413

Review & Approval

Project Engineer: R.C. Ransbottom R.C. Ransbottom

Reviewer: James Fontaine James P. Fontaine

Reviewer: _____

Document	Title
Action Memo	*UGL Action Memorandum, Final, September 2003*
RP	*UGLs Removal Plan. Final, April 2004*
WP	*Soil Removal, ELT-MND-105-00, April 2004*
VSAP	*Standard Verification Sampling & Analysis Plan, Final, August 2004*

☐ **Pre-Excavation** or ☒ **Post-Excavation**? 10-31-05

Summary of Changes (for Post-Excavation SUDs ONLY) (see following pages for details)	YES	NO	COMMENT
1. Did the COC(s) change?		X	
2. Did the grid size or N change?	X		deleted
3. Did the classification change?		X	
4. Were bias/judgmental samples collected?		X	
5. Other significant change?	X		No sampling required

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SUD Worksheet

ACRONYMS

AM	Action Memo
BGS	Below Ground Surface
CO	Cleanup Objective
COC	Contaminants of Concern
CU YDS	cubic yards
ELT	Earthline Technologies Inc. (UGL subcontractor)
HS	Hot Spot
MDC	Minimum Detectable Concentration
MEIMS	Mound Environmental Information Management System
mg/kg	milligram per kilogram
MND	Mound
N/A or na	Non-Applicable
PRS	Potential Release Site
QA/QC	Quality Assurance/Quality Control
SD	SD Building (Sewage Disposal)
SSL	Soil Screening Level
Std	Standard
SU	Survey Unit
SUD	Survey Unit Design
UGL	Underground Lines

Item 1	Summary of historic information relevant to this SUD: The Removal Plan associated with this SUD addressed identified contamination areas with contaminants of concern (COCs) above the cleanup objectives (COs). **Note: This SUD is collocated with the PRS 159 area, but because this PRS exclusively involves chemicals, this separate SUD has been prepared.** **PRS 413**: As part of an SD tank removal project, stained soil (presumed to be creosote) was found and sampled in December 1996 with several chemical compounds found above acceptable levels. Approximately 23 cu yds of stained soil was removed and two samples were collected at the base with the results being below guideline values and not sufficient to cause a threat to leach to groundwater at unacceptable levels.
	Changes if any, from Pre-ex SUD: The topographic elevation in 1998 at the time of the creosote spill was 798.175. The elevation in 2004 was 797.179. The elevation today is 793.176, which is 5 feet below the original elevation. See Appendix A for sample results.

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Item 2

Summary of historic data relevant to SU:

PRS 413: Authorizing Document: UGL Action Memo, Final, September 2003.

Contaminants include: Ethylbenzene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, and Dibenz(a,h) anthracene.

As stated in Item 1, after the contaminated soil was removed, two samples verified the removal of the creosote material. The Roy Weston – Lionville Laboratory processed the samples and stated that "...concentrations were well below the concentrations that could pose a threat to groundwater due to leaching from the soil." Reference – PRS413 PRS Package.

Item 3a

COC	BASIS	CO	(pCi/g) HS	MAX	Offsite Analysis & Compendium Method: gamma (A-015)	Iso Pu (A-012)	Iso Th (A-012)	Iso U (A-012)
na								

Changes if any, from Pre-ex SUD: n/a

Item 3b

Chem basis for std dev, AM COCs/New COCs

UGL Action Memo, PRS 413: COCs - Ethylbenzene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, and Dibenz(a,h) anthracene.

analytical method A-028 per Methods Compendium

analyte	Cleanup objective	SSL (mg/kg)	analyte	cleanup objective	SSL (mg/kg)
Ethylbenzene	0.48mg/kg	24.73	Benzo(a)pyrene	4.08 mg/kg	13.39
Benzo(a)anthracene	40.8 mg/kg	170.62	Indeno(1,2,3-c,d)pyrene	40.8 mg/kg	10.14

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Benzo(b)fluoranthene	40.8 mg/kg	551.91	Dibenz(a,h) anthracene	4.08 mg/kg	0.17

Changes if any, from Pre-ex SUD: Due to the soil having been excavated 5 feet below the original elevation and prior sampling being below any concentrations that could cause a threat, no further analysis is required.

Item 4

Classify Areas & provide justification

The Survey Unit (SU) is a Class 1. This is a verification effort only. Chemical remediation is complete.

Selection	Class	Scan Coverage guidelines
X	1	100%
	2	10-90%
	3	Judgmental

Changes if any, from Pre-ex SUD: No further analysis required. See 3b

Item 5

Subdivide areas into SUs

This SUD contains one SU (see attached Figure 1).

See Attachment A for Figure

Historical Sample Data – Standard Deviations for COCs not possible due to minimal historical data

Changes if any, from Pre-ex SUD: No further analysis required. See 3b

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Item 6a	Calculations / Rad 1. Calculate the (s) for each COC listed above: na. 2. Number of Samples (N): na. Spreadsheet-Calculated Numbers of Samples: SU1 =na SU1 Scanning MDC (Area Factor) corrected = na	
	Changes if any, from Pre-ex SUD: n/a	
Item 6b	Calculations/Chem, Std dev, Number of Samples	Small area of known contamination "23 cy removed" per the UGL AM. In lieu of scanning, surrogate samples will be collected over an area of 10'x10' at PRS 413. Six (6) sample locations will be collected and analyzed for COC. Sample locations chosen via judgmental sampling. The six judgmental samples to be collected following completion of rad removal for PRS 159+ SUD SU3. Six samples were selected on the basis of the small area (<100 m^2) provision of the Standard VSAP, paragraph 3.5.1.
	Changes if any, from Pre-ex SUD: With prior samples being below any concentrations that could cause a threat and with the soil having been excavated 5 feet below the original elevation, no further analysis is required.	
Item 7	Grid spacing	judgmental
	Changes if any, from Pre-ex SUD: n/a	

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Item 8	**QA/QC:** Collection of QA/QC samples shall be in accordance with the Standard VSAP, Final, August 2004. Q-002 Chain-of-Custody Procedures Q-003 Documentation Requirements Q-004 Laboratory Data Reduction Q-006 Validation of Laboratory Data Packages Q-007 Data Assessment Q-008 Data Integrity Verification Q-010 Electronic Data Deliverable Format Specifications – MEIMS Std. ... S-001 General Instructions for Field Personnel S-002 Soil Sampling With a Spade and Scoop S-028 Sample Control and Documentation S-029 Guide to Handling, Packaging, and Shipping of Samples and Method Q-002
Item 9	Bias/judgement samples (Additional bias samples are always within the discretion of the EPA.)
Item 10	Not otherwise covered.../ comments

A55/108

APPENDIX D

BACKFILL PACKAGES

Standard VSAP Backfill Info for SUs 1-3 of HH Footprint & PRS 151... A48/99
(submitted to regulators in October 2005)

Standard VSAP Backfill Info for SU4 of HH Footprint & PRS 151..... A77/99
(submitted to regulators in October 2005)

A56/108

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STD VSAP BACKFILL INFO

This information will be represented in the Data Report.

For: HH Footprint (SU1 – SU3 only)
Rev 2

Checklist:

(per Section 5.6 of Std VSAP, Final, Aug 04)

- ☒ final Graphic
  (show sample locations & note any >CO and/or >HS)
- ☒ sample results
  (show DLs, HS, COs, and COC std deviation(s))
- ☒ recalc of N
- ☒ preliminary data were reviewed
  (Data Review & Validation Report will be submitted with the Data Report)
- n/a Sign test & 95%UCL (per SU)
  (not required if all results <CO, see pg 19/21 of VSAP)
- ☒ retro curve

From: (sign/date)_____

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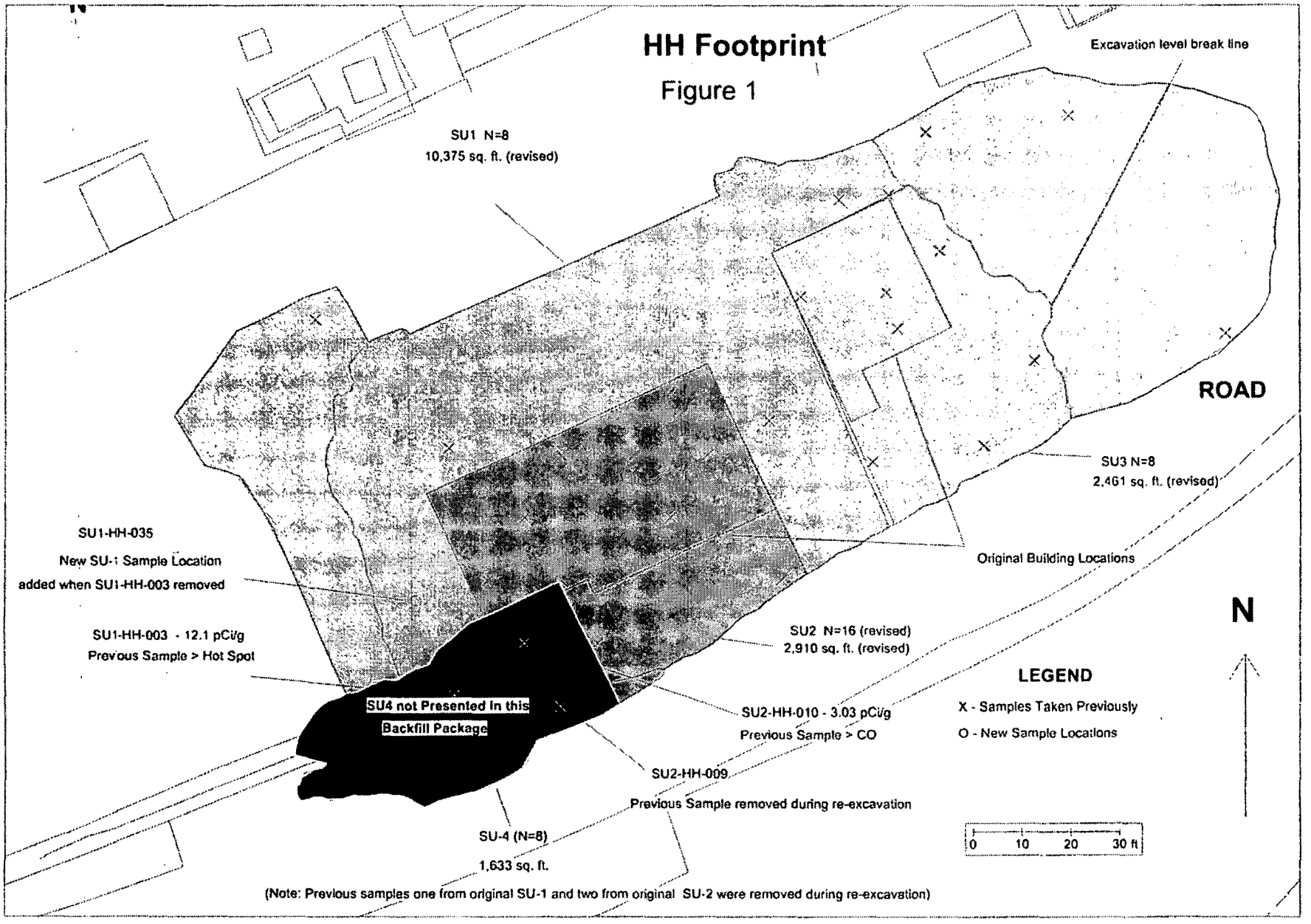
EXPLANATION PAGE
HH FOOTPRINT PARTIAL BACKFILL
SU 1 – SU 3

The original verification sampling for HH Footprint was conducted over three Survey Units (SU). However one sample in SU 1 was 12.1 pCi/g Th-230, which is above hot spot criteria (HS) and one sample in SU 2 was 3.03 pCi/g Th-230, which is above the cleanup objective (CO). The decision was made to carve a new SU 4 out of the portions of SU 1 and SU 2 where the elevated readings were located. Since SU 1 – SU 3 results were all below CO, the decision was made to submit a backfill package for SU 1 – SU 3 only. The size of SU4 was driven by the removal of an underground storm drain and not by contamination being chased. Only SU 1 – SU 3 will be backfilled at this time.


HH Footprint
Figure 1
Excavation level break line
SU1 N=8
10,375 sq. ft. (revised)
ROAD
SU3 N=8
2,461 sq. ft. (revised)
Original Building Locations
SU1-HH-035
New SU-1 Sample Location
added when SU1-HH-003 removed
SU1-HH-003 - 12.1 pCi/g
Previous Sample > Hot Spot
SU2 N=16 (revised)
2,910 sq. ft. (revised)
SU4 not Presented in this
Backfill Package
SU2-HH-010 - 3.03 pCi/g
Previous Sample > CO
SU2-HH-009
Previous Sample removed during re-excavation
SU-4 (N=8)
1,633 sq. ft.
(Note: Previous samples one from original SU-1 and two from original SU-2 were removed during re-excavation)
N
LEGEND
X - Samples Taken Previously
O - New Sample Locations
0 10 20 30 ft

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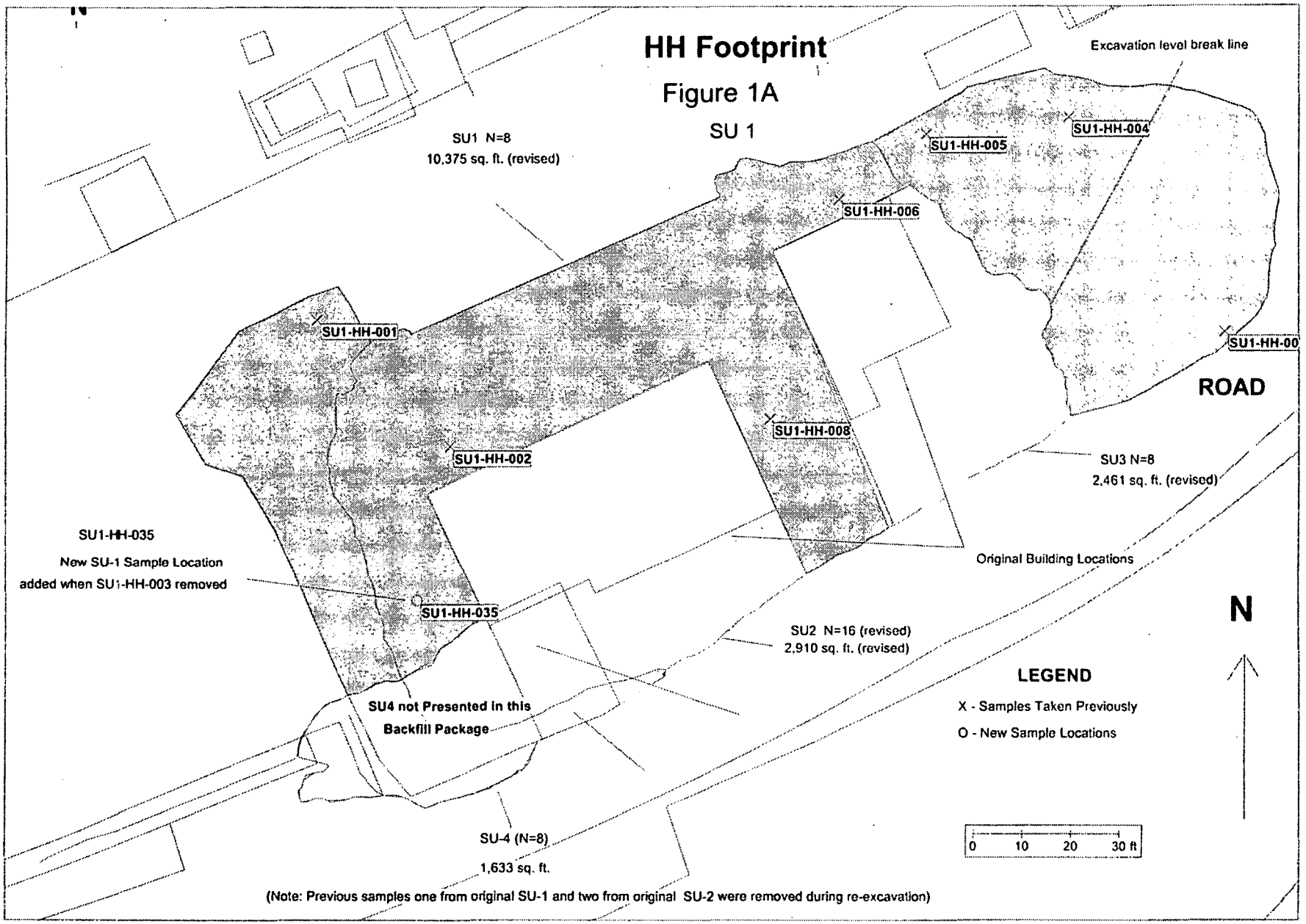
HH Footprint
Figure 1A
SU 1
Excavation level break line
SU1 N=8
10,375 sq. ft. (revised)
SU1-HH-004
SU1-HH-005
SU1-HH-006
SU1-HH-001
SU1-HH-00
ROAD
SU1-HH-008
SU1-HH-002
SU3 N=8
2,461 sq. ft. (revised)
SU1-HH-035
New SU-1 Sample Location
added when SU1-HH-003 removed
Original Building Locations
SU1-HH-035
N
SU2 N=16 (revised)
2,910 sq. ft. (revised)
LEGEND
X - Samples Taken Previously
O - New Sample Locations
SU4 not Presented in this
Backfill Package
0 10 20 30 ft
SU-4 (N=8)
1,633 sq. ft.
(Note: Previous samples one from original SU-1 and two from original SU-2 were removed during re-excavation)

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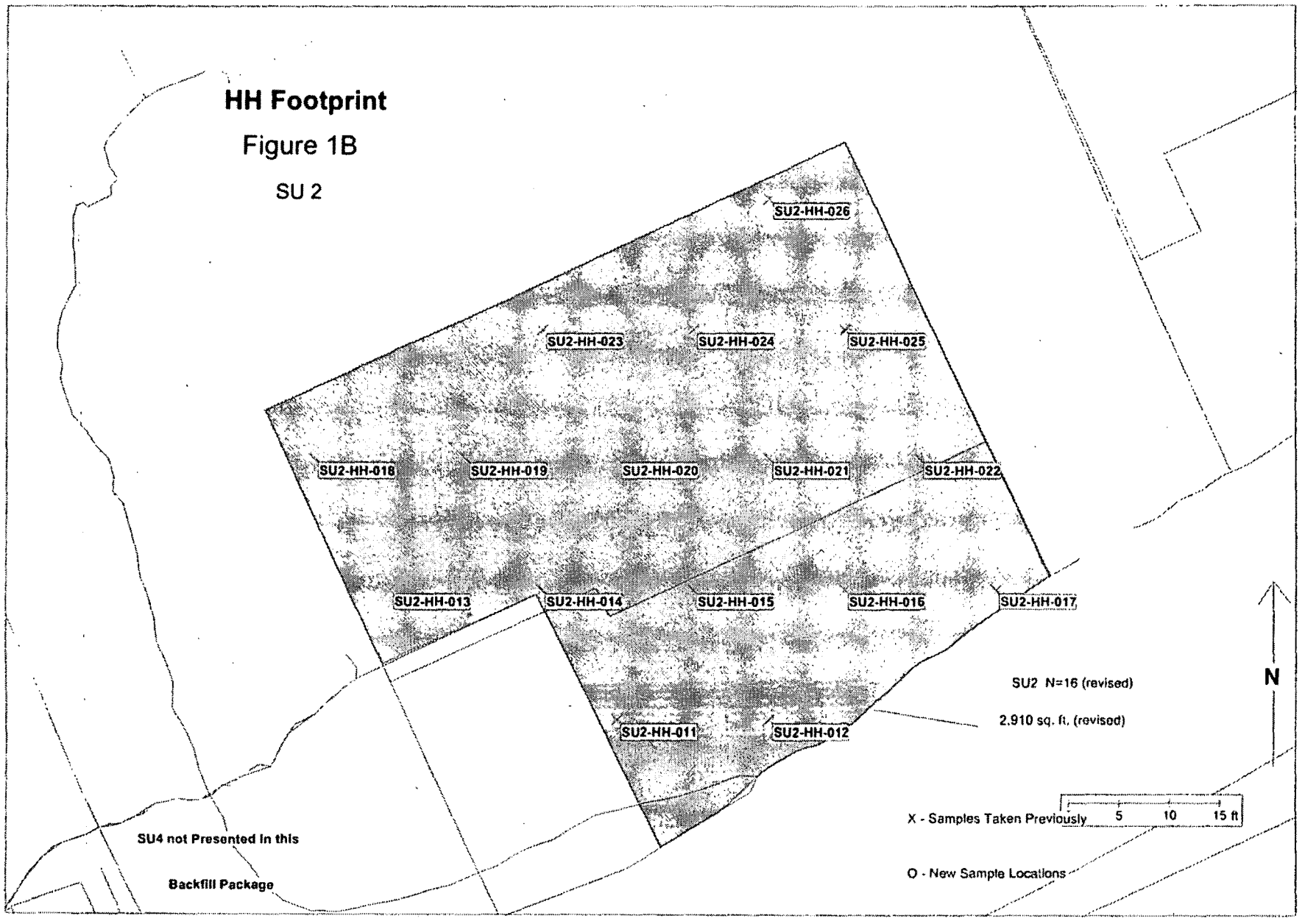
HH Footprint
Figure 1B
SU 2
SU2-HH-026
SU2-HH-023
SU2-HH-024
SU2-HH-025
SU2-HH-018
SU2-HH-019
SU2-HH-020
SU2-HH-021
SU2-HH-022
SU2-HH-013
SU2-HH-014
SU2-HH-015
SU2-HH-016
SU2-HH-017
SU2-HH-011
SU2-HH-012
SU2 N=16 (revised)
2,910 sq. ft. (revised)
N
X - Samples Taken Previously
5
10
15 ft
O - New Sample Locations
SU4 not Presented in this
Backfill Package

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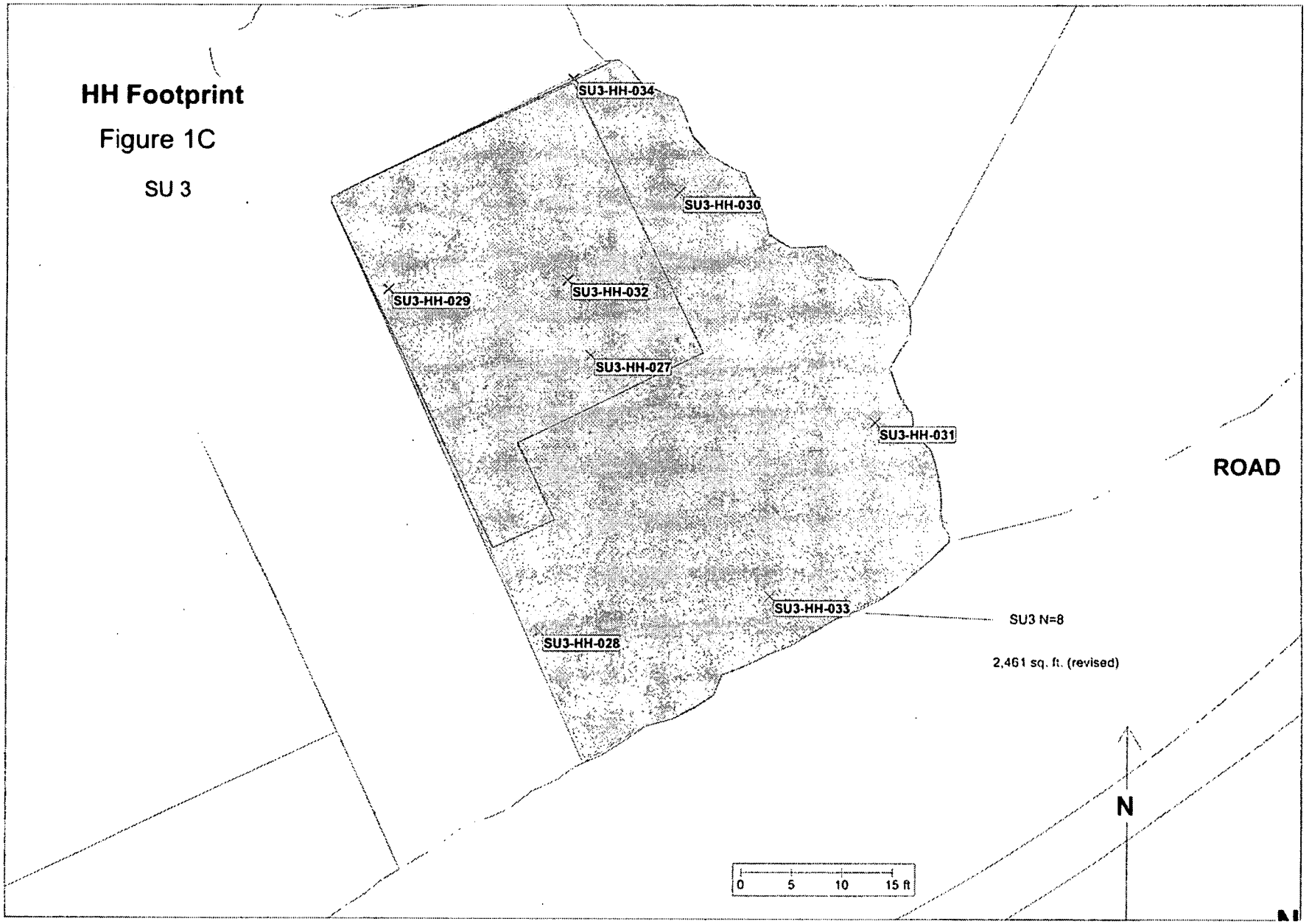
HH Footprint
Figure 1C
SU 3
SU3-HH-034
SU3-HH-030
SU3-HH-029
SU3-HH-032
SU3-HH-027
SU3-HH-031
ROAD
SU3-HH-033
SU3 N=8
SU3-HH-028
2,461 sq. ft. (revised)
N
0
5
10
15 ft

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Iso Th Results
Table 1

			Th-228		Th-230		Th-232	
	CO pCi/g		2.6		2.8		2.1	
	HS pCi/g		4.79		4.66		3.39	
Sample Number	Terran #	STL #	Result	MDA	Result	MDA	Result	MDA
SU1-HH-001	000159	F5G270142-001	0.5	0.04	1.08	0.03	0.55	0.03
SU1-HH-002	000160	F5G270142-002	0.82	0.04	1.61	0.03	0.77	0.02
SU1-HH-004	000162	F5G270142-004	0.58	0.05	1.43	0.03	0.56	0.03
SU1-HH-005	000163	F5G270142-005	0.38	0.02	0.72	0.02	0.41	0.02
SU1-HH-006	000164	F5G270142-006	1.1	0.02	0.94	0.02	1.15	0.02
SU1-HH-007	000165	F5G270142-007	0.6	0.04	0.74	0.03	0.58	0.02
SU1-HH-008	000166	F5G270142-008	0.87	0.02	1.32	0.02	0.79	0.02
SU1-HH-35	n/a		0.64	0.14	1.86	0.08	0.59	0.06
Std. Dev.			0.2306		0.4130		0.2278	
SU2-HH-011	000169	F5G270142-011	1.52	0.06	1.41	0.05	1.33	0.06
SU2-HH-012	000170	F5G270142-012	1.04	0.05	1.11	0.03	1.08	0.03
SU2-HH-013	000171	F5G270142-013	0.094	0.032	0.49	0.02	0.21	0.018
SU2-HH-014	000172	F5G270142-014	0.91	0.01	0.94	0.02	0.88	0.01
SU2-HH-015	000173	F5G270142-015	1.1	0.07	1.36	0.05	1.08	0.03
SU2-HH-016	000174	F5G270142-016	0.92	0.09	1.41	0.03	0.91	0.04
SU2-HH-017	000175	F5G270142-017	0.43	0.06	1.46	0.04	0.46	0.04
SU2-HH-018	000176	F5G270142-018	0.36	0.05	0.59	0.03	0.34	0.03
SU2-HH-019	000177	F5G270142-019	0.66	0.04	0.74	0.01	0.6	0.02
SU2-HH-020	000178	F5G270142-020	0.77	0.05	1.4	0.04	0.82	0.04
SU2-HH-021	000179	F5G270142-021	0.69	0.04	0.71	0.03	0.77	0.03
SU2-HH-022	000180	F5G270142-022	0.87	0.06	1.11	0.05	0.87	0.03
SU2-HH-023	000181	F5G270142-023	0.66	0.04	0.83	0.04	0.48	0.03
SU2-HH-024	000182	F5G270142-024	0.71	0.06	0.62	0.04	0.63	0.03
SU2-HH-025	000183	F5G270142-025	0.81	0.08	1.32	0.03	0.82	0.04
SU2-HH-026	000184	F5G270142-026	0.6	0.04	1.12	0.02	0.68	0.02
Std. Dev.			0.3266		0.3378		0.2921	
SU3-HH-027	000185	F5G270142-027	1.07	0.05	1.19	0.03	0.82	0.03
SU3-HH-028	000187	F5G270142-029	0.85	0.04	1.09	0.02	0.83	0.02
SU3-HH-029	000189	F5G270142-031	0.49	0.04	0.78	0.02	0.58	0.03

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Iso Th Results
Table 1

			Th-228		Th-230		Th-232	
	CO pCi/g		2.6		2.8		2.1	
	HS pCi/g		4.79		4.66		3.39	
Sample Number	Terran #	STL #	Result	MDA	Result	MDA	Result	MDA
SU3-HH-030	000191	F5G270142-033	1.05	0.03	1.01	0.03	0.91	0.02
SU3-HH-031	000193	F5G270142-035	0.47	0.04	1.13	0.03	0.51	0.03
SU3-HH-032	000195	F5G270142-037	0.42	0.03	0.92	0.02	0.41	0.03
SU3-HH-033	000197	F5G270142-039	1.1	0.04	1.09	0.04	0.96	0.04
SU3-HH-034	000199	F5G270142-041	0.85	0.03	0.79	0.02	0.85	0.01
Std. Dev.			0.2875		0.1550		0.2039	
Removed Samples								
SU1-HH-003	000161	F5G270142-003	0.49	0.05	12.1	0.03	0.51	0.02
SU2-HH-009	000167	F5G270142-009	0.243	0.05	0.36	0.04	0.182	0.047
SU2-HH-010	000168	F5G270142-010	0.4	0.04	3.03	0.02	0.38	0.02
CO = Cleanup Objective								
HS = Hot Spot								
Std. Dev. = Standard Deviation								
NR = None Reported								
For Standard Deviation Calculations:								
If the reported result was less than the MDA, the reported result was used.								
If no result was reported (NR), 1/2 the MDA was used.								

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blank spaces = no data available

HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Ac-227			Ac-228			Am-241		
		CO pCi/g	**4.64**			**1.93**			**63.1**		
		HS pCi/g	13.7			**5.8**			189		
Sample Number	Terran #	STL #	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**
SU1-HH-001	000159	F5G270142-001									
SU1-HH-002	000160	F5G270142-002									
SU1-HH-004	000162	F5G270142-004									
SU1-HH-005	000163	F5G270142-005									
SU1-HH-006	000164	F5G270142-006									
SU1-HH-007	000165	F5G270142-007									
SU1-HH-008	000166	F5G270142-008									
SU1-HH-35	n/a		0.25		0.21				0		0.06
Std. Dev.											
SU2-HH-011	000169	F5G270142-011	0.19	0.19	0.54	0.79	0.79	0.49	0.008	0.008	0.19
SU2-HH-012	000170	F5G270142-012	0.14	0.14	0.5	NR	0.36	0.72	0	0	0.2
SU2-HH-013	000171	F5G270142-013	0	0	0.27	NR	0.2	0.4	0.006	0.006	0.11
SU2-HH-014	000172	F5G270142-014	0.39	0.39	0.56	1.59	1.59	0.37	0	0	0.18
SU2-HH-015	000173	F5G270142-015	0	0	0.56	NR	0.435	0.87	0.11	0.11	0.24
SU2-HH-016	000174	F5G270142-016	0.05	0.05	0.5	NR	0.34	0.68	0.06	0.06	0.2
SU2-HH-017	000175	F5G270142-017	0.12	0.12	0.41	NR	0.215	0.43	0.025	0.025	0.14
SU2-HH-018	000176	F5G270142-018	0.04	0.04	0.26	NR	0.18	0.36	0	0	0.098
SU2-HH-019	000177	F5G270142-019	0	0	0.33	0.47	0.47	0.29	0.02	0.02	0.16
SU2-HH-020	000178	F5G270142-020	0.36	0.36	0.41	0.65	0.65	0.29	0	0	0.14
SU2-HH-021	000179	F5G270142-021	0.07	0.07	0.42	NR	0.295	0.59	0	0	0.16
SU2-HH-022	000180	F5G270142-022	0.09	0.09	0.38	NR	0.275	0.55	0.033	0.033	0.14
SU2-HH-023	000181	F5G270142-023	0.12	0.12	0.4	NR	0.26	0.52	0	0	0.15
SU2-HH-024	000182	F5G270142-024	0.25	0.25	0.4	NR	0.215	0.43	0.042	0.042	0.14
SU2-HH-025	000183	F5G270142-025	0.17	0.17	0.51	0.84	0.84	0.36	0.11	0.11	0.23
SU2-HH-026	000184	F5G270142-026	0.06	0.06	0.38	0.66	0.66	0.3	0.012	0.012	0.15
Std. Dev.				0.1199			0.3641			0.0370	
SU3-HH-027	000185	F5G270142-027									
SU3-HH-028	000187	F5G270142-029									
SU3-HH-029	000189	F5G270142-031									

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Ac-227			Ac-228			Am-241		
		CO pCi/g	**4.64**			**1.93**			**63.1**		
		HS pCi/g	13.7			**5.8**			189		
Sample Number	Terran #	STL #	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**
SU3-HH-030	000191	F5G270142-033									
SU3-HH-031	000193	F5G270142-035									
SU3-HH-032	000195	F5G270142-037									
SU3-HH-033	000197	F5G270142-039									
SU3-HH-034	000199	F5G270142-041									
Std. Dev.											

Removed Samples

SU1-HH-003	000161	F5G270142-003									
SU2-HH-009	000167	F5G270142-009	0.13	0.15	0.27	NR		0.027	0.02	0.049	0.092
SU2-HH-010	000168	F5G270142-010	0.13	0.22	0.36	NR		0.37	0.061	0.079	0.14

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
For Standard Deviation Calculations:
If the reported result was less than the MDA, the reported result was used.
If no result was reported (NR), 1/2 the MDA was used.

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Ag-108m			Bi-207			Bi-210m		
		CO pCi/g	1.22			1.24			8.34		
		HS pCi/g	3.66			3.6			24.9		
Sample Number	Terran #	STL #	Reported	Used	MDA	Reported	Used	MDA	Reported	Used	MDA
SU1-HH-001	000159	F5G270142-001									
SU1-HH-002	000160	F5G270142-002									
SU1-HH-004	000162	F5G270142-004									
SU1-HH-005	000163	F5G270142-005									
SU1-HH-006	000164	F5G270142-006									
SU1-HH-007	000165	F5G270142-007									
SU1-HH-008	000166	F5G270142-008									
SU1-HH-35	n/a								0.2		0.04
Std. Dev.											
SU2-HH-011	000169	F5G270142-011	NR	0.035	0.07	0	0	0.086	0.031	0.031	0.12
SU2-HH-012	000170	F5G270142-012	NR	0.041	0.082	0.026	0.026	0.095	0	0	0.11
SU2-HH-013	000171	F5G270142-013	NR	0.0195	0.039	0.024	0.024	0.06	0	0	0.075
SU2-HH-014	000172	F5G270142-014	NR	0.04	0.08	0.051	0.051	0.1	0.026	0.026	0.12
SU2-HH-015	000173	F5G270142-015	NR	0.055	0.11	0.048	0.048	0.12	0.064	0.064	0.16
SU2-HH-016	000174	F5G270142-016	NR	0.034	0.068	0.004	0.004	0.094	0.14	0.14	0.11
SU2-HH-017	000175	F5G270142-017	NR	0.025	0.05	0	0	0.063	0	0	0.078
SU2-HH-018	000176	F5G270142-018	NR	0.02	0.04	0	0	0.025	0	0	0.056
SU2-HH-019	000177	F5G270142-019	NR	0.039	0.078	0.005	0.005	0.081	0.066	0.066	0.12
SU2-HH-020	000178	F5G270142-020	NR	0.029	0.058	0.029	0.029	0.077	0.178	0.178	0.13
SU2-HH-021	000179	F5G270142-021	NR	0.03	0.06	0	0	0.065	0	0	0.11
SU2-HH-022	000180	F5G270142-022	NR	0.0225	0.045	0	0	0.059	0	0	0.089
SU2-HH-023	000181	F5G270142-023	NR	0.038	0.076	0.033	0.033	0.086	0.44	0.44	0.1
SU2-HH-024	000182	F5G270142-024	NR	0.026	0.052	0.038	0.038	0.072	0	0	0.079
SU2-HH-025	000183	F5G270142-025	NR	0.04	0.08	0	0	0.091	0.017	0.017	0.14
SU2-HH-026	000184	F5G270142-026	NR	0.033	0.066	0.011	0.011	0.074	0.026	0.026	0.1
Std. Dev.				0.0094			0.0186			0.1140	
SU3-HH-027	000185	F5G270142-027									
SU3-HH-028	000187	F5G270142-029									
SU3-HH-029	000189	F5G270142-031									

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blank spaces = no data available

HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Ag-108m			Bi-207			Bi-210m		
		CO pCi/g	**1.22**			**1.24**			**8.34**		
		HS pCi/g	**3.66**			3.6			**24.9**		
Sample Number	Terran #	STL #	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**
SU3-HH-030	000191	F5G270142-033									
SU3-HH-031	000193	F5G270142-035									
SU3-HH-032	000195	F5G270142-037									
SU3-HH-033	000197	F5G270142-039									
SU3-HH-034	000199	F5G270142-041									
Std. Dev.											

Removed Samples

SU1-HH-003	000161	F5G270142-003									
SU2-HH-009	000167	F5G270142-009	NR		0.043	0	0.023	0.041	0	0.034	0.06
SU2-HH-010	000168	F5G270142-010	NR		0.06	0.043	0.038	0.08	0.334	0.093	0.094

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
For Standard Deviation Calculations:
If the reported result was less than the MDA, the reported result was used.
If no result was reported (NR), 1/2 the MDA was used.

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Bi-212			Bi-214			Cs-137		
		CO pCi/g	**9.87**			**1.17**			**3.84**		
		HS pCi/g	**29.6**			**3.51**			**10.7**		
Sample Number	Terran #	STL #	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**
SU1-HH-001	000159	F5G270142-001									
SU1-HH-002	000160	F5G270142-002									
SU1-HH-004	000162	F5G270142-004									
SU1-HH-005	000163	F5G270142-005									
SU1-HH-006	000164	F5G270142-006									
SU1-HH-007	000165	F5G270142-007									
SU1-HH-008	000166	F5G270142-008									
SU1-HH-35	n/a								0		0.05
Std. Dev.											
SU2-HH-011	000169	F5G270142-011	1.04	1.04	0.88	0.82	0.82	0.18	0.018	0.018	0.13
SU2-HH-012	000170	F5G270142-012	NR	0.545	1.09	0.53	0.53	0.25	0	0	0.1
SU2-HH-013	000171	F5G270142-013	NR	0.275	0.55	0.35	0.35	0.1	0	0	0.054
SU2-HH-014	000172	F5G270142-014	1.3	1.3	0.85	0.88	0.88	0.23	0.014	0.014	0.13
SU2-HH-015	000173	F5G270142-015	NR	0.75	1.5	0.82	0.82	0.24	0.018	0.018	0.15
SU2-HH-016	000174	F5G270142-016	NR	0.474	0.948	0.49	0.49	0.19	0	0	0.094
SU2-HH-017	000175	F5G270142-017	NR	0.365	0.73	0.41	0.41	0.13	0.004	0.004	0.09
SU2-HH-018	000176	F5G270142-018	NR	0.315	0.63	0.31	0.31	0.11	0.029	0.029	0.08
SU2-HH-019	000177	F5G270142-019	NR	0.045	0.09	0.5	0.5	0.16	0.025	0.025	0.098
SU2-HH-020	000178	F5G270142-020	NR	0.365	0.73	0.35	0.35	0.16	0.004	0.004	0.082
SU2-HH-021	000179	F5G270142-021	NR	0.515	1.03	0.59	0.59	0.13	0	0	0.11
SU2-HH-022	000180	F5G270142-022	NR	0.45	0.9	0.32	0.32	0.13	0	0	0.085
SU2-HH-023	000181	F5G270142-023	NR	0.42	0.84	0.32	0.32	0.19	0	0	0.068
SU2-HH-024	000182	F5G270142-024	NR	0.355	0.71	0.35	0.35	0.13	0.006	0.006	0.074
SU2-HH-025	000183	F5G270142-025	NR	0.62	1.24	0.64	0.64	0.24	0	0	0.11
SU2-HH-026	000184	F5G270142-026	NR	0.365	0.73	0.59	0.59	0.15	0.006	0.006	0.099
Std. Dev.				0.3039			0.1929			0.0098	
SU3-HH-027	000185	F5G270142-027									
SU3-HH-028	000187	F5G270142-029									
SU3-HH-029	000189	F5G270142-031									

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Bi-212			Bi-214			Cs-137		
		CO pCi/g	**9.87**			**1.17**			**3.84**		
		HS pCi/g	**29.6**			**3.51**			**10.7**		
Sample Number	Terran #	STL #	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**
SU3-HH-030	000191	F5G270142-033									
SU3-HH-031	000193	F5G270142-035									
SU3-HH-032	000195	F5G270142-037									
SU3-HH-033	000197	F5G270142-039									
SU3-HH-034	000199	F5G270142-041									
Std. Dev.											

Removed Samples

SU1-HH-003	000161	F5G270142-003									
SU2-HH-009	000167	F5G270142-009	NR		0.47	NR		0.2	0.0002	0.025	0.051
SU2-HH-010	000168	F5G270142-010	NR		0.61	0.37		0.12	0.018	0.038	0.078

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
For Standard Deviation Calculations:
If the reported result was less than the MDA, the reported result was used.
If no result was reported (NR), 1/2 the MDA was used.

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Co-60			K-40			Pa-231		
		CO pCi/g	**0.76**			**47.8**			**4**		
		HS pCi/g	**2.12**			**69.3**			**11.8**		
Sample Number	Terran #	STL #	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**
SU1-HH-001	000159	F5G270142-001									
SU1-HH-002	000160	F5G270142-002									
SU1-HH-004	000162	F5G270142-004									
SU1-HH-005	000163	F5G270142-005									
SU1-HH-006	000164	F5G270142-006									
SU1-HH-007	000165	F5G270142-007									
SU1-HH-008	000166	F5G270142-008									
SU1-HH-35	n/a		0		0.07						
Std. Dev.											
SU2-HH-011	000169	F5G270142-011	0	0	0.12	26.3	26.3	1.1	2	2	3
SU2-HH-012	000170	F5G270142-012	0	0	0.1	22.7	22.7	1.2	2.7	2.7	3.4
SU2-HH-013	000171	F5G270142-013	0.012	0.012	0.072	9.7	9.7	0.5	0.14	0.14	1.5
SU2-HH-014	000172	F5G270142-014	0.029	0.029	0.17	25.4	25.4	0.8	1.2	1.2	2.9
SU2-HH-015	000173	F5G270142-015	0.083	0.083	0.18	32.8	32.8	1.6	1.2	1.2	3.7
SU2-HH-016	000174	F5G270142-016	0.014	0.014	0.12	22.6	22.6	1.1	1.4	1.4	2.4
SU2-HH-017	000175	F5G270142-017	0.034	0.034	0.1	8.6	8.6	1	0.17	0.17	1.7
SU2-HH-018	000176	F5G270142-018	0.013	0.013	0.071	9.4	9.4	0.1	0	0	1.4
SU2-HH-019	000177	F5G270142-019	0.006	0.006	0.12	16	16	0.7	0.4	0.4	2.3
SU2-HH-020	000178	F5G270142-020	0.05	0.05	0.14	15.4	15.4	0.8	0.4	0.4	1.9
SU2-HH-021	000179	F5G270142-021	0.017	0.017	0.12	20.4	20.4	0.6	0.7	0.7	2.7
SU2-HH-022	000180	F5G270142-022	0.012	0.012	0.11	17.3	17.3	0.6	1.9	1.9	2.2
SU2-HH-023	000181	F5G270142-023	0	0	0.1	11.2	11.2	0.7	0	0	1.9
SU2-HH-024	000182	F5G270142-024	0.013	0.013	0.088	13.3	13.3	0.9	0.5	0.5	1.8
SU2-HH-025	000183	F5G270142-025	0.003	0.003	0.16	24.4	24.4	0.9	0	0	2.6
SU2-HH-026	000184	F5G270142-026	0	0	0.12	16.1	16.1	0.8	1.1	1.1	2.3
Std. Dev.				0.0223			7.0534			0.8221	
SU3-HH-027	000185	F5G270142-027									
SU3-HH-028	000187	F5G270142-029									
SU3-HH-029	000189	F5G270142-031									

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Co-60			K-40			Pa-231		
		CO pCi/g	0.76			47.8			4		
		HS pCi/g	2.12			69.3			11.8		
Sample Number	Terran #	STL #	Reported	Used	MDA	Reported	Used	MDA	Reported	Used	MDA
SU3-HH-030	000191	F5G270142-033									
SU3-HH-031	000193	F5G270142-035									
SU3-HH-032	000195	F5G270142-037									
SU3-HH-033	000197	F5G270142-039									
SU3-HH-034	000199	F5G270142-041									
Std. Dev.											

Removed Samples

SU1-HH-003	000161	F5G270142-003									
SU2-HH-009	000167	F5G270142-009	0	0.03	0.055	4.5	1.2	0.7	0.05	0.63	1.2
SU2-HH-010	000168	F5G270142-010	0.042	0.048	0.11	8.6	1.8	0.7	0.2	1.1	1.9

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
For Standard Deviation Calculations:
If the reported result was less than the MDA, the reported result was used.
If no result was reported (NR), 1/2 the MDA was used.

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Pb-210			Pb-212			Pb-214		
		CO pCi/g	**7.45**			**16.6**			**8.92**		
		HS pCi/g	**19.9**			**49.8**			**26.8**		
Sample Number	Terran #	STL #	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**	**Reported**	**Used**	**MDA**
SU1-HH-001	000159	F5G270142-001									
SU1-HH-002	000160	F5G270142-002									
SU1-HH-004	000162	F5G270142-004									
SU1-HH-005	000163	F5G270142-005									
SU1-HH-006	000164	F5G270142-006									
SU1-HH-007	000165	F5G270142-007									
SU1-HH-008	000166	F5G270142-008									
SU1-HH-35	n/a		0.87		0.52						
Std. Dev.											
SU2-HH-011	000169	F5G270142-011	1.8	1.8	2.5	0.98	0.98	0.19	0.76	0.76	0.17
SU2-HH-012	000170	F5G270142-012	1.5	1.5	3	0.73	0.73	0.17	0.5	0.5	0.18
SU2-HH-013	000171	F5G270142-013	0.43	0.43	1.4	0.182	0.182	0.11	0.35	0.35	0.1
SU2-HH-014	000172	F5G270142-014	0.04	0.04	2.5	0.81	0.81	0.19	0.78	0.78	0.17
SU2-HH-015	000173	F5G270142-015	0.8	0.8	3	1.11	1.11	0.2	0.67	0.67	0.17
SU2-HH-016	000174	F5G270142-016	0.9	0.9	2.4	0.62	0.62	0.15	0.55	0.55	0.16
SU2-HH-017	000175	F5G270142-017	0.29	0.29	1.6	0.27	0.27	0.13	0.52	0.52	0.13
SU2-HH-018	000176	F5G270142-018	0	0	1.2	0.243	0.243	0.089	0.39	0.39	0.09
SU2-HH-019	000177	F5G270142-019	0	0	1.9	0.56	0.56	0.12	0.31	0.31	0.17
SU2-HH-020	000178	F5G270142-020	0.8	0.8	2	0.52	0.52	0.16	0.54	0.54	0.12
SU2-HH-021	000179	F5G270142-021	0.8	0.8	2.2	0.48	0.48	0.16	NR	0.015	0.03
SU2-HH-022	000180	F5G270142-022	0.18	0.18	1.7	0.53	0.53	0.14	0.34	0.34	0.14
SU2-HH-023	000181	F5G270142-023	0.4	0.4	2.1	0.38	0.38	0.1	NR	0.12	0.24
SU2-HH-024	000182	F5G270142-024	0.003	0.003	1.7	0.446	0.446	0.092	0.34	0.34	0.12
SU2-HH-025	000183	F5G270142-025	0.4	0.4	2.6	0.73	0.73	0.18	0.79	0.79	0.19
SU2-HH-026	000184	F5G270142-026	0.9	0.9	1.9	0.54	0.54	0.13	0.39	0.39	0.13
Std. Dev.				0.5362			0.2560			0.2239	
SU3-HH-027	000185	F5G270142-027									
SU3-HH-028	000187	F5G270142-029									
SU3-HH-029	000189	F5G270142-031									

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Pb-210			Pb-212			Pb-214		
		CO pCi/g	7.45			16.6			8.92		
		HS pCi/g	19.9			49.8			26.8		
Sample Number	Terran #	STL #	Reported	Used	MDA	Reported	Used	MDA	Reported	Used	MDA
SU3-HH-030	000191	F5G270142-033									
SU3-HH-031	000193	F5G270142-035									
SU3-HH-032	000195	F5G270142-037									
SU3-HH-033	000197	F5G270142-039									
SU3-HH-034	000199	F5G270142-041									
Std. Dev.											
Removed Samples											
SU1-HH-003	000161	F5G270142-003									
SU2-HH-009	000167	F5G270142-009	0.3	0.71	1.4	0.141	0.07	0.078	NR		0.14
SU2-HH-010	000168	F5G270142-010	0.24	0.89	1.6	0.283	0.12	0.12	NR		0.25

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
For Standard Deviation Calculations:
If the reported result was less than the MDA, the reported result was used.
If no result was reported (NR), 1/2 the MDA was used.

blank spaces = no data available

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Ra-226			Ra-228			Th-232 (gamma spec)		
		CO pCi/g	2.93			2.07			2.06		
		HS pCi/g	4.79			3.4			3.39		
Sample Number	Terran #	STL #	Reported	Used	MDA	Reported	Used	MDA	Reported	Used	MDA
SU1-HH-001	000159	F5G270142-001									
SU1-HH-002	000160	F5G270142-002									
SU1-HH-004	000162	F5G270142-004									
SU1-HH-005	000163	F5G270142-005									
SU1-HH-006	000164	F5G270142-006									
SU1-HH-007	000165	F5G270142-007									
SU1-HH-008	000166	F5G270142-008									
SU1-HH-35	n/a		1.39		0.64				0.59		0.19
Std. Dev.											
SU2-HH-011	000169	F5G270142-011	0.82	0.82	0.18	0.79	0.79	0.49	0.79	0.79	0.49
SU2-HH-012	000170	F5G270142-012	0.53	0.53	0.25	0.62	0.62	0.72	NR	0.36	0.72
SU2-HH-013	000171	F5G270142-013	0.35	0.35	0.1	0.31	0.31	0.4	NR	0.2	0.4
SU2-HH-014	000172	F5G270142-014	0.88	0.88	0.23	1.59	1.59	0.37	1.59	1.59	0.37
SU2-HH-015	000173	F5G270142-015	0.82	0.82	0.24	0.76	0.76	0.87	NR	0.435	0.87
SU2-HH-016	000174	F5G270142-016	0.49	0.49	0.19	0.77	0.77	0.68	NR	0.34	0.68
SU2-HH-017	000175	F5G270142-017	0.41	0.41	0.13	0.34	0.34	0.43	NR	0.215	0.43
SU2-HH-018	000176	F5G270142-018	0.31	0.31	0.11	0.26	0.26	0.36	NR	0.18	0.36
SU2-HH-019	000177	F5G270142-019	0.5	0.5	0.16	0.47	0.47	0.29	0.47	0.47	0.29
SU2-HH-020	000178	F5G270142-020	0.35	0.35	0.16	0.65	0.65	0.29	0.65	0.65	0.29
SU2-HH-021	000179	F5G270142-021	0.59	0.59	0.13	0.54	0.54	0.59	NR	0.295	0.59
SU2-HH-022	000180	F5G270142-022	0.32	0.32	0.13	0.58	0.58	0.55	NR	0.275	0.55
SU2-HH-023	000181	F5G270142-023	0.32	0.32	0.19	0.3	0.3	0.52	NR	0.26	0.52
SU2-HH-024	000182	F5G270142-024	0.35	0.35	0.13	0.36	0.36	0.43	NR	0.215	0.43
SU2-HH-025	000183	F5G270142-025	0.64	0.64	0.24	0.84	0.84	0.36	0.84	0.84	0.36
SU2-HH-026	000184	F5G270142-026	0.59	0.59	0.15	0.66	0.66	0.3	0.66	0.66	0.3
Std. Dev.				0.1929			0.3232			0.3641	
SU3-HH-027	000185	F5G270142-027									
SU3-HH-028	000187	F5G270142-029									
SU3-HH-029	000189	F5G270142-031									

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Ra-226			Ra-228			Th-232 (gamma spec)		
		CO pCi/g	2.93			2.07			2.06		
		HS pCi/g	4.79			3.4			3.39		
Sample Number	Terran #	STL #	Reported	Used	MDA	Reported	Used	MDA	Reported	Used	MDA
SU3-HH-030	000191	F5G270142-033									
SU3-HH-031	000193	F5G270142-035									
SU3-HH-032	000195	F5G270142-037									
SU3-HH-033	000197	F5G270142-039									
SU3-HH-034	000199	F5G270142-041									
Std. Dev.											
Removed Samples											
SU1-HH-003	000161	F5G270142-003									
SU2-HH-009	000167	F5G270142-009	0.219	0.086	0.2	0.14	0.11	0.27	NR		0.27
SU2-HH-010	000168	F5G270142-010	0.37	0.12	0.12	0.19	0.17	0.37	NR		0.37

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
For Standard Deviation Calculations:
If the reported result was less than the MDA, the reported result was used.
If no result was reported (NR), 1/2 the MDA was used.

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blank spaces = no data available

HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Tl-208		
		CO pCi/g	**0.498**		
		HS pCi/g	**1.49**		
Sample Number	Terran #	STL #	**Reported**	**Used**	**MDA**
SU1-HH-001	000159	F5G270142-001			
SU1-HH-002	000160	F5G270142-002			
SU1-HH-004	000162	F5G270142-004			
SU1-HH-005	000163	F5G270142-005			
SU1-HH-006	000164	F5G270142-006			
SU1-HH-007	000165	F5G270142-007			
SU1-HH-008	000166	F5G270142-008			
SU1-HH-35	n/a				
Std. Dev.					
SU2-HH-011	000169	F5G270142-011	0.28	0.28	0.11
SU2-HH-012	000170	F5G270142-012	0.27	0.27	0.1
SU2-HH-013	000171	F5G270142-013	0.127	0.127	0.07
SU2-HH-014	000172	F5G270142-014	0.37	0.37	0.11
SU2-HH-015	000173	F5G270142-015	0.38	0.38	0.13
SU2-HH-016	000174	F5G270142-016	0.338	0.338	0.1
SU2-HH-017	000175	F5G270142-017	0.119	0.119	0.077
SU2-HH-018	000176	F5G270142-018	0.095	0.095	0.052
SU2-HH-019	000177	F5G270142-019	0.169	0.169	0.083
SU2-HH-020	000178	F5G270142-020	0.147	0.147	0.057
SU2-HH-021	000179	F5G270142-021	0.335	0.335	0.083
SU2-HH-022	000180	F5G270142-022	0.156	0.156	0.07
SU2-HH-023	000181	F5G270142-023	0.108	0.108	0.08
SU2-HH-024	000182	F5G270142-024	0.138	0.138	0.066
SU2-HH-025	000183	F5G270142-025	0.27	0.27	0.1
SU2-HH-026	000184	F5G270142-026	0.204	0.204	0.078
Std. Dev.				0.1000	
SU3-HH-027	000185	F5G270142-027			
SU3-HH-028	000187	F5G270142-029			
SU3-HH-029	000189	F5G270142-031			

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HH Bldg Verification Sampling
Sampled July 2005
Offsite Gamma Spec Results
Table 2

			Tl-208		
		CO pCi/g	0.498		
		HS pCi/g	1.49		
Sample Number	Terran #	STL #	Reported	Used	MDA
SU3-HH-030	000191	F5G270142-033			
SU3-HH-031	000193	F5G270142-035			
SU3-HH-032	000195	F5G270142-037			
SU3-HH-033	000197	F5G270142-039			
SU3-HH-034	000199	F5G270142-041			
Std. Dev.					

Removed Samples

SU1-HH-003	000161	F5G270142-003			
SU2-HH-009	000167	F5G270142-009	0.074	0.049	0.045
SU2-HH-010	000168	F5G270142-010	NR	0.094	0.1

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
For Standard Deviation Calculations:
If the reported result was less than the MDA, the reported result was used.
If no result was reported (NR), 1/2 the MDA was used.

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HH Bldg Verification Sampling
Sampled July 2005
Tritium Results
Table 3

			HTO	
	CO pCi/g		328	
	HS pCi/g		n/a	
Sample Number	Terran #	STL #	Result	MDA
SU3-HH-027 Tritium	000186	F5G270142-028	160	0.6
SU3-HH-028 Tritium	000188	F5G270142-030	187	0.6
SU3-HH-029 Tritium	000190	F5G270142-032	19.4	0.6
SU3-HH-030 Tritium	000192	F5G270142-034	1.75	0.58
SU3-HH-031 Tritium	000194	F5G270142-036	8	0.6
SU3-HH-032 Tritium	000196	F5G270142-038	36.8	0.6
SU3-HH-033 Tritium	000198	F5G270142-040	29.3	0.6
Std. Dev.			76.6860	

Removed Samples

SU1-HH-003	000161	F5G270142-003		
SU2-HH-009	000167	F5G270142-009		
SU2-HH-010	000168	F5G270142-010		

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
For Standard Deviation Calculations:
If the reported result was less than the MDA, the reported result was used.
If no result was reported (NR), 1/2 the MDA was used.

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Sample Standard Deviation (s)	Radionuclide	Cleanup Objective	Units
	Ac-227+D	4.6	(pCi/g)
	Am-241	63	(pCi/g)
	Ce-141	38	(pCi/g)
	Cs-137+D	3.8	(pCi/g)
	Co-60	0.7	(pCi/g)
	Cu-244	92	(pCi/g)
	Pb-210+D	7.4	(pCi/g)
	Np-237+D	10.4	(pCi/g)
	Ni-95	2.5	(pCi/g)
	Pu-238	55	(pCi/g)
	Pu-239/240	62	(pCi/g)
	Pa-231+D	4	(pCi/g)
	Ra-226+D	2.9	(pCi/g)
	Ra-228	2.1	(pCi/g)
	Th-228+D	2.6	(pCi/g)
	Th-230+D	2.8	(pCi/g)
0.2278	Th-232+D	2.1	(pCi/g)
	U-233+D	4.8	(pCi/g)
	U-234	106.1	(pCi/g)
	U-234+D	2	(pCi/g)
	U-235	16.11	(pCi/g)
	U-235+D	3.2	(pCi/g)
	U-238	121.2	(pCi/g)
	U-238+D	2.2	(pCi/g)
	Bi-207	1.2	(pCi/g)
	Bi-210m	8.3	(pCi/g)
	Tc-99	2140	(pCi/g)
	Sr-90	94.72	(pCi/g)

Type I Error	0.05		
$Z_{1\text{-alpha}}$	1.645		
Type II Error	0.2		
$Z_{1\text{-beta}}$	0.842		
Effective	0.23	*(s)*	
Sign p	0.993790		

Estimate (N) - Sign Test

DCGL	1
LBGR	0.43
Delta	0.57
(s)	0.23
Rel Shift	2.502
(N)	8.00

Pu-238 Area Factor (N) na

Calculate the Total Effective (s)

Sample Grid Spacing

SU Area	964.88	m^2
Grid Length	10.2	m
Grid Height	8.9	m

Sample Grid Spacing

SU Area	10375	ft^2
Grid Length	33.5	ft
Grid Height	29.0	ft

PRS HH Footprint

Survey Unit SU1

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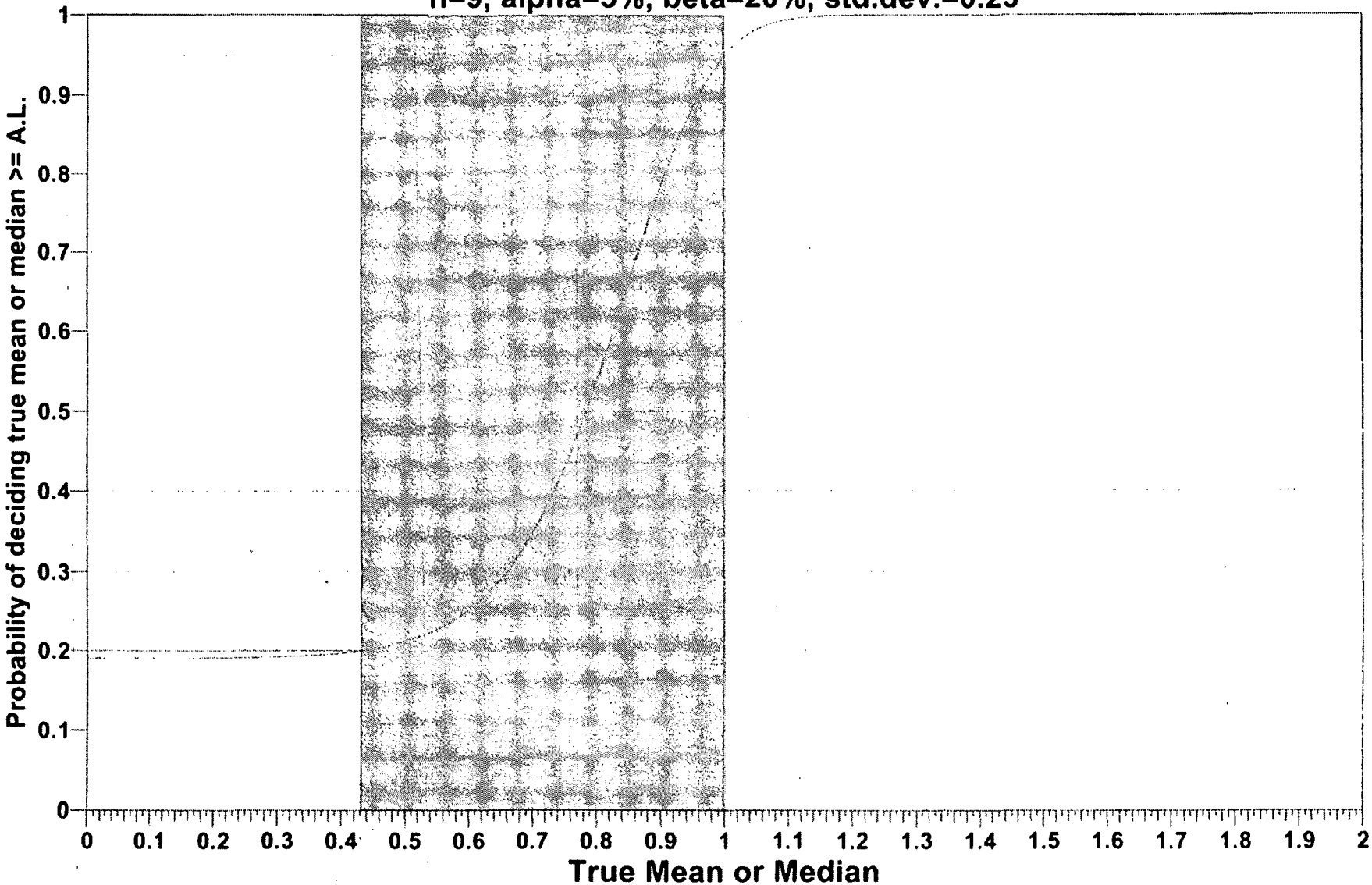
SU 1

MARSSIM Sign Test

n=9, alpha=5%, beta=20%, std.dev.=0.23



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Sample Standard Deviation (s)	Radionuclide	Cleanup Objective	Units
0.1199	Ac-227+D	4.6	(pCi/g)
0.0094	Ag-108m	1.22	(pCi/g)
	Am-241	63	(pCi/g)
	Ce-141	38	(pCi/g)
0.0098	Cs-137+D	3.8	(pCi/g)
0.0223	Co-60	0.7	(pCi/g)
	Cu-244	92	(pCi/g)
	Pb-210+D	7.4	(pCi/g)
0.2239	Pb-214	7.4	(pCi/g)
	Np-237+D	10.4	(pCi/g)
	Ni-95	2.5	(pCi/g)
	Pu-238	55	(pCi/g)
	Pu-239/240	62	(pCi/g)
0.8221	Pa-231+D	4	(pCi/g)
0.1929	Ra-226+D	2.9	(pCi/g)
	Ra-228	2.1	(pCi/g)
	Th-228+D	2.6	(pCi/g)
0.3378	Th-230+D	2.8	(pCi/g)
0.2921	Th-232+D	2.1	(pCi/g)
	U-233+D	4.8	(pCi/g)
	U-234	106.1	(pCi/g)
	U-234+D	2	(pCi/g)
	U-235	16.11	(pCi/g)
	U-235+D	3.2	(pCi/g)
	U-238	121.2	(pCi/g)
	U-238+D	2.2	(pCi/g)
0.0186	Bi-207	1.2	(pCi/g)
0.1140	Bi-210m	8.3	(pCi/g)
0.1929	Bi-214	11.7	(pCi/g)
	Tc-99	2140	(pCi/g)
	Sr-90	94.72	(pCi/g)

Type I Error	0.05		
$Z_{1\text{-alpha}}$	1.645		
Type II Error	0.2		
$Z_{1\text{-beta}}$	0.842		
Effective	0.29	*(s)*	
Sign p	0.955435		

Estimate (N) - Sign Test

DCGL	1
LBGR	0.50
Delta	0.50
(s)	0.29
Rel Shift	1.726
(N)	9.00

Area Factor Adjusted (N) 100

Calculate the Total Effective (s)

Sample Grid Spacing

SU Area	270.63	m^2
Grid Length	5.1	m
Grid Height	4.4	m

Sample Grid Spacing

SU Area	2910	ft^2
Grid Length	16.7	ft
Grid Height	14.5	ft

PRS: HH Footprint

Survey Unit: SU2

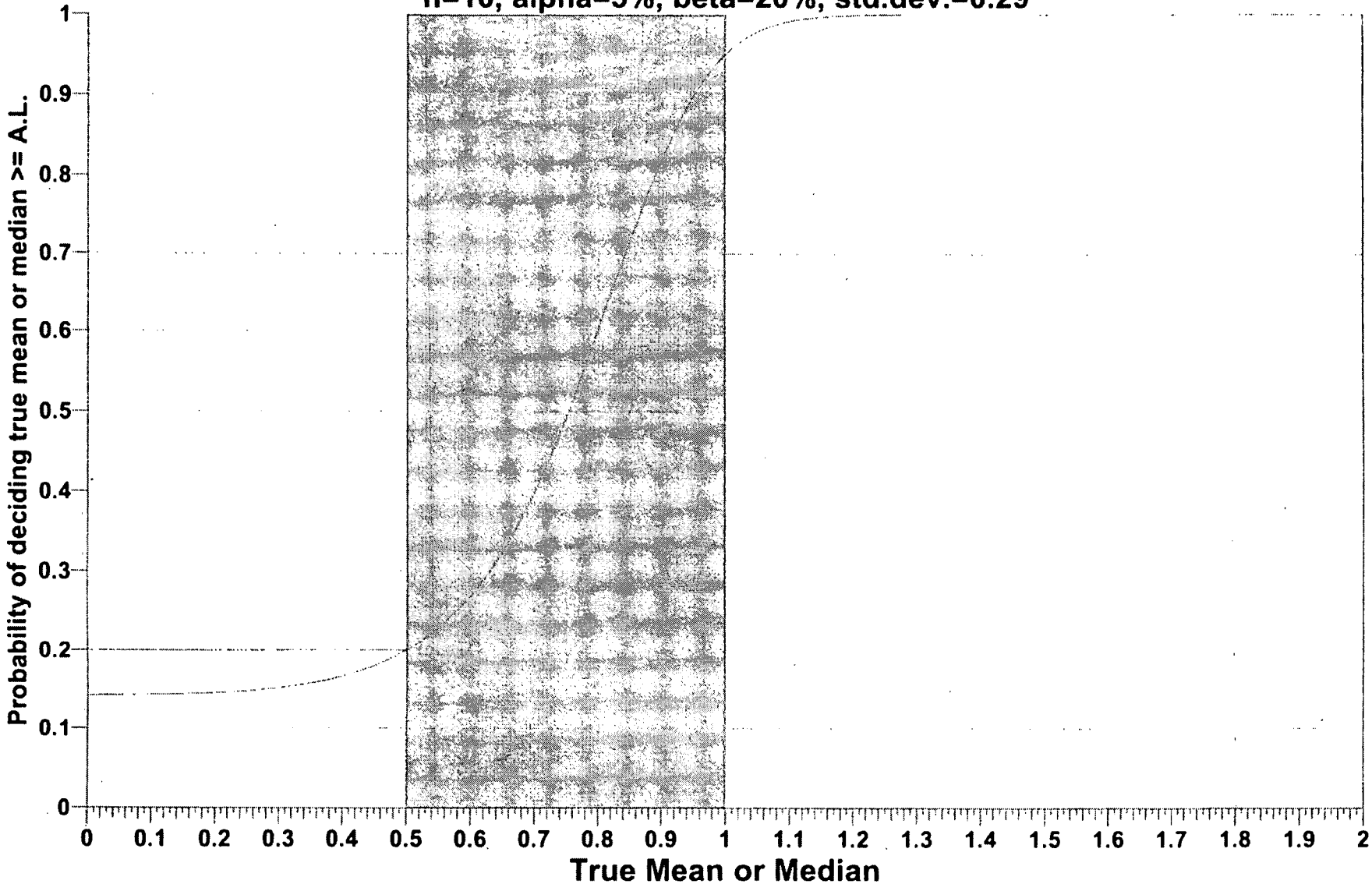
Notes:
Th-230 was identified as the COC of concern with respect to Scan MDC and no table is available in the SVSAP Appendix D.
The table for Pu-238 was used due to being more conservative (Pu-238 Area Factor = 6.4 vs Th-230 Area Factor = 5.51)

A82/08

SU 2

MARSSIM Sign Test

n=10, alpha=5%, beta=20%, std.dev.=0.29



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Sample Standard Deviation (s)	Radionuclide	Cleanup Objective	Units
	Ac-227+D	4.6	(pCi/g)
	Am-241	63	(pCi/g)
	Ce-141	38	(pCi/g)
	Cs-137+D	3.8	(pCi/g)
	Co-60	0.7	(pCi/g)
	Cu-244	92	(pCi/g)
	Pb-210+D	7.4	(pCi/g)
	Np-237+D	10.4	(pCi/g)
	Ni-95	2.5	(pCi/g)
	Pu-238	55	(pCi/g)
	Pu-239/240	62	(pCi/g)
	Pa-231+D	4	(pCi/g)
	Ra-226+D	2.9	(pCi/g)
	Ra-228	2.1	(pCi/g)
76.6860	Tritium	328	(pCi/g)
	Th-228+D	2.6	(pCi/g)
	Th-230+D	2.8	(pCi/g)
0.2039	Th-232+D	2.1	(pCi/g)
	U-233+D	4.8	(pCi/g)
	U-234	106.1	(pCi/g)
	U-234+D	2	(pCi/g)
	U-235	16.11	(pCi/g)
	U-235+D	3.2	(pCi/g)
	U-238	121.2	(pCi/g)
	U-238+D	2.2	(pCi/g)
	Bi-207	1.2	(pCi/g)
	Bi-210m	8.3	(pCi/g)
	Tc-99	2140	(pCi/g)
	Sr-90	94.72	(pCi/g)

Type I Error	0.05		
$Z_{1\text{-alpha}}$	1.645		
Type II Error	0.2		
$Z_{1\text{-beta}}$	0.842		
Effective	0.25	*(s)*	
Sign p	0.993790		

Estimate (N) - Sign Test

DCGL	1
LBGR	0.36
Delta	0.64
(s)	0.25
Rel Shift	2.528
(N)	8.00

Pu-238 Area Factor (N) na

Calculate the Total Effective (s)

Sample Grid Spacing

SU Area	228.87	m^2
Grid Length	5.0	m
Grid Height	4.3	m

Sample Grid Spacing

SU Area	2461	ft^2
Grid Length	16.3	ft
Grid Height	14.1	ft

PRS: HH Footprint

Survey Unit: SU3

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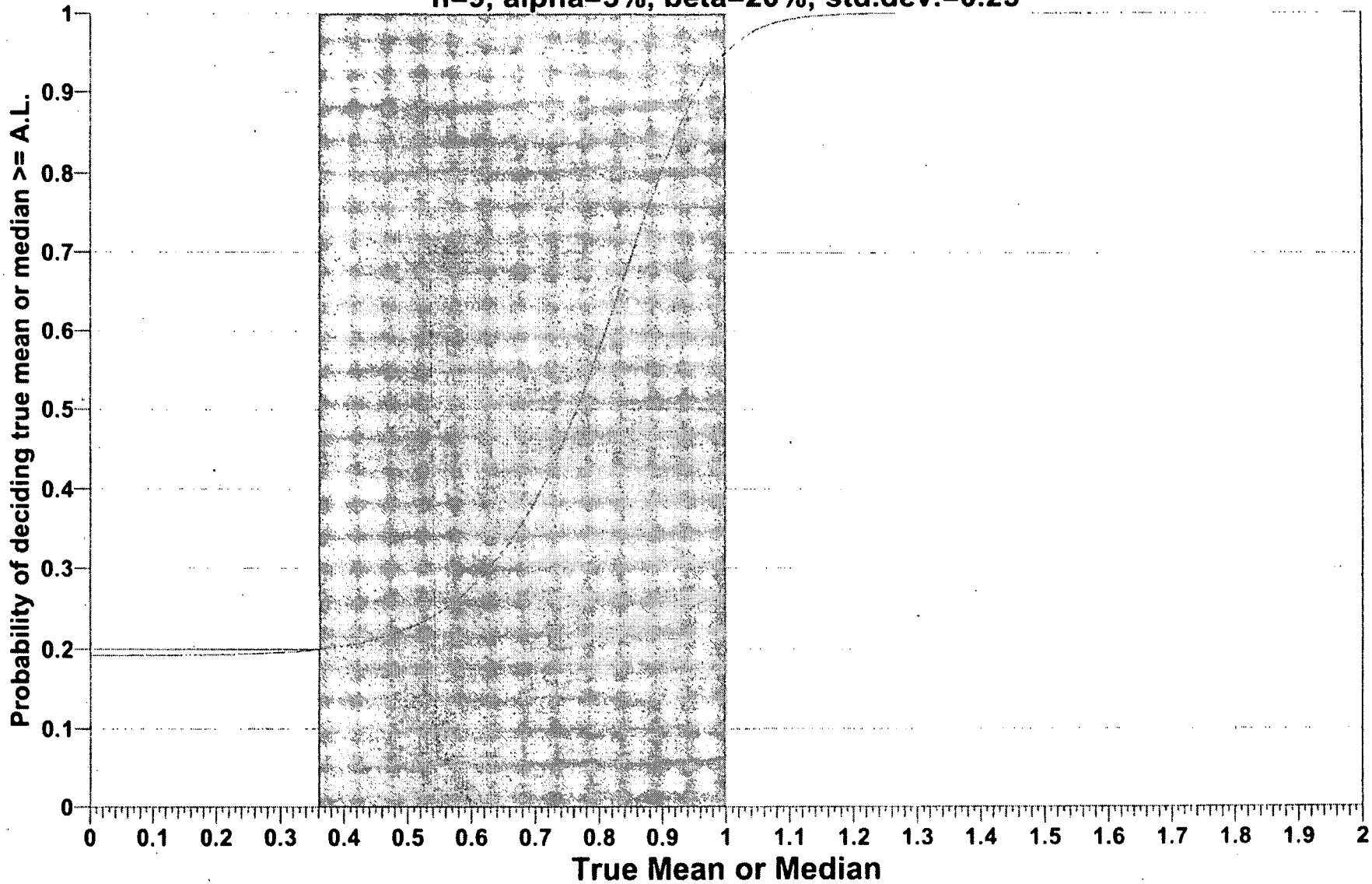
SU3

MARSSIM Sign Test

n=9, alpha=5%, beta=20%, std.dev.=0.25



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STD VSAP BACKFILL INFO

This information will be represented in the Data Report.

For: HH Footprint (SU4)

Rev 1

Checklist:

(per Section 5.6 of Std VSAP, Final, Aug 04)

- ☒ final Graphic
  (show sample locations & note any >CO and/or >HS)
- ☒ sample results
  (show DLs, HS, COs, and COC std deviation(s))
- ☒ recalc of N
- ☒ preliminary data were reviewed
  (Data Review & Validation Report will be submitted with the Data Report)
- n/a Sign test & 95%UCL (per SU)
  (not required if all results <CO, see pg 19/21 of VSAP)
- ☒ retro curve

From: (sign/date)_____

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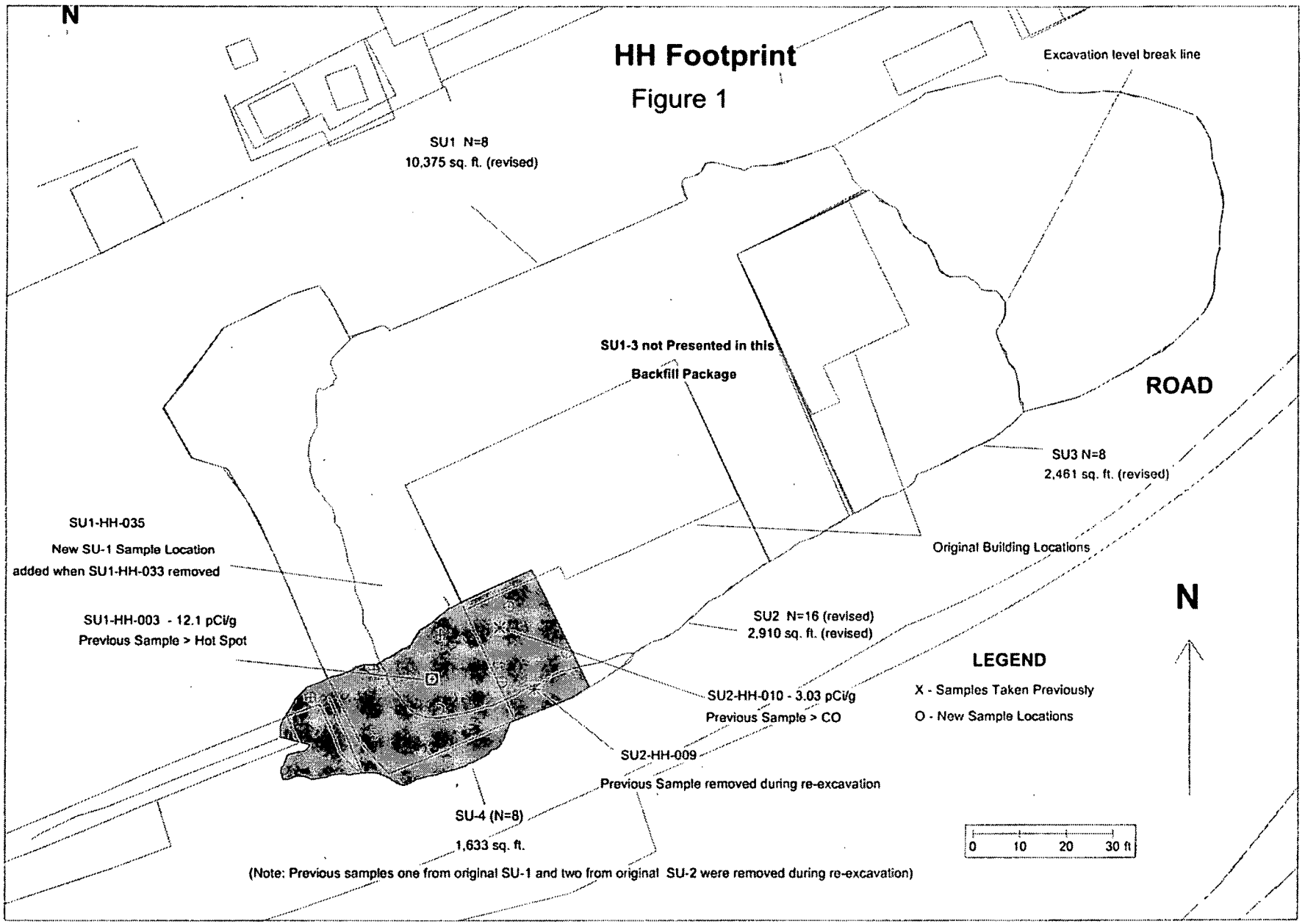
EXPLANATION PAGE
HH FOOTPRINT PARTIAL BACKFILL
SU 4

The original verification sampling for HH Footprint was conducted over three Survey Units (SU). However one sample in SU 1 was 12.1 pCi/g Th-230, which is above hot spot criteria (HS) and one sample in SU 2 was 3.03 pCi/g Th-230, which is above the cleanup objective (CO). The decision was made to carve a new SU 4 out of the portions of SU 1 and SU 2 where the elevated readings were located. Since SU 1 – SU 3 results were all below CO, the decision was made to submit a backfill package for SU 1 – SU 3 only. The size of SU 4 was driven by the removal of an underground storm drain and not by contamination being chased. One verification sample in SU 4 for Th-230 was 4.05 pCi/g, which is above CO. The sample set did not pass the 95% UCL test, so the elevated location was excavated and re-sampled. The resample was 0.99 pCi/g.

NOTE: all results indicate that the Cleanup Criteria have been met and backfill may proceed


N
HH Footprint
Figure 1
Excavation level break line
SU1 N=8
10,375 sq. ft. (revised)
SU1-3 not Presented in this
Backfill Package
ROAD
SU3 N=8
2,461 sq. ft. (revised)
SU1-HH-035
New SU-1 Sample Location
added when SU1-HH-033 removed
Original Building Locations
N
SU1-HH-003 - 12.1 pCi/g
Previous Sample > Hot Spot
SU2 N=16 (revised)
2,910 sq. ft. (revised)
LEGEND
X - Samples Taken Previously
O - New Sample Locations
SU2-HH-010 - 3.03 pCi/g
Previous Sample > CO
SU2-HH-009
Previous Sample removed during re-excavation
SU-4 (N=8)
1,633 sq. ft.
0 10 20 30 ft
(Note: Previous samples one from original SU-1 and two from original SU-2 were removed during re-excavation)

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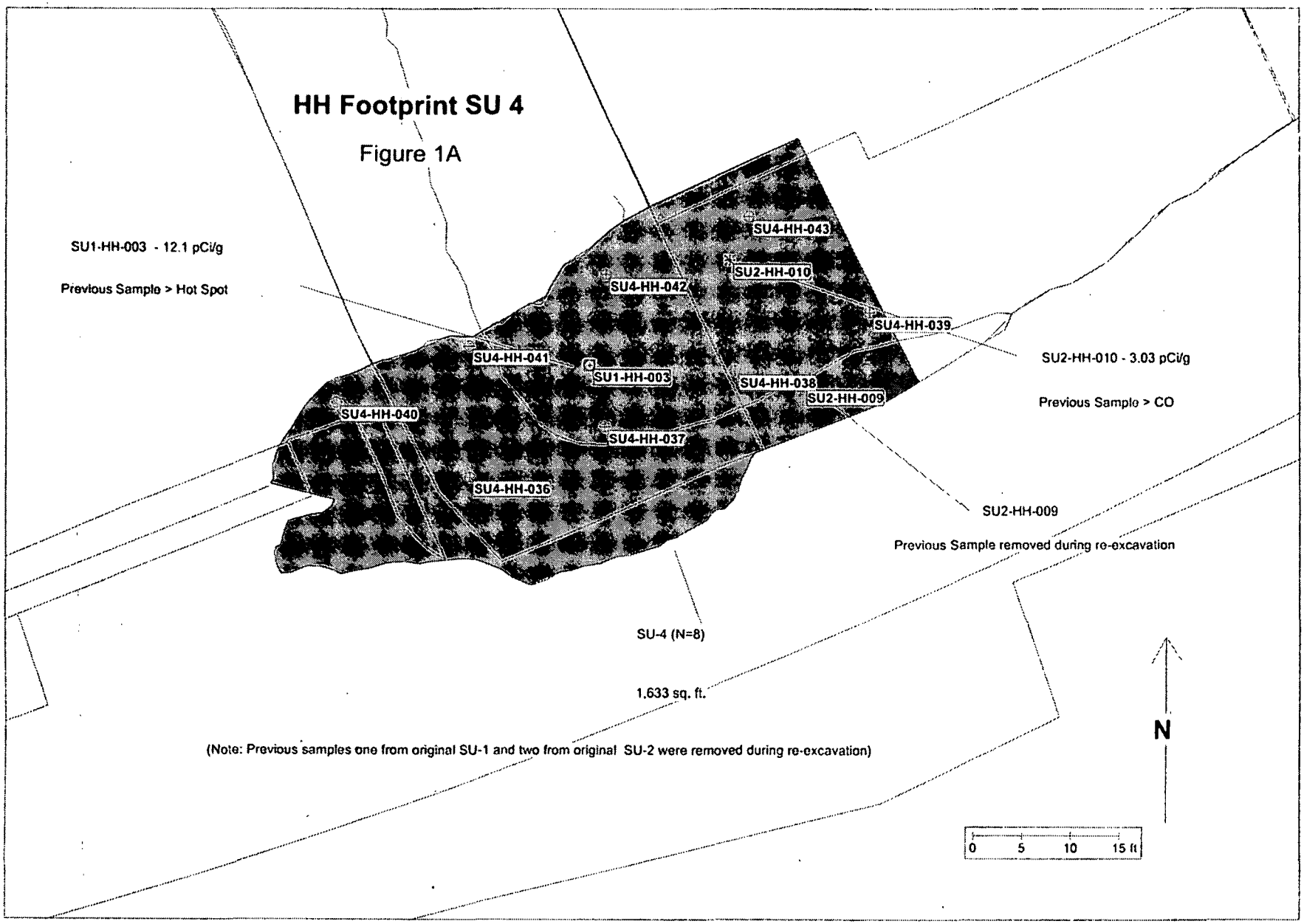
HH Footprint SU 4

Figure 1A



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HH Bldg Footprint Verification Sampling (SU4)

Offsite Iso Th Results pCi/g

Table 1

		Th-228		Th-230		Th-232	
	CO pCi/g	**2.6**		**2.8**		**2.1**	
	HS pCi/g	**4.79**		**4.66**		**3.39**	
Sample Number	Terran #	**Result**	**MDA**	**Result**	**MDA**	**Result**	**MDA**
SU4-HH-36	n/a	0.37	0.07	1.08	0.04	0.25	0.045
SU4-HH-37A*	n/a	1.11	0.04	0.99	0.03	1.18	0.02
SU4-HH-38	n/a	0.72	0.13	0.88	0.08	0.67	0.08
SU4-HH-39	n/a	0.59	0.09	1.31	0.05	0.5	0.05
SU4-HH-40	n/a	0.93	0.08	1.39	0.03	1	0.05
SU4-HH-41	n/a	0.51	0.08	1.31	0.06	0.68	0.05
SU4-HH-42	n/a	0.46	0.07	0.83	0.04	0.45	0.05
SU4-HH-43	n/a	0.52	0.06	0.79	0.04	0.4	0.05
Std. Dev.		0.253402		0.237893		0.313753	
Removed Location							
SU4-HH-37*	n/a	0.95	0.08	4.05	0.05	1.13	0.03
*SU4-HH-37 results replaced with SU4-HH-37A resample results after soil removal at sample location							
CO = Cleanup Objective							
HS = Hot Spot							
Std. Dev. = Standard Deviation							

HH Bldg Footprint Verification Sampling (SU4)
Onsite Gamma Spec Results pCi/g
Table 2

		Ac-227		Am-241		Ag-108m		Bi-207	
	CO pCi/g	4.64		63.1		1.22		1.24	
	HS pCi/g	13.7		189		3.66		3.6	
Sample Number	Terran #	Result	MDA	Result	MDA	Result	MDA	Result	MDA
SU4-HH-36	n/a	0.07	0.16	0	0.05	0	0.03	0.01	0.02
SU4-HH-37A	n/a	0.09	0.27	0	0.09	0	0.06	0	0.05
SU4-HH-38	n/a	0	0.21	0	0.05	0	0.04	0	0.03
SU4-HH-39	n/a	0.01	0.19	0	0.05	0	0.04	0.02	0.02
SU4-HH-40	n/a	0	0.16	0.02	0.04	0	0.03	0.02	0.02
SU4-HH-41	n/a	0	0.15	0	0.04	0	0.03	0.01	0.02
SU4-HH-42	n/a	0	0.23	0.01	0.06	0	0.04	0	0.03
SU4-HH-43	n/a	0	0.22	0	0.06	0	0.04	0	0.03
Std. Dev.		0.036815		0.00744		0		0.008864	
Removed Samples									
SU4-HH-37*	n/a	0	0.24	0.01	0.06	0	0.04	0	0.03

*SU4-HH-37 results replaced with SU4-HH-37A
resample results after soil removal at sample location

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
Results shown as 0 were reported
as 0

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blank spaces = no data available

HH Bldg Footprint Verification Sampling (SU4)
Onsite Gamma Spec Results pCi/g
Table 2

		Bi-210m		Bi-214		Cs-137		Co-60	
	CO pCi/g	8.34		1.17		3.84		0.76	
	HS pCi/g	24.9		3.51		10.7		2.12	
Sample Number	Terran #	Result	MDA	Result	MDA	Result	MDA	Result	MDA
SU4-HH-36	n/a	0	0.03	0.43	0.29	0	0.03	0	0.05
SU4-HH-37A	n/a	0	0.06	0.64	0.5	0	0.05	0.03	0.07
SU4-HH-38	n/a	0.02	0.04	0.47	0.33	0.01	0.04	0.02	0.04
SU4-HH-39	n/a	0.05	0.03	0.39	0.26	0.01	0.04	0	0.06
SU4-HH-40	n/a	0	0.03	0.52	0.28	0.12	0.03	0	0.04
SU4-HH-41	n/a	0	0.02	0.48	0.23	0.02	0.02	0	0.03
SU4-HH-42	n/a	0.04	0.04	0.52	0.29	0.03	0.03	0	0.06
SU4-HH-43	n/a	0.01	0.04	0.53	0.38	0	0.05	0.04	0.05
Std. Dev.		0.02		0.075166		0.040333		0.016421	
Removed Samples									
SU4-HH-37*	n/a	0.01	0.04	0.54	0.3	0.04	0.04	0.06	0.07

*SU4-HH-37 results replaced with SU4-HH-37A
resample results after soil removal at sample location

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
Results shown as 0 were reported
as 0

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HH Bldg Footprint Verification Sampling (SU4)
Onsite Gamma Spec Results pCi/g
Table 2

		Pa-231		Pb-210		Pb-214		Pu-238 (gamma spec)	
	CO pCi/g	4		7.45		8.92		55	
	HS pCi/g	11.8		19.9		26.8		165	
Sample Number	Terran #	Result	MDA	Result	MDA	Result	MDA	Result	MDA
SU4-HH-36	n/a	0	1.02	0.66	0.41	0.55	0.22	1.89	9.57
SU4-HH-37A	n/a	0.27	1.61	1.13	0.68	0.67	0.35	0	16.5
SU4-HH-38	n/a	0.52	1.13	0.74	0.52	0.49	0.32	0	12.72
SU4-HH-39	n/a	0.84	1.05	0.52	0.46	0.51	0.26	0	11.91
SU4-HH-40	n/a	0	0.9	0.84	0.37	0.53	0.16	0	7.08
SU4-HH-41	n/a	0	0.77	0.39	0.32	0.58	0.17	0	5.94
SU4-HH-42	n/a	0.68	1.25	0.97	0.51	0.57	0.32	0	11.88
SU4-HH-43	n/a	0.64	1.17	0.85	0.54	0.6	0.36	4.84	14.29
Std. Dev.		0.344982		0.23915		0.056758		1.745856	
Removed Samples									
SU4-HH-37*	n/a	0.78	1.17	0.91	0.52	0.54	0.32	0	13.11

*SU4-HH-37 results replaced with SU4-HH-37A
resample results after soil removal at sample location

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
Results shown as 0 were reported
as 0

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blank spaces = no data available

HH Bldg Footprint Verification Sampling (SU4)
Onsite Gamma Spec Results pCi/g
Table 2

		Ra-226	
	CO pCi/g	2.93	
	HS pCi/g	4.79	
Sample Number	Terran #	Result	MDA
SU4-HH-36	n/a	1.59	0.52
SU4-HH-37A	n/a	1.26	0.81
SU4-HH-38	n/a	1.54	0.64
SU4-HH-39	n/a	1.78	0.58
SU4-HH-40	n/a	1.77	0.46
SU4-HH-41	n/a	1.25	0.35
SU4-HH-42	n/a	1.41	0.63
SU4-HH-43	n/a	1.26	0.06
Std. Dev.		0.221795	

Removed Samples

SU4-HH-37*	n/a	1.32	0.63

*SU4-HH-37 results replaced with SU4-HH-37A
resample results after soil removal at sample location

CO = Cleanup Objective
HS = Hot Spot
Std. Dev. = Standard Deviation
NR = None Reported
Results shown as 0 were reported
as 0

blank spaces = no data available

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Sample Standard Deviation (s)	Radionuclide	Cleanup Objective	Units
0.0368	Ac-227+D	4.6	(pCi/g)
0.0000	Ag-108m	1.22	(pCi/g)
	Am-241	63	(pCi/g)
	Ce-141	38	(pCi/g)
0.0403	Cs-137+D	3.8	(pCi/g)
0.0164	Co-60	0.7	(pCi/g)
	Cu-244	92	(pCi/g)
	Pb-210+D	7.4	(pCi/g)
0.0568	Pb-214	7.4	(pCi/g)
	Np-237+D	10.4	(pCi/g)
	Ni-95	2.5	(pCi/g)
	Pu-238	55	(pCi/g)
	Pu-239/240	62	(pCi/g)
0.3450	Pa-231+D	4	(pCi/g)
0.2218	Ra-226+D	2.9	(pCi/g)
	Ra-228	2.1	(pCi/g)
	Th-228+D	2.6	(pCi/g)
0.2379	Th-230+D	2.8	(pCi/g)
0.3138	Th-232+D	2.1	(pCi/g)
	U-233+D	4.8	(pCi/g)
	U-234	106.1	(pCi/g)
	U-234+D	2	(pCi/g)
	U-235	16.11	(pCi/g)
	U-235+D	3.2	(pCi/g)
	U-238	121.2	(pCi/g)
	U-238+D	2.2	(pCi/g)
0.0089	Bi-207	1.2	(pCi/g)
0.0200	Bi-210m	8.3	(pCi/g)
0.0752	Bi-214	11.7	(pCi/g)
	Tc-99	2140	(pCi/g)
	Sr-90	94.72	(pCi/g)

Type I Error	0.05		
$Z_{1\text{-alpha}}$	1.645		
Type II Error	0.2		
$Z_{1\text{-beta}}$	0.842		
Effective	0.21	*(s)*	
Sign p	0.993790		

Estimate (N) - Sign Test

DCGL	1
LBGR	0.47
Delta	0.53
(s)	0.21
Rel Shift	2.535
(N)	8.00

Area Factor Adjusted (N) 56

Calculate the Total Effective (s)

Sample Grid Spacing

SU Area	151.87	m^2
Grid Length	4.1	m
Grid Height	3.5	m

Sample Grid Spacing

SU Area	1633	ft^2
Grid Length	13.3	ft
Grid Height	11.5	ft

PRS: HH Footprint

Survey Unit: SU4

Notes:

1) Th-230 was identified as the COC of concern with respect to Scan MDC and no table is available in the SVSAP Appendix D. The table for Pu-238 was used due to being more conservative (Pu-238 Area Factor = 6.4 vs Th-230 Area Factor = 5.51)

2) COCs and standard deviations from the adjacent SU-2 were used for SU-4

3) All results for Ag-108m are zero

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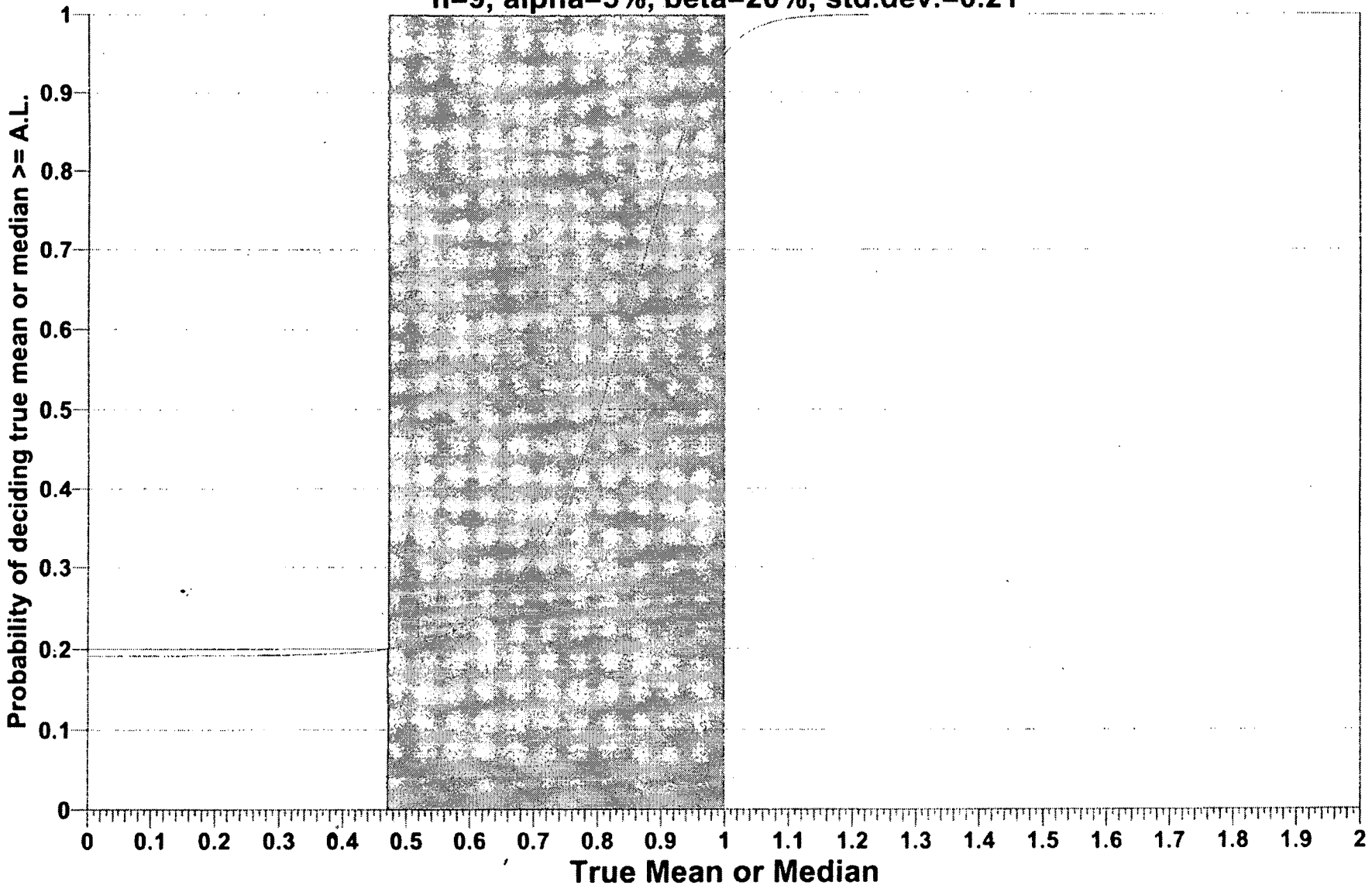
SU 4

MARSSIM Sign Test

n=9, alpha=5%, beta=20%, std.dev.=0.21



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APPENDIX E

DATA REVIEW & VALIDATION

There are 2 R&V Reports for HH Footprint/PRS 151 included herein, one for SUs 1-3 and one for SU4. Because there was no sampling conducted at PRS 413 as part of the SUD process, there is no R&V Report for PRS 413.

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1.0 Introduction

Analytical data can be evaluated on at least three quality control levels:

Data Review involves an assessment of the quality controls used by the laboratory during the performance of the analysis. These include such things as laboratory blanks, system monitoring compound (surrogate) recoveries, matrix spikes, etc. Which controls are assessed and what criteria are applied depend on the analysis performed. The results of field quality control measures such as field duplicates and trip blanks may also be evaluated. Data Review is normally performed on 100% of the analytical data.

Data Validation is a more detailed review of the entire laboratory data package. It includes all the elements of the Data Review plus verification of such checks as proper instrument calibration, proper use of standards and correct performance of data calculations. Data Validation is used to identify systemic problems with the way the laboratory performs and reports analyses.

Data Assessment may also evaluate whether project data quality objectives and other program needs that led to the collection of samples in the first place were met. Data assessment typically draws on the results of data validation of one or more data sets.

2.0 Description of the Data Set

This data assessment covers samples collected July 20-21, 2005, from the Miamisburg Closure Project (Group 9 Sampling – HH Footprint) to confirm environmental compliance prior to site closure. Offsite sample analyses were performed at Severn-Trent Laboratories of Earth City (St. Louis), MO, as analytical batch (LSDG, lab sample delivery group) F5G270142. Samples included 44 solid and three aqueous (rinsate) samples, among which were three field duplicate sample pairs, and three samples designated as matrix spike samples for analytical quality control (QC) purposes.

There were no problems associated with the documentation, shipment, or chain of custody of the samples. Analyte detection goals were achieved, except in the infrequent situation where high levels of one analyte required sample dilution, raising detection limits for other analytes as well. Table 1 summarizes the identification of the samples and the analyses performed (next page); the analytical methods performed were:

- Alpha spectroscopy for isotopic thorium (Th) by DOE Environmental Monitoring Lab (EML) Method A-01-R, Modified.
- Gamma spectroscopy for Cesium-137 (Cs-137) and other radionuclides by EML Method GA-01-R, Modified.
- Liquid Scintillation Counting for Tritium (H-3) by EML H3-04-RC, Modified.
- Percent Moisture by EPA Methods for the Chemical Analysis of Water and Wastewater (MCAWW) Method 160.3, Modified (applicable to soil samples only).

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Table 1: Sampling Information

Field Sample ID	Laboratory ID	Alpha Spectrometry	Scintillation Counting (Tritium Analysis)	Gamma Spectrometry
000159	F5G0142-001			
000160	F5G0142-002			
000161	F5G0142-003			
000162	F5G0142-004			
000163	F5G0142-005			
000164	F5G0142-006			
000165	F5G0142-007			
000166	F5G0142-008			
000167	F5G0142-009			
000168	F5G0142-010			
000169	F5G0142-011	MS/MSD		
000170	F5G0142-012			
000171	F5G0142-013			
000172	F5G0142-014			
000173	F5G0142-015			
000174	F5G0142-016			
000175	F5G0142-017			
000176	F5G0142-018			
000177	F5G0142-019			
000178	F5G0142-020			
000179	F5G0142-021			
000180	F5G0142-022			
000181	F5G0142-023			
000182	F5G0142-024			
000183	F5G0142-025			
000184	F5G0142-026			
000185	F5G0142-027			
000186	F5G0142-028			
000187	F5G0142-029	MS/MSD		
000188	F5G0142-030			
000189	F5G0142-031			
000190	F5G0142-032			
000191	F5G0142-033			
000192	F5G0142-034			
000193	F5G0142-035			
000194	F5G0142-036			
000195	F5G0142-037			
000196	F5G0142-038			
000197	F5G0142-039			
000198	F5G0142-040			
000199	F5G0142-041			
000205	F5G0142-042 FDup 000195			
000206	F5G0142-044 FDup 000184			
000207	F5G0142-045 FDup 000196		MS/MSD	
000208	F5G0142-046			
000209	F5G0142-047			
000210	F5G0142-048		MS/MSD	

KEY:

MS/MSD	= The sample was also analyzed spiked for QC purposes. (matrix spike/matrix spike duplicate)
FDup XXX	= The sample is a field duplicate of sample number XXX
	= Analysis not performed for that sample.
	= Sample is an aqueous (rinsate) sample.

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3.0 Data Review

The quality control data submitted with the analytical data packages were reviewed and assessed. The results of the assessment are presented in this section. The following qualification flags are used to indicate data quality problems identified during the data review process.

Table 2 - Data Review Qualifications

Flag	Description
J	Estimated sample result
U	Non-detect sample result
UJ	Non-detected sample result at an estimated reporting limit
R	Rejected (unusable) sample result – (NOT required for these data)

3.1 Tracer Recovery

The laboratory spikes every alpha spectrometry sample with Th-229 (and other isotopes if appropriate). The percent recovery of this isotope is then used to scale the detected presence of the target isotopes. To fully meet QC criteria the isotope recovery must be between 30 – 110 % and have an accumulated count of at least 200 counts. Tracer recovery for all samples met QC criteria, with recoveries of 49-109 percent.

3.2 Blanks

The laboratory analyzes one blank for every 20 samples or LSDG. Laboratory blanks are analyzed to determine if laboratory processes are contributing to the detected sample activities. Laboratory blanks were analyzed at an appropriate frequency.

The laboratory method blanks associated with the verification samples were either free of contamination or were contaminated at such low levels relative to the concentrations in the associated field samples that data qualification was not needed (the situation for Th-230).

3.3 Laboratory Duplicate

A laboratory duplicate analysis is performed to assess the precision and accuracy of the laboratory analysis. At least one duplicate is performed for every 20 samples or LSDG. In some cases, the laboratory counted a matrix spike duplicate (MSD) or LCS (lab control sample) duplicate as the laboratory duplicate in order to achieve this frequency; no data were qualified for these occurrences.

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To meet QC criteria the relative error ratio (RER) of duplicate samples must be < 3.0, or if one or both results are nondetect.

$$RER = \frac{[\text{Sample Result} - \text{Duplicate Result}]}{[TPU^2_{sample} + TPU^2_{dup}]^{1/2}}$$

note: TPU: total propagated uncertainty

It is known that for Mound soils contamination is usually distributed non-homogeneously even in dried and ground samples. Divergent results obtained from analysis of second portions from the same sample, if found, are a demonstration of this fact and not of the laboratory capability for precision. However, the relative error ratio for the laboratory duplicate analyses was within QC criteria in all cases for this sampling event.

3.4 Matrix Spike

A matrix spike (MS) analysis is performed to assess the precision and accuracy of the laboratory analysis. One matrix spike is to be performed for every 20 samples of a given matrix or at least once per LSDG. This frequency was met except for the gamma spectroscopy analyses, for which no MS/MSD was performed. No data were qualified for this occurrence, as LCS data (below) were acceptable. At the time of the collection of these samples, additional sampling (later cancelled) was planned, which likely accounts for the lack of MS/MSD samples for the gamma analyses.

For all analytes/samples spiked, the matrix spike recoveries were within QC criteria for the target analytes and no data qualification was required.

3.5 Laboratory Control Sample

The Laboratory Control Sample (LCS) is a standard sample with a known quantity of the analyte of concern. The LCS recovery is an indication of whether the analytical process was in control during the analysis. The LCS recoveries were generally within QC requirements, demonstrating good analytical accuracy, and were analyzed at an acceptable frequency. In one instance, the thorium-228 LCS associated with the rinsate samples, the recovery was 1% below the lower control limit. As a result, the values for this isotope in the three rinsate samples were qualified as nondetect at an estimated detection limit, "UJ."

3.6 Equipment Rinsates

Equipment rinsates are used to ensure efficacy of equipment field decontamination procedures, and that the sample collection process is not causing cross contamination. All of the rinsates were free of measurable contamination.

For this sampling event, three aqueous (rinse) samples were collected and 41 field samples collected (i.e. excluding field duplicate QC samples). This frequency meets the 1/20 frequency required for this project.

3.7 Field Duplicates

Field duplicates give an indication of the degree of homogeneity within the sample material. As with laboratory duplicates, they are reported as RER. Agreement between field duplicates was acceptable for all analyte pairs. Three field duplicate samples were reported for this sampling event.

As noted under laboratory duplicates, it is known that for Mound soils contamination is usually distributed non-homogeneously even in dried and ground samples. If divergent results are obtained from analysis of field duplicate pairs from the same sampling location, such an outlier would be a demonstration of this fact. However, the relative error ratio for the field duplicate analyses was within QC criteria in all cases for this sampling event.

3.8 Other Issues

Consistent with standard laboratory practice, detected results that were found below the required reporting limit were qualified as estimated by the laboratory. These results have inherently poor precision, as they are close to the analytical detection limit. The qualifiers were retained during data validation, and pose no significant limitation to data usability.

In one case each for thorium-230 and for tritium, positive results were reported with uncertainties greater than the result. Such data was qualified as estimated, as this implies a less than 95% confidence in the detection. Nondetect results where the uncertainty was greater than the absolute value of the result were present, and were qualified "UJ" (nondetect at an estimated reporting limit), as the sample count may be less than the background reading in such cases. These instances did not result in data rejection; the results may be used as estimated values.

The laboratory made the following observation in their case narrative for this data package:

> "Ra-226 is reported in these samples at the client's request... Because the samples have not had a 21-day ingrowth, the activity for Ra-226 is an estimated value and may be biased low..."

As a result of this occurrence, all detected Ra-226 data are qualified "J" as estimated (affecting all solid samples) and all nondetect results are qualified "UJ" as nondetect at an estimated (biased low) reporting limit (affecting the rinsate sample).

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4.0 Data Validation

The results of 10% of samples in each LSDG were fully data validated. In addition to the items discussed above, the following items were evaluated:

1. Instrument calibration
2. Daily Source checks
3. Background and efficiency measurement
4. Proper frequency and use of blanks
5. All calculations

No additional qualification resulted from this assessment. There was no indication of a systemic deficiency.

5.0 Certification

Based upon this review the analytical data maybe used as presented with no further qualifications. No data required rejection; 100% completeness for all analyses was obtained.

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1.0 Introduction

Analytical data assessment can be performed on many quality control levels. The most basic level is a review of the data for completeness. Does the reported data cover the intended samples? Were the samples analyzed for the planned analyses? Does the data package contain all the information called for by the Statement of Work (SOW) or the analysis plan? A completeness check is normally performed on all Mound analytical data packages.

A Data Review involves a higher degree of assessment in which the quality controls used by the laboratory during the performance of the analysis are appraised. These include such techniques as laboratory blanks, system monitoring compound (surrogate) recoveries, matrix spikes, etc. Were the correct quality control (QC) controls used, and does the QC data indicate the analyses were performed acceptably? Which controls are assessed and what criteria are applied depend on the analysis performed. The results of field quality control measures such as field duplicates and trip blanks may also be evaluated. Data Review is normally performed on a 100% of the analytical data.

A full Data Validation is a much more detailed review of the full laboratory data package. It includes all the elements of a Data Review plus verification of such things as proper instrument calibration, proper use of standards and correct performance of data calculations. Data Validation is used to identify systemic problems with the way the laboratory performs and reports analyses.

2.0 Description of the Data Set

The data being evaluated was collected in accordance with the HH Footprint Survey Unit Design (SUD) for SU4. The SUD called for 8 surface samples to be collected in the southwest corner of the HH Building footprint.

All eight locations were sampled on 8/24/05. In addition, one sample (SU1-HH-035) was collected from SU 1 adjacent to SU4. One field duplicate was collected (SU4-HH-42FD).

The result from one location, SU4-HH-037, exceeded the clean up standard. This location was further remediated and resampled on 9/20/05. A field duplicate was also collected at this time.

The contaminant of concern, thorium-230, was picked based upon process knowledge and previous sampling performed in the area.

The current data evaluation is being preformed to support the verification that the location has been successfully remediated.

Fresh sampling equipment was used for each sample location so no equipment rinsates were collected.

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All samples were run for a long count screening at the Mound Soil Screening Laboratory (Gamma Spectroscopy) prior to any off site analysis.

The samples were sent off site to Severn Trent Laboratories, St. Louis for measurement of Thorium alpha-emitting isotopes by alpha spectroscopy

There were no problems associated with the documentation, shipment, or chain of custody of the samples. There were no problems in achieving the analyte detection goals.

Table 1. Sample Identification

Sample Date	LSDG	Number of Samples	Mound Sample IDs
8/24/05	F5H300234	10	SU1-HH-035 SU4-HH-036 SU4-HH-037 SU4-HH-038 SU4-HH-039 SU4-HH-040 SU4-HH-041 SU4-HH-042 SU4-HH-043 SU4-HH-042FD
9/20/05	F5I230262	2	SU4-HH-037A SU4-HH-037AD

LSDG: lab sample delivery group

3.0 Data Completeness

The correct samples were submitted and analyzed for the analyses requested. The data packages received back from the laboratory were complete.

4.0 Data Review

The quality control data submitted with the analytical data packages were reviewed and assessed. The results of the assessment are presented in this section. The following qualification flags are used to indicate data quality problems identified during the data review process.

Table 2 Data Review Qualifications

Flag	Description
J	Estimated sample result
U	Non-detect sample result
UJ	Estimated non-detected sample result
R	Rejected (unusable) sample result

4.1 Blanks

The laboratory analyzes one blank for every 20 samples or LSDG. Laboratory blanks are analyzed to determine if laboratory processes are contributing to the detected sample activities.

A trace amount (0.03 pCi/g) of Th-230 was detected in the blank associated with the first batch of samples. Th-230 was also detected (0.02 pCi/g) in the re-sample batch of samples. This is a typical amount of laboratory contamination.

4.2 Tracer Yields

Each sample is spiked with a known amount of an internal standard, Th-229, prior to sample preparation. The measured recovery percentage (% yield) of this 'tracer' is then used to scale the measured concentrations of the other isotopes. Tracer yields less than 20% or greater than 110% should be recounted and possibly re-prepared. Within a given sample matrix significant yield inconsistencies may be indicative of problems with sample preparation.

The tracer yields ranged from 66 to 110%. The average tracer yield was 81%. All tracer yields were within acceptable bounds.

4.3 Laboratory Duplicates

A laboratory duplicate analysis is performed to assess the precision and accuracy of the laboratory analysis. One duplicate is performed for every 20 samples or LSDG. Normally to meet QC criteria the Relative Error Ratio (RER) of duplicate samples must be < 3.0.

$$RER = \frac{[\text{Sample Result} - \text{Duplicate Result}]}{[TPU^2_{sample} + TPU^2_{dup}]^{1/2}}$$

where TPU is the Total Propagated Uncertainty.

There was acceptable agreement between the lab duplicates for the Th isotopes considering the very low amounts of activity measured.

4.4 Laboratory Control Sample

The Laboratory Control Sample (LCS) is a standard sample with a known quantity of the analytes of concern. The LCS recovery is an indication of whether the analytical process was in control during the analysis.

The Th-230 isotope recoveries for the LCS were 103 and 95%.

4.5 Equipment Rinsates

Equipment rinsates are used to ensure efficacy of equipment field decontamination procedures, and that the sample collection process is not causing cross contamination.

Since no field decontamination was performed, no equipment rinsates were collected.

4.6 Field Duplicates

Field Duplicates give an indication of the degree of homogeneity within the sample material. As with Laboratory duplicates they are reported as relative percent difference (RPD).

There is good agreement between the field duplicate consistent with the usual degree of homogeneity in Mound soils.

5.0 Data Validation

The results were further validated by examination of the following items:

1. Instrument calibration
2. Daily Source checks
3. Background and efficiency measurement

No additional qualification resulted from this assessment. There was no indication of a systemic deficiency.

6.0 Certification

Based upon this review the Th Alpha Spectroscopy analysis data may be used as presented with no further qualifications.

Table 3 HH Verification Th Alpha Spectroscopy Analysis

	Th-228			Th-230			Th-232		
pCi/g	Result	MDA	TPU	Result	MDA	TPU	Result	MDA	TPU
SU1-HH-35	0.64	0.14	0.20	1.86	0.08	0.35	0.59	0.06	0.17
SU1-HH-35 DUP	0.62	0.09	0.18	1.52	0.06	0.30	0.71	0.03	0.19
SU4-HH-36	0.37	0.07	0.12	1.08	0.04	0.22	0.25	0.05	0.10
SU4-HH-37	0.95	0.08	0.23	**4.05**	0.05	0.62	1.13	0.03	0.25
SU4-HH-38	0.72	0.13	0.21	0.88	0.08	0.22	0.67	0.08	0.19
SU4-HH-39	0.59	0.09	0.17	1.31	0.05	0.27	0.50	0.08	0.15
SU4-HH-40	0.93	0.08	0.22	1.39	0.03	0.27	1.00	0.05	0.22
SU4-HH-41	0.51	0.08	0.16	1.31	0.06	0.27	0.68	0.05	0.18
SU4-HH-42	0.46	0.07	0.14	0.83	0.04	0.19	0.45	0.05	0.13
SU4-HH-42FD	0.67	0.07	0.17	1.02	0.04	0.21	0.61	0.04	0.16
SU4-HH-43	0.52	0.06	0.14	0.79	0.04	0.18	0.40	0.05	0.12
Blank	< 0.023			*0.03*			< 0.014		
LCS				103 %					
SU4-HH-37A	1.11	0.04	0.21	0.99	0.03	0.19	1.18	0.02	0.22
SU4-HH-37A DUP	1.10	0.05	0.20	1.09	0.03	0.20	1.21	0.01	0.21
SU4-HH-37AFD	1.28	0.03	0.22	1.17	0.02	0.20	1.16	0.03	0.20
Blank				*0.02*					
LCS				95 %					

"<" Quantities indicate non-detects with stated MDAs
Italic indicate results that are less than Practical Quantitation Limits
DUP indicates laboratory duplicates
FD indicates field duplicates
LCS – Laboratory Control Sample

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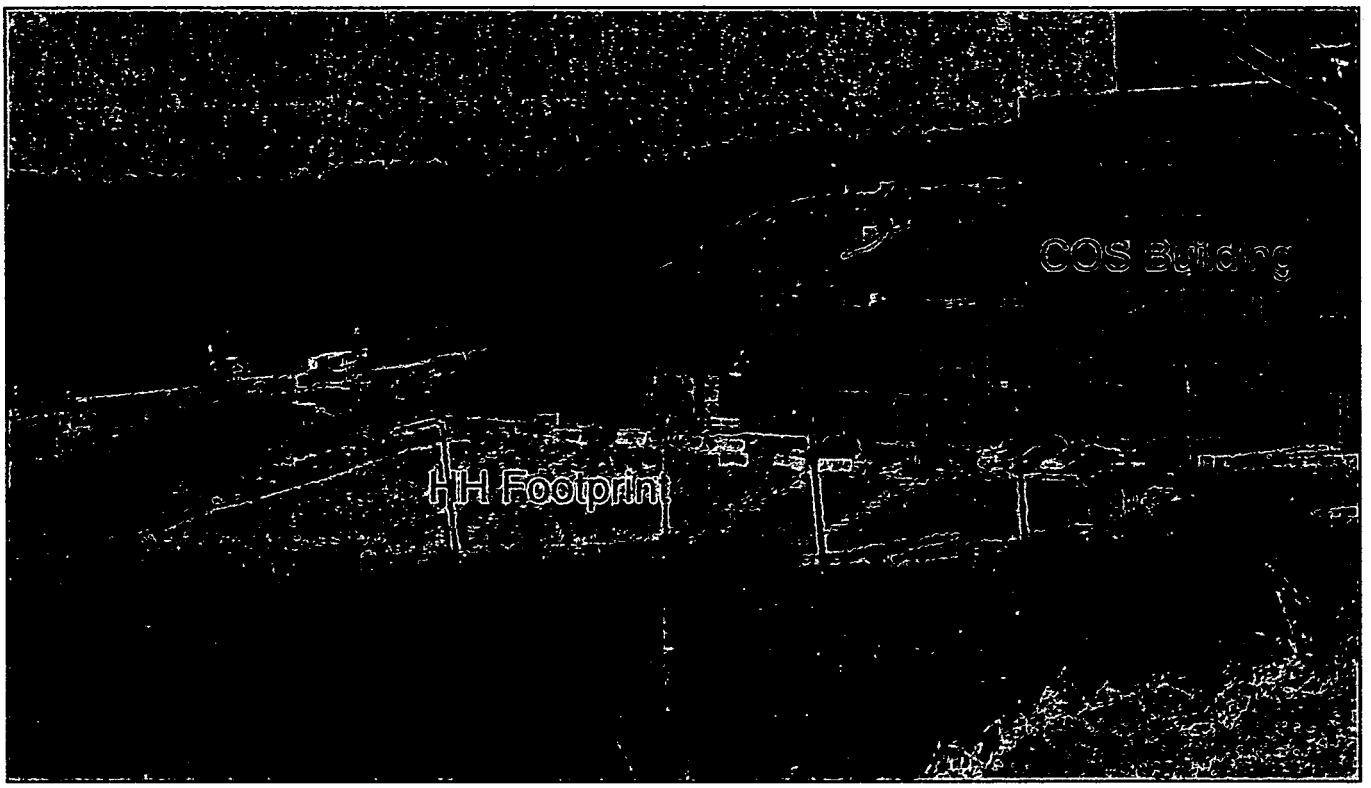
ATTACHMENT B

GENERAL MEDIA INFORMATION

(There was no information released to the media regarding HH Footprint or PRSs 151 or 413)

ATTACHMENT C

PHOTOGRAPH DOCUMENTATION



Restoration of HH Footprint